# Standards Council Meeting

**SUPPLEMENTAL AGENDA**

**August 17-19, 2015**

Quincy Marriott  
1000 Marriott Drive  
Quincy, MA 02169  
1-617-472-1000

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td><strong>15-8-1</strong></td>
<td>Act on the issuance of NFPA 11, <em>Standard for Low-, Medium-, and High-Expansion Foam</em>, with an issuance date of August 20, 2015 and an effective date of September 9, 2015, as acted on at the Association Meeting, with one amendment and no appeals.</td>
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<tr>
<td><strong>15-8-1-a</strong></td>
<td>Amendment No. 11-1 (CAM 11-15): Reject Second Revision No. 12, thereby recommending First Draft Text. This motion (CAM 11-15) passed on the floor of the Association Meeting. <em>(PASSED TC Ballot)</em> See Attachment 15-8-1-a</td>
</tr>
<tr>
<td><strong>15-8-2</strong></td>
<td>Act on the issuance of NFPA 13, <em>Standard for the Installation of Sprinkler Systems</em>, with an issuance date of August 20, 2015 and an effective date of September 9, 2015, as acted on at the Association Meeting, with one amendment and one appeal. See Related Items 15-8-14, 15-8-15, 15-8-16, 15-8-17, and 15-8-18.</td>
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<tr>
<td><strong>15-8-2-a</strong></td>
<td>Amendment No. 13-1 (CAM 13-4): Accept Public Comment No. 222 and Reject an Identifiable Part of Second Revision No. 24, thereby deleting new sections 9.1.1.6.3 and A.9.1.1.6.3. This motion (CAM 13-4) passed on the floor of the Association Meeting. <em>(PASSED TC Ballot/PASSED CC Ballot)</em> See Attachment 15-8-2-a</td>
</tr>
</tbody>
</table>
| **15-8-2-b** | **APPEAL**  
Appeal of A. Carp of Buenos Aires, Argentina, requesting the Council to Accept Public Comment No. 222 and Reject an Identifiable Part of Second Correlating Revision No. 24. The Identifiable Part is to retain reference to “AWWA M11, A Guide for Steel Pipe Design and Installation, 3rd edition, 1989”. See Attachment 15-8-4-b |
| **15-8-2-b-1** | Comments received by K. Wagoner, Chair of the Technical Committee on Private Water Supply Piping Systems, on the appeal of A. Carp. See Attachment 15-8-4-b-1 See Related 15-8-4-a-1 |
| **15-8-2-b-2** | Comments received on the appeal of A. Carp. See Attachment 15-8-2-b-2 |
| **15-8-3** | Act on the issuance of NFPA 13R, *Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies*, with an issuance date of August 20, 2015 and an effective date of September 9, 2015, as acted on at the Association Meeting, with one amendment and no appeals as follows: |
| **15-8-3-a** | Amendment No. 13R-1 (CAM 13R-1): Reject Second Revision No. 21, thereby deleting new sections 6.9.5 and 6.9.6. This motion (CAM 13R-1) passed on the floor of the Association Meeting. *(No TC/CC Ballot required)* See Attachment 15-8-3-a |
| 15-8-4 | Act on the issuance of NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances*, with an issuance date of August 20, 2015 and an effective date of September 9, 2015. NFPA 24 was not acted on at the Association Meeting but has received one appeal. |
| 15-8-4-a | Appeal of A. Carp of Buenos Aires, Argentina, requesting the Council Accept Public Comment Nos. 2 and 16 and Reject an Identifiable Part of Second Revision No. 3. The Identifiable Part is to retain reference to “AWWA M11, A Guide for Steel Pipe Design and Installation, 3rd edition, 1989”. See Attachment 15-8-4-a |
| 15-8-4-a-1 | Comment received by K. Wagoner, Chair of the Technical Committee on Private Water Supply Piping Systems, on the appeal of A. Carp. See Attachment 15-8-4-a-1 See Related 15-8-2-b-1 |
| 15-8-4-a-2 | Comments received on the appeal of A. Carp. See Attachment 15-8-4-a-2 |
| 15-8-5 | Act on the issuance of NFPA 33, *Standard for Spray Application Using Flammable or Combustible Materials*, with an issuance date of August 20, 2015 and an effective date of September 9, 2015, as acted on at the Association Meeting, with no amendments and two appeals. See Related Items 15-8-19 and 15-8-40 |
| 15-8-5-a | Appeal of M. Hirschler of GBH International, requesting the Council overturn the Association action and Accept Public Comment No. 14. This motion (CAM 33-1) failed on the floor of the Association Meeting. See Attachment 15-8-5-a. |
| 15-8-5-a-1 | Comment received by T. Euson Chair of the Technical Committee on Finishing Processes, on the appeal of M. Hirschler. SA15-8-5-a-1 ADDITION |
| 15-8-5-b | Appeal of M. Hirschler of GBH International, requesting the Council overturn the Association action and Accept Public Comment Nos. 10, 11, 12 and 13. This motion (CAM 33-2) failed on the floor of the Association Meeting. See Attachment 15-8-5-b. |
| 15-8-5-b-1 | Comment received by T. Euson Chair of the Technical Committee on Finishing Processes, on the appeal of M. Hirschler. SA15-8-5-b-1 ADDITION |
| 15-8-6 | Act on the issuance of NFPA 72, *National Fire Alarm and Signaling Code*, with an issuance date of August 20, 2015 and an effective date of September 9, 2015, as acted on at the Association Meeting, with one amendment and one appeal. See Related Items 15-8-21 and 15-8-22 |
| 15-8-6-a | Amendment No. 72-1 (CAM 72-8): Accept Public Comment No. 140. This motion (CAM 72-8) passed on the floor of the Association Meeting. (PASSED TC Ballot/PASSED CC Ballot) See Attachment 15-8-6-a SA15-8-6-a |
| 15-8-6-b | Appeal of V. Humm of Humm and Associates, requesting the Council overturn the Association action and Reject Second Revision No. 71. This motion (CAM 72-2) failed on the floor of the Association Meeting. See Attachment 15-8-6-b. |
| 15-8-6-b-1 | Comments received on the appeal of V. Humm. See Attachment 15-8-6-b-1 SA15-8-6-b-1 |
15-8-6-b-2 Comment received by D. Lowrey, Chair of the Technical Committee on Notification Appliances for Fire Alarm and Signaling Systems, on the appeal of V. Humm.
SA 15-8-6-b-2 ADDITION

15-8-7 Act on the issuance of NFPA 520, Standard on Subterranean Spaces, with an issuance date of August 20, 2015 and an effective date of September 9, 2015, as acted on at the Association Meeting, with no amendments and one appeal.

15-8-7-a APPEAL Appeal of M. Hirschler of GBH International, requesting the Council overturn the Association action and Accept Public Comment Nos. 1 and 2. This motion (CAM 520-1) failed on the floor of the Association Meeting. See Attachment 15-8-7-a.

15-8-7-a-1 Comment received by J. Poole, Chair of the Technical Committee on Subterranean Spaces on the appeal of M. Hirschler. SA 15-8-7-a-1 ADDITION

15-8-8 Act on the issuance of NFPA 652, Standard on Fundamentals of Combustible Dusts, with an issuance date of August 20, 2015 and an effective date of September 9, 2015, as acted on at the Association Meeting, with no amendments and no appeals. No Attachment

15-8-9 Act on the issuance of NFPA 1710, Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments, with an issuance date of August 20, 2015 and an effective date of September 9, 2015, as acted on at the Association Meeting, with no amendments and no appeals. No Attachment

15-8-10 Act on the issuance of NFPA 1901, Standard for Automotive Fire Apparatus, with an issuance date of August 20, 2015 and an effective date of September 9, 2015, as acted on at the Association Meeting, with one amendment and one appeal.

15-8-10-a Amendment No. 1901-1 (CAM 1901-1): Accept Public Comment No. 154. This motion (CAM 1901-1) passed on the floor of the Association Meeting. (FAILED TC Ballot) See Attachment 15-8-10-a

15-8-10-b APPEAL Appeal of J. Brinkley of the International Association of Fire Fighters, requesting the Council overturn the Committee action and accept Public Comment No. 154. This motion (CAM 1901-1) passed on the floor of the Association Meeting, but failed Committee ballot. SA 15-8-10-b ADDITION

15-8-11 Act on the issuance of NFPA 1917, Standard for Automotive Ambulances, with an issuance date of August 20, 2015 and an effective date of September 9, 2015, as acted on at the Association Meeting, with no amendments and no appeals. No Attachment See Related Item 15-8-25

15-8-12 Annual 2015 Revision Cycle Consent Standards that did not receive NITMAMs, were letter balloted by the Council with an issuance date of May 26, 2015 and an effective date of June 15, 2015:

NFPA 2 Hydrogen Technologies Code
<table>
<thead>
<tr>
<th>NFPA 13D</th>
<th>Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFPA 20</td>
<td>Standard for the Installation of Stationary Pumps for Fire Protection</td>
</tr>
<tr>
<td>NFPA 40</td>
<td>Standard for the Storage and Handling of Cellulose Nitrate Film</td>
</tr>
<tr>
<td>NFPA 55</td>
<td>Compressed Gases and Cryogenic Fluids Code</td>
</tr>
<tr>
<td>NFPA 73</td>
<td>Standard for Electrical Inspections for Existing Dwellings</td>
</tr>
<tr>
<td>NFPA 80</td>
<td>Standard for Fire Doors and Other Opening Protectives</td>
</tr>
<tr>
<td>NFPA 101A</td>
<td>Guide on Alternative Approaches to Life Safety</td>
</tr>
<tr>
<td>NFPA 105</td>
<td>Standard for Smoke Door Assemblies and Other Opening Protectives</td>
</tr>
<tr>
<td>NFPA 110</td>
<td>Standard for Emergency and Standby Power Systems</td>
</tr>
<tr>
<td>NFPA 111</td>
<td>Standard on Stored Electrical Energy Emergency and Standby Power Systems</td>
</tr>
<tr>
<td>NFPA 150</td>
<td>Standard on Fire and Life Safety in Animal Housing Facilities</td>
</tr>
<tr>
<td>NFPA 160</td>
<td>Standard for the Use of Flame Effects Before an Audience</td>
</tr>
<tr>
<td>NFPA 291</td>
<td>Recommended Practice for Fire Flow Testing and Marking of Hydrants</td>
</tr>
<tr>
<td>NFPA 303</td>
<td>Fire Protection Standard for Marinas and Boatyards</td>
</tr>
<tr>
<td>NFPA 307</td>
<td>Standard for the Construction and Fire Protection of Marine Terminals, Piers, and Wharves</td>
</tr>
<tr>
<td>NFPA 400</td>
<td>Hazardous Materials Code</td>
</tr>
<tr>
<td>NFPA 409</td>
<td>Standard on Aircraft Hangars</td>
</tr>
<tr>
<td>NFPA 415</td>
<td>Standard on Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways</td>
</tr>
<tr>
<td>NFPA 556</td>
<td>Guide on Methods for Evaluating Fire Hazard to Occupants of Passenger Road Vehicles</td>
</tr>
<tr>
<td>NFPA 557</td>
<td>Standard for Determination of Fire Loads for Use in Structural Fire Protection Design</td>
</tr>
<tr>
<td>NFPA 820</td>
<td>Standard for Fire Protection in Wastewater Treatment and Collection Facilities</td>
</tr>
<tr>
<td>NFPA 1126</td>
<td>Standard for the Use of Pyrotechnics Before a Proximate Audience</td>
</tr>
<tr>
<td>NFPA 1221</td>
<td>Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems</td>
</tr>
<tr>
<td>NFPA 1906</td>
<td>Standard for Wildland Fire Apparatus</td>
</tr>
<tr>
<td>NFPA 1953</td>
<td>Standard on Protective Ensembles for Contaminated Water Diving</td>
</tr>
</tbody>
</table>

Fall 2015 Revision Cycle Consent Standards that did not receive public comments or voted to hold a second draft meeting that produced no further revisions, were letter balloted by the Council with an issuance date of January 28, 2015 and an effective date of February 17, 2015:
<p>| | | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>15-8-13</strong></td>
<td>Act on the issuance of proposed Tentative Interim Amendment (TIA) to section 18.3.3 of the proposed 2016 edition of NFPA 2, <em>Hydrogen Technologies Code</em>, (TIA No. 1178).</td>
<td>No Attachment  No Action Needed</td>
</tr>
<tr>
<td><strong>15-8-13-a</strong></td>
<td>Text of proposed TIA No. 1178. See Attachment 15-8-13-a</td>
<td></td>
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<tr>
<td><strong>15-8-13-b</strong></td>
<td>Ballot results of TIA No. 1178. <strong>PASSED</strong> TC ballot on both technical merit and emergency nature. See Attachment 15-8-13-b</td>
<td></td>
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<tr>
<td><strong>15-8-13-c</strong></td>
<td>No comment were received. No Attachment</td>
<td></td>
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<tr>
<td><strong>15-8-14</strong></td>
<td>Act on the issuance of proposed Tentative Interim Amendment (TIA) to sections 17.2.3.5.6, A.17.2.3.5 and A.17.3.3.5 of the proposed 2016 edition of NFPA 13, <em>Standard for the Installation of Sprinkler Systems</em>, (TIA No. 1165). See Related Item 15-8-2</td>
<td></td>
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<tr>
<td><strong>15-8-14-a</strong></td>
<td>Text of proposed TIA No. 1165. See Attachment 15-8-14-a</td>
<td></td>
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<tr>
<td><strong>15-8-14-b</strong></td>
<td>Ballot results of TIA No. 1165. <strong>PASSED</strong> TC ballot on both technical merit and emergency nature. <strong>PASSED</strong> the CC ballot on both correlation and emergency nature. See Attachment 15-8-14-b</td>
<td></td>
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<tr>
<td><strong>15-8-14-c</strong></td>
<td>One comment was received. See Attachment 15-8-14-c</td>
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<tr>
<td><strong>15-8-15</strong></td>
<td>Act on the issuance of proposed Tentative Interim Amendment (TIA) to sections 2.3.1, 2.3.2, 3.11.9, A.3.11.9, 9.3.5.12, A.9.3.5.12.1 and E.7 of the proposed 2016 edition of NFPA 13, <em>Standard for the Installation of Sprinkler Systems</em>, (TIA No. 1180). See Related Item 15-8-2</td>
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<tr>
<td><strong>15-8-15-a</strong></td>
<td>Text of proposed TIA No. 1180. See Attachment 15-8-15-a</td>
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<tr>
<td><strong>15-8-15-b</strong></td>
<td>Ballot results of TIA No. 1180. <strong>PASSED</strong> TC ballot on both technical merit and emergency nature. <strong>PASSED</strong> the CC ballot on both correlation and emergency nature. See Attachment 15-8-15-b</td>
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<tr>
<td><strong>15-8-15-c</strong></td>
<td>No comments were received. No Attachment</td>
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<td><strong>15-8-16</strong></td>
<td>Act on the issuance of proposed Tentative Interim Amendment (TIA) to sections 5.6.3.3, Figure 5.6.3.4.2, Figure 5.6.3.3.2(new), 5.6.3.4, 5.6.4, A.5.6 and Table A.5.6.1.1 of the proposed 2016 edition of NFPA 13, <em>Standard for the Installation of Sprinkler Systems</em>, (TIA No. 1183). See Related Item 15-8-2</td>
<td></td>
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<tr>
<td><strong>15-8-16-a</strong></td>
<td>Text of proposed TIA No. 1183. See Attachment 15-8-16-a</td>
<td></td>
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<tr>
<td><strong>15-8-16-b</strong></td>
<td>Ballot results of TIA No. 1183. <strong>PASSED</strong> TC ballot on both technical merit and emergency nature. <strong>PASSED</strong> the CC ballot on both correlation and emergency nature. See Attachment 15-8-16-b</td>
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<tr>
<td><strong>15-8-16-c</strong></td>
<td>No comments were received. No Attachment</td>
<td></td>
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<tr>
<td><strong>15-8-17</strong></td>
<td>Act on the issuance of proposed Tentative Interim Amendment (TIA) to Tables A.5.6.3, A.5.6.4 and A.5.6.4.1 of the proposed 2016 edition of NFPA</td>
<td></td>
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</tbody>
</table>

15-8-17-a Text of proposed TIA No. 1184. See Attachment 15-8-17-a

15-8-17-b Ballot results of TIA No. 1184. **PASSED** TC ballot on both technical merit and emergency nature. **PASSED** the CC ballot on both correlation and emergency nature. See Attachment 15-8-17-b

15-8-17-c No comments were received. No Attachment

15-8-18 Act on the issuance of proposed Tentative Interim Amendment (TIA) to Table 9.2.6.3.1, A.9.2.6.3.1 and Table 9.2.6.5.3 of the proposed 2016 edition of NFPA 13, *Standard for the Installation of Sprinkler Systems*, (TIA No. 1185). See Related Item 15-8-2

15-8-18-a Text of proposed TIA No. 1185. See Attachment 15-8-18-a

15-8-18-b Ballot results of TIA No. 1185. **PASSED** TC ballot on both technical merit and emergency nature. **PASSED** the CC ballot on both correlation and emergency nature. See Attachment 15-8-18-b

15-8-18-c No comments were received. No Attachment


15-8-19-a Text of proposed TIA No. 1179. See Attachment 15-8-19-a

15-8-19-b Ballot results of TIA No. 1179. **PASSED** TC ballot on both technical merit and emergency nature. See Attachment 15-8-19-b

15-8-19-c No comments were received. No Attachment

15-8-20 Act on the issuance of proposed Tentative Interim Amendment (TIA) to Various Sections of the proposed 2016 edition of NFPA 59A, *Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG)*, (TIA No. 1187).

15-8-20-a Text of proposed TIA No. 1187. See Attachment 15-8-20-a

15-8-20-b Ballot results of TIA No. 1187. **PASSED** TC ballot on both technical merit and emergency nature. See Attachment 15-8-20-b

15-8-20-c Twenty-nine comments were received. See Attachment 15-8-20-c

15-8-21 Act on the issuance of proposed Tentative Interim Amendment (TIA) to Various Sections on Battery of the 2013 edition of NFPA 72®, *National Fire Alarm and Signaling Code*, (TIA No. 1188). See Related Item 15-8-6

15-8-21-a Text of proposed TIA No. 1188. See Attachment 15-8-21-a

15-8-21-b Ballot results of TIA No. 1188. **FAILED** TC ballot (SIG-FUN, SIG-PRS and SIG-TMS) on both technical merit and emergency nature. **FAILED** the CC ballot on both correlation and emergency nature. See Attachment 15-8-21-b

15-8-21-c One comment was received. See Attachment 15-8-21-c

15-8-22 Act on the issuance of proposed Tentative Interim Amendment (TIA) to Various Sections on Battery of the proposed 2016 edition of NFPA 72®, *National Fire Alarm and Signaling Code*, (TIA No. 1189). See Related Item 15-8-6

15-8-22-a Text of proposed TIA No. 1189. See Attachment 15-8-22-a

August 7, 2015
Supplemental Agenda Standards Council Meeting August 17-19, 2015
Page 6 of 536
| 15-8-22-b | Ballot results of TIA No. 1189. **FAILED** TC ballot (SIG-FUN, SIG-PRS and SIG-TMS) on both technical merit and emergency nature. **FAILED** the CC ballot on both correlation and emergency nature. See Attachment 15-8-22-b |
| 15-8-22-c | One comment was received. See Attachment 15-8-22-c |
| **15-8-23** | Act on the issuance of proposed Tentative Interim Amendment (TIA) to Table 4.2.2 of the proposed 2016 edition of NFPA 111, *Standard on Electrical Energy Emergency and Standby Power Systems*, (TIA No. 1175). |
| 15-8-23-a | Text of proposed TIA No. 1175. See Attachment 15-8-23-a |
| 15-8-23-b | Ballot results of TIA No. 1175. **PASSED** TC ballot on both technical merit and emergency nature. **PASSED** the CC ballot on correlation but **FAILED** on emergency nature. See Attachment 15-8-23-b |
| 15-8-23-c | One comment was received. See Attachment 15-8-23-c |
| 15-8-23-d-1 | Comments received by D. Stymiest, Chair of the Technical Committee on Emergency Power Supplies and M. Johnston, Chair of the Correlating Committee on National Electrical Code on the appeal of S. Sappington. See 15-8-23-d-1 |
| **15-8-24** | Act on the issuance of proposed Tentative Interim Amendment (TIA) to Sections 3.3.X (New), 8.6 (New), and new Corresponding Annex material of proposed 2016 edition of NFPA 1221, *Standard for the Installation, Maintenance, and Use of Emergency Services Communication Systems*, (TIA No. 1171). |
| 15-8-24-a | Text of proposed TIA No. 1171. See Attachment 15-8-24-a |
| 15-8-24-b | Ballot results of TIA No. 1171. **PASSED** TC ballot on both technical merit and emergency nature. See Attachment 15-8-24-b |
| 15-8-24-c | One comment was received. See Attachment 15-8-24-c |
| 15-8-24-d | Response from Curt Floyd, Staff Liaison for Public Emergency Service Communication Committee to the Standards Council. See Attachment 15-8-24-d |
| **15-8-25** | Act on the issuance of proposed Tentative Interim Amendment (TIA) to Sections 2.3.6, 4.7.1, Figure 4.16.3.1, 7.6.5.1, 8.2.7, and 9.1.4 of proposed 2016 edition of NFPA 1917, *Standard for Automotive Ambulances*, (TIA No. 1170). **NOTE:** This TIA appeared in the April 2015 Agenda. Since the 2016 edition of the document had not been issued by the Council, the proposed TIA was not considered by the Council. Instead it is being placed on this Agenda for issuance concurrently with the 2016 edition of NFPA 1917. See Related 15-8-11 |
| 15-8-25-a | Text of proposed TIA No. 1170. See Attachment 15-8-25-a |
| 15-8-25-b | Ballot results of TIA No. 1170. **PASSED** TC ballot on both technical merit and emergency nature. See Attachment 15-8-25-b |
| 15-8-25-c | No comments were received. See Attachment 15-8-25-c |
| 15-8-26-a | Text of proposed TIA No. 1182. See Attachment 15-8-26-a |
| 15-8-26-b | Ballot results of TIA No. 1182. **PASSED** TC ballot on both technical merit and emergency nature. **PASSED** the CC ballot on both correlation and emergency nature. See Attachment 15-8-26-b |
| 15-8-26-c | Two comment were received. See Attachment 15-8-26-c |
| 15-8-27 | The Council reviewed the request of Richard Dyer, Kansas City, Missouri, that NFPA establish a new project to develop an NFPA Standard on fire control of structures based upon fire dynamics. After review of all the material before it, the Council voted to solicit public comments. The comment period has now ended and twenty-two comments were received. See Attachment 15-8-27 See Related Item 15-8-38-b |
| 15-8-28 | The Council reviewed the request of John Cudahy of the International Council of Air Shows that NFPA establish a new project on aircraft rescue and firefighting (ARFF) response to incidents/accidents at public air shows. After review of all the material before it, the Council voted to solicit public comments. The comment period has now ended and fifty comments were received. See Attachment 15-8-28 |
| 15-8-29 | The Council reviewed the request of Chris Powers of Transport Canada that NFPA establish a new project on competencies for responders to incidents of flammable liquids in transport-high hazard flammable trains (HHFT). After review of all the material before it, the Council voted to solicit public comments and from the Technical Committee on Hazardous Materials Response Personnel. The comment period has now ended and twenty-two comments were received. See Attachment 15-8-29  SA 15-8-29 |
| 15-8-29-a | Comment was received from G. Noll, Chair of the Technical Committee on Hazardous Materials Response Personnel. See Attachment 15-8-29-a |
| 15-8-30 | The Council reviewed the request of David Snyder, Jones and Bartlett Learning, that NFPA establish a new project on emergency medical services officer. After review of all the material before it, the Council voted to solicit public comments. The comment period has now ended and nineteen comments were received. See Attachment 15-8-30  SA 15-8-30 |
| 15-8-31 | The Council reviewed the request from NFPA staff to seek input from the stakeholders, members and affected parties as to the need for a separate NFPA Standard to address the various processes associated with hazardous waste disposal. After review of all the material before it, the Council voted to publish a notice to solicit public comments. The comment period has now ended and four comments were received. See Attachment 15-8-31 |
| 15-8-31-a | Presentation from M. Ehrlich, Board Member of U.S. Chemical Safety and Hazards Investigation Board, supporting the urgent need for a new standard addressing hazardous disposal activities, including fireworks disposal. No Attachment |
| 15-8-32 | Consider the request of B. Clifford of the Federal Bureau of Investigations that NFPA establish a new project on combination unit respirators that include one or more air-supplying and air-purifying types of respirators in one product. See Attachment 15-8-32 |
| 15-8-33 | Consider the request of the Correlating Committee on Signaling Systems for the Protection of Life and Property to relocate the material that is within the existing NFPA 720, Standard for the Installation of Carbon Monoxide (CO) Detection and Warning Equipment into various chapters of NFPA 72, National Fire Alarm and Signaling Code. The Correlating Committee is also requesting that NFPA 720 skip cycle from the Annual 2017 revision cycle to Annual 2019 revision cycle. This would be a change from a three-year revision cycle to five-year revision cycle. See Attachment 15-8-33  See Related 15-8-34 |
| 15-8-34 | Consider the request of the Correlating Committee on Signaling Systems for the Protection of Life and Property to revise the following scopes:  

**PROPOSED SCOPE: Technical Committee on Testing and Maintenance of Fire Alarm and Signaling Systems (SIG-TMS)**
This Committee shall have primary responsibility for documents and requirements for the inspection, testing, and maintenance of fire alarm and emergency communications signaling systems and associated components, for both new and existing systems. This Committee shall not have responsibility for inspection, testing, and maintenance of single- and multiple-station alarms and household alarm signaling systems.  

**PROPOSED SCOPE: Technical Committee on Single- and Multiple-Station Alarms and Household Fire Alarm Signaling Systems (SIG-HOU)**
This Committee shall have primary responsibility for documents on the performance, installation, operation, inspection, testing, maintenance, and use of single- and multiple-station alarms and household alarm signaling systems for fire warning.  

See Attachment 15-8-34  See Related 15-8-33 |
<p>| 15-8-35 | Presentation from Y. Chung, Chief Executive officer of OMNI LPS on Bipolar Conventional Air Terminals as a Lightning Protection System. See Attachment 15-8-35 |
| 15-8-36 | Consider approval of a scope for the new Technical Committee on Building Fire &amp; Life Safety Directors. See Attachment 15-8-36  See Replacement Committee Scope SA 15-8-36 |</p>
<table>
<thead>
<tr>
<th>15-8-38</th>
<th>Report of the Committee Membership Task Group (M. Snyder, Chair) No Attachment</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-8-38-a</td>
<td>Act on pending applications for Committee Members. SA 15-8-38-a</td>
</tr>
<tr>
<td>15-8-38-b</td>
<td>Roster for Technical Committee on Fire Control of Structures Based Upon Fire Dynamics SA 15-8-38-b</td>
</tr>
<tr>
<td>15-8-38-b-1</td>
<td>Clarification of Interest Classifications for Technical Committee on Fire Control of Structures Based Upon Fire Dynamics SA 15-8-38-b-1</td>
</tr>
<tr>
<td>15-8-38-c</td>
<td>Roster for Technical Committee on Building Fire &amp; Life Safety Directors. SA 15-8-38-c</td>
</tr>
<tr>
<td>15-8-38-d</td>
<td>Roster for Technical Committee on Tactical Operations for Video Equipment and Cameras. SA 15-8-38-d</td>
</tr>
<tr>
<td>15-8-38-e</td>
<td>Administratively Removed from the Agenda</td>
</tr>
<tr>
<td>15-8-38-f</td>
<td>Discuss vote limited committee members SA 15-8-38-f</td>
</tr>
<tr>
<td>15-8-38-g</td>
<td>Discuss international committee members. SA 15-8-38-g</td>
</tr>
<tr>
<td>15-8-38-h</td>
<td>Discuss interest classification for Chairs of Committees. SA 15-8-38-h</td>
</tr>
<tr>
<td>15-8-39</td>
<td>Consider the request of the NEC Technical Correlating Committee to approve revisions to the 2003 NEC© Manual of Style. See Attachment 11-8-39</td>
</tr>
<tr>
<td>15-8-40</td>
<td>Consider requests from NFPA Committees to change revision cycles for the following documents:</td>
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<tr>
<td>---------</td>
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</tr>
<tr>
<td>33</td>
<td>2011</td>
</tr>
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<td>40</td>
<td>2016</td>
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<tr>
<td>557</td>
<td>2016</td>
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<td>1852</td>
<td>2013</td>
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<td>1989</td>
<td>2013</td>
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<tr>
<td>2112</td>
<td>2012</td>
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<tr>
<td>See Attachment 15-8-40</td>
<td></td>
</tr>
<tr>
<td>15-8-41</td>
<td>Report of the Recording Secretary on the Minutes for the April 2015 meeting. No Attachment</td>
</tr>
<tr>
<td>15-8-42</td>
<td>The Council will review the dates and locations of upcoming Council Meetings, as follows:</td>
</tr>
<tr>
<td>December 8-9, 2015</td>
<td>Charleston, SC</td>
</tr>
<tr>
<td>April 5-6, 2016</td>
<td>San Juan, PR or Miami, FL</td>
</tr>
<tr>
<td>August 1-3, 2016 (REVISED)</td>
<td>Quincy, MA</td>
</tr>
<tr>
<td>December 6-7, 2016</td>
<td></td>
</tr>
<tr>
<td>15-8-43</td>
<td>Discuss NFPA Advisory Committees. No Attachment</td>
</tr>
<tr>
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</tbody>
</table>

LaJolla, CA or San Francisco, CA

No Attachment

August 7, 2015

Supplemental Agenda Standards Council Meeting August 17-19, 2015
Item 15-8-1
MEMORANDUM
(AMENDMENT)

TO: Technical Committee on Foam
FROM: Elena Carroll, Project Administrator
DATE: July 22, 2015

At the NFPA Technical Meeting (Tech Session), held June 24, 2015, NFPA 11 was amended by the acceptance of the following:

Amendment 11-15: Reject Second Revision No. 12, thereby recommending First Draft text.

The final results of balloting are as follows:

<table>
<thead>
<tr>
<th></th>
<th>Members Eligible to Vote</th>
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<tbody>
<tr>
<td>28</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Ballots not Returned (Hugill, Janz, Owen, Prather, Woycheese, Younis)</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Agree (Kasiski w/ comments)</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Disagree (Back)</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Abstentions (Ramsden)</td>
<td></td>
</tr>
</tbody>
</table>

According to 4.6 of the Regulations Governing the Development of NFPA Standards (Regs), the final results show the Amendment **HAS** achieved the 2/3 majority vote needed to recommend approval of the Association Action by the Technical Committee. The Committee has voted to support Amendment 11-15. As a result, the recommendation to the Standards Council will be to incorporate First Draft text in the NFPA Standard.

The number of votes needed to recommend approval of the Association Action is 14.

(28 eligible to vote - 7 not returned - 1 abstentions = 20 × 0.66 = 13.2)

Note: Please remember that the return of ballots is required in accordance with Section 3.1.3.1 of the Regulations Governing the Development of NFPA Standards.
Amendment 11-15: Reject Second Revision No. 12, thereby recommending First Draft text.

Instructions:
Vote Agree to support the Amendment and as a result recommend the First Draft text.
Vote Disagree to not support the Amendment and as a result recommend previous edition text. Note: where no previous edition text exists the text is simply deleted.

Agree  I support the Amendment and as a result recommend the First Draft text which reads as follows (changes shown legislatively to the Second Draft):

4.7.2.1 Foam solution pipe shall be made of one of the following materials:
(1) Galvanized steel
(2) Stainless steel
(3) Internal/external corrosion-resistant pipe in accordance with the foam manufacturer’s specification for compatibility and acceptable to the authority having jurisdiction
(4) Unprotected carbon steel pipe, when filled with foam solution or water and the discharge devices are closed to the atmosphere

Disagree* I do not support the Amendment and as a result recommend previous edition related text which reads as follows (text shown clean):

4.7.2.1* Galvanized pipe shall be used.
A 4.7.2.1 Corrosive atmospheres could require other coatings.

Abstain*

*Please give reasons for voting “Disagree” or “Abstain”:

Item (4) lacks drainage provisions to prevent corrosion from occurring in partially filled piping

______________________________

Signature: ____________________________

Name - Please Print: __Gerard G Back___

Date:  7/12/15

Please return as soon as possible, but no later than July 13, 2015 to:
NFP 111, Standard for Low-, Medium-, and High-Expansion Foam
June 2015 Amendment 11-15 Ballot Form
For the Technical Committee on Foam

Amendment 11-15: Reject Second Revision No. 12, thereby recommending First Draft text.

Instructions:
Vote Agree to support the Amendment and as a result recommend the First Draft text.
Vote Disagree to not support the Amendment and as a result recommend previous edition text. Note: where no previous edition text exists the text is simply deleted.

☐ Agree
I support the Amendment and as a result recommend the First Draft text which reads as follows (changes shown legislatively to the Second Draft):

4.7.2.1 Foam solution pipe shall be made of one of the following materials:
(1) Galvanized steel
(2) Stainless steel
(3) Internal/external corrosion-resistant pipe in accordance with the foam manufacturer’s specification for compatibility and acceptable to the authority having jurisdiction
(4) Unprotected carbon steel pipe, when pipe when filled with foam solution or water and the discharge devices are closed to the atmosphere

☐ Disagree*
I do not support the Amendment and as a result recommend previous edition related text which reads as follows (text shown clean):

4.7.2.1* Galvanized pipe shall be used.
A 4.7.2.1 Corrosive atmospheres could require other coatings.

☐ Abstain*

*Please give reasons for voting “Disagree” or “Abstain”:
I am not convinced that either wording is correct as both options are too restrictive. In some cases standard carbon steel pipe might be suitable.

__________________________________________________________________________

__________________________________________________________________________

Signature: [Signature]
Name - Please Print: NIALL RAMSDEN
Date: [10 July 2015]
Amendment 11-15: Reject Second Revision No. 12, thereby recommending First Draft text.

Instructions:

Vote Agree to support the Amendment and as a result recommend the First Draft text.

Vote Disagree to not support the Amendment and as a result recommend previous edition text. Note: where no previous edition text exists the text is simply deleted.

| Agree | I support the Amendment and as a result recommend the First Draft text which reads as follows (changes shown legislatively to the Second Draft):

4.7.2.1 Foam solution pipe shall be made of one of the following materials:
(1) Galvanized steel
(2) Stainless steel
(3) Internal/external corrosion-resistant pipe in accordance with the foam manufacturer’s specification for compatibility and acceptable to the authority having jurisdiction
(4) Unprotected carbon steel pipe when pipe when filled with foam solution or water and the discharge devices are closed to the atmosphere

| Disagree* | I do not support the Amendment and as a result recommend previous edition related text which reads as follows (text shown clean):

4.7.2.1* Galvanized pipe shall be used.
A 4.7.2.1 Corrosive atmospheres could require other coatings.

| Abstain* |

*Please give reasons for voting “Disagree” or “Abstain”:

Agree, with comment: I am in agreement with the Amendment in that the First Draft text for 4.7.2.1 provides more appropriate discharge piping options to limit corrosion for proper performance of the foam system than the 2010 edition of NFPA 11. I do not technically agree with the Amendment as corrosion has a higher probability to occur in black steel pipe when closed to the atmosphere without foam solution or water.

Signature: 

Name - Please Print: Robert Kasiski

Date: 10 July, 2015

Please return as soon as possible, but no later than July 13, 2015 to:
the motion and recommend text on screen two, touch no. Please record your vote. Five seconds. Balloting is closed. Thank you.

The results of the vote are 141 against the motion and recommend the text on screen two and 95 for the motion and recommend the text on screen one. The motion has failed.

Is there any further discussion on NFPA 520? Seeing none, we will move on to the next document. Thank you, Mr. Poole.

MR. POOLE: Thank you.

MS. MANLEY: Before we move on to the last document, I would like to remind everyone to remain in the room for an informal discussion regarding the process.

The last report under consideration this afternoon is that of the Technical Committee on Foam. Here to present the committee report is the Committee Chair Fay Purvis of Vector Fire Technology, Incorporated, Coatesville, Pennsylvania. The committee report, that is, the Second and Draft Reports, are located on the document information page for NFPA 11 on the NFPA website. The Certified Amending Motions are
contained in the NFPA Technical Meeting Tech Session Agenda and will be displayed behind me on the screen.

We will proceed in the order of the motion sequence number presented. Mr. Purvis?

MR. PURVIS: Madam Chair, ladies and gentlemen, the report of the Technical Committee on Foam is presented for adoption and can be found in the First Draft and in the Second Draft for the 2014 Fall Meeting Revision Cycle.

The Technical Committee has published a First and Second Draft Report consisting of revisions to NFPA 11 Standard for Low, Medium and High Expansion Foam. These reports were submitted to letter ballot of the responsible Technical Committee. The reports and the ballot results can be found on the next edition tab of the document information page for NFPA 11 at www.nfpa.org/11next.

The presiding officer will now proceed with the Certified Amending Motions.

MS. MANLEY: Thank you, Mr. Purvis. Motions 11-1 through 11-14 appeared on our agenda. However, no one has signed in to make the Certified Amending Motions. Therefore, in accordance with
NFPA Convention Rules at Section 2.7, these motions may not be considered by the assembly as Certified Amending Motions and are removed from the agenda.

We will now move on to the next motion.

Let's proceed with the discussion on Certified Amending Motion 11-15. There you are.

Microphone 5. Thank you.

MR. DeLUCA: Jim DeLuca of Spec Services. I recommend adoption of Motion 11-15.

MS. MANLEY: Thank you. There is a motion on the floor to reject Second Revision Number 12. Is there a second?

A VOICE: Second.

MS. MANLEY: We do have a second. Please proceed with the discussion on the motion.

MR. DeLUCA: I originally submitted a change to NFPA 11 to allow more use of carbon steel piping. Thousands of petroleum tank systems are constructed with welded carbon steel pipe. Metallurgists see no reason to use galvanized piping. Galvanized piping is not readily available in the sizes needed for petroleum storage tank systems.

This forces me as the fire protection engineer to submit a justification every time I
submit a plan check package for permitting. These requests have always been approved, but they are necessary if the Code reflected proper materials.

Although the wording in the first revision is not ideal, the change made to the second provision to require carbon steel piping to be filled with foam solution or water is not practical. In order to do this, vent connections would need to be added at the base of the foam chambers which are typically over 40 feet in the air. The line would then need to be filled and vented at the base of each foam chamber.

There is no technical basis for this requirement to be made for carbon steel pipe and not for galvanized. Multiple papers have been published indicating that galvanized piping corrodes faster than black steel pipe under actual operating conditions. In fact, the presentation made earlier today at this conference indicated that galvanized pipe fails three to four times faster than carbon steel pipe under identical conditions.

One committee member commented on the second revision ballot that "carbon steel pipes
should be added without any restrictions." It should be noted that this committee member is also in the petroleum industry and his company has thousands of storage tanks around the world and the foam systems are fabricated out of welded carbon steel pipe, not galvanized.

NFPA 13 has recognized problems with galvanized pipe and has lowered C factors to move the requirements for its use. The Department of Defense and their unified facilities criteria, fire protection engineering facilities states galvanized piping is not permitted to be used in dry pipe, pre-action or wet pipe sprinkler systems.

There's no reason not to use carbon steel pipe in these systems, and there's no reason for these additional requirements on its use.

MS. MANLEY: Mr. Purvis, would you like to offer the Committee's position?

MR. PURVIS: Yes. I didn't make formal notes on this, but I can tell you that our committee formed up a task force group and spent a lot of time looking at this issue and concluded that galvanized pipe was indeed necessary. We looked at many, many field installation situations where they
were tested after installation, and these foam systems have typically small outlets, orifices at the inlet of foam-making devices, and those orifices can become clogged due to corrosion that takes place in the pipe.

These systems typically contain considerable pipe from the proportioning station out to the foam-making devices; and, as a result when they operate, all of that corrosion and particles can be lodged in the foam-making orifices. Many, many examples were shown to the committee, and the task force made a recommendation for the changes that are in the second draft based on experience in the field that has shown that we need to have improved corrosion characteristics on the piping, hence, the reason for the galvanized pipe recommendation.

The current motion really just addresses closed outlets, and the intent was -- and most of these systems that are used on storage tank protection are open to atmosphere. There are no closures. They're not like a wet closed head sprinkler system or even a dry sprinkler system where the outlets are closed. So as a result, in
many areas where you can get atmospheric conditions which produce corrosion, that's going to take place and has been seen in the past and I think will continue to be unless there's some improvements made in the piping to alleviate the corrosion.

The committee would recommend that you reject this motion.

MS. MANLEY: Thank you, Mr. Purvis. With that, we will open up debate on the motion. Please provide your name, your affiliation, and whether you are speaking in support of or against the motion. Microphone 4, please.

MR. AARON: Thank you. My name is Michael Aaron. I work with Jensen Hughes. I am the secretary of the Committee on Aircraft Facilities which writes NFPA 409.

MS. MANLEY: One second. I want to clarify that you are speaking for the motion, sir.

MR. AARON: Thank you. I'm speaking in favor of the motion.

MS. MANLEY: Thank you.

MR. AARON: The use of galvanized pipe for foam water solution is not restricted to fuel tanks. It is also a common occurrence in NFPA 409 aircraft...
hangar systems. And in these systems, we feel that for the foam water pipe leading to discharge devices that black steel is a preferable material actually from a corrosion point of view and an insulation point of view than galvanized steel.

In general, the members of the NFPA 409 Committee in the simple majority disagree with the NFPA 11 Committee on this point; and, in fact, further changes to NFPA 409 take exception to the NFPA 11 requirements in this matter.

So I would just recommend that although this language as I said before is not ideal, I would prefer that black steel be permitted for piping whether it is of deluge open style or closed head style to be permitted for the foam water solution, but this would be an improvement over the current situation. Thank you.

MS. MANLEY: Is there any further discussion on Motion 11-15 to reject Second Revision Number 12?

Seeing none, Mr. Chair, do you have any final comments?

MR. PURVIS: With regard to NFPA 409, although it wasn't the intent of 11 to address that, I can say from personal experience that high expansion
foam systems do have open outlets. They are deluge type systems. We find many times after going back and testing those systems at the five-year interval that there is severe clogging to the point where these systems would not operate due to corrosion getting clogged in strainers at the inlet of the high expansion generators and in the water motor part of them.

So I don’t accept that, for NFPA 409 ignoring the corrosion issues and going with carbon steel pipe is a good idea. Again, I would stress rejecting this motion.

MS. MANLEY: Thank you, Mr. Chair. Before we vote, let me restate the motion. The motion on the floor is to reject Second Revision Number 12. To vote, please touch the vote button. If you wish to vote in favor of the motion and recommend the text on screen one, touch yes. If you wish to vote against the motion and recommend the text on screen two, touch no. Please record your vote. The balloting will be closed in five seconds. The balloting is closed. Thank you.

The results of the vote are 113 for the motion recommending the text on the screen one, and
96 against the motion and recommending the text on screen two. The motion has passed.

Is there any further discussion on NFPA 11? Thank you, Mr. Purvis.

This officially concludes this portion of the 2015 Association Technical Meeting. I want to thank you for your participation, interest, and support. I now declare this part of the meeting officially closed and would like to introduce Dawn Michelle Bellis, the Secretary of this Standards Council.

MS. BELLIS: Thank you, Bonnie. Well, it looks like we just got started and we’re already concluding today.

First, I would like to thank you for your participation in NFPA Standards Development Process. Taking time from all that you do to bring your experience and expertise to NFPA illustrates your tremendous dedication and commitment to improving safety that affects lives of everyone every day.

As you know, this is our second annual Tech Session with the new process, and with the change in process, reform has brought many changes
as well, most of them obvious: Clarity of the document text, screens which show the motions on the floor, text should the motion pass, text should the motion fail right there before you; and, of course, our electronic voting devices with live results of your votes.

Another obvious development we see today is the decreased time spent in our Technical Meetings debating motions on NFPA Standards. It could partly be attributable to the new process and the transparency afforded at each level of the Standards Development Process. Public input, complete first drafts, public comments, and complete second draft reports are all visible 24/7 to anyone who wants to see those and follow the documents through the entire process.

Despite the decreased number of the NITMAMs filed, NFPA is actually seeing an increase, happily so, and participation by new participants which is encouraging and exciting. This year there were a number of NITMAMs that were filed by participants who had never been involved in our process before.

To continue to serve our membership and
make improvements, we would like to hear what you have to say about the Tech Session. We would like for you to take this opportunity to give us your thoughts and your feedback. We have six microphones that are ready and waiting to hear from you. We would like to hear things like what changes we could or should make to make this Tech Session better for you, our members. What did you like? What didn't work so well? What did work well? And what improvements would you like to see? Were your devices easy to use? Were they helpful in confirming your votes that you could see your votes today right before you after those votes closed?

So, with that, please take the opportunity to step to the microphones and give us your feedback. You're all going to be that bashful on me today? Really? Really? Microphone 3.

PARTICIPANT: I just wanted to compliment NFPA on a few things that I really appreciate. I don't think last year, unless I'm mistaken, there was green for pass and red for fail, the headers at the top of the screens, I really liked that. I think that's simple, but it really makes it easy to
follow. The iPads and the ease of choosing yes or no and then getting to see what your result was immediately. And also I like the digital agenda as opposed to the stacks of paperwork that we had in the past.

So all of those things are making it much more easy to participate and much more enjoyable to participate in.

MS. BELLIS: Thank you. Microphone 1.

PARTICIPANT: I'm not for or against the motion. I'll do that tomorrow. The one thing since, you are now giving us iPads, it would be nice to have the ability to access the agenda as opposed to having to flip through the paperwork. Since I've got some iPads myself, I know that they have the capability of doing that is to maybe make the iPad a little more purposeful rather than the static page just to cast the votes.

MS. BELLIS: Thank you very much.

Microphone 5.

PARTICIPANT: As one of the makers of a NITMAM I found the instructions very confusing, and it would be nice to get those clarified, put them in plain English so that we can understand how to do
it better.

And the other thing was that there was really no instructions as to how to prepare for the session, and it would be nice to have some, you know, this is -- we should have these items for this line of presentation and this is some idea of what you need to do.

I mean, I contacted NFPA and found out what was going on, but it would be nice just to have something that you send out to everybody to describe that.


PARTICIPANT: It's a small thing, but while we're discussing the iPads, if the red and green coating of the text on the screen did not run opposite of the red and green background on the yes and no on the iPads, it would create a little less dissonance.

PARTICIPANT: Or is that a test?


PARTICIPANT: I just want to say I thought it was great. Very easy to do. Very visual. It made
sense to everybody.

The other thing as far as being prepared with NITMAMS and what you're looking at, I think at the standards forum which totally could have been better advertised, I had a hard time even finding it, but the information you guys presented this year in our standards forum was fantastic and could have gone a long way with this.

Ms. BELLIS: Thank you. Microphone 5.

MR. HAGUE: Thank you, Dawn. David Hague of Liberty Mutual Insurance. I would like to go to 5 o'clock and finish early tomorrow. Just a suggestion. (Applause.)

Ms. BELLIS: I appreciate that comment. I will say we're looking at the issue very closely. We understand that today's short agenda may be an anomaly. It may be indicative of a trend that continues. We are looking at that very closely, and we appreciate your patience and understanding as we work through that. We're looking at -- and that's what we would really like to have your feedback on as well. What would work better for you? Would you rather us starting it to be one full day and we just go until we go? Perhaps
filling it up into two half days so we know on the
agenda that it's two half days? We're working
through that. So we appreciate your patience and
your feedback on that issue. Microphone 1.

PARTICIPANT: Dawn, Hi. I would like to echo
Dr. Clary's comments. I'm not really accustomed to
using a tablet because I use DOS.

MS. BELLIS: I use paper and pen.

PARTICIPANT: I just graduated from paper and
pen to DOS. But I think that having a lot of
references to the documents having a reference to
see the agenda for the whole text, it would be nice
if it was all pre-loaded on the tablet. So having
everything that you need to review for a vote there
would be a really good idea.


PARTICIPANT: I'm along with Art. I actually
had a slide rule. But, seriously, I used the
electronic a lot this week, and there's one little
tweak that I would suggest, and I had to use paper
to do it, just to see what's happening on the same
time period, what all the classes were on the same
time period. If that was on the electronic, it
would be much more helpful.
MS. BELLIS: Thank you. Microphone 5.

MR. DRAKE: Thank you, Dawn. Mark Drake with Liberty Mutual. I appreciate the information and visual presentation that is provided. It made it a lot easier in voting and seeing the exact text of what I was going to be voting for.

MS. BELLIS: Thank you. Microphone 1.

MR. REISWIG: A taller microphone would be nice first.

MS. BELLIS: Okay. Taller microphone.

MR. REISWIG: Rodger Reiswig with Tyco Fire Protection Products. I don't know if this is the right venue or if this is what you're looking for or not, but I'm hearing that some of the documents that are coming out that we're working on now are not going to have the changes visible for us. We won't have the bar to show us that something has changed or the doc to let us know that something was deleted and the like and that we need to buy a different version of the handbook to give us that. And I think that's a mistake. I think a lot of people are used to seeing that and need to see that in the regular version of the documents. I would urge NFPA not to go forward with that move.
(Applause.)

MRS. BELLIS: Thank you. Thank you for that comment. Microphone 3.

PARTICIPANT: I wanted to also suggest, too, for the sound folks, if they could be alert to amp up the sound especially in cases where with Mr. Reiswig, he's very tall and the microphone is down here, amp up the sound because it's tough to hear. And also when those who are presenting the motion are holding a lap top or a piece of paper and they're looking this way, away from the microphone rather than into the microphone, if they get in such a way that they're talking into the microphone or the Chair could remind them to do that, that way we can hear and get the benefit of what they're saying.

MRS. BELLIS: Thank you so much. Microphone 3.

PARTICIPANT: The iPad is great. However, one thing you may want to consider is once the vote has been taken, that disappears off your screen instead of showing how you voted.

MRS. BELLIS: Thank you. All great. All great feedback for us. Anyone else? Microphone 3.

MR. LACKORE: Roger Lackore with Oshkosh
Corporation. I'm sorry, I'm going to take the opportunity to also ask one other thing related to the Standards Development Process which is -- the new system I think is awesome, all of the electronics that we have, but as committee members who do a lot of work with the documents, if we could have some way to get a Word copy of the draft that we're working on rather than having to look at it online and retype things.

MS. BELLIS: Thank you. Does anyone else have any comments? All right.

I want to again thank you all very much for your participation today and especially for your comments and feedback so we help make this session more successful for both you and for NFPA.

If you have any comments, when you get away from here and think, you know what, I wish I had told them that, please e-mail me. My e-mail address is dbellis@nfpa.org, and I look forward to reading those comments. Thank you.

(Off the record at 3:12 p.m.)

(Which were all the proceedings had in the above cause this date and time.)
STATE OF ILLINOIS

 ) SS:

COUNTY OF W I L L )

ANNA M. MORALES, as an Officer of the Court, says that she is a shorthand reporter doing business in the State of Illinois; that she reported in shorthand the proceedings of said meeting, and that the foregoing is a true and correct transcript of her shorthand notes so taken as aforesaid, and contains the proceedings given at said meeting.

IN TESTIMONY WHEREOF: I have hereunto set my verified digital signature this 2nd day of July, 2015.

Anna M. Morales
Illinois Certified Shorthand Reporter
Item 15-8-2
MEMORANDUM
(AMENDMENT)

TO: Technical Committee on Hanging and Bracing of Water-Based Fire Protection Systems
FROM: Elena Carroll, Project Administrator
DATE: July 22, 2015

At the NFPA Technical Meeting (Tech Session), held June 25, 2015, NFPA 13 was amended by the acceptance of the following:

Amendment 13-4: Accept Public Comments Nos. 244 and 288, thereby deleting new sections 9.1.1.6.3 and A.9.1.1.6.3.

The final results of balloting are as follows:

32 Members Eligible to Vote
9 Ballots not Returned (Caputo, Forsythe, Gillengerten, Laguna, Mowrer, Nieraeth, Rothmier, Sanchez, Von Gnatsensky)
17 Agree (Hebenstreit w/ comments)
6 Disagree (Bachman, Deutsch, Kirschner, Tauby, Thompson, Wagoner)
0 Abstentions

According to 4.6 of the Regulations Governing the Development of NFPA Standards (Regs), the final results show the Amendment HAS achieved the 2/3 majority vote needed to recommend approval of the Association Action by the Technical Committee. The Committee has voted to support Amendment 13-4. As a result, the recommendation to the Standards Council will be to delete new sections 9.1.1.6.3 and A.9.1.1.6.3.

The number of votes needed to recommend approval of the Association Action is 16.

(32 eligible to vote - 9 not returned - 0 abstentions = 23 × 0.66 = 15.18)

Note: Please remember that the return of ballots is required in accordance with Section 3.1.3.1 of the Regulations Governing the Development of NFPA Standards.
Amendment 13-4: Accept Public Comments Nos. 244 and 288, thereby deleting new sections 9.1.1.6.3 and A.9.1.1.6.3.

Instructions:

**Vote Agree** to support the Amendment and as a result recommend the Public Comment text.

**Vote Disagree** to not support the Amendment and as a result recommend previous edition text. Note: where no previous edition text exists the text is simply deleted.

---

**Agree**

I support the Amendment and as a result recommend the Public Comment text which reads as follows (changes shown legislatively to the Second Draft):

The proposed new text (9.1.1.6.3 and A.9.1.1.6.3) is not recommended for inclusion in the 2016 edition of NFPA 13.

---

**Disagree**

I do not support the Amendment and as a result recommend previous edition text which reads as follows (text shown clean):

9.1.1.6.3* Ferrous hanger rods shall be fabricated from steel that meets the requirements of ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60 000 psi tensile strength, Grade A or B, or the material, strength and fit requirements of other equivalent standards.

A.9.1.1.6.3 Other standards equivalent to ASTM A307 grades A or B include SAE J429 Grades 1 or 2. Both fasteners are fabricated from low or medium carbon steel, and requirements have a minimum tensile strength of 60 ksi.

---

**Abstain**

*Please give reasons for voting “Disagree” or “Abstain”:

The currently adopted wording in NFPA 13 is fine in my opinion. We do need to specify the material properties for hanger rods and the word “ferrous” is not sufficient. I am not in agreement with the arguments provided in the Technical Committee Transcript in support of this change and the fears associated with obtaining documentation or cheating. I am of the opinion that sprinkler contractors are professionals and will utilize quality materials that satisfy these material properties.

Signature: ____________________________

Name - Please Print: Robert Bachman - Alternate for Flexhead

Date: 7/10/2015
Amendment 13-4: Accept Public Comments Nos. 244 and 288, thereby deleting new sections 9.1.1.6.3 and A.9.1.1.6.3.

Instructions:
Vote Agree to support the Amendment and as a result recommend the Public Comment text.
Vote Disagree to not support the Amendment and as a result recommend previous edition text. Note: where no previous edition text exists the text is simply deleted.

☐ Agree

I support the Amendment and as a result recommend the Public Comment text which reads as follows (changes shown legislatively to the Second Draft):

The proposed new text (9.1.1.6.3 and A.9.1.1.6.3) is not recommended for inclusion in the 2016 edition of NFPA 13.

☒ Disagree*

I do not support the Amendment and as a result recommend previous edition text which reads as follows (text shown clean):

9.1.1.6.3* Ferrous hanger rods shall be fabricated from steel that meets the requirements of ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60 000 psi tensile strength, Grade A or B, or the material, strength and fit requirements of other equivalent standards.

A.9.1.1.6.3 Other standards equivalent to ASTM A307 grades A or B include SAE J429 Grades 1 or 2. Both fasteners are fabricated from low or medium carbon steel, and requirements have a minimum tensile strength of 60 ksi.

☐ Abstain*

*Please give reasons for voting “Disagree” or “Abstain”:

SEE ATTACHED

Signature: [Signature]

Name - Please Print: JOHN DEUTSCH

Date: 7-6-15

Please return as soon as possible, but no later than July 13, 2015 to:

Elena Carroll, Administrator, Technical Projects National Fire Protection Association
1 Batterymarch Park, Quincy, MA 02169 Email: ecarroll@nfpa.org Fax: 617-984-7110

August 7, 2015 Supplemental Agenda Standards Council Meeting August 17-19, 2015
If the standard reverts to the previous language it will say

“9.1.1.6.1 Unless permitted by 9.1.1.6.2 or 9.1.1.6.3, hangers and their components shall be ferrous.”

By definition something is considered to “ferrous” if it contains iron. This means that any grade or strength of steel is a ferrous material. Another common ferrous material is Cast Iron which is strong but brittle and has a high compressive strength.

The hangers with rods less than 6” the ferrous rod component is frequently used to in lieu of sway bracing. The hanger is expected to resist the lateral seismic forces. It seems to me that a ferrous cast iron hanger rods would be standard compliant but may not be an appropriate material for this application.

The previous language does not even require the components to be a ferrous metal. In theory if plastic or any other material were mixed with a tiny bit of iron shavings it would be “ferrous” and therefore the requirements for nonferrous components would not apply. Because the word metal or any minimum strength is not included in the old language any material which contains any amount of iron would meet the requirements of ferrous.
Supplemental Agenda Standards Council Meeting August 17-19, 2015

Amendment 13-4: Accept Public Comments Nos. 244 and 288, thereby deleting new sections 9.1.1.6.3 and A.9.1.1.6.3.

Instructions:

Vote Agree to support the Amendment and as a result recommend the Public Comment text.

Vote Disagree to not support the Amendment and as a result recommend previous edition text. Note: where no previous edition text exists the text is simply deleted.

☐ Agree

I support the Amendment and as a result recommend the Public Comment text which reads as follows (changes shown legislatively to the Second Draft):

The proposed new text (9.1.1.6.3 and A.9.1.1.6.3) is not recommended for inclusion in the 2016 edition of NFPA 13.

☒ Disagree*

I do not support the Amendment and as a result recommend previous edition text which reads as follows (text shown clean):

9.1.1.6.3* Ferrous hanger rods shall be fabricated from steel that meets the requirements of ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60 000 psi tensile strength, Grade A or B, or the material, strength and fit requirements of other equivalent standards.

A.9.1.1.6.3 Other standards equivalent to ASTM A307 grades A or B include SAE J429 Grades 1 or 2. Both fasteners are fabricated from low or medium carbon steel, and requirements have a minimum tensile strength of 60 ksi.

☐ Abstain*

*Please give reasons for voting “Disagree” or “Abstain”: WE NEED A Q.C. STATEMENT FOR ATR WHICH CAN BE PART OF THE P.O. NUMBER TO THE FABRICATION DISTRIBUTOR – DIFFICULT OR INCONVENIENT IS NOT A CONVINCING MIND SET.

Signature: [Signature]

Name - Please Print: [Signature]

Date: [Date]

Please return as soon as possible, but no later than July 13, 2015 to:

Elena Carroll, Administrator, Technical Projects National Fire Protection Association
1 Batterymarch Park, Quincy, MA 02169 Email: ecarroll@nfpa.org Fax: 617-984-7110

August 7, 2015 Supplemental Agenda Standards Council Meeting August 17-19, 2015 Page 49 of 536
Amendment 13-4: Accept Public Comments Nos. 244 and 288, thereby deleting new sections 9.1.1.6.3 and A.9.1.1.6.3.

Instructions:

Vote Agree to support the Amendment and as a result recommend the Public Comment text.

Vote Disagree to not support the Amendment and as a result recommend previous edition text. Note: where no previous edition text exists the text is simply deleted.

[ ] Agree

I support the Amendment and as a result recommend the Public Comment text which reads as follows (changes shown legislatively to the Second Draft):

The proposed new text (9.1.1.6.3 and A.9.1.1.6.3) is not recommended for inclusion in the 2016 edition of NFPA 13.

[ ] Disagree*

I do not support the Amendment and as a result recommend previous edition text which reads as follows (text shown clean):

9.1.1.6.3* Ferrous hanger rods shall be fabricated from steel that meets the requirements of ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60 000 psi tensile strength, Grade A or B, or the material, strength and fit requirements of other equivalent standards.

A.9.1.1.6.3 Other standards equivalent to ASTM A307 grades A or B include SAE J429 Grades 1 or 2. Both fasteners are fabricated from low or medium carbon steel, and requirements have a minimum tensile strength of 60 ksi.

[ ] Abstain*

*Please give reasons for voting “Disagree” or “Abstain”: the building code requires that threaded rod be according to MSS-58, see section 13.6.5.1 of ASCE-7-10. MSS 58 Table 2 calls out for the minimum strength of threaded rod to be 50Ksi.

Signature: ____________________________________________

Name - Please Print: James R. Tauby

Date: 7-6-15

Please return as soon as possible, but no later than July 13, 2015 to:

Elena Carroll, Administrator, Technical Projects  National Fire Protection Association
1 Batterymarch Park, Quincy, MA 02169  Email: ecarroll@nfpa.org  Fax: 617-984-7110
NFPA 13, Standard for the Installation of Sprinkler Systems
June 2015 Amendment 13-4 Ballot Form
For the Technical Committee on Hanging and Bracing of Water-Based Fire Protection Systems

Amendment 13-4: Accept Public Comments Nos. 244 and 288, thereby deleting new sections 9.1.1.6.3 and A.9.1.1.6.3.

Instructions:
Vote Agree to support the Amendment and as a result recommend the Public Comment text.
Vote Disagree to not support the Amendment and as a result recommend previous edition text. Note: where no previous edition text exists the text is simply deleted.

☐ Agree

I support the Amendment and as a result recommend the Public Comment text which reads as follows (changes shown legislatively to the Second Draft):

The proposed new text (9.1.1.6.3 and A.9.1.1.6.3) is not recommended for inclusion in the 2016 edition of NFPA 13.

☒ Disagree*

I do not support the Amendment and as a result recommend previous edition text which reads as follows (text shown clean):

9.1.1.6.3* Ferrous hanger rods shall be fabricated from steel that meets the requirements of ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60 000 psi tensile strength, Grade A or B, or the material, strength and fit requirements of other equivalent standards.

A.9.1.1.6.3 Other standards equivalent to ASTM A307 grades A or B include SAE J429 Grades 1 or 2. Both fasteners are fabricated from low or medium carbon steel, and requirements have a minimum tensile strength of 60 ksi.

☐ Abstain*

*Please give reasons for voting “Disagree” or “Abstain”:

A minimum standard is needed beyond simply “ferrous” and the adopted language provides criteria that can be cited when ordering materials. Manufacturers can provide documentation as needed verifying that the provided materials meet the criteria and the issue of marking of the rods is not a major concern.

____________________________
Signature:  

Name - Please Print:  Glenn E Thompson

Date:  7/14/2015

Please return as soon as possible, but no later than July 13, 2015 to:

Please return as soon as possible, but no later than July 13, 2015 to:
Amendment 13-4: Accept Public Comments Nos. 244 and 288, thereby deleting new sections 9.1.1.6.3 and A.9.1.1.6.3.

Instructions:

**Vote Agree** to support the Amendment and as a result recommend the Public Comment text.

**Vote Disagree** to not support the Amendment and as a result recommend previous edition text. Note: where no previous edition text exists the text is simply deleted.

☐ **Agree**

I support the Amendment and as a result recommend the Public Comment text which reads as follows *(changes shown legislatively to the Second Draft)*:

The proposed new text (9.1.1.6.3 and A.9.1.1.6.3) is not recommended for inclusion in the 2016 edition of NFPA 13.

☐ **Disagree**

I do not support the Amendment and as a result recommend previous edition text which reads as follows *(text shown clean)*:

9.1.1.6.3* Ferrous hanger rods shall be fabricated from steel that meets the requirements of ASTM A307, *Standard Specification for Carbon Steel Bolts and Studs*, 60 000 psi tensile strength, Grade A or B, or the material, strength and fit requirements of other equivalent standards.

A.9.1.1.6.3 Other standards equivalent to ASTM A307 grades A or B include SAE J429 Grades 1 or 2. Both fasteners are fabricated from low or medium carbon steel, and requirements have a minimum tensile strength of 60 ksi.

☐ **Abstain**

*Please give reasons for voting “Disagree” or “Abstain”:

I believe the AUT-HBS committee was correct in its decision to keep the text in place. Any documentation of the raw materials conforming to the applicable standards can easily be provided by the manufacturer, and the issue of “marking” the rods is no reason to remove this text.

Signature: ________________

Name - Please Print: Kenneth W. Wagoner

Date: July 7, 2015

Please return as soon as possible, but no later than July 13, 2015 to:

Elena Carroll, Administrator, Technical Projects National Fire Protection Association
1 Batterymarch Park, Quincy, MA 02169  Email: ecarroll@nfpa.org  Fax: 617-984-7110
Amendment 13-4: Accept Public Comments Nos. 244 and 288, thereby deleting new sections 9.1.1.6.3 and A.9.1.1.6.3.

Instructions:

Vote Agree to support the Amendment and as a result recommend the Public Comment text.

Vote Disagree to not support the Amendment and as a result recommend previous edition text. Note: where no previous edition text exists the text is simply deleted.

XX Agree

I support the Amendment and as a result recommend the Public Comment text which reads as follows (changes shown legislatively to the Second Draft):

The proposed new text (9.1.1.6.3 and A.9.1.1.6.3) is not recommended for inclusion in the 2016 edition of NFPA 13.

Disagree*

I do not support the Amendment and as a result recommend previous edition text which reads as follows (text shown clean):

9.1.1.6.3* Ferrous hanger rods shall be fabricated from steel that meets the requirements of ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60 000 psi tensile strength, Grade A or B, or the material, strength and fit requirements of other equivalent standards.

A.9.1.1.6.3 Other standards equivalent to ASTM A307 grades A or B include SAE J429 Grades 1 or 2. Both fasteners are fabricated from low or medium carbon steel, and requirements have a minimum tensile strength of 60 ksi.

Correction:

Technical Committee on Hanging and Bracing of Water-Based Fire Protection Systems:

Please note the text on the ballot form for Disagree should not have been shown as it is new text, per FR-5. The form should read as follows:

Disagree* I do not support the Amendment and as a result recommend previous edition text, if any. In this case, there is no previous edition text.

Abstain*

*Please give reasons for voting “Disagree” or “Abstain”:

Comment – based on the subsequent email correction on this ballot dated 7/9/2015 – in both cases with voting agree or disagree it appears that the action would be to go back to previous edition text.
Signature: __ __________________________________________

Name - Please Print: Jeff Hebenstreit

Date: 07/10/2015

Please return as soon as possible, but no later than July 13, 2015 to:

Elena Carroll, Administrator, Technical Projects  National Fire Protection Association
1 Batterymarch Park, Quincy, MA 02169  Email: ecarroll@nfpa.org  Fax: 617-984-7110
accordance with NFPA Rules, Convention Rules at Section 2.7, the motion may not be considered by the assembly and is removed from the agenda.

We will now move to the next item. We will now proceed with the discussion on Certified Amending Motion 13-4. Microphone 4, please.

MS. VALENTINE: My name is Victoria Valentine with the National Fire Sprinkler Association. I move to accept Public Comment Number 244.

VOICES: Second.

MR. SNYDER: Thank you. There is a group amending motion on the floor to accept Public Comment 244, and we have had several seconds. Please proceed with your discussion.

MS. VALENTINE: This comment will delete the new requirement for hanger rods to be -- to meet ASTM A307, their specifications for grade A and grade B 60,000 psi tensile strength. Quality components are important for the system in long-term performance of all of our sprinkler system, however, the requirement for hanger rods to comply with ASTM A307 will be an act of paperwork and a burden on enforcement by the AHJs. Material specs are common throughout NFPA 13, but
rods have been part of the hanger components since the beginning and they have performed well. Unlike other materials such as piping, there is no practical way to mark the rods, especially ATRs, to know that the installed product actually complies with the standard and matches the paperwork that the AHJ has approved.

The committee was split on the subject as common materials used were not intended to be eliminated by adding the requirement, yet confirming compliance could prove more than difficult for both the contractor and the AHJ.

I encourage you all to support the motion and accept Public Comment 244.

MR. SNYDER: Thank you. Mr. Linder, do you have the committee's comments?

MR. LINDER: I'll defer to the technical chair for the Hanging and Bracing Committee, Jim Biggins.

MR. BIGGINS: I'm Jim Biggins with Global Risk Consultants and Chair of the Technical Committee on Hanging and Bracing.

This section went into the document in the first draft stage along with other requirements for hangers. It was put in because there was no real
requirements for hanger rods with the exception that they be ferrous. It passed the first draft. In the second draft, there were two committee -- there were two comments submitted to remove the section. It was debated. It was -- one of the considerations was that enforcing it would be difficult; but after much discussion, the two comments to remove it were rejected and, as was noted, there were close votes. However, the majority felt that the ability to look at purchase orders and other documentation to verify the material was adequate and left the requirements in.

Mr. Snyder: Thank you. With that, we will open up debate on the motion. Again to please assist with the record, I ask that you state your name and affiliation and whether you are speaking in support of or against the motion. Microphone 4, please.

Mr. Higgins: Thank you, sir. My name is Roland Higgins with American Fire Sprinkler Association speaking in support of the motion.

This is another thing that seems like a good idea, and we all have -- many of us are on many technical committees. We have the propensity
to add and add and add; but, you know, as stated
earlier on one of the issues, we're not having
failures of these. So there's no demonstrated
need.

Hanger components, for instance, on a
2 inch pipe, the pipe itself weighs like 22 pounds.
We base the sizing of the components on five times
the weight plus 250. So it's up in the 300 pounds
as the assigned weight when we're dealing with
these components. So simply saying ferrous has
worked very well. This is really just a solution
looking for a problem. There's been no history of
failures of our hangers. And, granted, it's nice
to specify specific things. The ability to have a
hanger rod in your hand or in the field and to be
able to identify whether or not it meets a specific
ASTM standard is just not there. On pipe and so
forth, we require markings every 2 feet, and those
type of components we can readily identify.

But, you know, other than what's in the
initial cut sheet, out in the field, there's no
means to really identify whether or not this
standard is being met; but the bottomline is we
don't need to meet an additional standard. These
things are so oversized already that anything else
we add to it is really just meaningless. So why
add the additional requirements and text?

So with that, I urge you to support the
motion.

MR. SNYDER: Thank you. Microphone 3, please.

MR. HIRSCHLER: Marcelo Hirschler,
GBH International. I was struggling with it to
come up -- this seems a very innocuous statement.
It doesn't say you have to meet A307. It says A307
or equivalent.

I think it's important when we put -- the
gentleman who just spoke talked about the weight of
the sprinkler system and they are quite heavy. So
we need to make sure that the hangers are of
sufficient strength, and they give you a number of
equivalents. So it seems a very reasonable thing
to add. We want to make sure that the systems
don't fail just by falling down. Thank you. I'm
against the motion. Sorry.

MR. SNYDER: Thank you, sir. Microphone
Number 4, please.

MR. RAY: My name is Rich Ray with Cybor Fire
Protection, and I speak in support of the motion.
I heard the chair of the Hanging and Bracing Committee saying enforcing will be difficult. It will be a disaster. How do you mark a piece of rod that's threaded along its whole length? How do you mark that?

We have been installing sprinkler systems for -- I haven't -- but the industry has for a hundred years? 125 years? I don't hear about fire sprinkler system hangers failing. I hear about valves that fail or a pipe that fails. Corrosion was just an issue. I hear about sprinkler heads with old rings. We've lived all these things. We don't see, as an industry, hangers failing.

So you're trying to put a solution or a fix on a problem that doesn't exist. So I would ask everyone to please support the motion.

MR. SNYDER: Thank you. Microphone Number 3.

MR. HIRSCHLER: Marcelo Hirschler, GBH International --

MR. SNYDER: Sir, for or against the motion?

MR. HIRSCHLER: Against the motion. The gentleman just spoke it's impossible to mark these hanger rods. In the cable industry, all cable ties have to be listed and they are. There's been no
problem with enforcing that. Why is this different? Please vote against.

MR. SNYDER: Thank you. Microphone Number 4, please.

MR. HUGGINS: Roland Huggins, American Fire Sprinkler Association. Not to belabor the point --

MR. SNYDER: Sir, for or against?

MR. HUGGINS: I'm speaking for the motion. Not to belabor the point, I'm assuming the majority of you understood what I said and Marcelo just misunderstood it. A 2 inch section of pipe weighs 22 pounds. We basically assign a 348 pound weight to that when determining the size of the components. It's not what it's actually exposed to. It's what we assign to it in determining sizes of components, including the rods. So it's much, much, much lighter than the value that's assigned to it. So I just want to ensure that no one misunderstood that aspect. Thank you very much.

MR. SNYDER: Thank you. Microphone Number 6, please.

MR. EASTER: Les Easter, Atkore International speaking for myself and manufacturer of threaded rods. They're used in all sorts of applications --
MR. SNYDER: Sir, will you please specify, are you for or against the motion?

MR. EASTER: For the motion -- manufacture all sorts of threaded rods in all sorts of applications, and someone talked about earlier about specifications met as far as purchase requirements and stuff, and that adequately suffices for what the fire protection folks are talking about. So I speak in favor of the motion.

MR. SNYDER: Thank you, sir. Microphone Number 5, please.

MR. SHAPIRO: Jeff Shapiro, National Multifamily Housing Council speaking for the motion.

In my time as an authority having jurisdiction, there was a point at which I questioned the installation of a system based on the hanger spacing exceeding the hanger distances. Understanding that the basis of the hanger design is an individual hanging on the pipe, as Roland said, way in excess of what the normal weight of the system is, we're trying to carry an individual who might be hanging on the pipe.

When I questioned it, I had a contractor
there who weighed about 300 pounds who climbed up a 10 foot ladder, hung from the pipe, and said, how's this, Mr. Inspector. I wanted to put an UL label on him, but I didn't have one handy, but I said I would pass it.

The design of the hangers on these systems far exceeds what it normally needs to be. This requirement is excessive. I urge you to support the motion on the floor.

MR. SNYDER: Thank you. Is there any further discussion on Certified Amending Motion 13-4 to accept Public Comment Number 244?

Mr. Linder, do you have any final committee comments?

MR. LINDER: Not at this time, no.

MR. SNYDER: Thank you. We will now move to a vote. Before we vote, let me restate the motion. The Certified Amending Motion on the floor is accept Public Comment Number 244. We will ask you to touch the vote button on your voting screen. If you wish to vote in favor of the vote and recommend the text on screen one, touch yes. If you wish to vote against the motion and recommend the text on screen two, touch no. Please record your vote.
The balloting will close in five seconds. The balloting is now closed.

The results of the vote are 191 in favor, 62 against the motion. The motion passes.

The next motion on NFPA 13 appeared on our agenda. However, the maker of the motion has notified NFPA that they are no longer -- they no longer wish to pursue this motion. Therefore, in accordance with NFPA Rules, Convention Rules at Section 2.7, the motion may not be considered by the assembly as a Certified Amending Motion and is removed from the agenda. Is there any further discussion on NFPA 13?

Seeing none, we will move on to the next document. Part 2 of the committee report on Automatic Sprinkler Systems, that is, the First and Second Draft Reports, are located on the document information page for NFPA 13R on the NFPA website. The Certified Amending Motions are contained in the NFPA Technical Meeting Tech Session Agenda and will be displayed behind me on the screen.

We will proceed in the order of the motion sequence number presented. Mr. Linder?

MR. LINZER: Mr. Chair, ladies and gentlemen,
MEMORANDUM
(AMENDMENT)

TO: NFPA Correlating Committee on Automatic Sprinkler Systems

FROM: Elena Carroll, Project Administrator

DATE: July 31, 2015


At the NFPA Technical Meeting (Tech Session), held June 25, 2015, NFPA 13 was amended by the acceptance of the following:

Amendment 13-4: Accept Public Comments Nos. 244 and 288, thereby deleting new sections 9.1.1.6.3 and A.9.1.1.6.3.

The final results of the balloting of the Correlating Committee are as follows:

<table>
<thead>
<tr>
<th></th>
<th>Members Eligible to Vote</th>
<th>Ballots Not Returned</th>
<th>Agree (Linder, w/ comment)</th>
<th>Disagree</th>
<th>Abstentions</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td></td>
<td>Baz, Franson, Ketner, Lowrey, Mitchell, Stultz</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

16 Agree (Linder, w/ comment)

According to 4.6 of the Regulations Governing the Development of NFPA Standards, the final results show the Amendment HAS achieved the ¾ majority vote needed to recommend approval of the Association Action by the Correlating Committee. As a result, the recommendation to the Standards Council is to delete new sections 9.1.1.6.3 and A.9.1.1.6.3 in the NFPA Standard.

The number of votes needed to recommend approval of the Association Action is 12.

(22 eligible to vote - 6 not returned - 0 abstentions = 16 × 0.75 = 12)

Please remember that the return of ballots is required in accordance with the Regulations Governing the Development of NFPA Standards.
Elena,

Please record me as voting to Agree with Amendment Ballot 13-4. I do not see any correlation issues. However, I do agree with the intent of the original committee action to provide some additional guidance on the required specifications/quality of ferrous hanger rods as the current standard only requires them to be “ferrous.” Hopefully some of the issues brought up on the floor at the technical session in Chicago can be addressed in the next cycle.

Regards,
Ken

Kenneth Linder
Maynard, Mary

Subject: FW: Public Comment No. 16-NFPA 24-2014 [Section No. 2.3.3] was accepted.

From: Ariel Carp [mailto:arieltzvicarp@yahoo.com.ar]
Sent: Wednesday, July 15, 2015 1:04 PM
To: Maynard, Mary; Fuller, Linda
Subject: Re: Public Comment No. 16-NFPA 24-2014 [Section No. 2.3.3] was accepted.

Linda,

Thanks very much for your letter.

The NFPA Standards Council also is requested to Accept Public Comment No. 2-NFPA 24-2014 [Section No. 10.1.1.1].

It is said:
This will acknowledge receipt of your appeal received June 18, 2015 requesting the NFPA Standards Council Accept Public Comment No. 16, Public Comment 222 and Reject Second Revision 3 and Identifiable Part of Second Revision 24.

Comment:
The NFPA Standards Council is requested:
• to Accept Public Comment No. 16-NFPA 24-2014 [Section No. 2.3.3]
• to Accept Public Comment No. 222-NFPA 13-2014 [Section No. 10.1.1.1]
• to Accept Public Comment No. 2-NFPA 24-2014 [Section No. 10.1.1.1]
• to Reject Second Revision No. 3-NFPA 24-2014 [Section No. 2.3.3]
• to Reject an Identifiable Part of Second Correlating Revision No. 24-NFPA 13-2014 [Section No. 2.3.6]: the request is to keep, to not delete “AWWA M11, A Guide for Steel Pipe Design and Installation, 3rd edition, 1989.” from 2.3.6 of NFPA 13.

taking in account the following:
• Public Comment No. 222-NFPA 13-2014 [Section No. 10.1.1.1]
• Public Comment No. 16-NFPA 24-2014 [Section No. 2.3.3]
• Public Comment No. 2-NFPA 24-2014 [Section No. 10.1.1.1]
• NITMAM No. 2-NFPA 13-2015 [Section No. 2.3.6]
• NITMAM No. 3-NFPA 13-2015 [Section No. 10.1.1.1]
• NITMAM No. 6-NFPA 24-2015 [Section No. 2.3.3]
• NITMAM No. 4-NFPA 24-2015 [Section No. 10.1.1.1]
• Appeal:

(2) Statement identifying the particular action to which the appeal relates
Public Comment No. 16-NFPA 24-2014 [Section No. 2.3.3] was accepted.
No Second Revision was developed by incorporating the proposed text exactly as submitted.
(3) Argument setting forth the grounds for the appeal
There is no Second Revision where the text proposed by Public Comment 16 is incorporated exactly as submitted.
The Committee Statement of Public Comment No. 16 states: “Reference is made to the statement of problem and substantiation of Public Comment No. 2-NFPA 24-2014”.
The Committee Statement of Public Comment No. 16 makes neither view nor objection to the statement of problem and substantiation of Public Comment No. 2-NFPA 24-2014 [Section No. 10.1.1.1] whose proposed text states that AWWA M11, AWWA C200, AWWA C203, AWWA C205, AWWA C206, AWWA C207, AWWA C208 shall be kept in Table 10.1.1.1 of NFPA 24. Therefore the Public Comment No. 2 was accepted.

(4) Statement of the precise relief requested
Given that Public Comment No. 16 was accepted and that Public Comment No. 2 was accepted through Public Comment No. 16, then the proposed texts in both Public Comments shall be incorporated into the new NFPA 24-2016 edition.

To ensure correlation and identical requirements between NFPA 13 and NFPA 24 for underground private fire service mains, the proposed texts in Public Comments No. 16 and No. 2 shall also be incorporated in the new NFPA 13-2016 edition.

Regards,
Ariel Carp
Notes from AUT-PRI Chair Kenneth W. Wagoner
re: Appeal from Mr. Ariel Carp

Here are the results of the action at the First Draft Meeting, held August 14-15, 2013, in Nashville, Tennessee, with respect to the items on the agenda which were addressed by Mr. Carp:

Per the TerraView sections for the First Draft of NFPA 24 and 13, I found the information that Public Input No. 59 was rejected, and the following resolution statement observed, in part [all emphasis mine]:

There is the ability to use the table, the ability to use pipe specifically listed for underground use, and the allowance to use steel pipe between the FDC and the check valve. The steel piping references were removed from the table since steel pipe is required to be listed other than in the FDC line. A new table was added referencing the ASTM standards of steel pipe used in this part of the system.

Based entirely on my notes at the time, here are the results of the action at the Second Draft Meeting, held June 17, 2014, in Del Mar, California, with respect to the items on the agenda which were addressed by Mr. Carp:

- My notes indicated that NFPA 24, PC #2, covering section 10.1.1.1 of NFPA 24, was “approved in committee”, however, my notes may not have been accurate on this item, as I noted from TerraView for NFPA 24, that comment was rejected at the committee meeting, and as a result was not placed on the subsequent ballot.

- PC #16, referencing PC-2, and FR-19, covering Table 2.3.3, the item passed in committee, was placed upon and passed on the subsequent ballot.

- PC #222, referencing FR-49, covering section 10.1.1.1 and Table 10.1.1.1, the item was rejected in the committee, and as a result was not placed on the subsequent ballot.

Per the TerraView sections for the Second Draft of NFPA 24 and 13, I found the information that Public Comment No. 2 and No. 222 were rejected, and the following identical resolution statements observed:

The document has required steel piping for general underground service to be listed for the last few editions. If steel piping is to be used, the manufacturers installations instructions would need to be followed. Including the proposed data in the table does not add any value since the installation guidelines will cover all essential installation practices. Table 10.1.1.3 sufficiently addresses the allowance for the steel piping to be used in the fire department connection piping.

However, my notes are just that - my notes - and they don't reflect the official position of the committee. In the case of the notes I have, it merely notes what action was taken on an item (FR, SR, PC, CC), such as a motion to create a second revision, reject, or reject but hold for the next cycle. Those notes were taken during the meeting, and I may have marked an issue inaccurately. The NFPA staff liaison, Matt Klaus, keeps the official record of the committee actions, and I would defer on actual resolution to his records if they were to conflict with my own.

In speaking with another AUT-PRI committee member this morning (07/13/2015), I discussed my vague memory on these issues. The impression I had was that AUT-PRI is a standard for the installation of private “fire service” mains. The inclusion of “general underground” use in section 10.1.2 of previous editions (2010 and 2013) was present, and has been deleted. My memory, vague as it is, suggests that the coverage of installation guidelines for “general underground” mains was not within the scope of the AUT-PRI committee, and as such should not be addressed by the published documents.
June 14, 2015

NFPA Standards Council
1 Batterymarch Park
Quincy, MA 02169-7471

Re: Appeal from Ariel Carp
NFPA 24
Seeks to Accept PC No. 16, PC No. 222 and Reject SR No. 3 and identifiable part of second revision 24

Dear Standards Council,

I am writing as a member of the AUT-PRI committee and I am of the opinion that the above appeal not be granted.

If I understand the issue correctly, Mr. Carp is attempting to include steel piping on Table 10.1.1.1 of NFPA 24. I do not believe it was the intent of the committee to allow the use of steel piping for underground use as private fire service mains unless it meets a specific listing for such use.

If, as Mr. Carp suggests, AWWA M11- A Guide for Steel Pipe Design and Installation remains in Table 10.1.1, users would be permitted to choose to use steel pipe that is not specifically listed for underground installations. NFPA 24 states that piping shall be listed for fire protection service or shall comply with the standards in Table 10.1.1.

I do not believe it was the intent of the committee to allow the use of steel piping for underground use unless it is specifically listed for this use. This is important to ensure this vital portion of the water supply is not prematurely compromised by corrosion.

Unlisted steel pipe will be permitted to be used between on the fire department connection in accordance with NFPA 24 second draft section 10.1.1.3.

Sincerely,

Roland Asp, CET
Manager of Technical Services
National Fire Sprinkler Association
(845) 878 4200 ext:126
asp@nfsa.org
Item 15-8-3
MEMORANDUM

TO: Correlating Committee on Automatic Sprinkler Systems

FROM: Matthew Klaus, Staff Liaison

DATE: June 29, 2015


At the NFPA Technical Meeting (Tech Session), held June 25, 2015, NFPA 13R was amended by the acceptance of the following:

Amendment 13R-1: Reject Second Revision No. 21, thereby deleting new sections 6.9.5 and 6.9.6.

Based on the actions of the membership at the NFPA Technical Meeting (Tech Session), this Amendment is being submitted for ballot of the Technical Committee pursuant to section 4.6 and Table 1 of the Regulations Governing the Development of NFPA Standards (Regs).

Please review these items, complete the attached ballot, and return them to the attention of Elena Carroll, Project Administrator, at ecarroll@nfpa.org or via fax at 617-984-7110 as soon as possible, but no later than July 13, 2015.

If you Disagree or Abstain on an Amendment please indicate your reason(s) for doing so.

NOTE:
The impact of voting Agree on an Amendment is shown legislatively based on clean Second Draft text. The effect of voting Disagree on an Amendment is illustrated by showing the applicable previous edition text, or where no previous edition text exists, stating the text will be deleted. In the event the text is too large to display within the ballot, the applicable text will be attached to the ballot.

The transcripts from the Annual 2015 NFPA Technical Meeting (Tech Session) will be available within two weeks after the Tech Session at: www.nfpa.org/techsession.

Note: Please remember that the return of ballots and attendance at Committee Meetings is required in accordance with Section 3.1.3.1 of the Regulations Governing the Development of NFPA Standards.
MEMORANDUM

TO: Technical Committee on Residential Sprinkler Systems

FROM: Matthew Klaus, Staff Liaison

DATE: June 30, 2015


At the NFPA Technical Meeting (Tech Session), held June 24-25, 2015, amendment 13R-1 to Reject Second Revision No. 21, passed the floor, thereby deleting new sections 6.9.5 and 6.9.6 from the proposed 2016 Edition of NFPA 13R.

Pursuant to section 4.6 and Table 1 of the Regulations Governing the Development of NFPA Standards (Regs), because the Second Revision has no related First Revisions, this amendment is not subject to Committee ballot.

As a result, NFPA 13R shall be forwarded to the Standards Council for action in accordance with section 4.5.3.7 and 4.7 of the Regs.

The transcripts from the Annual 2015 NFPA Technical Meeting (Tech Session) will be available within two weeks after the Tech Session at: www.nfpa.org/techsession.

Note: In accordance with 1.6.2(a) of the Regs, anyone who is dissatisfied with the results of the floor motions from the June 2015 NFPA Technical Meeting may appeal the results. Appeals shall be filed no later than twenty days after the NFPA Technical Meeting at which Association action on the issuance of the Standard was recommended. The final date to file any such appeal is July 15, 2015.
The balloting will close in five seconds. The ballot is now closed.

The results of the vote are 191 in favor, 62 against the motion. The motion passes.

The next motion on NFPA 13 appeared on our agenda. However, the maker of the motion has notified NFPA that they are no longer -- they no longer wish to pursue this motion. Therefore, in accordance with NFPA Rules, Convention Rules at Section 2.7, the motion may not be considered by the assembly as a Certified Amending Motion and is removed from the agenda. Is there any further discussion on NFPA 13?

Seeing none, we will move on to the next document. Part 2 of the committee report on Automatic Sprinkler Systems, that is, the First and Second Draft Reports, are located on the document information page for NFPA 13R on the NFPA website. The Certified Amending Motions are contained in the NFPA Technical Meeting Tech Session Agenda and will be displayed behind me on the screen.

We will proceed in the order of the motion sequence number presented. Mr. Linder?

MR. LINDER: Mr. Chair, ladies and gentlemen,
the report of the Technical Committee on Residential Sprinkler Systems is presented for adoption and can be found in the First Draft Report and in the Second Draft Report for the 2015 Annual Meeting Revision Cycle. The Technical and Correlating Committees have published a First and Second Draft Report consisting of revisions to NFPA 13R, Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies. These reports were submitted to letter ballot of the responsible Technical and Correlating Committees. The reports and ballot results can be found on the next edition tab of the documents information page for NFPA 13R at www.nfpa.org/13Rnext.

The presiding officer will now proceed with the Certified Amending Motions.

MR. SNYDER: Okay. Let's proceed with the discussion on Certified Amending Motions on NFPA 13R. Microphone 4, please.

MR. ASP: My name is Roland Asp, and I'm speaking on behalf of the National Fire Sprinkler Association, and I move to accept Motion 13R-1 that would reject Second Revision 21.
VOICES: Second.

MR. SNYDER: Thank you. The motion on the floor is to reject Second Revision Number 21, and I have heard several seconds. Please proceed.

MR. ASP: Thank you. I'm speaking in favor of this motion. During the development of the 2016 edition of NFPA 13R, requirements were added to bring the auxiliary drain requirements from NFPA 13 to NFPA 13R. These are dealing with draining trapped pipes and wet pipe systems and dry systems that are not subject to freezing.

I seek to -- this CAM seeks to reject the Second Revision 21 and to remove these sections and revert to the previous language. Putting auxiliary drains on all systems, all 13R systems with trapped piping that -- mostly the ones with more than 5 gallons, it's simply going to assist in draining the system. However, it's really impractical for these residential occupancies that are the subject of NFPA 13R.

One of the goals of NFPA 13R is to keep the sprinkler systems affordable and to encourage the owners to actually install them in these low-rise residential occupancies. In these types
of installations, in these kind of low-rise residential occupancies, it's typically a lot of Gypsum board, Sheetrock ceilings and walls; and for every low point auxiliary drain we put in, we're going to have to put in an access panel. This is going to significantly increase the costs.

The majority of service companies out there already use industrial vacuums that eliminate the needs for these drains. We can still drain the systems with the vacuums without putting these auxiliary drains and their access panels.

Additionally, 13R occupancy don't traditionally, you know, have as much retrofit -- much retrofit activities as do the commercial occupancies. And even if it does, these industrial vacuums I'm just talking about can either hold back or remove the water for a sprinkler replacement job. In order to keep these systems affordable and to keep the owners in favor of installing them, NFPA 13R should be silent on the auxiliary drain requirements for trapped wet pipe systems and dry systems not subject to freezing.

I just want to note 13R already includes language that requires system drains that are
sufficient to drain the majority of water, and the methods I just talked about can handle -- are sufficient to deal with any trapped piping in the water and that. We should not require the owners to bear an additional cost to install drains and the associated access panels to deal with a problem that really doesn't exist.

So I urge you to support CAM 13R-1 and reject Second Revision 21. Thank you.

MR. SNYDER: Thank you. Mr. Linder, would you like to offer the committee's position?

MR. LINDE: I would like to defer to the chair of the residential committee, Maurice Pilette.

MR. PILLETTE: Maurice Pilette, Chair of the Residential Sprinkler Committee. I'm against this motion.

The committee reviewed this and felt that the standard needed some provisions to provide guidance for draining of trapped piping. It engaged and put together some language for various options, and this is based on a -- the committee accepted this on 23 in favor versus 6, and I would urge the membership to vote against the motion.

MR. SNYDER: Thank you, gentlemen. We will now
open up debate on the motion. Again to assist with
the record, please provide your name and
affiliation and whether you are speaking in support
of or against the motion. Microphone 5, please.

MR. DeVORE: Mike DeVore, State Farm and I'm
speaking in support of the motion. I have no idea
whether the drain should be in there or not, but
this was a second revision and it's been put in the
document without any public review which is against
the rules on Technical Committee action. So they
put new material in at the second revision. So I
courage the body to accept the motion on that
basis.

MR. SNYDER: Thank you. Microphone Number 4,
please.

MR. HUGGINS: Thank you, sir. Roland Huggins,
American Fire Sprinkler Association, speaking in
support of the motion.

There's really two reasons we need drains,
auxiliary drains in our systems, and they're
obviously highly desirable and needed in 413
systems, and those two reasons being, one, is you
need to get the water out, particularly in dry pipe
systems to avoid excessive corrosion to the systems
because it makes a very wet, moist internal environment. Well, that's a metallic pipe issue. You know, if this section for the dry pipe section said metallic pipe, this would have been a very good idea.

The overwhelming majority of 13R systems I believe are CBDCs. So we don't have a corrosion issue. So imposing the same requirement that's an issue for metallic dry pipe systems onto the CBDC side just really makes no sense.

The second reason that we want (phonetic) those auxiliary drains is we have been doing maintenance and changes in the system which is fairly prevalent and common in 413R systems. Again, in a 13R system this is not a very prevalent requirement, and as was already pointed out, you know, there are means to get the water out of the system so when the changes or maintenance are performed on it, so we open up the pipe, you know, we don't have the problem of, you know, water damage to the surrounding area.

So going back also to the point regarding the CBDC systems, now we're going to have to -- well, A, the sprinkler systems -- the option to
remove the sprinkler is really not an applicable option since most auxiliary drains are not going to be in locations with a sprinkler head. So that doesn't really help us a lot. Again, we have a plastic system so installing a flexible coupling so that it can easily fall apart to drain that section of pipe is problematic with a plastic system. So now we're having to install a component that we really don't need that is just one more potential source of failure into a system.

So I encourage you to support this motion and remove this text. Thank you very much.

MR. SNYDER: Thank you. Microphone Number 5, please.

MR. SHAPIRO: Jeff Shapiro, National Multifamily Housing Council speaking in support of the motion.

One other issue with this is that it encourages the use of removing a single pendent sprinkler as a means of draining the system but 5.1.1.1 in 13R only allows the installation of new sprinklers. So if you remove a sprinkler to drain that part of the system, now you have to find the new sprinkler that's equivalent to reinstall. How
many times are you going to have to start searching for a new sprinkler that matches those criteria and may no longer be available? Now you're having to make judgments on what's the appropriate sprinkler to use to replace it.

I will point out 13R is not as clear as the latest edition of 13 which specifically says that once you remove a sprinkler, you cannot replace it, but I'm assuming that that's going to go into 13R as a clarification of 5.1.1.1 at some point in the future, and certainly I think based on the new text in 13, that's how people are going to be reading 13R.

This is a bad requirement. It increases the cost of a system unnecessarily. It increases the complexity. It introduces a place for failure, and we don't need it in the standard. I encourage you to vote in favor of the motion.

MR. SNYDER: Thank you. Microphone Number 3, please.

MR. MERTENS: Matthew Mertens, North Shore Fire speaking on behalf of myself. Just to address --

MR. SNYDER: Sir, can you state for or against the motion?
MR. MERTENS: I'm urging against the motion.

One of the comments earlier that this is really only regarding corrosion in the pipe and it doesn't apply to plastics is, in my opinion, okay, that's a valid point. But there are issues with the plastic pipe, and it's something that we're moving towards a solution for.

One of the biggest problems that we're seeing is AHJ's in the field right now with the plastic pipes is the installation of purge cage systems in these low-rise buildings. One of the manufacturer's requirements and recommendations based on the listings, you can't use air to pressurize these systems. Well, if you can't -- and I understand that a drain is not intended for release of the air, but it's one of the things that we're doing locally that allows them to get the majority of the air out so when we're putting these systems under pressure for 200 psi, they're actually able to relieve some of that air out of there and reducing the risk by accessing pressures into these buildings.

Hopefully, my hope, is down the road this
is just one step towards attaining a reasonable
solution for getting air out of these plastic
systems before hydro testing. Granted, it's not
perfect, but it's something in the right direction.

MR. SNYDER: Thank you, sir. Microphone
Number 4, please.

MR. RAY: My name is Rich Ray. I'm with Cybor
Fire Protection Company and I'm speaking in support
of the motion.

Keep in mind what NFPA 13R is about. It's
about getting fire sprinklers installed in mid-rise
multifamily type occupancies. United States has a
real problem with fire deaths and injuries in these
type of facilities. So the key is to get the
sprinklers installed. The biggest argument against
what we do is cost.

What you're going to do if we require
drains on these 13R systems, it's been said before
but I'll repeat it quickly, you're going to add the
cost of installing the drains and then a cost of
all these access panels all over the place.

So I would urge everyone please to support
this motion and let's get this passed.

MR. SNYDER: Thank you, sir. Microphone
Number 5.

MR. SHAPIRO: Jeff Shapiro, National Multifamily Housing Council, and in rebuttal to the previous comment, if the best reason we can come up with to add this requirement is that we're going to use it for something that wasn't intended, that's not a very good reason.

I urge you to support this motion.

NFPA 13R has been around for 25 years and we've been draining systems just fine. I speak in favor of the motion, vote in favor of the motion.

MR. SNYDER: Thank you, sir. Is there any further discussion on Motion 13R-1 to reject Second Revision Number 21?

Mr. Linder, any final comments on behalf of the committee?

MR. LINDER: No.

MR. SNYDER: Okay. We will move to a vote.

Before we vote, let me restate the motion. The motion on the floor is to reject Second Revision Number 21. To vote, please touch the vote button on your iPad. If you wish to vote in favor of the motion and recommend the text on screen one, touch yes. If you wish to vote against the motion and
recommend the text on screen two, touch no. Please record your vote. The balloting will be closed in five seconds. The balloting is now closed.

The results of the vote are 192 in favor, 51 votes against. The motion passes.

Is there any further discussion on NFPA 13R? Seeing none, we will move on to the next document. Thank you, Mr. Linder.

Okay. As we get people on the stage for the next report, again, I want to remind everybody we will not be taking a break for lunch and there are lunch and concessions available outside to the left and will remain open until 1 o'clock.

The next report under consideration this morning is that of the Committee on Signaling Systems for the Protection of Life and Property. Here to present the committee report is Correlating Committee Chair, Robert Schifiliti of R. P. Schifiliti & Associates, Reading, Massachusetts. The committee report, that is, the First and Second Draft Reports, are located on the document information page for NFPA 72 on the NFPA website. The Certified Amending Motions are contained in the NFPA Technical Committee Tech
Item 15-8-4
Subject: FW: Public Comment No. 16-NFPA 24-2014 [Section No. 2.3.3] was accepted.

From: Ariel Carp [mailto:arieltzvicarp@yahoo.com.ar]
Sent: Wednesday, July 15, 2015 1:04 PM
To: Maynard, Mary; Fuller, Linda
Subject: Re: Public Comment No. 16-NFPA 24-2014 [Section No. 2.3.3] was accepted.

Linda,

Thanks very much for your letter.

The NFPA Standards Council also is requested to Accept Public Comment No. 2-NFPA 24-2014 [Section No. 10.1.1.1].

It is said:
This will acknowledge receipt of your appeal received June 18, 2015 requesting the NFPA Standards Council Accept Public Comment No. 16, Public Comment 222 and Reject Second Revision 3 and Identifiable Part of Second Revision 24.

Comment:
The NFPA Standards Council is requested:

- to Accept Public Comment No. 16-NFPA 24-2014 [Section No. 2.3.3]
- to Accept Public Comment No. 222-NFPA 13-2014 [Section No. 10.1.1.1]
- to Accept Public Comment No. 2-NFPA 24-2014 [Section No. 10.1.1.1]
- to Reject Second Revision No. 3-NFPA 24-2014 [Section No. 2.3.3]
- to Reject an Identifiable Part of Second Correlating Revision No. 24-NFPA 13-2014 [Section No. 2.3.6]: the request is to keep, to not delete “AWWA M11, A Guide for Steel Pipe Design and Installation, 3rd edition, 1989.” from 2.3.6 of NFPA 13.

taking in account the following:
- Public Comment No. 222-NFPA 13-2014 [Section No. 10.1.1.1]
- Public Comment No. 16-NFPA 24-2014 [Section No. 2.3.3]
- Public Comment No. 2-NFPA 24-2014 [Section No. 10.1.1.1]
- NITMAM No. 2-NFPA 13-2015 [Section No. 2.3.6]
- NITMAM No. 3-NFPA 13-2015 [Section No. 10.1.1.1]
- NITMAM No. 6-NFPA 24-2015 [Section No. 2.3.3]
- NITMAM No. 4-NFPA 24-2015 [Section No. 10.1.1.1]
- Appeal:

(2) Statement identifying the particular action to which the appeal relates
Public Comment No. 16-NFPA 24-2014 [Section No. 2.3.3] was accepted.
No Second Revision was developed by incorporating the proposed text exactly as submitted.

(3) Argument setting forth the grounds for the appeal
There is no Second Revision where the text proposed by Public Comment 16 is incorporated exactly as submitted.
The Committee Statement of Public Comment No. 16 states: “Reference is made to the statement of problem and substantiation of Public Comment No. 2-NFPA 24-2014”.
The Committee Statement of Public Comment No. 16 makes neither view nor objection to the statement of problem and substantiation of Public Comment No. 2-NFPA 24-2014 [Section No. 10.1.1.1] whose proposed text states that AWWA M11, AWWA C200, AWWA C203, AWWA C205, AWWA C206, AWWA C207, AWWA C208 shall be kept in Table 10.1.1.1 of NFPA 24. Therefore the Public Comment No. 2 was accepted.

(4) Statement of the precise relief requested
Given that Public Comment No. 16 was accepted and that Public Comment No. 2 was accepted through Public Comment No. 16, then the proposed texts in both Public Comments shall be incorporated into the new NFPA 24-2016 edition.
To ensure correlation and identical requirements between NFPA 13 and NFPA 24 for underground private fire service mains, the proposed texts in Public Comments No. 16 and No. 2 shall also be incorporated in the new NFPA 13-2016 edition.

Regards,
Ariel Carp
final comments?

MR. KREITMAN: Not at this time.

MR. GOLINVEAUX: Thank you. Okay. So before we move to the vote, let me restate the motion. The motion on the floor is to accept Public Comment Number 625. To vote, touch the vote button. If you wish to vote in favor of the motion and recommend the text on screen one, touch yes. If you wish to vote against the motion and recommend the text on screen two, touch no. Please record your vote. Balloting will close in five seconds.

The balloting is closed.

The results are 16 in favor, 248 against. The motion fails.

Before we begin the next documents, I would like to introduce Mike Snyder, member of the Standards Council who will be the presiding officer for the next four documents. Mike.

MR. SNYDER: Thank you, James. The next document, NFPA 24, appeared on our agenda. However, the maker of the motion has notified NFPA that they no longer wish to pursue the Certified Amending Motion on this standard. Therefore, in accordance with NFPA rules, our Regulations at
4.5.3.7 and Convention Rules at 2.7, NFPA 24 will not be considered at this meeting and, instead, becomes a consensus standard that will be forwarded directly to the Standards Council for issuance or other action. We would like to thank the committee for their work on this standard. We will now move on to the next standard.

The next report under consideration this morning is that of the Committee on Automatic Sprinkler Systems. Here to present the two parts of the committee report is Correlating Committee Chair Kenneth Linder of XL Global Asset Protection Services, Windsor, Connecticut. Part one of the committee report on Automatic Sprinkler Systems, that is, the First and Second Draft Reports, are located on the document information page for NFPA 13 on the NFPA website. The certified amending motions are contained in the NFPA Technical Meeting Tech Session Agenda and will be displayed behind me on the screen.

We will proceed in the order of the motion sequence number presented. Mr. Linder.

MR. LINDER: Mr. Chair, ladies and gentlemen, the report of the Technical and Correlating
Here are the results of the action at the First Draft Meeting, held August 14-15, 2013, in Nashville, Tennessee, with respect to the items on the agenda which were addressed by Mr. Carp:

Per the TerraView sections for the First Draft of NFPA 24 and 13, I found the information that Public Input No. 59 was rejected, and the following resolution statement observed, in part [all emphasis mine]:

There is the ability to use the table, the ability to use pipe specifically listed for underground use, and the allowance to use steel pipe between the FDC and the check valve. The steel piping references were removed from the table since steel pipe is required to be listed other than in the FDC line. A new table was added referencing the ASTM standards of steel pipe used in this part of the system.

Based entirely on my notes at the time, here are the results of the action at the Second Draft Meeting, held June 17, 2014, in Del Mar, California, with respect to the items on the agenda which were addressed by Mr. Carp:

- My notes indicated that NFPA 24, PC #2, covering section 10.1.1.1 of NFPA 24, was “approved in committee”, however, my notes may not have been accurate on this item, as I noted from TerraView for NFPA 24, that is comment was rejected at the committee meeting, and as a result was not placed on the subsequent ballot.

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The document has required steel piping for general underground service to be listed for the last few editions. If steel piping is to be used, the manufacturers installations instructions would need to be followed. Including the proposed data in the table does not add any value since the installation guidelines will cover all essential installation practices. Table 10.1.1.3 sufficiently addresses the allowance for the steel piping to be used in the fire department connection piping.

However, my notes are just that - my notes - and they don't reflect the official position of the committee. In the case of the notes I have, it merely notes what action was taken on an item (FR, SR, PC, CC), such as a motion to create a second revision, reject, or reject but hold for the next cycle. Those notes were taken during the meeting, and I may have marked an issue inaccurately. The NFPA staff liaison, Matt Klaus, keeps the official record of the committee actions, and I would defer on actual resolution to his records if they were to conflict with my own.

In speaking with another AUT-PRI committee member this morning (07/13/2015), I discussed my vague memory on these issues. The impression I had was that AUT-PRI is a standard for the installation of private “fire service” mains. The inclusion of “general underground” use in section 10.1.2 of previous editions (2010 and 2013) was present, and has been deleted. My memory, vague as it is, suggests that the coverage of installation guidelines for “general underground” mains was not within the scope of the AUT-PRI committee, and as such should not be addressed by the published documents.
June 14, 2015

NFPA Standards Council
1 Batterymarch Park
Quincy, MA 02169-7471

Re: Appeal from Ariel Carp
NFPA 24
Seeks to Accept PC No. 16, PC No. 222 and Reject SR No. 3 and identifiable part of second revision 24

Dear Standards Council,

I am writing as a member of the AUT-PRI committee and I am of the opinion that the above appeal not be granted.

If I understand the issue correctly, Mr. Carp is attempting to include steel piping on Table 10.1.1.1 of NFPA 24. I do not believe it was the intent of the committee to allow the use of steel piping for underground use as private fire service mains unless it meets a specific listing for such use.

If, as Mr. Carp suggests, AWWA M11- A Guide for Steel Pipe Design and Installation remains in Table 10.1.1, users would be permitted to choose to use steel pipe that is not specifically listed for underground installations. NFPA 24 states that piping shall be listed for fire protection service or shall comply with the standards in Table 10.1.1.

I do not believe it was the intent of the committee to allow the use of steel piping for underground use unless it is specifically listed for this use. This is important to ensure this vital portion of the water supply is not prematurely compromised by corrosion.

Unlisted steel pipe will be permitted to be used between on the fire department connection in accordance with NFPA 24 second draft section 10.1.1.3.

Sincerely,

Roland Asp, CET
Manager of Technical Services
National Fire Sprinkler Association
(845) 878 4200 ext:126
asp@nfsa.org
TO: Linda Fuller, Secretary Standards Council  
NFPA  
1 Battery March Park  
Quincy, MA, 02269  

July 15, 2015

Dear Linda,

I hereby want to appeal the action of the Annual 2015 Technical Meeting regarding three certified amending motions I made, namely 33-1 (to accept public comment 14), 33-2 (to accept public comments 10, 11, 12 and 13) and 520-1 (to accept public comments 1 and 2).

All three motions dealt with issues associated with the NFPA Manual of Style and I believe that Standards Council needs to ensure that the Manual of Style is adhered to. I will provide some short details regarding each motion.

I. 33-1: The language proposed by the comment was as follows:

3.3.19.1 Limited Finishing Workstation. An apparatus that is capable of confining the vapors, mists, residues, dusts, or deposits that are generated by a spray application process and meets the requirements of Section 14.3, but does not meet the requirements of a spray booth or spray room, as herein defined.

A.3.3.19.1 Limited finishing workstations meet the requirements of Section 14.3 of this standard.

The committee stated: The deletion as suggested changes the meaning of the definition completely. A limited finishing workstation is a very specific type of ventilation enclosure and it must meet the requirements listed in Chapter 14. Without the reference to Chapter 14 the definition simply states that it is not a spray booth or spray room but is ANY apparatus that confines vapors. This could mean that it is any portable ventilation system including a flexible ventilation duct. No alternative wording was suggested by the submitter. The committee would consider alternative wording if suggested but there must be a reference to the requirements in Chapter 14.

The following are five sections from the NFPA Manual of Style

1. Definitions shall not be written in mandatory language (2.3.1.4).
2. A definition shall only describe the term being defined (2.3.2.1).
3. Definitions shall be in the format of a bold term followed by the definition phrase to form a single paragraph unit (2.3.2.2).
4. Definitions shall not contain requirements (2.3.2.3).
5. References to other documents or sections of a document, notes, lists, footnotes, cautions, warnings, or figures shall not be permitted in definitions (2.3.2.4).

The technical committee wants to continue using a definition that does not comply with more than one of the clauses in the Manual of Style and the solution proposed is simple and clear and eliminates the conflicts with the Manual of Style.

II. 33-2: The existing definitions of “limited combustible” and “Noncombustible Material” within NFPA 33 read as follows:

3.3.9 Limited Combustible. A building construction material not complying with the definition of noncombustible material that, in the form in which it is used, has a potential heat value not exceeding 8140 kJ/kg (3500 Btu/lb), where tested in accordance with NFPA 259 and complies with (a) or (b): (a) materials
having a structural base of noncombustible material, with a surfacing not exceeding a thickness of 3 mm (1/8 in.) that has a flame spread index not greater than 50; and (b) materials, in the form and thickness used, other than as described in (a), having neither a flame spread index greater than 25 nor evidence of continued progressive combustion of such composition that surfaces that would be exposed by cutting through the material on any plane would have neither a flame spread index greater than 25 nor evidence of continued progressive combustion. (Materials subject to increase in combustibility or flame spread index beyond the limits herein established through the effects of age, moisture, or other atmospheric condition shall be considered combustible.)

3.3.11.2 Noncombustible (Material). A material that, in the form in which it is used and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat. Materials that are reported as passing ASTM E 136, Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750° C, are considered noncombustible materials.

Once again, the definitions contain requirements and references to standards, in contravention with the NFPA Manual of Style. As you can see, limited combustible refers to NFPA 259 and (indirectly) to ASTM E84 when it calls for a specific flame spread index and smoke developed index and “noncombustible” refers to ASTM E136. The solution proposed simply puts a pointer into section 3 on definitions for both limited combustible material and noncombustible material and places the definitions (as extracted from NFPA 5000) into a place within the body of the standard where they can be referenced and made into a requirement. The reason there are 4 comments is that the comments refer to individual sections. NFPA staff recommended that the 4 comments be combined in one motion to complete the action. This approach has been adopted by a whole series of NFPA documents, including the following key documents (not a complete list):

NFPA 1, Fire Code
NFPA 5000, Building Code
NFPA 52, Vehicular Gases Code
NFPA 55, Compressed Gases Code
NFPA 90A, Air Conditioning Standard
NFPA 90B, Standard for Warm Air HVAC
NFPA 99, Health Care Code
NFPA 130, Rail Standard
NFPA 220, Types of Building Construction
NFPA 285, ISMA test (new edition)
NFPA 501, Manufactured Housing Standard
NFPA 502, Standard on Tunnels
NFPA 909, Code for Cultural Resources
NFPA 914, Code for Historic Structures
NFPA 1124, Code for Fireworks

I. 520.1 The existing definitions of “Noncombustible Material” within NFPA 520 reads as follows:

3.3.8 Noncombustible (Material). A material that, in the form in which it is used and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat. Materials that are reported as passing ASTM E 136, Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750° C, shall be considered noncombustible materials.
Once again, the definition in NFPA 520 contains requirements and references to standards, in contravention with the NFPA Manual of Style. As you can see, “noncombustible” refers to ASTM E136. The solution proposed is the same as for NFPA 33. It simply puts a pointer into section 3 on definitions for noncombustible material and places the definition into a place within the body of the standard where it can be referenced and made into a requirement.

In summary, Standards Council should override the action of the technical committees (and the assembly) and ensure that the documents are issued in a fashion that is consistent with the NFPA Manual of Style.

I will not attend the Standards Council meetings.

Yours sincerely,

Marcelo M. Hirschler
event.

Now that you're hopefully comfortable with the process that we will follow during the session, let's begin.

The first report under consideration this afternoon is that of Technical Committee on Finishing Processes. Here to present the committee report is Committee Chair Thomas Euson of 3S Incorporated, Harrison, Indiana. The committee report, that is, the First and Second Draft reports, are located on the document information page for NFPA 33 and on the NFPA website. The Certified Amending Motions are contained in the NFPA Technical Meeting Tech Session Agenda and will be displayed behind me on the screen.

We will proceed in the order of the motion sequence number presented. Mr. Euson.

MR. EUSON: Mr. Chair, ladies and gentlemen, the report on the Technical Committee on Finishing Processes is presented for adoption and can be found in the First Draft Report and in the Second Draft Report of the 2014 Fall Meeting Revision Cycle. The Technical Committee has published the First and Second Draft Report consisting of
Revisions NFPA 33, Standard for Spray Application Using Flammable or Combustible Materials. These reports were submitted to letter ballot of the responsible Technical Committee. The reports and the ballot results can be found in the next edition tab of the document information page for NFPA 33 at www.nfpa.org/33next. I don't know if I need to read the rest of all that.

MR. BELL: It's up to you.

MR. EUSON: We present our document for adoption.

MR. BELL: Thank you, Mr. Euson. Let's now proceed with the discussion on the Certified Amending Motions on NFPA 33. Microphone 1, please.

MR. HIRSCHLER: My name is Marcelo Hirschler from GBH International, and I hereby move Motion 33.1 to accept Comment 33-14.

MR. BELL: Thank you. There's a motion on the floor to accept Public Comment Number 14. Is there a second?

A VOICE: Second.

MR. BELL: I hear a second. Please proceed with the discussion on the motion, Mr. Hirschler.

MR. HIRSCHLER: This is a purely editorial
thing to comply with the NFPA Manual of Style. I will start by reading five sections of the NFPA Manual of Style verbatim:

"Definitions shall not be written in mandatory language.

"A definition shall only describe the term being defined.

"Definitions shall be in the format of a bold term followed by the definition phrase to form a single paragraph unit.

"Definitions shall not contain requirements.

"References to other documents or sections of a document, notes, lists, footnotes, cautions, warnings or figures shall not be permitted in definitions."

As you can see on the screen, what the motion does is eliminate the reference to a section of the document and send it to the annex note. The Committee stated that the deletion suggested changes the meaning and then it says, no alternative wording was suggested by the submitter. The Technical Committee wants to continue using a definition that does not comply with more
than one of the clauses in the Manual of Style as I have read to you before. The Committee wants me to invent a new technical definition but insists that it still contain a requirement and, thus, continues being in conflict with the Manual of Style.

Instead, the solution that I proposed and that's in the motion is very simple and clear. It eliminates the conflicts with the Manual of Style and permits the committee to continue using the term as needed in the appropriate fashion.

I hope you will support the motion. Thank you.

MR. BELL: Thank you. Mr. Euson, would you like to offer the Committee's position?

MR. EUSON: Thank you. The Technical Committee considered Mr. Hirschler's comments at their second draft meeting. During that review, the Technical Committee noted that Mr. Hirschler's comments were new material that had been only introduced at the comments stage.

The Committee recommends that you reject the motion for the following reasons: The definition, as currently written, does not establish requirements but rather refers the user
to Chapter 14, Section 14.3 which establishes the requirements under which the provisions normally required for spray booths and spray areas can be modified under very specific conditions that are set forth in what the Committee calls a Limited Finishing Work Station.

The Technical Committee has identified no acceptable alternative way to specify what a Limited Finishing Work Station is without specifying what those requirements are in Chapter 14.

The definition, as currently written, does not contain these requirements but simply refuses -– refers the user to Chapter 14. The deletion of text changes the meaning of the definition completely. By removing the text proposed by Mr. Hirschler, the definition is so vague as to lead the user to believe that a Limited Finishing Work Station can simply be a ventilation duct. As proposed, the definition could lead to a fire explosion hazard by allowing the user to misinterpret the Code or the meaning.

Finally, as mentioned earlier, the proposed change only came in at the comments stage
and was considered new material that had not been reviewed at the input stage. Based on the material not being filed at the public input stage for the reasons stated previously, the Technical Committee rejected PC Number 14. The Committee suggested that Mr. Hirschler propose alternative wording during the revision -- next revision cycle and retains the important reference to Chapter 14 and also addresses Mr. Hirschler's concern.

The Technical Committee on Finishing Processes respectfully urges you to reject this motion.

MR. BELL: Thank you, Mr. Euson. That will open up the debate on the motion. Please provide your name, affiliation, whether you're speaking in support of or against the motion. Microphone 1.

MR. HIRSCHLER: Marcelo Hirschler, GBH International, in support of the motion.

Let me start, the Chairman said that this does not contain requirements. It says, meets the requirements. So it does contain requirements. Manual of Style says no section of a document or a document shall be referenced in definition. They reference Section 14.3 of a document. It was with
regard to the issue this was introduced in the comments stage. If this motion was out of order, the committee accepting amending motions would not have accepted it.

This is simply getting the stuff in accordance with the Manual of Style. The vast majority of NFPA committees have done the work of completing the actions to comply with the Manual of Style. I pointed out that this does not comply with the Manual of Style in several instances.

Thank you.


MR. RAIFSNIDER: Geoffrey Raifsnider, mechanical engineer with Global Finishing Solutions. I'm also the secretary of the Technical Committee on Finishing Processes. I'm representing myself, and I am speaking against this motion.

As a manufacturer of this equipment, we actually make a Limited Finishing Work Station, and this change would create confusion in the industry. So we certainly are against that.

Also, while there may be problems with the existing language, it did not go through the full approval process and the public input phase and
then the comment phase, and we strongly urge you to reject this motion. Thank you.

MR. BELL: Thank you. Any further discussion?

Mr. Chairman, any final comments before we vote?

Okay.

Seeing none, we will move to vote. Before we vote, let me restate the motion. The motion on the floor is to accept Public Comment Number 14.

To vote, touch the vote button now. If you wish to vote in favor of the motion and recommend the text on screen one, touch yes. If you wish to vote against the motion and recommend the text on screen two, touch no. Please record your vote now. Five seconds. The balloting is closed. Thank you.

The results of the vote are 183 against, 50 in favor. The motion fails.

We will now proceed with the discussion on Certified Amending Motion 33-2. Microphone 1, please.

MR. HIRSCHLER: Marcelo Hirschler, GBH International, and I hereby move Motion 33.2 to accept Comments 33.10, 11, 12, and 13.

A VOICE: Second.

MR. BELL: Okay. Do we have a second?
Technical Committee on Finishing Processes

Certified Amending Motion 33-1

Committee Response to the Appeal to the Standards Council

August 6, 2015

It is our understanding that M. Hirschler is appealing the vote at the NFPA 2015 Technical Meeting regarding rejection of his CAM 33-1 regarding the definition of Limited Finishing Workstation. We have the following response:

1. The committee discussed Mr. Hirschler’s comment. It was the committee’s opinion that the comment could not be accepted as written since it changed the meaning of the definition in a manner so as to leave it, not just meaningless, but could lead to misinterpretation that could create or allow a hazardous fire situation. The committee, by unanimous vote, rejected the comment.

When the committee first began discussion on “limited finishing workstations”, we did so in response to the automotive refinishing industry’s request. They were seeing an influx of “devices” advertised for small area refinishing that were not booths and did not meet the requirements of NFPA 33. However, these units were far less expensive than a full body booth and there were competitive issues with those trying to comply with the code.

This was a big enough deal that we scheduled one of our technical committee meetings in New Orleans to coincide with the Automotive Service Association’s NACE Cars annual convention. What we saw were some manufacturers’ ideas of finishing workstations that created hazardous conditions within a refinishing paint shop.

The result of our efforts was incorporated into our Chapter 14, Limited Finishing Workstations” that met the needs of the industry, but was consistent with good fire prevention and protection practices.

The definition and the section on limited finishing workstations are so specific to a particular process that we have to be careful changing the definition or it becomes meaningless.

2. In rejecting the comment, we requested that Mr. Hirschler resubmit his recommendation at the next revision cycle during the public input stage in such a way as to preserve the meaning of the definition and satisfy his understanding of the NFPA regulations.

3. Mr. Hirschler submitted his proposal between the First Draft and Second Draft meetings. This did not give us the proper time to consider “new material”.

When this was discussed by the committee, we considered the possibility of modifying the definition at that meeting. However, we felt that any changes would be substantive and would have to be considered “new material”. As this was our Second Draft meeting and the definition would not go out for public comment, we rejected Mr. Hirschler’s public comment with plans to
discuss at our first Draft meeting of the next revision cycle.

4. Mr. Hirschler’s motion was rejected by the voting members at the NFPA Annual Technical Meeting – approximately 75% against.

5. Mr. Hirschler has not submitted any new material for consideration to the Standards Council.

6. The change Mr. Hirschler proposed is not substantive; it is editorial having to do with adherence (and interpretation thereof) to the NFPA Manual of Style.

Respectfully submitted,

Tom Euson
Chair, Committee on Finishing Processes
TO: Linda Fuller, Secretary Standards Council  
NFPA  
1 Battery March Park  
Quincy, MA, 02269  

July 15, 2015

Dear Linda,

I hereby want to appeal the action of the Annual 2015 Technical Meeting regarding three certified amending motions I made, namely 33-1 (to accept public comment 14), 33-2 (to accept public comments 10, 11, 12 and 13) and 520-1 (to accept public comments 1 and 2).

All three motions dealt with issues associated with the NFPA Manual of Style and I believe that Standards Council needs to ensure that the Manual of Style is adhered to. I will provide some short details regarding each motion.

I. 33-1: The language proposed by the comment was as follows:

3.3.19.1 Limited Finishing Workstation. An apparatus that is capable of confining the vapors, mists, residues, dusts, or deposits that are generated by a spray application process and that meets the requirements of Section 14.3, but does not meet the requirements of a spray booth or spray room, as herein defined.

A.3.3.19.1 Limited finishing workstations meet the requirements of Section 14.3 of this standard.

The committee stated: The deletion as suggested changes the meaning of the definition completely. A limited finishing workstation is a very specific type of ventilation enclosure and it must meet the requirements listed in Chapter 14. Without the reference to Chapter 14 the definition simply states that it is not a spray booth or spray room but is ANY apparatus that confines vapors. This could mean that it is any portable ventilation system including a flexible ventilation duct. No alternative wording was suggested by the submitter. The committee would consider alternative wording if suggested but there must be a reference to the requirements in Chapter 14.

The following are five sections from the NFPA Manual of Style:

1. Definitions shall not be written in mandatory language (2.3.1.4).
2. A definition shall only describe the term being defined (2.3.2.1).
3. Definitions shall be in the format of a bold term followed by the definition phrase to form a single paragraph unit (2.3.2.2).
4. Definitions shall not contain requirements (2.3.2.3).
5. References to other documents or sections of a document, notes, lists, footnotes, cautions, warnings, or figures shall not be permitted in definitions (2.3.2.4).

The technical committee wants to continue using a definition that does not comply with more than one of the clauses in the Manual of Style and the solution proposed is simple and clear and eliminates the conflicts with the Manual of Style.

II. 33-2: The existing definitions of “limited combustible” and “Noncombustible Material” within NFPA 33 read as follows:

3.3.9 Limited Combustible. A building construction material not complying with the definition of noncombustible material that, in the form in which it is used, has a potential heat value not exceeding 8140 kJ/kg (3500 Btu/lb), where tested in accordance with NFPA 259 and complies with (a) or (b): (a) materials...
having a structural base of noncombustible material, with a surfacing not exceeding a thickness of 3 mm (1/8 in.) that has a flame spread index not greater than 50; and (b) materials, in the form and thickness used, other than as described in (a), having neither a flame spread index greater than 25 nor evidence of continued progressive combustion and of such composition that surfaces that would be exposed by cutting through the material on any plane would have neither a flame spread index greater than 25 nor evidence of continued progressive combustion. (Materials subject to increase in combustibility or flame spread index beyond the limits herein established through the effects of age, moisture, or other atmospheric condition shall be considered combustible.)

3.3.11.2 Noncombustible (Material). A material that, in the form in which it is used and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat. Materials that are reported as passing ASTM E 136, Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750° C, are considered noncombustible materials.

Once again, the definitions contain requirements and references to standards, in contravention with the NFPA Manual of Style. As you can see, limited combustible refers to NFPA 259 and (indirectly) to ASTM E84 when it calls for a specific flame spread index and smoke developed index and “noncombustible” refers to ASTM E136. The solution proposed simply puts a pointer into section 3 on definitions for both limited combustible material and noncombustible material and places the definitions (as extracted from NFPA 5000) into a place within the body of the standard where they can be referenced and made into a requirement. The reason there are 4 comments is that the comments refer to individual sections. NFPA staff recommended that the 4 comments be combined in one motion to complete the action. This approach has been adopted by a whole series of NFPA documents, including the following key documents (not a complete list):

NFPA 1, Fire Code
NFPA 5000, Building Code
NFPA 52, Vehicular Gases Code
NFPA 55, Compressed Gases Code
NFPA 90A, Air Conditioning Standard
NFPA 90B, Standard for Warm Air HVAC
NFPA 99, Health Care Code
NFPA 130, Rail Standard
NFPA 220, Types of Building Construction
NFPA 285, ISMA test (new edition)
NFPA 501, Manufactured Housing Standard
NFPA 502, Standard on Tunnels
NFPA 909, Code for Cultural Resources
NFPA 914, Code for Historic Structures
NFPA 1124, Code for Fireworks

I. 520.1 The existing definitions of “Noncombustible Material” within NFPA 520 reads as follows:

3.3.8 Noncombustible (Material). A material that, in the form in which it is used and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat. Materials that are reported as passing ASTM E 136, Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750° C, shall be considered noncombustible materials.
Once again, the definition in NFPA 520 contains requirements and references to standards, in contravention with the NFPA Manual of Style. As you can see, “noncombustible” refers to ASTM E136. The solution proposed is the same as for NFPA 33. It simply puts a pointer into section 3 on definitions for noncombustible material and places the definition into a place within the body of the standard where it can be referenced and made into a requirement.

In summary, Standards Council should override the action of the technical committees (and the assembly) and ensure that the documents are issued in a fashion that is consistent with the NFPA Manual of Style.

I will not attend the Standards Council meetings.

Yours sincerely,

Marcelo M. Hirschler
then the comment phase, and we strongly urge you to reject this motion. Thank you.

MR. BELL: Thank you. Any further discussion? Mr. Chairman, any final comments before we vote? Okay.

Seeing none, we will move to vote. Before we vote, let me restate the motion. The motion on the floor is to accept Public Comment Number 14. To vote, touch the vote button now. If you wish to vote in favor of the motion and recommend the text on screen one, touch yes. If you wish to vote against the motion and recommend the text on screen two, touch no. Please record your vote now. Five seconds. The balloting is closed. Thank you.

The results of the vote are 183 against, 50 in favor. The motion fails.

We will now proceed with the discussion on Certified Amending Motion 33-2. Microphone 1, please.


MR. BELL: Okay. Do we have a second?
A VOICE: Second.

MR. BELL: All right. We have a second. Somebody's still awake. Mr. Hirschler, please continue.

MR. HIRSCHLER: Okay. I'm going to read again the sections of the Manual of Style. This is purely a Manual of Style issue.

"Definitions shall not be written in mandatory language.

"A definition shall only describe the term being defined.

"Definitions shall be in the format of a bold term followed by the definition phrase to form a single paragraph unit.

"Definition shall not contain requirements.

"References to other documents or sections of a document, notes, lists, footnotes, cautions, warnings or figures shall not be permitted in definitions."

The Technical Committee wants to continue using definitions that do not comply with more than one of the clauses of the Manual of Style.

What we're dealing with in this case is
the definitions of limited combustible material and noncombustible material. I thought the actual text was going to be shown, but it isn't. The definition of limited combustible material refers to NFPA 259 and requires that a limited combustible material must have a specific flame spread index, a specific smoke develop index, a specific heat content based on NFPA 259, if you leave here noncombustible material requires that it shall comply with ASTM E136. So both contain the requirements that comply with specific documents.

The committee says they would like to maintain the definition within the definition chapter and they do not want to put it anywhere else. They want to continue using definitions that don't comply with more than one of the clauses of the Manual of Style.

The solution proposed was adopted by a whole slew of other documents. I'm going to give you a list of some of them. The solution proposed simply puts a point in Section 3 of definitions for both limited combustible material and noncombustible material, places definitions as extracted from NFPA 5000, interplays within the
body of the standard where they can be referenced and made into a requirement.

The reason for the four comments are the comments referred to individual sections. NFPA staff recommended four comments be combined into one motion to complete the action. This approach has been adopted by a whole series of NFPA documents including the following key documents:

NFPA 1, Fire Code; NFPA 101, Life Safety Code; 5000 Building Code, 52, 55, 98, 90B, 99, 130, 220, 285, 501, 502, 909, 914, 1124. That's not a complete list. It's a list of most of the documents that have -- that use these definitions. This is something that's been going through the vast majority of the NFPA system.

Please support the motion and make this consistent with the Manual of Style and with the major documents in NFPA. Thank you.

MR. BELL: Thank you. Just a reminder to people that some of the text, if it's too large, cannot be shown on the screens. So please refer to your agenda for the entire text of all these motions.

Mr. Euson, would you like to offer the
Committee's position?

MR. EUSON: Thank you. The Technical Committee considered Mr. Hirschler's comments at the second draft meeting. During that review, the Technical Committee noted Mr. Hirschler's comments were new material that had not been introduced at the comments stage.

The committee did not outright reject Mr. Hirschler's request to move the definition to Chapter 5, but rather voted to reject to hold his four comments in accordance with NFPA Regulation 4.4.8.3.1 which state that the Technical Committee can in processing any comments presents new material that has not had time to be considered at the second draft meeting. The material was presented -- the material was not presented at the public input at the first draft meeting.

The Committee would like additional time to consider how to make the suggested changes in accordance with the Manual of Style but in a way that also meets the Committee's desire to maintain definitions within the definitions chapter.

The Committee also considered referencing NFPA 5000 instead of 2020 as currently referenced.
The Technical Committee is responsible for two documents, NFPA 30 and 34, requiring these two documents to mirror one another to the extent possible. The Committee needs additional time to review the comment, determine how to modify the requirements of NFPA 34 so that it also mirrors the requirements in 33.

Mr. Hirschler argues that the definitions of not noncombustible and limited combustible contain requirements. The Committee believes there is no requirement in the existing definition, but rather a description of what can be called limited combustible or noncombustible. Nowhere in the definition does it state the material shall contain -- consist of something. For example, if the definition stated "noncombustible material shall be made of steel", that would be a requirement.

In the opinion of the Technical Committee, stating that a noncombustible material will not ignite, burn or support combustion when subject to an ASTM test is not a requirement but merely a description of the parameters within which the material is defined as being noncombustible.
The Committee urges you to reject this motion.

MR. BELL: Thank you, Mr. Euson. With that, we will open up the debate on the motion. Please provide your name and affiliation, whether you're speaking in support of the motion or against it.

Microphone 1.

MR. HIRSCHLER: Marcelo Hirschler, GBH International, in support of the motion.

Limited combustible materials, building construction material not complying with noncombustible, that has a potential heat value when tested so-and-so and complies with so-and-so. These are requirements. These are requirements.

This exact same -- and what all the motion says is extract this from 5000 as has been done in the whole list of documents that I read to you before.

And, again, I don't want to keep going back to the same thing that I said before. The Manual of Style is very clear. There shall be no reference in the definition of any other documents. References to other documents or sections of a document shall not be permitted in definitions.
Both of these definitions are referenced into other documents, ASTM E136, NFPA 259. These definitions have requirements. They say that a noncombustible material shall comply with this, that, and the other. This exact same thing has been done in all these other major codes, 1, 101, 5000. I read you the whole list before.

Please make NFPA 33 consistent with all the other major NFPA documents. Thank you.


MR. RAIFSNIDER: Geoffrey Raifsnider, Global Finishing Solutions, representing myself and speaking against the motion.

In accepting this motion, it would place both the definition of limited combustible and noncombustible in Chapter 5. Chapter 5 does contain the requirements for the construction of spray areas and spray booths. However, the standard uses the definition of noncombustible for more than just the construction. It's also used when describing the material that is sprayed during the application operation.

The proposal does not appear to take this usage into account. It would need to be revised to
ensure that the use of this defined term is properly maintained throughout the document. As suggested by the Committee, the original proposal or any modifications the proponent may wish to make should be considered during the next revision cycle as this had introduced new material and has not had adequate time for public review.

Therefore, I urge you to reject this motion on the basis that it reduces the clarity of the document and it did not follow proper procedures to ensure sufficient review. Thank you.

MR. BELL: Is there any further discussion? Any further discussion on group amending motion 33-2 to accept Public Comments Number 10, 11, 12, and 13. Mr. Chairman, any final words? All right. Thank you, Mr. Chair.

Before we vote, let me restate the motion. The motion on the floor is a group amending motion to accept Public Comments Number 10, 11, 12, and 13. To vote, touch the vote button. If you wish to vote in favor of the motion and recommend the text on screen one, touch yes. If you wish to vote against the motion and recommend the text on screen two, touch no. Please record your vote. Five
seconds. Voting is closed.

194 against the motion, 42 in favor of the motion. The motion fails.

Is there any further discussion on NFPA 33? Hearing none, we'll move on to the next document. Thank you, Mr. Euson.

MR. EUSON: Thank you.

MR. BELL: Before we begin the next document, I would like to introduce Bonnie Manley, member of the Standards Council who will be the presiding officer for the next two documents. Bonnie.

MS. MANLEY: Good afternoon. The next report under consideration this afternoon is that of the Technical Committee on Subterranean Spaces. Here to present the Committee report is Committee Chair Jack Poole of Poole Fire Protection, Incorporated, of Kansas.

The committee report, that is, the First and Second Draft Reports, are located on the document information page for NFPA 520 on the NFPA website. The Certified Amending Motions are contained in the NFPA Technical Meeting Tech Session Agenda and will be displayed behind me on the screen.
Technical Committee on Finishing Processes

Certified Amending Motion 33-2

Committee Response to the Appeal to the Standards Council

August 6, 2015

It is our understanding that M. Hirschler is appealing the vote at the NFPA 2015 Technical Meeting regarding rejection of his CAM 33-2 regarding the definition of Non-Combustible Material. We have the following response:

1. The committee discussed Mr. Hirschler’s comment. It was the committee’s opinion that the comment could not be accepted as written since it the recommendation did not properly address all areas in the document where the term “noncombustible” is used. “Noncombustible” is used in 1.1.8, 5.1, 5.1.2, 5.6.4, 10.4 and 17.7.3.1. Mr. Hirschler’s recommendation specifically didn’t fit well with the use of “noncombustible” in 1.1.8 in the scope of the document. The committee, by unanimous vote, voted to “reject but hold” the comment.

   Please note that the committee did not outright reject the comment. We agreed to “hold” the comment until the next cycle.

2. Mr. Hirschler stated that the definition contained “requirements”. The committee disagrees. There are “parameters”, as any definition must have. However, there are no requirements (shall) as would be generally understood by the word. To state that a material “will not ignite, burn, support combustion or release flammable vapors…” when subject to an ASTM test is not a requirement, but merely stating parameters.

3. Mr. Hirschler submitted his proposal between the First Draft and Second Draft meetings. This did not give the Technical Committee the proper time to consider “new material”.

   When this was discussed by the committee, we considered the possibility of modifying the definition at that meeting. However, we felt that any changes would be substantive and would have to be considered “new material”. As this was our Second Draft meeting and the definition would not go out for public comment, we tabled it until the next cycle. We are still planning to discuss this at our first Draft meeting during the next revision cycle.

4. Mr. Hirschler’s motion was rejected by the voting members at the NFPA Annual Technical Meeting – approximately 75% against.

5. Mr. Hirschler has not submitted any new material for consideration to the Standards Council.
6. The change Mr. Hirschler proposed is not substantive; it is editorial having to do with adherence (and interpretation thereof) to the NFPA Manual of Style.

Respectfully submitted,

[Signature]

Tom Euson
Chair, Committee on Finishing Processes
Item 15-8-6
MEMORANDUM
(AMENDMENT)

TO: Technical Committee on Supervising Station Fire Alarm and Signaling Systems

FROM: Jenny Depew, Project Administrator

DATE: July 15, 2015

SUBJECT: Final Results - Amendment 72-8 Letter Ballot on the Proposed 2016 edition of NFPA 72

At the NFPA Technical Meeting (Tech Session), held June 25, 2015, NFPA 72 was amended by the acceptance of the following:

Amendment 72-8: Accept Public Comment No. 140.

The final results of balloting are as follows:

26 Members Eligible to Vote
4 Ballots not Returned (T. Connaughton, B. Elliott, S. May, G. Monaco)
22 Agree (w/comment R. Kleinman, S. Schmidt)
0 Disagree
0 Abstentions

According to 4.6 of the Regulations Governing the Development of NFPA Standards, the final results show the Amendment HAS achieved the 2/3 majority vote needed to recommend approval of the Association Action by the Technical Committee. The Committee has voted to support Amendment 72-8. As a result, the recommendation to the Standards Council is to incorporate the Public Comment text in the NFPA Standard.

The number of votes needed to recommend approval of the Association Action is 15.

(26 eligible to vote - 4 not returned - 0 abstentions = 22 × 0.66 = 14.52 = 15)

Please remember that the return of ballots is required in accordance with the Regulations Governing the Development of NFPA Standards.
Amendment 72-8: Accept Public Comment No. 140.

Instructions:
Vote Agree to support the Amendment and as a result recommend the Public Comment text.

Vote Disagree to not support the Amendment and as a result recommend previous edition text. Note: where no previous edition text exists the text is simply deleted.

☐ Agree

I support the Amendment and as a result recommend the Public Comment text which reads as follows (changes shown legislatively to the Second Draft):

26.5.3.1.3 When permitted by the Authority Having Jurisdiction, alarm Alarm, supervisory, and trouble signals shall be permitted to be received at a listed central supervising station

Please see my comments attached.

☐ Disagree*

I do not support the Amendment and as a result recommend previous edition text which reads as follows (text shown clean):

26.5.3.1.3 Alarm, supervisory, and trouble signals shall be permitted to be received at a listed central supervising station.

☐ Abstain*

*Please give reasons for voting “Disagree” or “Abstain”:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Signature: ___________________________

Name - Please Print: Richard Kleinman

Date: July 1, 2015

Please return as soon as possible, but no later than July 13, 2015 to:

Jenny Depew, Administrator, Technical Projects
National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169

EMAIL: jdepet@nfpa.org
FAX: 617-984-7110
NFPA 72 is the National Fire Alarm and Signaling Code. It is THE Standard to which fire alarm systems in the U.S. are to be installed, monitored, inspected and maintained. When an end user gets a fire alarm system from a company that is selling a Standards compliant system, the end user (an owner or occupant of a building) is expecting service that meets or exceeds the Standard. By accepting Public Comment No. 140, the end user is not necessarily assured of Standards compliant service.

AFA Protective Systems, Inc. operates three UL Listed and FM Approved central stations facilities. Our facilities and records are inspected by both UL and FM so that they have assurances that the services we supply comply, where required, with the applicable Standard. By enabling a local AHJ to offer services in competition with a Central Station service provider without the requirement to adhere to the Standard (approval by an independent third party NRTL), the end user may be getting substandard service and even worse, may not have a choice of the service provider they want.

We all understand that municipalities need to find ways to raise funds. However, the fundraising should not be done in a way that could jeopardize the properties and lives that NFPA 72 has been so painstakingly developed in order to protect those lives and properties.
NFPA 72, National Fire Alarm and Signaling Code
June 2015 Amendment 72-8 Ballot Form
For the Technical Committee on Supervising Station Fire Alarm and Signaling Systems

Amendment 72-8: Accept Public Comment No. 140.

Instructions:
Vote Agree to support the Amendment and as a result recommend the Public Comment text.
Vote Disagree to not support the Amendment and as a result recommend previous edition text. Note: where no previous edition text exists the text is simply deleted.

☐ Agree I support the Amendment and as a result recommend the Public Comment text which reads as follows (changes shown legislatively to the Second Draft):

26.5.3.1.3 When permitted by the Authority Having Jurisdiction, alarm Alarm, supervisory, and trouble signals shall be permitted to be received at a listed central supervising station

☐ Disagree* I do not support the Amendment and as a result recommend previous edition text which reads as follows (text shown clean):

26.5.3.1.3 Alarm, supervisory, and trouble signals shall be permitted to be received at a listed central supervising station.

☐ Abstain*

*Please give reasons for voting “Disagree” or “Abstain”:
I believe the text provided on this ballot for “Disagree” is in error.
NFPA’s Regulations Governing Standards Development, Table 1, first row, column 5 states that if CAM fails, related text reverts to previous edition. Ballot text reflects 2nd draft language.

Signature: [Signature]

Name - Please Print: Steve Schmit

Date: 7/13/2015

Please return as soon as possible, but no later than July 13, 2015 to:

Jenny Depew, Administrator, Technical Projects
National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169
EMAIL: JDepew@nfpa.org
FAX: 617-984-7110
discussion on Motion 72-6 to accept Public Comment Number 120?

Hearing none, Mr. Schifiliti, any final comments?

MR. SCHIFILITI: No final comments from myself or the Chair.

MR. SNYDER: We will now move to a vote. Before we vote, let me restate the motion. The motion on the floor is to accept Public Comment Number 120, and we'll vote again using the touch buttons on the iPad. If you wish to vote in favor of the motion and recommend the text on the screen one, touch yes. If you wish to vote against the motion and recommend the text on screen two, touch no. Please record your vote. The balloting will be closed in five seconds. The balloting is now closed.

The results of the vote are 17 in favor of the motion, 211 against the motion. The motion has failed.

Let's now proceed with the discussion on Certified Amending Motion 72-8. Microphone 1, please.

MR. BLACK: Thank you, Mr. Presiding Officer.
Art Black, Carmel Fire Protection. I move acceptance of Public Comment 140.

VOICES: Second.

MR. SNYDER: There is a motion on the floor to accept Public Comment Number 140, and I have heard several seconds. I would like to inform the membership that Motion 72-8 seeks to delete Section 26.5.3.13. If Motion 72-8 passes, Motion Number 72.9 will not be entertained as Motion 72.9 seeks to modify Section 26.5.3.13.

MR. BLACK: Just the opposite. 72-8 modifies. 72-9 deletes.

MR. SNYDER: And it's dot free. Let me try this one more time. Motion 72-8 seeks to modify Section 26.5.3.13. If Motion 72 -- one moment, please. One minute, Mr. Black.

MR. BLACK: No problem. The Cubs' umpires didn't have this much trouble.

MR. SNYDER: Okay. The phone lines were a little slow to New York. What we will do is the intent of Motion 72-8, and you are correct, is to modify Section 26.5.3.13.

MR. BLACK: No, 1.3. It's on your slide.

MR. SNYDER: Okay. Mr. Black, I would like to
ask on behalf of the presiding officer's position
if we might entertain 72-9 first which would be the
motion to delete, and then if that would come into
place, that would have -- already positioned to a
modification to that section.

MR. BLACK: As a life member of NFPA, I try to
accommodate the Standards Council any time I can.

MR. CLARY: Point of order, Mr. Chairman.

Mr. Chairman, point of order.


MR. CLARY: Thank you. Shane Clary, Bay Alarm
Company. We would oppose the suggestion. We would
like to take 72-8 prior to 72-9.

MR. SNYDER: One moment, please. After
conferring, we will begin in the order as the
agenda has published beginning with 72-8.

Mr. Black, thank you for your patience.

MR. BLACK: Shall I make the motion again?

MR. SNYDER: If you would, please.

MR. BLACK: Rewind. Start over again. My name
is Art Black, Carmel Fire Protection. I move
acceptance of Public Comment 140.

MR. SNYDER: Okay. There was a motion on the
floor --
VOICES: Second.

MR. SNYDER: -- to accept public Comment 140, and I hear several seconds. Please proceed.

MR. BLACK: Okay. I have heard from a lot of people. I teach NFPA 72 for a lot of organizations, including NFPA, and I have heard that Chapter 26 is relatively incomprehensible. So I'm going to give a little bit of history and let others do the arguing because I think there are people who will be speaking on this on both sides.

But in 1960, a pivotal year in the history of the United States, JFK was elected. You know, one of the top songs was Itsy Bitsy Teeny Weeny Polka Dot Bikini; Kerry Bell celebrated his sixth birthday; and the NFPA Standards Council adopted NFPA 72C which was the remote station standard. The remote station standard basically designated the public sector, in those days, the fire station or other public sector, as the location where the transmission of signals from a fire alarm system were to be monitored.

After the second edition of NFPA 72C, an exception was put into that document that said that even though signals had to be monitored at the
public sector, where the public sector was unable or unwilling to monitor, they could approve an alternate location. That exception was the way that remote stations have been running ever since up until several cycles ago in 2002, we changed from the exception to making an AB switch. Remote station monitoring was either at the public sector or, where approved by the authority having jurisdiction, at a location other than the public sector.

This motion purports and is to keep the tradition of remote station being under the control of the authority having jurisdiction. Thank you.

MR. SNYDER: Thank you, sir. Mr. Schifiliti, would you like to offer the committee's position?

MR. SCHIFILITI: The Correlating Committee has no position, and Rodger Reiswig has been designated by the Chair of the Supervising Station Committee to present the committee's position at Microphone 3.

MR. SNYDER: Proceed.

MR. REISWIG: Rodger Reiswig with Tyco Fire Protection Products. It should be noted that even though I'm standing at an against motion
microphone, I am neither for nor against. I am merely bringing the committee statement.

The committee voted in the first draft to include or create 26.5.3.1.3 as shown on screen number two. The committee added the paragraph to clarify that a listed central supervising station can provide remote station service, but also be noted that the TC ballot for the first draft meeting -- first draft meeting ballot indicates that 21 members were an affirmative vote and 4 were negative vote.

At the second draft meeting, a task group was formed to review 26.5.3.1.3, and after debate and committee discussion, it was -- and the vote, the straw vote that was taken, there were to be no changes done at the first draft -- from the first draft. That is all.

MR. SNYDER: Thank you. We will now open up debate on the motion. For the record, we will need you to provide your name and affiliation and whether you are speaking in support of or against the motion. Microsoft -- Microphone Number 6, please.

MR. BONIFAS: I like Microsoft, too. My name
is Ed Bonifas, and I'm a past president of the Central Station Alarm Association, and I'm speaking on their behalf as well as my company, Alarm Detection Systems. The problem here --

MR. SNYDER: Sir, for or against the motion?

MR. BONIFAS: I am against the motion.

MR. SNYDER: Thank you.

MR. BONIFAS: The problem here is that some AHJs here in Illinois have figured out how to leverage Chapter 26 for financial gain. Literally, there are AHJs that have become revenue-seeking service providers of alarm monitoring. They sign contracts with customers. They send out marketing materials, and they project profits. They show up for a building inspection and attempt to get contracts signed at the time they're enforcing the Code. They're both market participants and they're regulators.

These AHJs simply refuse to acknowledge all private alarm monitoring regardless of the merits of the facility. They anoint their own monitoring station as the only approved supervising station and reject all others.

The conflict of interest is blatant. The
AHJ is both the market participant and the arbiter of the Code. They're using the Code to maximize profits and restrict competition. The Code never contemplated that the AHJ would cross this line, and now that it has happened, the integrity of the Code is at risk.

One federal court has recently found a fire department to have created an illegal monopoly, to have acted arbitrarily by denying private supervising stations. The judge characterized their system as less safe; and, despite this court ruling, it continues.

NFPA should not allow discretion where the AHJ has a direct financial interest in its decision. Section 1.5.3 of the Code says, "The system's methods, devices or appliances that are found equivalent shall be approved." Our ETL, UL or FM listing certifies our compliance with this Code. This motion should be rejected.

MR. SNYDER: Thank you, sir. Microphone Number 4, please.

MR. AMES: Hello. My name is Blair Ames. I have a company, Montgomery Ames. I have been in the business for 45 years selling detection
systems, doing several hundred high-rise systems,
upgrading the original World Trade Center in New
York, and my father before me did the John Hancock,
the Prudential Building, the two largest buildings
in Massachusetts. As a matter of fact,
John Hancock was the largest high-rise in the
country outside of New York City.

I have been -- we've been working with
fire authorities for 60 years.

MR. SNYDER: Sir, are you speaking for or
against?

MR. AMES: I'm speaking for the motion.

MR. SNYDER: Thank you.

MR. AMES: And I am representing today the fire
communication officers of Rhode Island. That's
50 members that enforce the Code in Rhode Island.

In the 1970s when we didn't bring in
trouble and supervisory, I had several buildings
where the fire alarm didn't work, and I found that
the -- it went to the state fire marshal, and we
found there's an arson group within the fire
authority, and eventually we prosecuted the state
fire marshal for arson homicide. State fire
marshals in Connecticut and authorities in New York
were the joint force that the insurance companies funded. Once the insurance companies got involved, prosecutions occurred within six months.

Since that time, trouble and supervisory have been implemented by the dynamic state fire marshal in Massachusetts. It's been an overhaul.

In the last 45 years, if I bring out the good book like the gentleman from San Francisco and the state code and show the requirements, there's no argument. They go by Code. It's the bible for us.

So therefore, since that time, Code Standards have improved, and with NFPA, all we have to do is call, get a decision of what the Code is, and it's a fair and equal format.

Recently, trying to overcome the local authority having jurisdiction, I had a fatality in a fire in a town where the fire department was overridden to put in a central station that did not comply to anything. The system didn't work. I had a fatality; and if it had been adhered to and put a radio system in, there would have been no loss of life and they would have responded.

I do not -- I'm going for the motion because the authority having jurisdiction is the
final say. And today, with NFPA, they are thoroughly professional and reasonable in all the proposals. Thank you.

MR. SNYDER: Thank you, sir. Microphone Number 2, please.

MR. CALBY: Good afternoon. My name is Dennis Calby (phonetic), and I'm speaking as an individual member and speaking in opposition to the motion. Some here have argued that the language included in the revision draft may unreasonably restrict the purview of an authority having jurisdiction. The term "authority having jurisdiction" is mentioned over 300 times in NFPA 72, including 44 times in Chapter 26. The concept of having an authority, a local authority to mediate the Code language with conditions in the field is widely recognized, accepted, and is in fact needed. I'm not advocating changing this. However, if the authority having jurisdiction is providing alarm monitoring service for money and then eliminating other qualified, recognized, and accepted alternate methods, an equivalent service may be denied without...
demonstrated benefit. I am advocating eliminating an inherent conflict of interest. Thank you for your time.

MR. SNYDER: Thank you, sir. Microphone Number 1.

MR. BUNKER: Thank you, Mr. Chairman. Merton Bunker, U.S. Department of State representing the NFPA Electrical Section speaking in favor of the motion.

On Tuesday, the Electrical Section voted to support this Certified Amending Motion. Thank you.

MR. SNYDER: Thank you, sir. Microphone Number 6.

MR. BISH: Thank you, Mr. Chairman. My name is George Bish representing the Electronic Security Industry and speaking in opposition to the motion.

The industry voted to support opposition to this motion since, as previously stated, it's the AHJs, it's the hen watching -- the fox watching the hen house. When the AHJ is in competition with industry, they should not have the ability to be the AHJ. Thank you.

MR. SNYDER: Thank you, sir. Microphone 5,
please.

MR. LOWREY: Thank you, sir. My name is David Lowrey, City of Boulder Fire Rescue, Colorado, also representing the International Association of Fire Chiefs, Fire and Life Safety Division as well as the Fire Marshals Association of Colorado, and we speak in support of this motion.

The change that was voted on by the Technical Committee and approved here basically eliminates the AHJ or the fire service from approving remote supervising station systems. If this is allowed to remain in the Code, the AHJ will no longer have the authority to approve remote supervising stations.

And let's be honest about this, guys. This isn't a national issue out there. This is a very localized edition that we're talking about here that they have put or tried to put into our national standard here to enhance the local debate of this.

On behalf of the International Association of Fire Chiefs, Fire and Life Safety Division as well as the Fire Marshals Association of Colorado,
I strongly support both motions -- or this motion, Motion 8 here, which keeps the authority having jurisdiction in the fire service in the approval process.

MR. SNYDER: Thank you, sir. Microphone Number 4, please.

MR. TOIKA: Hello. My name is Mike Toika. I'm president of the Illinois Fire Inspectors, and I am here to speak on behalf -- and approve the motion as stated.

The committee's proposed Code change created two very significant issues. First was the ability of a central supervising station to provide remote monitoring and, second, remove the requirement for approval from the authority having jurisdiction. This motion restores the language within NFPA 72 with regards to when authority having jurisdiction's ability to review and determine where fire alarms are received within their community.

AHJ's, whether mayors, village presidents or board members across the country are charged with protecting their community against all types of issues, fire included. Removal of their
authority clearly reduces their ability to accomplish this goal.

Since 1896, NFPA's mission has been to, and I quote from the Mission Statement, "Reduce the worldwide burden of fire and other hazards on the quality of life." As a leading advocate on fire prevention and life safety, NFPA has developed and published more than 300 codes and standards intended to minimize the possibility and effects of fire and other risks.

The NFPA Code change process has been a long-standing process that addresses issues to increase public safety. All changes heard or evaluated and substantiating documents on how changes will significantly protect the public and first responders. This proposed change takes some of this into consideration.

Central Station Alarm Association indicated in their white paper that the proposed Code change improves their profits and CAM 72-8 and 72-9 must be defeated to continue to make that happen. They made it quite clear that this is about profit, not public safety.

For the record, the business model that
was stated earlier on by the first gentleman was
actually introduced by his company to the fire
service back in the mid '80s as a way for them to
help increase their funding and the newer
technologies that were out there and now he is
stating it as a problem

Approval of CAM 72-8 as written
significantly addresses the two issues created by
the proposed Code change. It leaves language
indicating that lists of central supervising
stations can provide remote station monitoring, but
it restores the necessary approval of the AHJ; and,
most importantly, I believe it meets the objectives
as stated in NFPA's Mission Statement. Thank you.

MR. SNYDER: Thank you, sir. Microphone
Number 6.

MR. DONATI: Yes, sir. Chet Donati. I'm
president of DMC Security and also president of the
Illinois Electronic Security Association and my
position is no.

I operate a UL-listed central station for
the past 25 years. The way the remote station
section of the Code is being abused in this area is
awful and needs to be fixed. The Code is supposed
to set a bar. Technology and practices that meet or exceed the Code are supposed to be approved.

What is happening here in Illinois is no matter. How fast our supervisory central stations can respond to alarms; how safe we can make our monitoring facilities; how many redundant systems we have in place or how much cutting-edge technology we implement. We are being banned from providing remote station monitoring in the name of profitability. I'm being excluded from the market in the name of NFPA 72 without any assessment of my merit. If there is -- were about technical deficiencies, we could rise to the occasion and fix it. My competitors would also rise to the challenge. We would meet the technology hurdles. We are not competitive in this issue.

And if it starts here, it's also going to start in other states because the manufacturer of these products is pushing this issue. But there isn't a technical issue. No matter what we do or how great we make our systems, we cannot get approved as remote stations in some jurisdictions.

NFPA 72 or no other code for that matter should vest authority in a market participant. The
Code should describe what you need to do to gain approval. The Code should not be allowed to arbitrarily make a decision to exclude participants solely because they create competition. This needs to get fixed. So please vote no to this motion.

Thank you.

MR. SNYDER: Thank you, sir. Microphone Number 1, please.

MR. HAMMERBERG: Thank you. Tom Hammerberg representing the Automatic Fire Alarm Association, and we feel very strongly that the AHJ needs to be kept in the loop on this. They have been in the loop for many, many years, and they need to have the oversight on it.

In addition, if this CAM is accepted, there is a compromise in the language where it used to say that, you know, where permitted by the AHJ, it can go to any other location other than the public sector. Now it's going to allow the use of central station things.

More than anything, this is a local Chicagoland issue and should not be addressed in the national codes. They can deal with it locally. It doesn't affect anywhere else in the country, and
it shouldn't be brought up and put into a national code to try to fix. Thank you.

MR. SNYDER: Thank you, sir. Microphone

Number 5.

MR. PAISS: My name is Matt Paiss. I'm a firefighter with San Jose Fire Department and I'm here representing the International Association of Firefighters. Additionally, I am the primary rep on NFPA 70 for IFF. I'm here speaking in favor -- or to speak in favor of this motion.

The proposed change will reduce the ability for fire departments or AHJs to have the knowledge of the status of alarms within their jurisdiction. Further, it could slow the dispatching of fire apparatus by sending signals through a third party or listed central station.

We do not support changing a national standard based on the practices and preferences of a small segment of the country with no data to suggest an increase in public safety, rather, one that appears to only support a financial gain by the central station monitoring industry.

Voting no on this motion does not add in any way an increase of safety to our communities.
In fact, it may detract from it. The IFF recommends a yes vote on this motion. Thank you very much.

MR. SNYDER: Thank you. Microphone Number 6.

MR. CLARY: Thank you. Shane M. Clary, Bay Alarm Company. We are not -- we don't do business within the Chicagoland area. We are based in California, but we have been operating a central station for over 70 years, close to 70 years. I'm for the motion -- or against the motion, against the motion, before you ask me what my position is.

I would just again support what the Technical Committee has done which is on the screen on the right-hand side. I mean, this is a committee of consensus. It is not a hundred percent dominated by the central station industry. There are others on the committee; and, at the end, their vote, consensus based, was to have the language which you see on the right-hand side.

The central station industry, by the way -- I mean, we operate Bay Alarm a central station. The requirements in 72 require that we have at least -- any central station have two people on duty. We have more, but they're
dedicated strictly to be monitoring the alarm and dispatching. They do a great job at the PSAPs and the 9-1-1 centers, but there could be instances where they are dealing with an emergency within their community and the fire alarm signal could come in and that signal could be delayed upon.

There's been some comments about the delay between a third-party station to get it to the dispatch center. The industry working with the 9-1-1 centers, we have what's called ASAP to the PSAP for those jurisdictions that would wish to adopt it and, in that case, as soon as the signal is received at a central station monitoring station, we can immediately get that information into their CAD system, Computer A to Dispatch, and that would then give them information as to what's happening at the premise right to the responding units.

So, again, I would urge to vote against the motion on the floor. Thank you.

MR. SNYDER: Thank you. Microphone Number 4.

MR. MORRIS: Robert Morris, Executive Director of the Illinois Fire Inspectors Association, fire marshal with the Village of Roselle and in support
of the motion.

I would like to clarify that remote station monitoring has nothing to do with the fire department's desire to be or compete with alarm companies. If alarm companies feel that, that's an individual decision they need to take on with the municipality, not within NFPA 72. It has to do with the remote station monitoring by the fire department which currently is in the Code. This monitoring has been done by many departments in the Chicagoland area for over 50 years without any problem. In fact, central station companies own that equipment the fire department used.

This is not broken now and does not need to be fixed. Your AHJs have the responsibility to protect their community. They need the ability to do what they feel is best for them. There's no way I can nor should tell a department what they should be doing. The new Code would remove the ability of the AHJ to make decisions that they feel best in their own community.

This amendment would still allow the Code -- for control of central station monitoring which is a viable option should the AHJ feel it is in
their best interest. Thank you.

MR. SNYDER: Thank you. Microphone Number 1.

MR. FINNEGAN: Good afternoon, fire service leadership. I stand in support of CAM 72-8. My name is Dan Finnegan, and I'm the manager of Codes and Standards for Siemens Building Technologies. I have 40 years of experience in the fire service industry or the fire life safety industry, 10 years of that which was served in the fire service as a fire prevention officer, and 30 years as a fire alarm manufacturer.

We see this proposed Code change as being harmful to the fire service and does not improve fire life safety. The fire service deserves our respect and support from the alarm industry. Their support has driven the fire alarm, smoke alarm, fire sprinkler activities into our Codes. Those Codes have saved lives daily and continue so forth. We know that since 1970, over 90,000 lives have been saved by the advancements in these activities that the fire service has helped to drive.

As previously mentioned, this proposed Code change is not a national issue. It is not a fire life safety issue, and there's no real
technical justification to make the change.

Siemens, my organization, does own and
operate a UL-listed central supervising station.
It operates on a national basis. The proponents
for this change have stated in many published
documents that people should support the proposed
Code action because it would be good for business.
When we take a look in making decisions on Code
change activity, it's based on fire life safety,
it's based on the safety of our first responders,
and it's based on technical merits and technical
issues. It's not based on commercial gain.

But with all that said, it's important, as
Mr. Hammerberg pointed out, that if both parties
take a step back and look at this, that there is a
compromise sitting here. The Technical Committee
has worked very hard to create the language
concerning the words you see on the right-hand
side. The compromise here is by taking that
language that the Technical Committee worked hard
on and just including AHJ here, the fire service,
into the process. I think we can all walk out of
here with a very positive, proactive step going
forward that will continue to aid life safety and
keep the most important people, the fire service, in the loop with this activity. I ask everyone to please vote yes on CAM 8, 72-8. Thank you.

MR. SNYDER: Thank you. Microphone Number 3.

MR. DeVORE: Mike DeVore, State Farm and we do operate a central station UL-listed and are a member of the Central Station Alarm Association.

I just want to point out that I find it odd that the NFPA Codes keep sticking in as permitted by the authority having jurisdiction when the authority having jurisdiction doesn't get their authority from NFPA. They get it from their governing body. And so if they want to approve central stations or remote stations, then they need to run that through their government body and enact a law, and NFPA has no business being in the idea of giving authority. The authority is in the enactment of the standard. Thank you.

MR. SNYDER: Thank you. Microphone Number 5.

MR. SHAPIRO: Jeff Shapiro, fire protection engineer, and I'm speaking on my own behalf on this issue. There's one thing that really --

MR. SNYDER: Sir, in favor or against the motion?
MR. SHAPIRO: I'm speaking in favor. You got me. Thanks, Mike.

There's one thing that's been entirely absent from this discussion that I think is very important. Authority having jurisdiction includes the fire department, but it's not only the fire department. There are other agencies, if you read the definition of AHJ, that could be the AHJ, not the least of which might be an insurance company who would want to require the alarm for a building that they insure to go to the fire department and not allow it to go to somebody else. The current text permits that. This is not only about the fire department as the AHJ. There are other AHJs that are impacted in this decision.

The other thing which I really think needs to be made clear, if you vote for this motion, you are keeping the standard the same as it currently is. To vote against this motion is making a change to the standard. So if you're not sure, keep the standard the way it is. It's been that way for decades, and there's no compelling reason that's been offered to change it other than the AHJ issue which, by the way, is not just the fire department.
The right thing to do is to support this motion to keep the standard the same, and I urge you to do that.

MR. SNYDER: Thank you. Microphone Number 6, please.

MR. EGAN: Yes. Good afternoon. Thank you. My name is Patrick Egan. I am a retired fire chief from Lancaster, Pennsylvania, Lancaster Township. I'm also the past president and founder of the Pennsylvania Burglar and Fire Alarm Association and currently known as the ESA, the former National Burglar and Fire Alarm Association. I operate four central stations. We're licensed in 37 states, and I'm speaking against the motion.

With all deference to all my fellow firefighters and everyone who has spoken on their behalf, I think it's very important that when you think about the technical benefits of central station service versus remote station service, you'll realize that the 30-, 40-, 50-year-old remote station service is archaic. It's dead. It does not have the technology. The municipalities are not supporting technology upgrades. It doesn't have redundancy, and it doesn't have the manpower...
standards that a certified central station has.

So I'm voting against the motion and asking you for your support in that direction.

MR. SNYDER: Thank you. Microphone Number 4, please.

MR. LATHROP: Jim Lathrop, Koffel Associates speaking for myself. As I mentioned earlier today, in October of this year --

MR. SNYDER: Speaking for or against the motion?

MR. LATHROP: Speaking for the motion. I had that all prepared and forgot.

As I mentioned earlier today, this October will be 50 years in the fire service for myself, and we've gone through ups and downs with fire alarm systems in my hometown. We used to have municipal fire alarm boxes. And speak about competition, we offered that for free to everybody; but anyhow, one of the problems I see with this, and I'll tell you right now, I hate to tell you how many times when we get the call from central station, we get a bad address. I hate to tell you how many times we pull up, there is no 22 West Main Street. Okay? Call central station back, find out
if you can get a better address. We didn't have that problem when we had our municipal fire alarm boxes.

MR. SNYDER: Thank you. Microphone Number 5, please.

MR. MARSHALL: Good afternoon. Robert Marshall, Contra Costa County Fire representing the California Fire Chiefs Association, Fire Prevention Officer Section, in support of the motion.

You've heard the opponents say that this is a legal fight. That's where this needs to be. If that's what the issue is, fight it in the courts because they're going to have more authority than what a standard is going to have.

I think it's a dangerous precedent to start removing things from the authority having jurisdiction. If we start that here in NFPA 72, is that going to be next in NFPA 13? Is it going to be next in NFPA 1? Where is that going to stop?

I urge you to support the motion. Thank you.

MR. SNYDER: Thank you. Is there someone at Microphone Number 6? No. Okay, sorry. Microphone
Number 4, please.

MR. McLEAN: Shawn McLean with the Cleveland Fire Department, also representing the International Association of Firefighters, and I'm for the motion.

As we heard in our discussions with 1710, timing is of the essence for the division of fire to respond especially in the current modern fire environment. I agree there are many quality providers out there, but that's what the AHJ is there for, to ensure that quality is there and it's consistent.

Removing the AHJ out of there removes that supervisory that can sit there and make sure that there's consistency and quality in the service with these central supervising stations. I urge your approval of this motion.

MR. SNYDER: Thank you, sir. Microphone Number 5, please.

MR. WALKER: Dean Walker with the Grays Lake Fire Protection District, Grays Lake, Illinois, certified safety professional, certified fire claims examiner through NFPA, a firefighter/paramedic, most recently for the last
ten years assigned as a fire inspector in the Fire Prevention Bureau, here on behalf of my chief, the Grays Lake Fire Protection District and the Northern Illinois Fire Inspectors Association. I just want to say that we are in support of this motion.

Let's keep this as a life safety issue, not a money issue. We are a fire district involved with about seven municipalities. I'm living this, I can tell you. In the last -- about six months ago, we lost our direct connect. Basically because of all the legal actions and things that were going on, had to go to central stations. I can tell you before six months ago, at least once a day I would be dealing with a trouble alarm following up on something dealing with a building owner trying to get it resolved. In the past six months, I can guarantee you I've heard about a trouble alarm once, twice a week, at most, more like -- I'd say it's more like once or twice a month which is ridiculous.

Last week, we were dispatched to the wrong address of a school by the listed central station. Also last week -- so we're not talking ancient
history here, we're talking last week -- was told
-- or checked on the fire alarm panel, saw that we
had a trouble alarm and the key-holder had not been
notified. And it only lasted about ten minutes.
The central station said, well, we didn't want to
bother anybody. So I said, What about when it went
back into alarm or trouble alarm 30 minutes later
and you didn't dispatch -- you didn't call the
key-holder for 24 -- over 24 hours until it
restored? They said, We don't have an answer for
that.

I can't see how this is any safer than us
watching it ourselves. Central stations always --
already have the ability to do this as listed
central station service. The remote station needs
to be there as an option. We're allowing it.
We're actually not even the AHJ in our fire
district. It's the Village of Grays Lake that has
approved the listed central stations.

So, again, there's others that are
involved, and I see that we just need to keep this
as an option and that, again, we're in support of
this motion. Thank you.

MR. SNYDER: Thank you, sir. Microphone
Number 6.

MR. CLARY: Yes, thank you. Shane M. Clary, Bay Alarm Company, speaking against the motion.

You know, again, we're not in the Chicagoland area, but we've been operating a central station for many years. I can't speak for what may be happening here, but we're not dispatching to the wrong address. We are calling the key-holders. We're dispatching on the troubles. We're getting out there to respond to trouble and supervisory alarms.

From what I'm hearing here, if this situation is that bad, then why don't we just ban central stations and just have every signal go into a fire department and be done with it? Thank you.

MR. SNYDER: Thank you. Microphone Number 4, please.

MR. RAY: My name is Rich Ray. I am with Cybor Fire. I'm a fire sprinkler contractor. I said earlier today I'm not a member of the fire service. I'm a fire protection engineer, but I'm a big proponent and supporter of the fire service. I'll try to make my points brief. Keep in mind that --

MR. SNYDER: For or against the motion?
MR. RAY: I'm for the motion. I apologize.

Keep in mind, the fire service doesn't want anything new here. NFPA 72 has been written with them having a voice in this decision for the past 30 plus years. All the fire service wants is to maintain their voice in this decision. They don't want anything new.

The fire service didn't drive this change. This change was driven by the alarm monitoring association. You want to talk about people having monetary-based motives? I'll stop with that.

Someone else just mentioned this. If we're going down this road of cutting out the AHJ, we're going down a bad road in the world of NFPA. Because what's the definition of "approved" in NFPA? Acceptable to the authority having jurisdiction. So if we're going to start whittling away at them what's next? Sprinkler joints don't have to go to authorities having jurisdiction. I do what I want? I don't think that's a good place for good fire protection.

And the last comment I'll make is I've heard this brought up before, if the committee vote did this and the committee said that. Well, if
that's what -- if we're going to base everything on what the committee did, then what's the point of the NITMAM process and what's the point of this meeting?

So I respect the committee's actions, but there's other people involved in this association than the committee and its members. And a lot of them are here today, and you guys made a big mistake by trying to get this adopted.

I recommend everyone, everyone, please support this motion.

MR. SNYDER: Thank you, sir. Microphone Number 3.

MR. HIRSCHLER: Marcelo Hirschler, GBH International, I call the question.

MR. SNYDER: There is a motion to call the question. That is a nondebatable motion. At this point, I do not see anyone at the microphones waiting to speak, and I will now proceed with the vote on calling the question. Do I have a second?

VOICE: Second.

MR. SNYDER: We do have a second. In order to vote on this motion, you will need to scroll to the
bottom of your tablet to vote. If you wish to vote
in favor of the motion, that is, to call the
question, touch yes. If you wish to vote against
the motion, that is, to not call the question,
touch no. Please record your vote. The balloting
will be closed in five seconds. The balloting is
now closed.

The results of the vote are 205 for
closing -- or calling the question and 11 against.
So we will immediately go to vote.

So before we vote, let me restate the
motion. The motion on the floor is to accept
Public Comment Number 140. You will need again to
touch the buttons on your iPad. If you wish to
vote in favor of the motion and recommend the text
that is contained on screen one, touch yes. If you
wish to vote against the motion and recommend the
text on screen two, touch no. Please record your
vote. The balloting will be closed in five
seconds. The balloting is now closed.

The results of the vote are 142 for the
motion and 80 against the motion. The motion has
passed.

Okay. We will now proceed to the
MEMORANDUM
(AMENDMENT)

TO: NFPA Correlating Committee on Signaling Systems for the Protection of Life and Property

FROM: Jenny Depew, Project Administrator

DATE: July 29, 2015

SUBJECT: Final Results - Amendment 72-8 Letter Ballot on the Proposed 2016 edition of NFPA 72

At the NFPA Technical Meeting (Tech Session), held June 25, 2015, NFPA 72 was amended by the acceptance of the following:

Amendment 72-8: Accept Public Comment No. 140.

The final results of the balloting of the Correlating Committee are as follows:

20 Members Eligible to Vote
2 Ballots Not Returned (J. Fannin, T. Norton)
17 Agree
0 Disagree
1 Abstentions (J. Van Keuren)

According to 4.6 of the Regulations Governing the Development of NFPA Standards, the final results show the Amendment HAS achieved the ¾ majority vote needed to recommend approval of the Association Action by the Correlating Committee. As a result, the recommendation to the Standards Council is to incorporate the Public Comment text in the NFPA Standard.

The number of votes needed to recommend approval of the Association Action is 13.

(20 eligible to vote - 2 not returned - 1 abstention = 17 × 0.75 = 12.75 = 13)

Please remember that the return of ballots is required in accordance with the Regulations Governing the Development of NFPA Standards.
Amendment 72-8: Accept Public Comment No. 140

The Amendment achieved the necessary 2/3rds majority vote of the Technical Committee (TC) on Supervising Station Fire Alarm and Signaling Systems. As a result, the recommendation of the TC is to incorporate the following Public Comment text:

26.5.3.1.3 When permitted by the Authority Having Jurisdiction, alarm Alarm, supervisory, and trouble signals shall be permitted to be received at a listed central supervising station.

Instructions:

Vote Agree if you foresee no correlation issues with the Technical Committee recommendation.

Vote Disagree if you see one or more correlation issues with the Technical Committee recommendation.

☐ Agree

I foresee no correlation issues being created as a result of incorporating the Public Comment text into the NFPA Code.

☐ Disagree*

I foresee one or more correlation issues being created as a result of incorporating the Public Comment text into the NFPA Code.

☒ Abstain*

*Please give reasons for voting “Disagree” or “Abstain”:

Both sides of the issue made convincing arguments. I don’t feel my agreement or disagreement should have any bearing on this process outcome.

________________________________________________________

Signature: 

Name - Please Print: Jeff Van Keuren

Date: 7/28/2015

Please return as soon as possible, but no later than Tuesday, July 28, 2015 to:

Jenny DePew, Administrator, Technical Projects
National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169
EMAIL: jdepew@nfpa.org
FAX: 617-720-7990
NFPA Appeal of CAM 72-2
By Vic Humm, P.E.
July 15, 2015

A proposal to alter the language of NFPA 72 §18.5.3.2 and limit strobe flash duration to a 20 ms maximum and the duty cycle to 40% was recently approved by the Second Draft Revision Technical Committee vote as posted in the session minutes and the NFPA Website. We believe this to have been a premature action resulting from incomplete information and is contrary to the generally accepted principle that requirements and standards should be based on sound scientific consensus.

What is new in this appeal are two scientific reviews of the research reports that were advanced in support of the 20 ms proposal. Those should have been in the hands of the voting members of the Technical Committee before the vote was taken.

The Science

Several speakers in favor of accepting Public Input No. 222-NFPA 72-2013 [Section No. 18.5.3.2] asserted that the scientific evidence is conclusive with respect to the proposition that limiting strobe flash duration to 20 ms and duty cycle to 40% will result in greater indirect alerting efficacy [7]. That simply is not the case.

One speaker referred to four research reports that were offered in support of those assertions, though we were able to locate five. [1,2,4,5,8] These reports and others tangentially related to them have recently been examined carefully by two scientific reviews that have been provided with this document [3,6] With regard to effective flash duration and indirect alerting the conclusions of both reviews are that:

- The methods and experimental designs addressed very limited range of independent variable values and cannot be interpreted as defining an optimum flash duration for indirect alerting.

- The conclusions presented in the papers cited did not support or contain any recommendation of any specific value for a flash duration. In fact they avoided it.

There are other specific criticisms. However the both reviews agreed that light pulse intensity and duration interactions and indirect alerting by means of reflected light alone are not well understood. This merits additional research, but there is not enough weight of evidence over a wide enough range of durations and intensities to define a sound requirement. The 20 ms figure seems to have appeared out of thin air.

Parallel UL task group activity

It must be noted that in October of 2013 a UL task group was formed to address the pulse duration issues raised by Public Input No. 222- to NFPA 72-2013 [Section No. 18.5.3.2] to limit flash duration. Notification of this action was sent to the Standards
Technical Panel Members. The composition of this task group, chaired by this author is in appendix A.

However, the ballot results for the proposal contained in Second Revision No 71-NFPA 72-2014 [section No. 18.5.3.2] suggest that some members of the Second Draft Revision Technical Committee must have been unaware that:

- The UL task group has been actively pursuing the development of a valid and scientifically-based standard that takes account of indirect alerting effects and flash intensity and duration.
- UL has acquired new instrumentation and developed new methods for testing strobes.
- UL has human factors research in progress addressing indirect alerting by means of reflected light alone.
- UL is mustering support for independent human factors research by Oklahoma State University, with results expected about 16 months after work begins.

More than one UL Task Group member also had membership on the NFPA Task Group addressing the same issues. The sharing of the UL Task Group Drop Box containing reference documents supporting the activity was permitted and encouraged, in order to coordinate the activity of the NFPA and UL task groups, but apparently that did not happen in the press of events.

**Process Summary**

- UL task force was set up in Oct 2013 to study Public Input No. 222-NFPA 72-2013
- UL task force determined that insufficient research or data exists to support Public Input No. 222-NFPA 72-2013 and reports back to NFPA technical committee
- NFPA technical committee voted to uphold the above Public Input after being advised of insufficient data supporting the change
- Voting members cited language and conclusions not found in any of the reports
- Peer review research reports become available disputing the findings and clarifying conclusions after the voting had taken place

Regrettably, the technical committee was not privy to the peer review reports at the time of the voting.

**Urgency**

It may be noted that there has been no citation of evidence showing that injuries or deaths have resulted from failures of indirect alerting by strobes. The arguments that appeal to safety and calling for immediate action are based on speculation, not
evidence. It appears there is no demonstrable urgency here, though the issues raised may be significant. There is time to conduct the necessary research in an orderly manner and arrive at a scientifically defensible standard and requirements.

**Unintended Consequences**

If it is agreed that sound standards and requirements should be based on convincing scientific evidence, then the 20 ms limitation on flash duration is not a sound requirement.

With sincere respect for all concerned, we contend that implementing the 20 ms limitation on flash duration at this time, on the basis of the sparse and indirect evidence now available will prove to be both premature if not rash. The potential unintended consequences include:

- **Difficulties in synchronization.** Synchronization of strobe flash onsets is done by central alarm systems. Flash durations are ordinarily an intrinsic property of the notification devices themselves. Synchronization of onset and duration may require one of two solutions:
  - Replacement of all strobe units in a synchronized circuit to match flash durations.
  - Modification of central systems to provide synchronization of both onset and duration.

- **Medical risks may be inherent in the requirement.** A 20 ms flash duration and a 40% duty cycle can lead to installation of strobes with 20 Hz flash rates that may induce seizures in susceptible occupants.

- **Liability risks.** See Medical risks, and note that the medical risk was clearly described in the public minutes documenting the Technical Committee discussion prior to the decision. NFPA defines requirements. The risk takes little imagination.

- **Conflicts in harmonization of requirements and standards within the US and internationally that will require time and additional scientific evidence to resolve.**

- **Confusion in implementing two different requirements, one for 20 ms flash durations and another allowing flash durations up to 100 ms.**

And the ramifications of the 20 ms duration and 40% duty cycle may have to be reversed on the basis of new scientific evidence. If that turns out to be the case, the entire process of modifying NFPA 72 and codes where the pending edition has been adopted will have to be repeated. Some installations may have to be modified to accommodate the reversal, with obvious cost and time consequences.
Recommendation

Patience with the process required to accumulate evidence and arrive at a scientifically
sound consensus does not come easily. But a precipitous response when there is
speculation about an undocumented safety risk is unwise at best. Government and
regulatory history is full of examples of unintended consequences.

We propose that the results of that Second Draft Revision Technical Committee ballot
be overruled and the language in NFPA 72 §18.5.3.2 revert back to the previous edition
until such time as the scientific research currently being pursued is completed and
properly evaluated, and a durable standard can be defined and put in place. With that in
hand a TIA substantiated by directly applicable scientific evidence will be generated and
processed for public review.
References:


10. UL response by email of history of listed LED Appliances by Dan Grosch [Attached]

11. UL response by email of listing if Appeal is not honored by Dan Grosch [Attached]
### Appendix A: Composition of UL 1971 Task Group

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
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<tbody>
<tr>
<td>Diane Haithcock</td>
<td>UL Standards Program. Mgr.</td>
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<tr>
<td>Vic Humm (UL TG Chair)</td>
<td>Vic Humm &amp; Associates</td>
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<td>Brian Boisse</td>
<td>Mircom Technologies</td>
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<td>Dan Grosch</td>
<td>UL</td>
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<td>Dave Mills</td>
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<td>Dave Newhouse</td>
<td>Gentex</td>
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<td>Donald Boynowski</td>
<td>Siemens Canada Limited</td>
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<td>Goran Djordjevic</td>
<td>System Sensor</td>
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<td>Ken Savage</td>
<td>Tyco</td>
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<td>Landgrave Smith</td>
<td>Lifetone Technology</td>
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<td>Leon Newsome</td>
<td>Cooper Notification</td>
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<td>Levent Taspek</td>
<td>Edwards/UTC</td>
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<tr>
<td>Nancy Trench</td>
<td>Fire Protection Publications Oklahoma St University.</td>
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<tr>
<td>Thomas Conover</td>
<td>Cooper Notification</td>
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Critique of the 20 ms Maximum On-time for Strobe Notification Appliances in NFPA 72 § 18.5.3.2.

Landgrave Smith, PhD¹
UL 1971 Task Group, 2 March 2015

Recently there has been a proposal to limit the flash duration (on-time) of an emergency notification strobe to 20ms. The suggested language is:

18.5.3.2
A maximum pulse duration shall be 20 milliseconds.

Please note that the language is very broad would apply to all intensities and to all installation conditions and intended uses.

The substance of the assertions and substantiations supporting the proposal has been that strobe flashes of durations up to 20 ms have been shown to be more effective for indirect alerting, than longer flashes. This turns out not to be the case.

Indirect alerting, in this context, means that the light source is outside the field of vision, and the alerting effect is achieved by means of reflected light alone.

In ensuing discussions, three research reports have been cited in support of the proposed 20 ms limitation. These have served to raise the issue of strobe pulse intensity and duration in indirect alerting, but these reports have stopped well short of any specific recommendation for a set of flash intensity and duration parameters.

I take no issue with the quality of the science cited. I do take issue with the conclusion that the science supports a 20 ms on-time as most effective strobe flash duration at all strobe intensities (15 to 170 cd), under all installation and use conditions. It does not.

First, let's review the three papers to see what scientific questions they address, and what they do not. Then we will discuss their

¹ The content of this review reflects only the professional opinion of the author, and does not reflect any opinion, position, or interest of any employer, past or present.
findings in the context of the 20 ms requirement. The matter of generalization of results is the point at issue.


Savage (2011) used LED and XENON light sources with maximum on axis outputs of 15 candela, with flashes at 1 Hz, and pulse widths of 0.5, 25, 50 and 100 ms.

The light distribution was a relatively narrow beam as opposed to the wider dispersion required by UL for a 15 candela strobe (UL 1971). The figure at right was estimated by digitizing the Savage (2011) Figure 2. It compares the narrow polar distribution used by Savage (red), and the wider 15 cd UL requirement (blue). The X and Y plane dispersions were very similar, so one is sufficient to illustrate the relationship.

The point of the figure is that it might be argued that the total amount of light released into the room by a flash event was a great deal less than what would be expected from a 15 cd UL-listed strobe. Further the narrow beam minimized the effects of the light that would have been reflected from walls at the sides of the room. The flash events for the test devices and a UL-listed strobe are not equivalent at all.

The light source was behind the subjects, and was advanced toward them at a constant rate\(^2\) until the flashes were noticed, as indicated by the subject raising a hand or verbalizing detection. Since light obeys the inverse square law, reducing the distance effectively increased the light intensity that was falling on the wall in front of the subjects, distance is then an indirect measure of intensity.

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\(^2\) Not quite constant actually. The "cart" carrying the light source was advanced at 1 inch / second until within 10 feet, then the rate of advance was slowed to 1/2 inch / second. The rate of advance was not shown to be a significant variable. With that caveat, "constant" may be considered a reasonable description. It does not affect the conclusions of the critique.
The subjects were aware that the strobe would be presented, which necessarily introduces cognitive expectancy, a powerful uncontrolled variable. That is a challenging issue in any alerting or vigilance experiment design. This was mitigated to some extent by giving the subjects material to read as a distractor or interference task.

This account does not do justice to the care with which the experiment was conducted, but in summary, Savage concluded that indirect alerting, defined by a subject raising a finger or verbally identifying the visual stimulus event, was inversely proportional to the duration of the light pulse, where the pulses were matched for total light output. That is, the shorter the pulse, the greater the distance at which the subject responded to the signal.

However, there is absolutely no data at all of 30, 60, 110 and 170 cd strobes. The Savage (2011) conclusions cannot be generalized to strobe intensities greater than the 15 candela tested at best. Indeed even that is questionable. The amount of light released into the room by a flash from the 15 candela narrow beam test device is clearly much less than that which would be generated by a 15 candela UL 1971-compliant strobe. So from one viewpoint, the results may apply only at flash intensities below those normally used for emergency notification.

Further, reflected light is affected by the spectrum of the light source, the color and texture of the reflecting surface and of course ambient lighting. This is quite obvious and part of common experience. The experiment provides only evidence that might apply to one set of conditions. Results are quite likely to be different with different wall colors and textures. These are clearly important variables, and we simply do not know what those differences look like at this time.

Indeed, Savage (2011) cautions us that "The test program was limited, and intended only to highlight if the units performed equivalently. It also did not explore a broad variety of notification situations."

There is another limitation. What was actually measured in this experiment was distance. That does not tell us how many seconds it
will take for a signal of a given intensity and duration to alert an occupant. Or how many seconds it will take to alert a given proportion of occupants. There is no data to support an "optimum" 20 ms maximum flash duration.


Bullough et.al. (2013) proposed that the mechanism for indirect alerting involved visual response to a change in the wide field illumination falling on the surface in front of the subject. In this approach, it was expected that an increase in reflected light, by some amount above ambient levels, would result in detection of the flash event.

The subjects were seated at a table facing a white wall at a distance of what appears from Figure 1 in Bullough et.al. (2013) to be about 8 feet. The flash source appears to have been about the same distance behind the subjects. A high ambient lighting condition was 500 lux on the table top with 200 lux on the wall facing the subject, and a low ambient lighting condition was 250 lux on the table top with 100 lux on the wall. Flash intensities that would produce 1%, 2%, 4% and 8% increments in the illuminance above those ambient levels were used, together with beam angles of 6° and 40°. The latter most closely approximates the light distribution required of a 15 candela strobe by UL 1971. Flash durations were varied with values of 10, 25, 50, and 100 ms.

Seven experiments were done, each one representing a different combination of ambient light, one beam angle, one flash rate, four illuminance increments, and four flash durations. In three of the experiments the subjects were looking at the illuminated wall facing them, and in four, were doing a visual number search and verify task. Alerting was defined as a verbal report of seeing the flash. It appears that in all but one experiment, the subjects were expecting the flash events.
Bullough et.al. (2013) concluded that the Blondel-Rey equation, with a 0.2 second time constant was not a reliable predictor of human response. The hypothesis was advanced that a shorter time constant might prove to be predictive, and needs to be systematically explored. What was said here is that further experimentation is needed; not that the maximum duration of a strobe flash should be limited to 20 ms.


In this very short paper, Vollenweider used a match-to-sample procedure to test a leaky-integrator model of the eye’s response to pulse duration and intensity. This is an experiment in human perception. Presented with a reference flash, subjects adjusted the intensity of a second flash of a fixed pulse duration until the brightness was perceived to be the same as that of the reference flash. In one set of conditions an interference task involving reading a book.

Vollenweider reported that subjects adjusted the intensity of the variable-power flash to higher levels when the reference flash was shorter. The adjustments corresponded to time constants in the Blondel-Rey equation that were between 10 and 30 ms (depending on the experiment), rather than 200 ms. At a glance, one might infer that indirect alerting might be improved if the flash duration is limited to 20 ms maximum by NFPA mandate.

However - there are three fundamental logic problems with applying Vollenweider's results to indirect alerting with strobes.

First, there is no measure of response-time. The experiment does not address alerting. The experiments were a test of a model of the eye's response to intermittent light, and used a stimulus intensity matching method for that purpose.
Second, N=4. Even had the experiment addressed indirect alerting, which it did not, it is very risky to generalize to the population on the basis of the performance of four individuals.

Third, Vollenweider very clearly tells us, "It is difficult to compare pulses with a length of 50 ms and more to a short flash. The results for longer pulses should therefore be taken with caution." and "Further experiments were conducted, with the subject concentrating more on the book, and less on operating the test equipment. The results became more pronounced, but they are difficult to reproduce." (Italics added.)

To summarize the significance of this experiment in this context,

1) There is no response-time measure, and so the experiment did not address alerting as we would normally define it.
2) The sample size is very small, with only four subjects.
3) The author states clearly that:
   a) The results do not generalize to pulse durations greater than 50 ms.
   b) Results with a distractor task are variable and difficult to reproduce.

Setting aside the small sample, I conclude that this intensity matching paper represents useful background reading, but it is not directly applicable to the engineering problem at hand. There is no alerting response time measure. It did not address alerting at all. Citing it in support of limiting the pulse durations of emergency notification strobes to 20 ms is reaching far beyond the data.

**Discussion and conclusion:**

To summarize, Savage (2011) tells us that shorter flashes are more effective at shorter distances, equivalent to higher intensities. But because the light was in a narrow beam, the light released into the room by a flash was well short of what a UL-listed 15 cd strobe would have released. It may be difficult to generalize the results to 15 candela strobes, much less higher intensities. Further the assumption that functions are linear over the range of 15 to 170 candela is unwarranted, and the proposed 20 ms maximum would apply to all strobes.
The Bullough et.al.(2013) paper quite reasonably points out that reliable indirect alerting must overcome ambient lighting on the reflecting surfaces. Their results suggest that the intensities required in realistic situations (ambient values of 250 to 500 lux) may be an order of magnitude greater than was thought when room size and strobe intensity tables were generated, possibly because the math is based on direct alerting performance in dark environments.

Bullough et.al.(2013) found that Blondel-Rey was not reliably predictive of alerting results. However they do not say that a requirement for reducing maximum flash duration to 20 ms will improve indirect alerting. Indeed, under one set of conditions, a 100 ms flash was reported to be more effective than 10 ms or 1 ms flashes (Exp 1), and this was with a 40° flash dispersion which is closer to what might be expected from a UL-listed strobe than the dispersion used by Savage (2011).

The Vollenweider (2014) found that perceived intensity matching results fitted well with Blondel-Rey time constants in the range of 10 to 30 ms. The experiments were well done and are thought provoking, but there was no measure of alerting. With no response time measure, it tells us nothing about indirect alerting. And so nothing in any direct sense about what flash duration would be optimal for indirect alerting.

So. None of these experiments provided us with human factors data that allows us to predict how many subjects will be alerted by reflected light in what length of time with any given pulse duration and intensity. And there is certainly no direct recommendation of a 20 ms strobe pulse duration in any of these reports.

Limiting strobe pulse duration to 20 ms at this time is premature, is not supported in any compelling way by scientific evidence, and the proposal should be declined.
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Primary interests:
Human Factors and Performance,  Emergency Notification, Sleep, and Medical ECG Evaluation Methods.

Patents:
6 patents for acoustic emergency notification devices, co-inventor.
1 patent for a smartphone ECG FM encoding and decoding algorithm, co-inventor.

Publications:
39 peer-reviewed scientific publications, numerous internal technical research reports.

History:
2013-2015,  Member of the UL 1971 task group charged with developing a strobe standard to include consideration of indirect alerting by means of reflected light.
2013-2015, AliveCor Inc.
Senior Scientist. Testing and evaluation signal processing algorithms and estimations of ECG beat features and parameters comparing ECG LI and LII, and calculated 6-lead data with those of other ECG recording and monitoring systems and evaluation methods.
2009-2011,  Participant in UL 217 task group activity developing the 520 Hz low frequency sounder standard.
2008-2013, Lifetone Technology.
Senior Scientist. Design, development, testing, documenting, and supporting products for fire and carbon monoxide emergency detection and alerting
Senior Software Scientist. Design, testing, and documentation of real-time medical monitoring applications, and personal emergency and fire alarm detection applications, that used handheld platforms and smartphones with wireless SMS and e-mail alerting mechanisms.
1993-2005, Data Critical Corporation; GE Medical Systems; Caretools Inc.; Delphi Medical Systems.
Senior Software Developer. Development of a wide range of applications for remote home-care, remote ECG evaluation, and clinical transport ECG monitoring, and a medical pump monitoring and control system, using paging, mobile computing, and smart phone platforms and Bluetooth technology. Developed features for a comprehensive handheld electronic medical records system supporting complete records and histories for over 1000 patients. These included user interface enhancements, wireless FAX prescription transmission, medical imagery display, integration with the Thomson PDR with drug interaction checking, and near real-time coordination with a web-based central medical records system.

1983-1993, University of Oklahoma Health Sciences Center, Dept. of Psychiatry  Assistant Professor of Research.  Effects of sleep deprivation, interactions with alcohol on human performance and cognition, Principle investigator for NIDA and NIAAA grant-supported research addressing the effects of drug and alcohol interactions on human performance, cognition, and brain electrophysiology. Developed process control and data acquisition systems for human performance and EEG recording, feature recognition and analysis.

**Education:**


B.A. English Language and Psychology. Northwestern Oklahoma State University.
Lighthouses, Flash Strobes, and the Blondel-Rey Equation

*Is the eye a leaky integrator?*

Walter Vollenweider
Siemens AG, Zug, Switzerland

Abstract

The Blondel-Rey equation is used in the standards EN54-23 and UL1971 for flash strobes to calculate the perceived intensity of a pulse of light. The equation is based on a model of the human eye, and is equivalent to a leaky integrator. A light pulse which is produced by a Xenon flash tube is short, so that the time constant of the model has no significant effect. This is no longer true in the case of LED based strobes, which produce much longer pulses. There is increasing concern that the Blondel-Rey equation does not adequately model the response of the human eye. It may well be that a LED strobe fulfils all requirements of all standards, but that it will not be as efficient as a Xenon strobe.

A light source was built, which allows to produce with the same LED module flashes which are comparable in length and intensity to a Xenon strobe, but which can also be set to values which are the same as those of a LED strobe. It is possible to compare directly the response of the eye to flashes of both types, and also to explore the region which is in between. It becomes clear from the results that a leaky integrator is not a valid model for the whole range of settings.

The present results are from subjects who concentrated on operating the test equipment, and who were aware that there will be flashes of light. The results are different if the subject concentrates more on another task, and less on the flashes. This makes us believe that the response to flashes is not only a result of the characteristics of the light sensitive cells in the eye, but also of the processing in the retina, and of the activity of the brain. It may well be that the light sensitive cells behave like leaky integrators, but the overall response is more complex.

**Keywords:** Flash strobe, Blondel-Rey, perception
The Work of Blondel and Rey

It was known since the 19th century that the eye behaves like an integrator. Broca and Sulzer found in 1902 that the response of the eye in a well lit environment has a resonance if the length of the light pulse is a few 10 ms. Other experiments came to similar results, but we still know very little about this effect. [1], [2]

Blondel and Rey wanted to extend the existing knowledge, and to find the effect of flashing lights at the limits of visibility [3]. It is their equation which is in the relevant standards for flash strobes.

\[
I_e = \frac{d^2}{\int_{t_1}^{t_2} I \, dt} \left( 0.2 \text{ sec} + \left( \frac{t_2 - t_1}{2} \right) \right)
\]

(1)

There is a source of light in a lighthouse, and a lens or a mirror which rotates around it. This optical element can be designed to produce a wide beam of light, which has a relatively low intensity. The sailor will see a long pulse in this case. A different design can produce a narrow beam at a high intensity, but the perceived length of the pulse is much shorter.

Fig. 1. Result of the original Blondel and Rey experiment.

Fig. 1. is based on the original paper by Blondel and Rey. The energy which is required for a flash to be visible increases linearly with its length. It seems that a minimum energy is necessary to gain the attention of the observer. It would be possible to make the flash extremely short, if only the energy content reaches this minimum value. The required energy increases linearly, which means that a certain power is necessary to keep the impression of the flash alive. This power is, essentially, wasted.
The Eye as a leaky integrator

Vision is based on an electrochemical process. Retinal changes from the original to a slightly different form when it is hit by a photon. This transformation generates electric charges, which are integrated. The charges produce the visual impression, and are dissipated in this process.

Blondel and Rey compared the response of the eye to a galvanometer, with the damping inversely proportional to the luminous intensity. It is equivalent to a leaky integrator if the level of the ambient light is low, so that the damping is high.

Fig. 2. The Blondel-Rey equation applied to a leaky integrator.

An integrator will always reach the same output value if a pulse with a constant product of time and amplitude is applied at its input. This is not the case for a leaky integrator. Longer pulses will produce a smaller output signal. This can be compensated by increasing the energy for longer pulses. Fig. 2 shows the output for different lengths of the input pulse when the energy is adjusted according to the Blondel-Rey equation. The output is not constant, but close to it. The Blondel-Rey equation does not exactly describe the leaky integrator, but it is a reasonably good approximation.

Blondel and Rey made a remark that their results are only valid if the subject is far away from the light source. A short flash appears to be brighter than a long pulse if it is seen at a short distance. A flash strobe is usually seen at a short distance. We have to fear that the Blondel-Rey equation cannot be applied in this case. Recent experiments show that this fear might be justified. [4], [5]
Our experiment

We use a custom built current source, and a radiating device which is made from eight 100 W LED modules, so that we are sure that it remains in the linear region. The combined time constant of the current source and of the LED modules is less than 100 µs, so that we do not introduce a significant systematic error if the length of the flash is at least 1 ms. The radiation pattern of the device is Lambertian, which is close to the one which is specified by UL1971.

The experiments took place in a room which measures 4.5 x 6 m. UL72 specifies a 15 cd strobe for this size of room. The required electrical power is 60 W if LEDs with a 100 lm/W efficiency are used, and if the length of the flash is 1 ms. The room is empty, with the exception of the subject and the equipment for the experiment, so that no shadows are visible.

The subjects are seated at five different positions. The first measurements at the position “Front” were taken with the subject looking directly into the strobe. This was a painful experiment, and we do not even know whether it was safe. The subject in the position "Front" looks therefore on a white sheet of paper, which reflects the light of the strobe.

The subject in the seat marked “Side” sees the strobe, but only at the very periphery of the eye. The seat marked “Back” will not allow the subject to see the strobe, but reflections which fall on the opposite wall. The position "Reading" is similar, but the subject sees the light which is reflected by a book or a sheet of white paper. The seat “Corner” is placed in such a way that the light is only seen after at least two reflections.

Fig. 3. Equipment used in the experiment.
Two flashes are seen alternatively by the subject. One flash is fixed in its length and intensity, and is used as a reference. The second flash is varied in its length, and its power is adjusted by the subject, so that the two flashes appear to have the same intensity.

Eight series of measurements were taken for every position, and the geometric mean calculated. It is difficult to compare pulses with a length of 50 ms and more to a short flash. The results for longer pulses should therefore be taken with caution.

**Results of the measurements**

![Graph showing results of measurements](image)

Fig. 4. Results of measurements with one subject at five positions.

The results of the measurements are equivalent to a Blondel-Rey constant between 10 ms and 20 ms. The position "Front" results in the longest, and the position "Side" in the shortest constant. This is consistent with the fact that the eye reacts faster at its periphery than in the center.

Another, similar experiment compared the responses of four subjects. The measurements were taken with the subjects looking at the pictures in an illustrated book. The responses are equivalent to a Blondel-Rey constant between 10 ms and 30 ms. Three of the subjects are apprentices. Their age is approximately 20 years. The age of the fourth subject is the same as the three other subjects combined. The response of this subject was between the responses of the younger people. We may conclude that the reason for the different responses is not the age of the subject. It may be that there are not only brown and blue, but also faster and slower eyes.
Fig. 5. Experiments with subjects of different ages.

Note that the slope of the graph is ascending for pulses of 30 ms and more in three out of four experiments, and not continuously falling as is predicted by the Blondel and Rey model.

The subjects were instructed to look at a book, and to operate the test equipment at the same time. It is a difficult task, and we may suppose that the brains of the subjects were busy. An experiment compared the response when the subject was reading a book, to the response when it was just looking at a blank page.

Fig. 6. Reading versus looking at a blank page.
The response is similar in the two cases up to a length of 30 ms, but a difference can be seen for longer pulses. Further experiments were conducted, with the subject concentrating more on the book, and less on operating the test equipment. The results became more pronounced, but they are difficult to reproduce.

The response at low ambient illumination levels

The ambient illumination was 250 lx in most cases. It was reduced in another experiment. The measurements were taken with the strobe at the back of the subject. It resulted in a longer Blondel-Rey constant, but only if the length of the pulse was more than 20 ms.

![Graph showing response at low illumination levels](image)

Fig. 7. Response at low illumination levels.

The experiment without ambient illumination resulted in a Blondel-Rey constant in the order of 100 ms for a length of 100 ms. Blondel and Rey were able to produce pulses with a length down to 1 ms. We find the raw data in the original publication, so that we can directly compare their to our measurements. The results are clearly different. One reason may be that the light hits just a few cells in the center of the retina in their experiment, whereas our experiment illuminates the whole eye.

The eye seems to be more sensitive when the length of the pulse is in the order of 3 ms, and when the measurement is taken in darkness. We have seen a similar effect in some of our experiments, and we will certainly remember the Broca and Sulzer paper.
Conclusions

Fig. 8. The situation in the Blondel and Rey, and in our experiment.

The light of a distant lighthouse reaches only a small spot in the eye of a sailor. There are just a few light sensitive cells which are illuminated. It may well be that the response has the characteristics of a leaky integrator.

The light of a flash strobe may be seen indirectly. It falls on a large portion of the retina. It seems that the signals of the light sensitive cells are processed in a complex way, which helps us in our daily effort to survive.

References


Good Afternoon, Everyone

One note for Laurie, Dr. Smith has his PhD and Masters Human Response Engineering and is a self-taught Engineer.

I need from Dan Grosch – the following:

A. When did Signal Link get the first LED listing and what is the bandwidth or pulse with. Now Signal Link is owned by Mircom and what is the current band width. **Approx 2006, and had 200ms pulse width.**
B. Cooper came in at 100 MS- **Correct**
C. Tyco came in at 20MS- **Correct**
D. Light Engine of China came in at 100 MS. **Correct**
E. The current listing of items Nos. B, C, & D was granted within the limits of the existing standard. **Correct**

Also 100 MS is permitted in large areas such as Lodging Ballrooms, etc. to be at 100 MS for Synchronization issues. This provides two different flash rates for the general public to understand. That is not right.

Since the appeal can be done in writing, I feel it wise to go in person to appear before the Council. Since I am totally independent and been an NFPA Committee Member, Chairperson, and Correlating Member for 43 years. In regards to UL Standard Technical Panels, I am a principal on 12 since around 2001. Also in regards to 72 G, I was a principal member in the first Recommended Practice. Thus, I have a good history of service. I hope that the day of presentation Mircom can have present representative and the NRC as least by conference phone.

I am asking Dr. Smith to do a short Bio Summary for NFPA. The NRC speaks for itself.

According to NFPA Reg. Sect 1.6.2 we have until the 15th to file this appeal.

Next Tuesday, I am out of pocket, we need to talk on a conference call so the request can be put forth.

1.6.2 Time for Filing an Appeal.
(a) Issuance of NFPA Standards. An appeal related to the issuance of
an NFPA Standard includes any appeal that could result in the issuance or
return of an NFPA Standard or that could affect the text of an NFPA Standard.
Except as provided in (b) and (c) below, an appeal related to the issuance of
an NFPA Standard shall be filed no later than 20 days after the close of the
NFPA Technical Meeting at which NFPA membership action on the issuance of
the NFPA Standard was recommended in accordance with 4.5.3.7. Where a
The proposed NFPA Standard is considered a Consent Standard pursuant to 4.4.8.4 or 4.5.2.5, an appeal related to the issuance of such a Consent Standard shall be filed within 15 days of the published Notice of a Consent Standard. Unless clear and substantial reasons exist to consider an appeal pursuant to 4.5.2.5, the Standards Council may summarily dismiss the appeal on account of the procedural failure to

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Hi Members

Now that CAM 72-2 has failed, UL 1971 will need to be revised to work with NFPA 72. The maximum pulse width will need to be changed to 100 ms with all strobes being marked with their pulse width. Now before everyone e-mails me back saying I have a typo and that 100 ms should be 20 ms. Let me remind you that UL 1971 is a product certification Standard and that NFPA 72 is the installation Standard. It will be up to the AHJ to enforce section 18.5.3.2 below from NFPA 72.

18.5.3.2
The maximum light pulse duration shall be 20 milliseconds with a maximum duty cycle of 40 percent.
Exception: Lights used to meet the requirements of 18.5.5.5 shall be permitted to be listed and labeled to have pulse durations up to 100 milliseconds.

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Mr. Schifiliti, any final comments on behalf of the committee?

MR. SCHIFILITI: No.

MR. SNYDER: Thank you. We will now proceed to a vote. Before we vote, let me restate the motion. The motion on the floor is to accept Public Comments Number 172 and 124. To vote, touch the vote button on your iPad. If you wish to vote in favor of the motion and recommend the text on screen one, touch yes. If you wish to vote against the motion and recommend the text on screen two, touch no. Please record your vote. The balloting will be closed in five seconds. The balloting is now closed.

The result of the vote are 57 for the motion and 190 against the motion. The motion has failed.

Let's now proceed with the discussion on Certified Amending Motion 72-2. Microphone Number 4, please.

MR. HUMM: My name is Vic Humm. I'm the submitter of this, Vic Humm & Associates. I also serve on the UL Standard Technical Task Force addressing this issue to create a better standard,
and in order to do so, I had to verify to the UL that I have no affiliation with any of the manufacturers.

MR. SNYDER: Sir, would you start by moving the motion, please?

MR. HUMM: I'm sorry. I move acceptance of Motion 72-2.

MR. SNYDER: Okay. We have a motion to proceed with Motion 72-2 which is involving multiple notices for a single motion to reject Second Provision Number 71. Is there a second?

A VOICE: Second.

MR. SNYDER: I hear a second. Please proceed.

MR. HUMM: Okay. As I was explaining, there is an Underwriters Laboratory Standards Technical Panel working to create criteria so that it will be technology neutral, and whichever technology is required, any adjustments will result in same spacing in the field.

So we also have a report that's available for the public from the National Research Council of Canada that says that the information developed thus far is not warranted to make this without the proper decision in the Human Factors Study. Thank
you.

MR. SNYDER: Thank you. Mr. Schifiliti, do you have any comments on behalf of the committee?

MR. SCHIFILITI: I defer to Dave Lowery, the chairman of the Notification Appliances Committee at Microphone Number 3.

MR. LOWREY: Thank you, sir. Dave Lowrey, City of Boulder Fire Rescue, current Technical Chair of this committee. I'm not going to give a position from the committee officially. I just want to tell you how the committee got here.

Upon the first revision, a proposal was submitted to change it from currently the 200 milliseconds to 20 milliseconds. The committee rejected that based on the fact that the Fire Protection Research Foundation was currently researching this and the report was not available at that time.

Upon the second revision, there were three proposals submitted on this particular issue, two of them to change it from 200 milliseconds to 20 milliseconds, and one of them to change it from 200 milliseconds to 100 milliseconds. The committee voted 18 to 6 to change it to the
20 milliseconds. Thank you.

MR. SNYDER: Thank you, gentlemen. We will now open debate on the motion. Again to assist with the record, please provide your name and affiliation and whether you are speaking in support of or against the motion. Microphone Number 4, please.

MR. EISNER: Hello. My name is Laurie Eisner. I work for Mircom Technologies and I'm for the motion.

I wanted to make a comment that we took -- we actually sponsored the NRC study that you -- that is available to the public, and to claim that the pulse width should be changed from a maximum of 200 milliseconds to a maximum of 20 milliseconds requires additional evidence that simply is not present in the cited studies.

In short, there is a proposed change to the NFPA 72, Chapter 18 that changes the maximum flash pulse duration from 200 milliseconds to 20 milliseconds. I offer the following ten reasons why I think you should vote yes for this motion.

The proposed value of 20 milliseconds which now forms the core of the proposed 2016
standard does not appear a single time in the cited studies. You can scan the studies to check for yourself. The reference to 40 percent duty cycle is mathematically incorrect if the maximum pulse is changed to 20 milliseconds. It will reflect badly on us if we have such mathematical errors in the standard.

The change from 200 to 20 milliseconds will have unintended consequences. The change will probably have an effect on LED technologies coming into the life safety industry and LED technology will have benefits -- great benefits over time.

NFPA 72 Spacing and Application Guidelines are based upon direct viewing. Adding reference to indirect viewing conflicts with parts of the standard. The independent NRC study concludes there is no justification for the change based on the current data. Neither the NRC study nor the RPI study supports the change. No basis for this change has been provided.

NFPA 72 is an installation standard, not an equipment standard. This requirement belongs in an equipment standard. If the proposed change is implemented, the text in this section becomes
inconsistent with the text in 18.5.3. If the proposed NFPA 72 for 2016 is allowed to stand, it will be very difficult for field personnel and AHJs to verify whether devices meet this requirement or not. Indirect and direct viewing have not been clearly identified or quantified.

Voting yes to this CAM would overturn the proposed change to the 2016 version and return it to its original text found in the 2013 version while allowing the existing UL Task Group to address all requirements comprehensively. I urge you to vote yes for this motion. Thank you.

MR. SNYDER: Thank you, sir. Microphone Number 3, please.

MR. PAPIER: My name is Isaac Papier. I work for Honeywell Fire Safety, but I am against the motion and I speak for myself.

The original signaling appliance strobe research was conducted at UL while I was an employee there. The research was done under my direction, and it resulted in UL 1971 which is the product standard and is the basis for the specifications in Chapter 18.

The 200 millisecond pulse duration was an
artifact of the way the original testing was done more than 20 years ago. Based on all published research to date, the 200 millisecond devices when compared with 100, 50, 25 milliseconds was the worst actually functioning device. The Xenon device that is out there today which was the original basis for all of this research operates at .3 milliseconds. The key to all of this is the actual intensity of the pulse. What works for indirect is the difference in power and light intensity between the signaling device and the actual background that is in the room that is illuminated.

UL 1971 talks about signaling for the hearing impaired. That makes the assumption that the occupants of the room are not looking at the signaling device. That means that we are talking specifically about indirect signaling.

It's very unfortunate that a factor that has absolutely nothing to do with the ability of the device to function for its intended purpose is being used here to try to bring a technology that is not ready for prime time. We need to be concerned with safety and the ability to alert
people to be able to vacate the premises when there is an emergency. Trying to make an accommodation for a technology that isn't ready is unfortunate and counter to the intent of a life safety function. Thank you.

MR. SNYDER: Thank you, sir. Microphone Number 2, please.

MR. KLEIN: My name is Jeff Klein, and I work for Honeywell, and I am also a principal member of Chapter 18 Technical Committee. I am making a statement against the motion because this motion endorses and reinstates a pulse width of 200 milliseconds for visual light notification appliances. Research has shown that 200 millisecond pulse widths may not be effective for indirect viewing.

I'm against the motion based on two aspects. One is public safety and the second is research and data. In terms of public safety, consideration of a worst case scenario should be made as it relates to visual notification of the public during an emergency especially the hearing impaired which, in this case, means indirect viewing. Indirect viewing means that the person is
not looking directly at the visual notification, is concentrating on a task, and the visual notification appliance is behind the person. This is the worst case scenario. This Code specification should deliver equal or better performance than achieved by the current technology in the worst case scenario.

Four research studies have been conducted that included 100 human test subjects and indirect viewing. The studies all used varying pulse widths of newer technology and compared detection by the human subjects versus the short fixed pulse width of current technology at the same effective light intensity.

Two studies sponsored by the Fire Protection Research Foundation were conducted by the Lighting Research Center at RPI. The findings from this research suggest a pulse width of 25 milliseconds would provide human detection on par with current technology in the worst case indirect viewing scenario. Two studies conducted by Tyco Fire Protection Products, these studies also tested the worst case scenario.

The conclusion and recommendation from
this research is a pulse width less than 20 milliseconds to achieve detection on par with current technology. Therefore, after four published research studies of pulse widths conducted with 100 human test subjects in worst case indirect viewing scenarios, pulse widths of 25 and 20 milliseconds were recommended consistent with the new Code language and new technologies can meet these requirements.

It is therefore reasonable to suggest that a 200 millisecond pulse width might not be effective with indirect viewing and, therefore, this motion should not be passed.

MR. SNYDER: Thank you, sir. Microphone Number 5, please.

MR. BLEDSOE: Hi. My name is Brian Bledsoe (phonetic). I'm speaking on behalf of Mircom Technologies, and we support this motion.

I noticed that the last speaker had mentioned they had a recommendation from these research studies mentioning that there was a recommendation of 20 and 25 milliseconds. I would challenge him to show where he finds that in those research studies. I have these studies here,
printed in front of me. I can at least read one conclusion from them all right.

Using a constant value -- sorry, wrong one. Here. Okay. The proposed change in pulse duration for visible notification appliances is based on a misapprehension. Parties supporting this change have stated that data exists to show that flash detection improves when the pulse duration is lower. A thorough scientific assessment of the study cited in support of the statement shows that the statement is not true.

So, you know, we also looked at the data in the National Research Council report and they found curves where 50 milliseconds may have been more, you know, detectable, but they don't come to a conclusion on that. And there is no conclusion in any report that says 20 or 25 milliseconds is a good number. There's also no conclusion that says 200 is bad.

As a matter of fact, if you go to Page 8 on the RPI report, you'll see that the hundred millisecond pulse with a 2 percent luminous increment was detected 90 percent of the time and shorter pulses were detected much less with the
1 percent being detected -- with the 1 millisecond being detected so low that they dropped it from the research study. RPI also reported as a conclusion that nor effective intensity nor illuminance on their own were particularly good predictors of indirect viewing. That is actually what was said. There was no recommendations under 20, 25, and also there wasn't really four studies that I'm aware of that were cited. I know of two. The two salvage reports are essentially the same. There was a BRE that was released recently with no date on it and a unanimous supporter.

So I think people should consider that on the hard data. Read the real reports. We made them public. They're there for everybody to read. The conclusions are clear on both RPI and NRC and the review of everything that there are no recommendations. The only recommendation is that further research needs to be done and it should be done with the UL Task Force which we came back and recommended back in last October. Thank you.

MR. SNYDER: Thank you, sir. Microphone Number 3, please.

MR. REISWIG: Thank you. Rodger Reiswig with
Tyco Fire Protection Products speaking against the motion.

We have known there is a problem with long pulse duration and LED strobes since 2009. The first proposals were submitted for the 2013 Code Cycle of NFPA 72. The Mircom report also acknowledges that there is a problem and I quote, "Perhaps more importantly, the research does identify problems with the current specifications for visual signal appliances. Peak luminous intensity matters particularly in contrast to room light levels."

The proposed changes submitted for the 2013 cycle of NFPA 72 were rejected. The TC said more data was needed. Based on that proposal and the projection by the TC and because more data was needed, the Fire Protection Research Foundation commissioned a study and confirmed the issue that was identified.

The testing verifies that nothing in the Mircom report contradicts that strobes with long pulse durations are less noticeable than Xenon strobes at the same Candela rating. There is no one who has presented any data that indicates
otherwise. The reason that long pulse widths are used is that an LED strobe design is easier with a longer pulse width, not because of any positive characteristics in the notification capabilities of the strobe.

Delaying the implementation of a shorter pulse width with another Code Cycle so we can collect more information just means that more strobes will be put in the buildings with effectivity that is provably lower than Xenon strobes. Remember that the standard for spacing and room size were based on testing done with Xenon strobes.

I am speaking against the motion on the floor and ask the membership to vote against the motion.

MR. SNYDER: Thank you. Microphone 1, please.

MR. FALBO: My name is Jason Falbo. I'm with Mircom Group of Companies and I am for the motion.

I like to first discuss our main issue with the cherry-picking of the pulse duration. We know when you talk about signaling appliances, there are multiple characteristics that factor into their efficacy. Flash duration is one of them as
is flash frequency, the duty cycle, and the
effective intensity and the color of that flash.

The fact that the Technical Committee has
focused on only one parameter has lead to
unintended consequences. Some of these unintended
consequences include the stifling of innovation in
this area which allows LED technology to be used to
provide more effective signaling in life safety
applications.

The 20 millisecond number in itself, the
language as proposed, is in conflict between the
two sentences in the proposed changes. If you take
the math and look at it, the 20 milliseconds pulse
with the maximum duty cycle at 40 percent would
imply a maximum period of 50 milliseconds.

The rule for frequency is you take the one
divided by the frequency and what effectively
you've decided within NFPA is that we are
supporting a 20 hertz flash frequency for these
appliances now. At 20 hertz, we know the problems
that that can cause for epileptic seizures and
issues with people seeing things flashing at that
rate.

This is just one example of the haste
which we believe the decision has been made and the
effort to push something through before the proper
due diligence and research has been done to make
sure that we're making the changes for the right
reasons accurately and correctly.

I want to speak to the firefighting
community that's here in the room today again with
respect to the intended consequences that we see.
With less competition in this industry due to the
pattern protection of existing firms who are
proponents of Xenon devices, we will see continued
high prices for consumers of these NAC appliances
which will reduce the adoption of life safety
protection equipment in buildings around the world.

We will also have slower updates of
buildings with respect to the costs. The testing
done always used a bright lit room ignoring the
actual real-world fire conditions where buildings
are often filled with smoke in the corridors or
emergency lighting is in play which has a reduced
brightness level compared to where the tests were
done. This does not cover all applications.
Again, the study cherry-picks specific parts of the
application and parameters to meet their own
objectives.

I want to talk a little bit about the benefits of LEDs. They're used quite extensively and approved by the FAA for avionics applications. Police, fire, paramedics and emergency services are using them within their vehicles to help manage traffic conditions. They're used in traffic lights and digital sign displays which are known to be a great effective way to promote messaging during an emergency. We are adopting LED displays in wide spread areas of the globe and LEDs are the power behind these technologies.

We do have a plan in place. That plan is to return the question of the research back to the UL Task Force who was adopted to provide this research in the first place before it was snowballed by first and second revision modifications to the Code. We suggest not to make multiple changes in three consecutive Code Cycles 2013, 2016, and 2019 due to the fact that the Technical Committee has identified that this is a stop gap and not the end result. Let's not make changes unnecessarily and with haste.

MR. SNYDER: Thank you. Microphone Number 3,
MR. PAPIER: My name is Isaac Papier. I am speaking on behalf of myself as the head of the research group that did the original work. The original work --

MR. SNYDER: Sir, for or against the motion?

MR. PAPIER: I speak against the motion. The original work that was done to develop the requirements were done at Gallaudet University with over one hundred hearing-impaired individuals. The only variable that was in play to determine whether these devices worked or not was the actual intensity of the flashes.

At the time, Xenon tubes were the only things that was available, but the point was that what is critical is the amount of energy that the flash has versus the amount of energy in the background lighting. The actual duration of the pulse has nothing to do with it. It is all in the intensity. The effective intensity that is being used is simply an excuse for the intensity on the power output of the signaling device.

The committee did the right thing by choosing 20 milliseconds which forces the actual
minimum intensity of the signaling device. You should not be confused. The pulse duration has nothing, absolutely nothing to do with it. It is the amount of energy that comes out of the signaling device.

There are now LEDs -- I was informed yesterday during a show that there are actually LEDs that can do the 20 milliseconds. So we shouldn't be changing the requirements to accommodate a technology or a particular device that cannot do it. We are in the business of saving lives and we should not compromise requirements to accommodate a technology that can't do the minimum amount of power to signal people in an emergency situation.

MR. SNYDER: Thank you, sir. Microphone Number 4, please.

A VOICE: Call for the question.

MR. SNYDER: There is a motion to call the question and that motion is nondebatable. For the record, I will note that there is one person remaining at the microphones waiting to speak, but we will proceed with the vote on the call for the question. Do we have a second?
VOICES: Second.

MR. SNYDER: We do have a second. In order to vote on this motion, please scroll to the bottom of your tablet to vote. If you wish to vote in favor of the motion to call the question, touch yes. If you wish to vote against the motion, that is, to not call the question, touch no. Please record your vote. The balloting will be closed in five seconds. The balloting is now closed.

On the motion of calling the question, there are 208 in favor. There are 31 against. The motion to call the question is approved.

So we will immediately go to the vote on Motion 72-2 which is to reject the Second Revision Number 71. Again, if you wish to vote in favor of the motion and recommend the text shown on the screen one, touch yes. If you wish to vote against the motion and recommend the text on screen two, touch no. Please record your vote. The balloting will be closed in five seconds. The balloting is now closed.

The results of the vote are 69 in favor of the motion, and 177 against the motion. The motion has failed.
July 20, 2015

NFPA Standards Council
 c/o National Fire Protection Association
 1 Batterymarch Park
 Quincy, MA 02169

To Members of the NFPA Standards Council:

I am writing in opposition to the appeal by Vic Humm, Red Bank, TN, requesting that NFPA Standards Council overturn the Association Action on CAM 72-2 and restore the language to previous edition text.

I am a technical committee member of Chapter 18.

I agree with the committee action on the Second Revision to implement a change to a 20 millisecond (ms) light pulse width by a vote of 18 to 6. I also agree with the vote by the membership at the NFPA Technical Meeting in Chicago on June 25, 2015 to maintain the 20 millisecond (ms) pulse width and reject CAM 72-2 by a vote of 177 to 69.

I have attached (as Attachment 1) my code change submission to change the pulse width to 20 ms: Comment on PI No. 222 Section 18.5.3.2. I am confirming this same position.

I have attached (as Attachment 2) my oral statement at the NFPA Technical Meeting in Chicago on June 25, 2015 against the motion. I am confirming this same position.

Thank you for your consideration.

Very truly yours,

Jeffrey M. Klein
Honeywell Fire Safety Americas
Copy of substantiation text to support a change in code language to 20 ms.

Comment on PI No. 222 Section 18.5.3.2

18.5.3.2 **Effective January 1, 2017.** A maximum pulse duration shall be 0.2 second with a maximum duty cycle of 40 percent. *20 milliseconds.*

Substantiation:

Submitter recommends this change in order to ensure that visual signaling devices continue to be effective at notifying the public, especially in indirect viewing situations. Indirect viewing is a key component, especially for situations when the public is concentrating on other tasks and not looking directly at the visual appliance or looking directly at a wall in the space. This distinction matters, as the code should be written in order to be effective as it pertains to a more typical scenario; whereby, the public is viewing, reading, or writing something such as a newspaper, book, numerical task, smart device, etc.

With the advent of new light source technologies, the submitter wants to ensure that the code stays relevant by allowing for new technologies but also maintains the current safety level associated with visual notification that exists today.

A key difference between the technology historically used and some of the newer technology is the pulse width in addition to the effective intensity (candela). The technology typically employed today and in the past has been a Xenon flash tube that has a very short pulse width that is less than 1 millisecond (ms) in addition to meeting the effective intensity requirements. Further, the effective intensity and pulse width for the Xenon product has been used effectively in NFPA 72 for device spacing and coverage area, such as a 15 candela strobe for 20 foot by 20 foot spacing. Therefore, new technology should perform in a similar manner whereas the same intensity (candela), device spacing, and coverage area would still apply.

Newer technologies can incorporate a longer pulse width than the Xenon flash tube. Up to this point, the 200 millisecond (0.2 second) pulse width in the code was acceptable since the visual notification appliances utilized a Xenon flash tube that had a very short pulse width, well below the 200 millisecond pulse duration. Newer technologies have the ability to vary the pulse width and can be set to, but not limited to, the following: 1 ms, 8 ms, 10 ms, 14 ms, 18 ms, 25 ms, 50 ms, 100 ms, or 200 ms.

Two studies have been conducted and published that test alerting and detection ability in indirect viewing situations of the Xenon flash tube versus various pulse widths of newer technology. One study is *Human Factors Comparison of Detectability For LED and Xenon Tube Light Sources for Fire Alarm Notification Strobes Follow On Testing to Determine Xenon Equivalency,* by Ken Savage, TYCO Fire Protection Products, May 7, 2012 (The Savage Study). The second study is *Parameters for Indirect Viewing of Visual Signals Used in Emergency Notification,* Prepared by John D. Bullough, Nicholas Skinner, and Yiting Zhu, Lighting Research Center, Rensselaer Polytechnic Institute, September 2013, on behalf of
The Fire Protection Research Foundation (The FPRF Study). Both studies are attached to this submission.

Combined, these experimental studies tested the pulse width hypothesis on 100 test subjects: 30 for the Savage Study and 70 for the FPRF Study. The relevant testing from both was conducted in rooms that approximate 20 foot spacing and test 15 candelas and 40 candelas Effective Intensity. The subjects were given a task (newspaper reading in the Savage Study and numerical problems in the FPRF study) and the visual signal was behind the subject. The relevant lighting level was typical (an average of 250 lx in the case of the FPRF Study – which is considered a moderately lit room). These test environments were designed to test a likely public safety scenario.

The Savage Study results were that a 15 cd (Effective Intensity) LED light source at a 14 ms pulse width was equivalent in alerting and detection capability to a 15 cd Xenon flash tube. Using additional data, The Savage Study recommends a pulse width of 20 ms.

"In many cases, the 100 millisecond pulse was essentially invisible to the test subjects, yet the current standard allows up to a 200 millisecond pulse width."


The FPRF Study found (in Experiment 5) that when conducting a numerical verification task (NVT) test subjects detected the 40 cd Xenon flash tube 100 percent of the time. (Note: The commercially available Xenon flash tube product was set to the nominal 15 cd setting. Based on intensity profile data provided by the manufacturer, an estimated value of 40 cd for the effective intensity was used for subsequent analysis.) Test subjects performing the NVT detected the 25 ms pulse width LED 100 percent of the time with an effective intensity of 61 cd. Test subjects performing the NVT detected the 50 ms pulse width LED 100 percent of the time with an effective intensity of 109 cd. Test subjects performing the NVT detected the 100 ms pulse width LED 90 percent of the time with an effective intensity 182 cd. Stated differently, the 40 cd Xenon flash tube had 100 percent detection while the detection rates at the same effective intensity were as follows through extrapolation in Figure 11.a: 25 ms pulse width had 75 percent detection as did the 50 ms pulse width while the 100 ms pulse width had 25 percent detection.

Source: Parameters for Indirect Viewing of Visual Signals Used in Emergency Notification, Prepared by John D. Bullough, Nicholas Skinner, and Yiting Zhu, Lighting Research Center, Rensselaer Polytechnic Institute, September 2013, on behalf of The Fire Protection Research Foundation, page7, page 12, Figure 11.a.

Therefore, because of the results of these 2 studies, submitter recommends changing the pulse width to 20 ms to ensure equal performance to Xenon flash tubes in the NFPA 72 spacing and coverage area requirements.

Submitter recommends an effective date of January 1, 2017. While submitter recognizes the need for a change to the code to ensure the same level of safety as with the older technology – there is a recognition of the need for a practical approach that requires that time be allotted for manufacturers to design, test, and modify their products (if necessary) and allow for recognized testing laboratories to develop tests and certify compliance. Further, when research has been conducted that necessitates technology changes in the code, the committee for this chapter has enacted an effective date.
Text from oral statement against motion 72-2 presented on June 25, 2015

Statement on CAM 72-2: Motion to reject SR-71

My name is Jeff Klein and I work for Honeywell and I am also a principal member of the Chapter 18 Technical Committee. I am making a statement against the motion because this motion endorses and reinstates a pulse width of 200 milliseconds for visual light notification appliances. Research has shown that 200 millisecond pulse widths may not be effective for indirect viewing. I am against the motion based upon 2 aspects: one is public safety and the second is research and data.

In terms of public safety, consideration of worst case scenarios should be made as it relates to visual notification of the public during an emergency, especially the hearing impaired which in this case means indirect viewing situations.

Indirect viewing means that the person is not looking directly at the visual notification, is concentrating on a task, and the visual notification appliance is behind the person. This is the worst case scenario. This code specification should deliver equal or better performance than that achieved by the current technology in a worst case scenario.

Four research studies have been conducted that included 100 human test subjects in indirect viewing situations. The studies all used varying pulse widths of newer technology and compared detection by the human subjects versus the short fixed pulse width of current technology.

Two studies sponsored by the Fire Protection Research Foundation were conducted by the Lighting Research Center at Rensselaer Polytechnic Institute. The findings from this research suggest a pulse width less than 25 milliseconds would provide detection on par with current technology in a worst case indirect viewing scenario.

Two studies were conducted by Tyco Fire Protection Products. These studies also tested the worst case scenario. The conclusion and recommendation from this research is a pulse width less than 20 milliseconds.

Therefore, after 4 published research studies of pulse widths conducted with 100 human test subjects in worst case indirect viewing scenarios, pulse widths of 25 and 20 milliseconds were recommended – consistent with the new code language - AND new technologies can meet these requirements. It is therefore reasonable to suggest that a 200 millisecond pulse width might not be effective in indirect viewing and, therefore, this motion should not be passed.
NFPA Standards Council

July 22, 2015

Re: Request that the NFPA Standards Council overturn the Association Action on CAM 72-2

An appeal of the change in strobe duration requirements in NFPA 72, 2016 (CAM 72-2) was filed. The general theme of the appeal is that there is insufficient evidence to support 20 milliseconds as a maximum pulse duration for strobes notifying via indirect illumination. We believe that the appeal should be rejected for the following reasons:

- We know that 200 millisecond light pulses are not as effective as xenon tube flashes. To our knowledge, this is not contested by anyone.

- While it would be useful to have more research to absolutely determine if 20 milliseconds is the “best” requirement, to our knowledge it is uncontested that 20 milliseconds is more effective at notifying than 200 milliseconds is. None of the reports cited in the appeal make the claim that 200 milliseconds is more noticeable than 20 milliseconds. They only claim that the research is inadequate to support 20 milliseconds as a maximum. We offer that, although 20 milliseconds may or may not be the “best” requirement, it is a “better” requirement than 200 milliseconds.

- The appeal claims that there is inadequate evidence to support a 20 millisecond maximum light pulse. However, there is adequate evidence to support the fact that 200 milliseconds is not effective. Granting the appeal would be returning the standard to a specification that is known to be inadequate.

- The reports commissioned and cited by the parties making the appeal suggest that the research does not support the 20 millisecond requirement. However, none of those reports suggests that 200 milliseconds is the correct answer, and one of them explicitly says that 200 milliseconds is problematic.

- While it would be useful to have more research to absolutely determine if 20 milliseconds is the “best” requirement, the industry has known that there is a problem with long light pulse durations since 2011. The first proposal to reduce pulse width requirements was made in the last code cycle and was voted down so that more research could be done. The NFPA Research foundation funded that research which confirmed the problem. Deferring action for another three years means that more ineffective products will reach the market and more buildings will be built with systems that have inadequate notification systems.

- The NFPA research foundation conducted research on this problem. The research plan was open for comments, the research results were open for comments, and the experimental methods were open for comments. The parties making the appeal had the opportunity to influence the testing and to comment on the methodologies. To pass on that and later take issue with the requirements that resulted from the testing is simply a delaying tactic.
Should research find a better number than 20 milliseconds (and in our opinion it is equally probable that the number, if different, would be smaller than 20 rather than larger) the code can be updated in the next cycle. In the absence of that research we should not leave a known bad requirement in place because we think more research is needed to verify that the “better” requirement is indeed the “best” requirement.

There has been a lot of deliberation on this issue, and it has taken two code cycles to reach consensus. However, there is a real problem with the current requirements that the committee recognized. We urge you not to ignore the difficult work the committees have done to try to improve the situation. Returning the code to a requirement that is known not to be effective is not the answer.

Sincerely,

Rodger Reiswig, SET
Director, Industry Relations
Dear Ms. Fuller,

I am writing with several comments on the appeal of the NFPA Standards Council's Association Action on CAM 72-2 related to language to limit pulse duration of visual alarms to 20 milliseconds. In reviewing the appeal document (and appended documents/references) I found several inaccuracies regarding research work that was carried out by myself and co-workers.

In the comments below I refer to pages of the 26-page appeal document package, since only the first six pages are numbered. I have also attached a couple of articles that are mentioned in my comments and should be considered a part of my comments.

Thank you for the opportunity to provide comments on this appeal.

Sincerely,

John

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John D. Bullough, Ph.D., FIES - bulloj@rpi.edu Director of Transportation and Safety Lighting Programs, Adjunct Faculty Lighting Research Center, Rensselaer Polytechnic Institute, Troy, NY, USA Tel +1.518.687.7100, Fax +1.518.687.7120, Web www.lrc.rpi.edu/safety

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COMMENTS ON NFPA APPEAL OF CAM 72-2
Comments Prepared by John D. Bullough, Ph.D., FIES July 24, 2015

ABBREVIATIONS USED:

cd: candela
Hz: hertz (a unit of frequency in cycles/second)
IEQ: indirect effectiveness quantity
lx: lux
ms: millisecond
s: second
μs: microsecond

In the 2nd paragraph under "The Science": In addition to references 1, 2, 4, 5 and 8 that purportedly support short duration pulses (in the case of the Bullough et al. study at least, while simultaneously maintaining a particular effective intensity value), a recent additional study from the U.K. by Raman Chagger from the Building Research Establishment (BRE: http://www.bre.co.uk/filelibrary/Briefing%20papers/VAD-Briefing-Paper.pdf) was recently published. It also has data consistent with those of Bullough et al. for pulse durations between 10 and 40 ms. 10-20 ms pulses could be
detected at lower effective intensity than 40 ms pulses. [NOTE: When I refer to effective intensity requirements, unless otherwise specified, I refer to the Blondel-Rey formulation for effective intensity using a time constant (usually represented by the letter "a") equal to 0.2 s.]

1st bullet item under "The Science": It is stated that there was a "very limited range of independent variables" in the experimental designs reviewed, including the study by Bullough et al. Not knowing the appealer’s definition of "very limited" I would point out that we (Bullough et al.) tested sources with durations ranging from <1 μs to 100 ms, effective intensity values from about 0.3 cd to more than 100 cd, and illuminance increments from 0% to 16%. What does the appealer consider not "very limited"?

Page 3

Regarding "Difficulties in synchronization" (1st bullet), this problem would be just as acute, if not more so, if durations longer than 20 ms were allowed, because it would still be necessary to synchronize the ends of longer pulses. Certainly there is no technical reason why 50 ms pulses would not require the ends to be specially synchronized but 20 ms pulses would.

Regarding "Medical risks" (2nd bullet), the appealer seems to be unaware of the existing requirement limiting flash frequency to 2 Hz. With a pulse duration limit of 20 ms, the 40% duty cycle limit (which is an upper limit, not a requirement that the duty cycle actually be 40% as the appealer implies) will never even be approached. A 20-ms pulse with a frequency of 1 Hz results in a 2% duty cycle. If the frequency is 2 Hz the duty cycle would only be 4%. Both values are well under the 40% limit that would be specified. Frequencies of 20 Hz are not, nor will not, be allowed by NFPA.

Regarding "Confusion in implementing two different requirements" (5th bullet), the two requirements have substantial overlap: pulse durations under 20 ms meet both requirements. Thus it would not be problematic to meet both requirements.

Page 7

2nd paragraph after the quotation of section 18.5.3.2: The author says "This turns out not to be the case" (referring to the statement that shorter duration flashes are more effective for indirect alerting than longer flashes). Inspection of Figure 4, Figure 5, Figure 8, Figure 9 and Figure 11 of our peer-reviewed journal article (attached file: ft15.pdf) based on the study we (Bullough et al.) did for the Fire Protection Research Foundation show, for example, that for a given effective intensity (such as near 20 cd), the detection performance for the shorter pulses (e.g., 10 ms) was better than for the longer pulses (e.g., 50 or 100 ms). And the reason for that is that the peak instantaneous intensity for these shorter-pulse conditions needed to be higher in order to achieve the same effective intensity.

In the 2nd-to-last paragraph on this page, the author states "I do take issue with the conclusion that the science supports a 20 ms on-time as most effective strobe duration at all strobe intensities (15 to 170 cd)." I would take issue with such a conclusion as well, but I do not believe that anyone has made this conclusion. As I understand it, a duration of 20 ms was selected as an upper limit on the duration, not the optimal or most effective duration - these lights can always (and usually do for xenon strobes) have pulse durations shorter than 20 ms and in fact, for the same effective intensity, a shorter duration will be better, even one that is shorter than 20 ms. That's why the xenon strobe we tested outperformed the 10 ms and 25 ms pulses for the same effective intensity every time it was used.

Page 10

There are a few inaccuracies regarding the description of our study (Bullough et al.) later in this document. Some conditions increased the wall illuminance by 16% (not 8% as stated), and we also looked at 1 ms durations as well as about a μs or so, from the xenon strobe we tested (not only 10 to 100 ms as stated). Also, the distance between the subject and the wall in front of them was more like 16-17 feet (not 8 feet).
Continuing the comments related to page 10, the reviewer states that our (Bullough et al.) study advanced the hypothesis that "a shorter time constant might prove to be predictive, and needs to be systematically explored." In fact, the Chagger study from BRE (mentioned above) has done just this, showing that 10 to 20 ms pulses require lower effective intensities than 40 ms pulses to achieve a criterion level of detection performance.

Regarding the review of the study by Vollenweider, that researcher conducted some experiments and concluded that a Blondel-Rey constant of a=0.01 or a=0.02 s was more predictive of equal appearance of effectiveness than a constant a=0.2 s. That seems to agree with our indirect effectiveness quantity (IEQ) metric and is consistent with the notion mentioned several times above, that for the same effective intensity, the pulse with the shorter duration (and therefore with a higher peak instantaneous intensity) will be detected more often, and judged as more visible. One criticism of the Vollenweider paper made by the reviewer is that the subjects used subjective responses, not detection. However, our (Bullough et al.) study for FPRF included subjective assessments of visibility, and as also summarized in a recent conference paper (attached file: cie15b.pdf), the reviewer's criticism is unfounded, because both detection percentages and subjective ratings are rectified by our IEQ metric where the Blondel-Rey constant a=0.01 s. Thus, for the same effective intensity, shorter duration pulses will elicit higher ratings of subjective visibility or ease of detection, and will elicit higher likelihood of detection.

The criticism of the small number of subjects used by Vollenweider (N=4) would be an issue of concern were it not for multiple instances of other independently-conducted studies all consistent with the same basic conclusion (that shorter pulse durations, for the same effective intensity, result in improved visibility compared to longer pulse durations).


Although not included in the 26-page appeal document, this report was cited in the appeal and may have been intended to be attached. Since it is cited as evidence in support of the appeal, I include a few comments about that report as well.

In that report there is an extensive discussion of our (Bullough et al.) study. One comment made on page ES 3 was that the study was not independently peer-reviewed; this is no longer the case as the study was published in the peer-reviewed journal Fire Technology as mentioned above (and attached).

Also on page ES 3, there is a statement in the 3rd paragraph of the review of our (Bullough et al.) study that "these curve fits do not differ from one pulse duration to another", referring to the plots we generated showing detection as a function of our IEQ metric. We agree, and in fact it was our objective to make the curves as identical for different pulse durations as possible. However, this has nothing to do with the fact that for a given effective intensity (where the Blondel-Rey constant a=0.2 s), shorter pulse durations result in improved detection as shown in Figures 4, 5, 8, 9 and 11 of our peer-reviewed journal article based on our (Bullough et al.) study.

On page 15 of the report, a criticism is made that the color of the room illumination in our (Bullough et al.) study was similar to that of the LED sources used in the tests, whereas xenon strobe sources usually have a more "bluish-white" color than the illumination in a room. This may be generally true but many light sources used for interior lighting could have similar "bluish-white" color as a xenon strobe, so it is certainly not always true. The study by Chagger from BRE mentioned above used different colors of "white" light and found no substantial difference between them, so this point may be more of a red herring than a useful criticism.

Also on page 15, the report states "The proposed change in pulse duration for visual notification appliances is based on a misapprehension." To my understanding the misapprehension is that of the authors of this report, and the appealer in this case (CAM 72-2). Obviously keeping the maximum instantaneous intensity equal, shorter pulse durations will tend to perform more poorly than longer pulse durations for indirect detection. But the authors of this report, and the
appealer, have overlooked the fact that NFPA will continue to require a minimum effective intensity to visual alarms. Given that, for the same effective intensity (which is very different from instantaneous or peak intensity), shorter duration pulses will in fact be more visible than longer durations. That is because to maintain the same effective intensity, the shorter duration pulse needs to have a higher peak intensity. It is this point that seems to have escaped this report and the appeal. By limiting pulse duration to 20 ms, while keeping existing requirements for effective intensity, the new language would require visual alarms to have higher peak intensities, which will result in them being easier to detect and more visible. The primary error of the appeal, and of the authors of the report, are in treating the 20 ms duration limit in isolation and not in the context of other requirements already in place by NFPA.
Indirect Detection of Visual Signals for Emergency Notification

John D. Bullough*, Nicholas P. Skinner and Yiting Zhu, Lighting Research Center, Rensselaer Polytechnic Institute, 21 Union Street, Troy, NY 12180, USA

Received: 12 September 2014/Accepted: 15 April 2015

Abstract. Flashing visual signal lights for emergency notification have usually used xenon strobe light sources, which produce very short flashes of light. Photometric performance specifications for these signal lights use the effective intensity as the primary metric. Effective intensity appears to be a suitable metric for characterizing detection of signal lights when directly viewed at or near the line of sight. For the indirect detection of xenon strobe light sources, when the light source is in the far periphery or outside of the field of view and the primary cue of the signal’s flashing is the increase in brightness of adjacent room surfaces, an effective intensity of 15 cd seems to be sufficient. When signal lights produce longer flashes of light than xenon strobe sources, much higher effective intensities are needed for indirect detection, suggesting that effective intensity is poorly correlated with detection performance. A series of human factors experiments confirmed this suggestion. Based on the experimental results, a modified metric for characterizing the indirect detection of visual signals, termed the indirect effectiveness quantity (IEQ), was developed. The IEQ metric may be particularly useful at predicting indirect detection of visual signals with flash durations longer than those of xenon strobe light sources, such as some configurations using light-emitting diodes. Experimental data from the present study suggest that under ambient room illumination of 500 lx, an IEQ value of 750 cd will elicit indirect detection percentages of about 90%, independent of the flash duration.

Keywords: Human factors, Visual performance, Signal light detection, Emergency notification

1. Introduction

For the safety of their occupants, buildings are required to be equipped with emergency notification systems in the case of a fire or other life-threatening situations [1]. Traditionally these systems have used auditory alarms like horns or bells. In recent decades, visual alarms mainly consisting of flashing lights have been deployed to provide notification to individuals with hearing loss [2], as a supplementary notification for individuals who may be sleeping [3] and to provide notification in challenging environments such as very noisy locations where an auditory alarm could be unnoticed or confusing [4]. Because visual alarms are important elements of building occupant safety, the present paper describes a study of human responses to these systems under realistic illumination conditions.

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In recent years, visual signaling appliances used for emergency notification have commonly used xenon strobe lights that produce very brief (<1 ms), high-intensity flashes of light. Their specified performance [1] is characterized by their effective intensity, which is an estimate of the luminous intensity (in cd) of a steady-burning light that has equivalent visual effectiveness as the flashing light, regardless of the duration of the flash of light or the instantaneous intensity of the flashing light at any given time. Specifying the effective intensity is supposed to be a way to make meaningful comparisons among flashing lights with different flash characteristics, and an objective of the present study is to assess the predictive ability of effective intensity as a metric for the utility of visual alarm signals.

Evaluations of visual signals used in a wide variety of applications have generally confirmed the utility of the effective intensity for visual signals when they are viewed within the central portion of the field of view [5–8], regardless of the specific temporal characteristics of the flashing light. The effective intensity ($I_{e}$, in cd) is defined [9] in terms of Eq. 1:

$$I_{e} = \int_{t_{1}}^{t_{2}} I(t) dt / (z + t_{2} - t_{1})$$

where $t_{1}$ and $t_{2}$ are the start and end times (in s) of the flash of light, respectively; $I(t)$ is the instantaneous luminous intensity (in cd) of the flash at time $t$; $z$ is a constant determined empirically by Blondel and Rey [10] to have a value near 0.2 s.

Equation 1 [10] was derived for the visual detection of point-source flashes of light viewed under dark conditions, when they are just visible. Therefore, the constant $z$ in Eq. 1 is related to the temporal integration of the visual system under visual conditions similar to those under which navigational signal lights are just at the threshold for detection at night [10], when the visual system is operating at very low light levels (dark adaptation). Even though many visual signals, including those deployed in buildings for emergency notification applications, are not viewed under dark adaptation but under typical building interior light levels, and are designed to be seen at well above threshold levels, the effective intensity concept has held up well [6, 8] for on-axis and near-on-axis viewing conditions, referred to in this paper as direct viewing conditions. Indirect viewing conditions occur when a signal light is not in the field of view or only in the far periphery, and the flashing can only be detected indirectly via reflections from surrounding surfaces filling the field of view.

Inspection of Eq. 1 suggests that the same effective intensity can be achieved with signal lights having very different temporal intensity characteristics: the duration of the flash of light and its instantaneous intensity can be traded off, so that a very brief, high-intensity flash could have the same effective intensity as a longer, lower-intensity flash of light. (This trade-off is appropriate for flash durations at least up to about 0.4 s [9]). This has implications for visual signals using solid-state lighting technology such as light-emitting diodes (LEDs). LEDs are available with increasing efficiency and brightness, making these sources practical
for visual signaling devices. Unlike the xenon sources in strobe lights, LEDs can be flashed with different durations and temporal waveforms, so that two appliances could have the same calculated effective intensity but have very different temporal flash patterns [11].

A review of previous literature [12] describing the results of studies conducted with xenon strobe light sources [13] confirmed that for both direct and indirect detection, an effective intensity of 15 cd provided reliable levels of detection and this is a primary basis for the current performance specification of visual signals for emergency notification [1]. However, results from the same study [13] showed that flashing incandescent sources used as visual signals required much higher effective intensities for reliable indirect detection. Incandescent flashing sources have longer flash durations than xenon strobe lights because of the inherent properties of the tungsten filament that must heat up to produce light [14], and cool off to stop producing light.

Recently, LED visual signaling sources with varying combinations of intensity and duration scaled to achieve the same 15 cd effective intensity were tested for indirect detection [15], and the sources with longer durations (and hence, lower instantaneous intensities) tended to have lower detectability. The results of studies on large field, low-frequency flicker perception [16] suggested that when flashing of a large field (as in indirect viewing of an emergency visual signal) occurred at a frequency near 1 to 2 Hz, an absolute modulation level of about 7% produced reliable detection. Based on these findings, it has been postulated [12] that perhaps the absolute maximum instantaneous intensity from a signal when viewed indirectly might be more meaningful than its effective intensity characterized using Eq. 1 [9].

To test the effectiveness of Eq. 1 for characterizing the performance of visual signals producing flashes of light with longer durations than those produced by xenon strobes, a series of seven human factors experiments was conducted.

2. Methods

Table 1 summarizes the light levels, light source characteristics and experimental conditions used in each of the seven experiments.

2.1. Experimental Laboratory

The test laboratory used for the human factors experiments was a large classroom space with white paint on three walls and unpainted brick on the fourth wall. Figure 1 illustrates a schematic diagram of the overall experimental set-up, showing the relative locations of the experimental subjects, the test light source and the opposite wall in the field of view (not to scale). Subjects were seated at a table facing away from the unpainted brick wall. Figure 2 shows the subjects’ view of the white wall facing them, which was 20 ft (6 m) from the test light source.

The lighting system in the room was able to be controlled through a series of dimming switches. Depending upon the experiment, the illuminance in the seminar room was adjusted to produce one of the following conditions (see Table 1): a
<table>
<thead>
<tr>
<th>Experiment</th>
<th>Ambient illuminance</th>
<th>Vertical wall illuminance</th>
<th>Test source beam angle (°)</th>
<th>Flash durations</th>
<th>Flash illuminance increments</th>
<th>Flash frequency (Hz)</th>
<th>Numerical verification task?</th>
<th>Subjects aware of experiment purpose?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>500</td>
<td>200</td>
<td>40</td>
<td>1, 10 or 100 ms</td>
<td>1, 2, 4 or 8%</td>
<td>1</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>2</td>
<td>500</td>
<td>200</td>
<td>40</td>
<td>10, 25, 50 or 100 ms</td>
<td>1, 2, 4 or 8%</td>
<td>2</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>3</td>
<td>250</td>
<td>100</td>
<td>40</td>
<td>10, 25, 50 or 100 ms</td>
<td>2, 4, 8 or 16%</td>
<td>1</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>4</td>
<td>500</td>
<td>200</td>
<td>40</td>
<td>10, 25, 50 or 100 ms</td>
<td>1, 2, 4 or 8%</td>
<td>1</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>5</td>
<td>250</td>
<td>100</td>
<td>40</td>
<td>10, 25, 50 or 100 ms</td>
<td>2, 4, 8 or 16%</td>
<td>1</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>6</td>
<td>250</td>
<td>100</td>
<td>6</td>
<td>10, 25, 50 or 100 ms</td>
<td>2, 4, 8 or 16%</td>
<td>1</td>
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<td>Yes</td>
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<tr>
<td>7</td>
<td>250</td>
<td>100</td>
<td>40</td>
<td>50 ms</td>
<td>4% or 16%</td>
<td>1</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>
high ambient condition with an average horizontal illuminance on the table top of 500 lx and an average vertical illuminance on the wall facing subjects of 200 lx, and a low ambient condition with an average horizontal illuminance on the table top of 250 lx and an average vertical illuminance on the wall facing subjects of 100 lx. These light levels correspond to high and low values within the range commonly specified [14] for building interiors.

2.2. Test Light Source

Figure 3 shows the test light source, which consisted of an array of three high-power white LEDs (Cree, XREWHT-L1-0000) over which lenses (Khatod, KEPL1127) were fitted. The lenses included options for a broad (40°) or a narrow (6°) beam pattern. The 40° lens resulted in uniform illumination of a 12 × 12 ft (3.7 × 3.7 m) area of the wall, while the 6° lens only illuminated a 2 × 2 ft (0.6 × 0.6 m) area. The correlated color temperature (CCT) range of the white
LEDs was approximately 3200 K, which matched the CCT of the room lighting in the test laboratory. The light source was mounted in the ceiling behind the subjects’ seating position, adjacent to a duct in the ceiling. A plywood baffle was used to block a portion of the light from the source to avoid illuminating a shadowed portion of the wall facing the subjects, as shown in Figure 3.

2.3. Experimental Conditions

The light sources were controlled using a custom (National Instruments, LabVIEW™) program that used a function generator and power supply/driver unit to produce flashes of light varying in intensity (in terms of the illuminance increment on the wall facing the subjects’ seating position) and duration, with flash rates from 1 Hz to 2 Hz. In some experiments, subjects were requested to look straight ahead at the wall facing them, and in others, subjects performed a numerical verification task (NVT) placed on the table in front of them and would have detected the flashing in their peripheral vision, as they would in an office space while performing a similar task. The NVT consisted of printed columns of nearly matching 5-digit numbers, with 3% of the digits not matching. Subjects were instructed to place a check mark near non-matching 5-digit numbers and to report whether they indirectly observed flashing while performing this task. In the final experiment, subjects unaware of the purpose of the experiment performed the task and then afterward answered whether they noticed the flashing after a single experimental condition was displayed.

The light source was calibrated and adjusted to produce the conditions (ambient illuminance in the room, beam angle, duration of each flash of light, incremental illuminance produced on the wall by each flash as a percentage of that produced by the ambient lighting, frequency of flashing, and subjects’ task and awareness of the purpose of the experiment) summarized in Table 1.
In Experiments 4 and 5, a commercially-available emergency notification visual signal (SensorSwitch, SW) was also included, so that its detection performance could be compared to the other conditions in the study. The signal had an adjustable effective intensity setting, which was set during both experiments to its nominal setting of a minimum effective intensity of 15 cd. Based on photometric data provided by the manufacturer, it was estimated that the effective intensity of the central portion of the beam pattern was 40 cd (when calculated using Eq. 1). During the experiments in which this signal was used, it was fitted with a baffle to produce a distribution similar to that of the LED test source when equipped with the 40° beam angle lens.

2.4. Subjects and Procedure

Ten subjects participated in each experiment. Using ten subjects per experiment limits the resolution in the subsequent detection data to 10%, but previous studies of flickering light detection [17, 18] successfully identified overall trends with the same number of subjects. The subjects in Experiments 1 through 3 were 6 males/4 females averaging 44 years old (range 30 to 63, standard deviation 12 years). The subjects in Experiments 4 through 6 were 6 males/4 females averaging 45 years old (range 29 to 63, standard deviation 13 years). Seven subjects participated in all of Experiments 1 through 6. None of the subjects in Experiment 7 participated in any of the previous experiments. In Experiment 7, subjects were 7 males/3 females averaging 39 years old (range 21 to 58, standard deviation 11 years). Each experiment was conducted sequentially, with several days between experiments. All subjects in all experiments had at least 20/40 (6/12) Snellen far acuity (with corrective lenses if needed), which is the minimum acuity permissible for licensed drivers in New York State, where the study occurred. Visual acuity is probably an unimportant criterion for the present study, since even the smallest beam angle (6°) produced stimuli nearly 200 times larger than the threshold size for 20/40 (6/12) acuity (0.03°).

In Experiments 1 through 6, subjects were exposed to all of the experimental conditions (i.e., a within-subjects design) in a random order for 10 s after which they were asked whether they detected the flashing light. Each trial was followed by the next trial as soon as both the subject and the experimenter were ready, usually several seconds after completing the trial. Three null condition trials with no flashing present were also included in Experiments 1 through 6 to measure responses when no signal was present. In Experiment 7, subjects were shown one condition only (i.e., a between-subjects design); each half of the subjects saw one of the two conditions used in this experiment.

3. Results

For the null-condition trials in all of the experiments, the false-positive detection rates in all of the experiments ranged from 0% to 3%. These rates were low enough to provide confidence that subjects were only very rarely responding that they detected something when no flashing condition was presented, and that the
detection percentages reported here are representative of the actual likelihood that a signal light would be detected.

3.1. Experiment 1

Figure 4 shows the detection percentages for Experiment 1, plotted as a function of effective intensity for each condition. It can be seen in this figure that the ability to see the flashing signals indirectly was not well predicted by their effective intensity calculated based on Eq. 1, because the curves for each flash duration, when plotted as a function of effective intensity, were clearly separated from each other. Nor was the absolute illuminance increment predictive of performance. For example, the 10 ms flash with a 2% illuminance increment (the second square data point from the left in Figure 4) yielded only 20% detection, but the 100 ms flash with the same illuminance increment (the second triangular data point from the left in Figure 4) was detected 90% of the time. The 1 ms signals were hardly ever detected.

Based on these results, the 1 ms conditions used in this experiment were eliminated from future experiments, and in order to provide more resolution between 10 ms and 100 ms, flash durations of 25 and 50 ms were added.

3.2. Experiment 2

Figure 5 shows the detection percentages for Experiment 2 plotted in a similar manner as in Figure 4. As with Experiment 1, neither effective intensity nor the absolute illuminance increment was predictive of detection performance for the conditions in Experiment 2. In addition, although the flash frequency between Experiments 1 and 2 differed (1 Hz in Experiment 1 and 2 Hz in Experiment 2), the detection performance for the conditions common to both experiments (10 and 100 ms, for all illuminance increments) were highly positively correlated to each other (Pearson correlation coefficient $r = +0.95$) and very similar in magnitude.
Based on this correlation, all subsequent experiments used a flash rate of 1 Hz, since there did not appear to be an effect of frequency on indirect detection between 1 Hz and 2 Hz.

3.3. Experiment 3

Figure 6 shows the detection percentages for Experiment 3. As might be expected, since the ambient light level (250 lx) in this experiment was lower than in Experiments 1 and 2 (500 lx), detection performance in Experiment 3 was higher than in the earlier experiments. Comparing the conditions for which the flash duration and the relative illuminance increment (2, 4 and 8%) were common to
Experiments 2 and 3 (Figure 7), the results of these experiments were correlated with each other (Pearson correlation coefficient $r = +0.87$). This suggests that the illuminance increment relative to the ambient lighting in the room, rather than the absolute illuminance increment, is more important for the detection of a signal light when viewed indirectly. It should be noted, however, that the positive y-intercept value of the best-fitting linear function in Figure 7 suggests that detection performance was slightly improved under the higher ambient level, for the same duration and relative illuminance increment.

3.4. Experiment 4

Figure 8 shows the detection percentages for Experiment 4. The detection performance is lower for this experiment, in which subjects performed the NVT, than for Experiment 2, in which subjects were asked to look directly at the facing wall. It can also be seen that the detection of the xenon signal was 100%, higher than of any of the other conditions used in this experiment.

3.5. Experiment 5

Figure 9 shows the detection percentages for Experiment 5. Detection performance in Experiment 5 was higher than for Experiment 4, which used a higher ambient light level (500 lx, compared to 250 lx in Experiment 5). However, when compared for the same duration and the same relative illuminance increments common to both experiments (2%, 4%, 8%), the results were similar and reasonably correlated (Pearson correlation coefficient $r = +0.77$) with each other (Figure 10). The positive y-intercept in Figure 10 suggests, as in Figure 8, that performance was slightly improved under the higher ambient level for the same relative illuminance increment and flash duration. As in Experiment 4, the xenon strobe signal was detected 100% of the time.
3.6. Experiment 6

Figure 11 shows the detection percentages for Experiment 6. It can be seen that using the narrow beam light source in Experiment 6 resulted in generally low detection performance. Only the highest illuminance increment (16%) for a flash duration of 50 ms was detected at least half the time.

3.7. Experiment 7

Figure 12 shows the detection percentages for the two conditions used in Experiment 7. Fewer conditions were used in Experiment 7 than in Experiment 5 because of the between-subjects design of this experiment. Subjects in Experiment 7 only viewed a single condition while performing the NVT in order to identify the responses of people unaware of the purpose of the experiment. Once subjects were...
asked whether they detected the first condition they saw, they would be aware of the nature of the experiment for any subsequent presentations. To compare the responses of such unaware subjects to those aware of the experiment’s purpose, the data in Experiments 5 and 7 were compared for corresponding conditions. Detection performance for the unaware subjects in Experiment 7 to the 4% increment condition was lower than the performance for the corresponding condition in Experiment 5, where subjects were aware of the purpose of the experiment. The 16% increment condition was detected 100% of the time in both experiments.

4. Discussion

As described above, the effective intensity (defined in Eq. 1) was not a useful predictive metric of the indirect detection performance for visual signals having
different durations. Nor was the maximum illuminance increment [12] predictive of performance.

The effective intensity formulation [9] is based on the concept that the intensity and duration of a light source can be traded off in order to maintain detection performance. As mentioned previously [5], the original effective intensity formulation developed by Blondel and Rey [10] is primarily applicable to threshold detection of signal lights viewed directly (on-axis) from long distances (and seen as point sources of light) under dark adaptation conditions, when visual integration times are relatively long (e.g., 0.2 s). In comparison, the visual signals in the present study were viewed under high light levels common to office and other interior applications, and under indirect viewing, could fill a relatively large portion of the field of view and often in the visual periphery.

Under the indirect viewing conditions used in the present study, Eq. 1 in its current form does not appear to be useful as a performance metric. One aspect of Eq. 1 that pertains to the specific experimental conditions used by Blondel and Rey [10] in their studies underlying the effective intensity formulation, is the value of the constant $a$ in the equation. A value of $a = 0.2$ s was empirically determined by Blondel and Rey [10]. As stated above, this constant is thought to be related to the temporal integration time of the visual system during which intensity and duration could be traded off for equivalent performance at detection threshold under dark adaptation conditions. Under these conditions the visual system can have relatively long integration times, on the order of 0.1–0.2 s [14]. For the conditions used by Blondel and Rey [10], the signal lights were point-sized sources viewed under very dark conditions using on-axis vision, when the signals were just barely able to be detected.

Other values for the constant $a$ have been found in various studies [8], but there has been relatively little systematic investigation of the optimal value of $a$ under specific viewing conditions differing from those used by Blondel and Rey [10]. One

![Figure 12. Detection percentages for Experiment 7 (ambient illuminance 250 lx; beam angle 40°, frequency 1 Hz, NVT; subjects unaware of experiment purpose) plotted as a function of effective intensity.](image-url)
exemplary study was conducted by Schmidt-Clausen [19], who investigated the role of the ambient light level, the size of the signal light, and its eccentricity from the line of sight, on the optimal values of $a$ in Eq. 1. Schmidt-Clausen [19] found that lower values of $a$ were found for higher ambient light levels, larger signal light sizes, and greater eccentricities from the line of sight. These findings are consistent with data from Battersby and Schuckman [20], who reported that the temporal integration times for cone photoreceptors, which are the primary receptors used by the visual system under daytime light levels [14], were on the order of 0.01 s.

Consistent with the shorter integration times of the visual system under high light levels [20], and with the experimental data from Schmidt-Clausen [19], the
data from Experiments 1 through 6 were compared with modified effective intensity quantities calculated using different values of $a$ in Eq. 1. It was found that a value of $a = 0.01$ s resulted in the curves for different signal flash durations being largely superimposed over each other. (The data for Experiment 7 were not included in this analysis because only two conditions were used in this experiment.)

Figure 13 shows the detection data for Experiments 1 through 6 (data for Experiments 1 and 2 were combined since there was no difference in detection between the 1 Hz and 2 Hz conditions in these experiments), when Eq. 1 was modified using a value of $a = 0.01$ s. In the panels of this figure, the curves are located closer to one another than the curves in previous figures. Goodness-of-fit ($r^2$) values between the best-fitting sigmoid curves to all of the data in each experiment, using photometric quantities based on $a = 0.2$ s and on $a = 0.01$ s, are listed in Table 2. There is a consistent improvement in the overall goodness of fit when $a = 0.01$ s. In addition, the curves for Experiments 4 and 5 are also collinear with the detection data for the xenon source used in those experiments, suggesting that the modification of Eq. 1 is applicable to a wide range of light flash durations. This consistency suggests that an indirect effectiveness quantity (IEQ) based on Eq. 1, but using a value of $a = 0.01$ s, may be a useful predictive metric for characterizing indirect detection performance.

### Table 2
**Goodness-of-Fit ($r^2$) Values Between the Best-Fitting Sigmoid Curves and the Detection Data for Each Experiment, Using Effective Intensity Values Calculated with $a = 0.2$ s and with $a = 0.01$ s**

<table>
<thead>
<tr>
<th>Experiment (s)</th>
<th>Goodness of fit ($r^2$): $a = 0.2$ s</th>
<th>Goodness of fit ($r^2$): $a = 0.01$ s</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 and 2</td>
<td>0.72</td>
<td>0.99</td>
</tr>
<tr>
<td>3</td>
<td>0.73</td>
<td>0.84</td>
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<tr>
<td>4</td>
<td>0.49</td>
<td>0.95</td>
</tr>
<tr>
<td>5</td>
<td>0.66</td>
<td>0.88</td>
</tr>
<tr>
<td>6</td>
<td>0.29</td>
<td>0.50</td>
</tr>
</tbody>
</table>

5. Conclusions

The present experimental results and analyses conducted using variations on the formulation for effective intensity suggest that the conventional effective intensity formulation in Eq. 1, using a value of 0.2 s for the constant $a$ in the denominator, is not a suitable metric for predicting the detection performance for a signal light that is viewed indirectly. Essentially, effective intensity overestimates the effectiveness of visual signals with longer flash durations, relative to those with very short flash durations, such as xenon strobe sources. With the evolution of solid-state lighting technologies such as LEDs, it is possible to develop LED signals with effective intensities similar to those of commercially available xenon signals, but with lower maximum intensities and longer flash durations.
Nor is the relative instantaneous illuminance increment a useful metric for characterizing indirect detection performance. Instead, it appears that a useful predictive metric (denoted IEQ) can be developed from Eq. 1, using a smaller value for the constant $a$. Setting $a = 0.01 \text{s}$ allows the present experimental data for flashes of light having different durations to be largely superimposed over each other. As a rough approximation from Figure 13, and using the detection for the $40^\circ$ beam pattern, when subjects were aware of the nature of the experiment, but were performing the NVT and not looking straight at the facing wall, the IEQ value needs to be approximately 500 cd when the ambient illuminance is 500 lx, and 250 cd when the ambient illuminance is 250 lx, in order to achieve a detection percentage of about 75% to 80%. In order to achieve a detection percentage of about 90%, a criterion used previous in developing specifications for visual signals [13], the IEQ value should be 750 cd for an ambient illuminance of 500 lx, and 375 cd for an ambient illuminance of 250 lx. Such values could possibly serve as the basis for future performance specifications geared toward ensuring high levels of indirect detection of visual signals for environments with ambient illuminances between 250 lx and 500 lx, but further validation should be performed for illuminances well outside this limited range.

It is worth emphasizing again that the IEQ values listed above are based on the wider, $40^\circ$ beam pattern that illuminated a large portion of the wall facing subjects. Detection of the narrow, $6^\circ$ beam conditions was always quite low (Figure 11). Based on the present data, an emergency notification signal intended to be viewed indirectly should illuminate a relatively larger area of the room surfaces (e.g., producing a beam angle of at least $40^\circ$) in order to be reliably detected.

The present study used an LED light source with a CCT of 3200 K, matching the ambient illumination in the test laboratory. The xenon source tested has a CCT closer to 5000 K. Although the results from the present study do not suggest that the difference in CCT between the xenon light and the ambient room illumination made a large difference in detection, much larger chromaticity differences such as the use of colored illumination [12], might be easier to detect than the nominally “white” light sources employed in the present experiments.

It should also be recalled that the distance between the test light source and the wall it illuminated was fixed at 20 ft (6 m) in the present study. To generate the same illuminance increments on a wall further away, it would be necessary to increase the intensity of the light source proportionally to the square of the distance (i.e., the inverse-square law) [14].

Acknowledgments

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Warren Olsen, Isaac Papier, Mark Pavlica, Rodger Reiswig, Lee Richardson, Robert Schifiliti and Andrew Trotta.

References

perception and application of flashing lights University of Toronto, Toronto, pp 95–111
SUBJECTIVE RESPONSES TO VISUAL ALARMS FOR EMERGENCY
NOTIFICATION VIEWED INDIRECTLY

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Abstract

Flashing visual alarms for emergency notification systems are important components of building safety systems to help ensure that emergency warnings are detected by individuals with hearing loss or in noisy environments. In the U.S., photometric performance of visual alarms is specified in terms of effective intensity. A growing body of evidence suggests that effective intensity does not rectify the visual responses to flashing alarms, especially when the alarm flashes have different durations and they are not located near the line of sight. A series of experiments was conducted to measure visual responses to flashing lights viewed indirectly with different peak intensities, different beam angles, different flash rates, different flash durations, under different ambient light levels, and while observers were performing different visual tasks. Observers were asked whether they detected the flashing in their peripheral field of view and if so, how easy it was to detect and how much urgency the flashing light conveyed. None of the responses were well-correlated with the effective intensity of the light; rather, a new metric denoted the indirect effectiveness quantity (IEQ), was correlated with both detection and subjective responses to the flashing lights used in the experiments.

1 Introduction

Flashing visual alarms for emergency notification systems are an important component of building safety systems to ensure that emergency warnings can be detected by individuals with hearing loss or by individuals in noisy environments, when auditory alarms are ineffective. It is important that such alarms can be detected and that they can be interpreted as providing an urgent message to building occupants. In the U.S., the National Fire Alarm and Signaling Code (NFPA, 2013) specifies the photometric performance of visual signals in terms of the effective intensity as defined through classic research by Blondel and Rey (1912). The effective intensity of a flashing light represents the luminous intensity of a steady-burning signal light that has the same visibility threshold as the flashing light, and is very approximately related to the integrated light energy of the flash of light (e.g., intensity × duration).

The Blondel-Rey (1912) formulation for effective intensity includes a mathematical term, denoted $a$, which corresponds approximately to the integration time of the visual system under the conditions that were used to define it. Namely, these are threshold visibility conditions under dark adaptation luminances, such as might be experienced when viewing a nautical beacon from miles away at night. Under these conditions a value of about 0.2 $s$ for $a$ was derived empirically by Blondel and Rey (1912). These conditions differ from those under which visual alarms for emergency notification are detected, especially when the visual alarms are not directly within the line of sight. Under these indirect detection conditions, an observer only sees the modulation of the illumination on room surfaces and not the flashing light itself. Light levels in buildings are generally much higher than ambient nighttime levels (Rea, 2000).

Most visual alarms for emergency notification use flashing xenon strobe lamps, which have very short ($<<1$ ms) flash durations. In principle other sources such as incandescent lamps or light emitting diodes (LEDs) could also be used. Incandescent lamps have inherently longer rise and decay times than xenon strobes meaning the duration of an incandescent lamp flash is longer than that of a xenon strobe lamp. To produce a similar light energy quantity and hence a similar effective intensity value, the maximum intensity of the incandescent lamp
flash would not have to be as high as that of a xenon strobe lamp because of its longer
duration. Similarly, although LED sources can be pulsed to create very short flashes of light, it
would be possible to create a flash profile with a similar effective intensity as a xenon strobe
by using a lower maximum intensity in combination with a longer flash duration.

Earlier investigation of the detectability of visual alarms (DeVoss, 1991) found that an
effective intensity value of 15 cd resulted in high levels (>90%) of detection performance for
direct detection regardless of the flash duration. Using effective intensity for the on-axis
visibility of flashing lights, even those above the visual threshold, seems to yield reasonable
predictions (Bullough et al., 2013; Bullough and Skinner, 2013). Further, DeVoss (1991) found
that an effective intensity value of 15 cd also elicited high levels of indirect detection when
xenon strobe lamps were used. There is an increasing amount of experimental evidence,
however (DeVoss, 1991; Savage, 2011; Bullough et al., 2015), that an effective intensity of 15
cd is not sufficient for indirect detection when the flash duration from a visual alarm signal is
longer than that from a xenon strobe lamp. Recently (Bullough et al., 2015) it has been shown
that modifying the Blondel-Rey effective intensity equation, using a value of 0.01 s for a,
which more accurately represents the integration time of the visual system at high light levels
(Battersby and Schuckman, 1970), results in a quantity, termed the indirect effectiveness
quantity (IEQ), that rectifies the indirect detection performance of visual alarm signals varying
in duration.

The present paper describes data on subjective responses to visual alarm signals viewed
indirectly, in terms of the ease of seeing the effects of the light and in terms of the level of
urgency conveyed by the light.

2 Method

A series of human factors experiments was conducted in a large classroom spaced with white
painted walls, illuminated to produce either 250 lx or 500 lx on the table tops in the room
producing either 100 lx or 200 lx on the opposite wall, respectively. The flashing light
sources were mounted on the wall above and behind the subjects’ seating position, so that
they illuminated the opposite wall in front of subjects (20 ft [6 m] away from the light) with
either a 12 ft by 12 ft (3.7 m by 3.7 m) area (a 40° beam angle) or a 2 ft by 2 ft (0.6 m by 0.6
m) area (6° beam angle). The light sources were either LEDs producing flashes (either at 1 Hz
or at 2 Hz) between 1 and 100 ms in duration, or a xenon strobe light source with a flash
duration of about 1 μs.

The LED light source could be adjusted so that when it was on, it produced 2, 4, 8 or 16 lx on
the opposite wall for the duration of its flash. This produced an illuminance increment on the
opposite wall of 2%, 4%, 8% or 16%, respectively; when the ambient illuminance was 250 lx,
the illuminance increment was 1%, 2%, 4% or 8%, respectively, when the ambient illuminance
was 500 lx. In each of six experiments, ten subjects (between 23 and 63 years old, with at
least 20/40 visual acuity) either viewed the wall in front of them or performed a numerical
verification task (NVT) on the table where they sat. Table 1 summarizes the experimental
conditions for the experiments.

Table 1 – Experimental Conditions for the Present Study

<table>
<thead>
<tr>
<th>Experiment</th>
<th>Ambient illuminance</th>
<th>Vertical wall illuminance</th>
<th>Test source beam angle</th>
<th>Flash durations</th>
<th>Flash illuminance increments</th>
<th>Flash frequency</th>
<th>Numerical verification task?</th>
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<tbody>
<tr>
<td>1</td>
<td>500 lx</td>
<td>200 lx</td>
<td>40°</td>
<td>1, 10 or 100 ms</td>
<td>1%, 2%, 4% or 8%</td>
<td>1 Hz</td>
<td>No</td>
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<tr>
<td>2</td>
<td>500 lx</td>
<td>200 lx</td>
<td>40°</td>
<td>10, 25, 50 or 100 ms</td>
<td>1%, 2%, 4% or 8%</td>
<td>2 Hz</td>
<td>No</td>
</tr>
<tr>
<td>3</td>
<td>250 lx</td>
<td>100 lx</td>
<td>40°</td>
<td>10, 25, 50 or 100 ms</td>
<td>2%, 4%, 8% or 16%</td>
<td>1 Hz</td>
<td>No</td>
</tr>
<tr>
<td>4</td>
<td>500 lx</td>
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<td>40°</td>
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</tbody>
</table>
After a randomly-timed exposure of a visual alarm signal condition for 10 s, observers were asked whether they could identify any flashing or modulation of the light, and if so, how easy it was to detect (−2: very difficult, −1: somewhat difficult, 0: neither easy nor difficult, +1: somewhat easy, +2: very easy) and, for Experiments 2 through 6, how urgent it appeared to be (0: not at all urgent, 1: slightly urgent, 2: somewhat urgent, 3: very urgent). If a condition was not detected it was assigned an ease rating value of −2 and an urgency rating value of 0.

3 Results

Detection data are reported by Bullough et al. (2015). The difficulty rating data from the experiments are shown in Figure 1, plotted as a function of the calculated effective intensity (Blondel and Rey, 1912) for each condition.

For flashing light conditions with the same effective intensity (Blondel and Rey, 1912), there is a systematic difference in the mean ratings of ease, so that the conditions with the shorter flash durations elicited higher ease ratings than those with longer durations. This suggests that effective intensity was not a useful predictor of ease of detection.

In addition, mean ease ratings in Experiments 1 and 2 were strongly correlated ($r^2=0.96$) and similar in magnitude to each other, suggesting that differences in the flash rate between 1 Hz and 2 Hz have little, if any, impact on judgments of ease of detection.
The mean ratings of urgency for each of the experiments in which this question was asked are shown in Figure 2, plotted as a function of effective intensity (Blondel and Rey, 1912) for each condition.

**Figure 2 – Mean ratings of urgency for the flashing visual alarms in Experiments 2-6, as a function of their effective intensities.**

The mean urgency data follow similar trends as the ease rating data, with systematic differences in perceived urgency for flashing light conditions producing the same effective intensities but differing in their flash durations. Effective intensity does not serve as a useful predictor of urgency, nor of ease (Figure 1), nor of observers’ ability to detect the flashing light conditions (Bullough et al., 2015).

### 4 Discussion

Bullough et al. (2015) found that detection performance of the flashing light conditions in the present experiments was characterized rather well when the characterization was made in terms of the IEQ metric they devised. In order to determine whether IEQ values might also rectify the ease ratings and the urgency ratings, the mean values for each condition in each experiment were plotted as a function of the IEQ values in Figure 3 (ease ratings) and Figure 4 (urgency ratings). In Figure 4, mean ease rating values from Experiments 1 and 2 were combined since they were so highly correlated and similar in magnitude, as described above.
Figure 3 – Mean ratings of easiness for detecting the flashing visual alarms in each experiment, as a function of their IEQ values (a=0.01 s).

As shown in Figure 3, the ease rating data for each of the experimental conditions in each experiment more nearly fall along a single function in each panel of this figure. The same is true for the mean urgency rating data in Figure 4. Based on inspection of both figures, the IEQ value, defined using a value for a of 0.01 s rather than 0.2 s as in the conventional effective intensity formulation (Blondel and Rey, 1912), appears to be a better rectifying variable for perceptions of easiness of detection and for perceived urgency of the flashing lights in this study.
5 Conclusions

Flashing visual alarms having the same effective intensity but with different flash durations are not judged equally easy to detect indirectly, nor are they judged as equally urgent. The visual alarm with the shorter duration will be judged as easier to see and as more urgent. Importantly, the IEQ metric derived for indirect detection performance (Bullough et al., 2015) also rectifies both of these subjective responses to visual alarms viewed indirectly regardless of the duration of the flash of light that is produced by the signal. These findings suggest that the IEQ metric (Bullough et al., 2015) can be used as a meaningful specification for the performance of visual alarms when viewed indirectly, measured in terms of the probability of detection, the perceived ease of seeing the effects of the light, and the sense of urgency conveyed by the visual alarm signal.

Acknowledgments

This study was sponsored by Siemens, Honeywell, SimplexGrinnell, the National Electrical Manufacturers Association (NEMA), Bosch Security Systems, and Gentex Corporation, and was managed by the Fire Protection Research Foundation of the National Fire Protection...
Association (NFPA). Amanda Kimball from the Foundation served as the project manager. Helpful feedback from Robert Elliot, Dan Finnegan, Bruce Fraser, Larry Grodsky, Jack McNamara, Dave Newhouse, Warren Olsen, Isaac Papier, Mark Pavlica, Rodger Reiswig, Lee Richardson, Robert Schifiliti, and Andrew Trotta is gratefully acknowledged.

References


This information is provided the Standards Council as detailed statement of the technical committee’s action concerning Section 18.5.3.2 within NFPA 72.

At the first revision one public comment was submitted addressing Section 18.5.3.2 concerning the stated pulse duration of 200 ms. The comment ask for the pulse duration to be reduced from .2 second to 20 milliseconds. This proposal was resolved based on current research being conducted on this issue. It was resolved with the understanding that we would address this subject again on second revision when the results of the research report(s) was published.

At second revision, there were three public comments submitted for review. Each comment addressing the pulse duration within Section 18.5.3.2.

- Public comment # 111 ask for a reduction in pulse duration from .2 second to 20 milliseconds with an implementation date if Jan. 1st 2017.
- Public comment #3 ask for a reduction in pulse duration from .2 second to 20 milliseconds.
- Public comment #83 as for a reduction in pulse duration from 0.2 second to 0.1 second.

The technical committee, after a lengthy discussion, voted to change Section 18.5.3.2 with a reduction in the pulse duration to 20 milliseconds (Second Revision #71). The committee also added a second statement within this second that would allow strobe devices placed in a corridor to have a longer pulse duration of 100 milliseconds. The intent by allow a strobe device with a longer pulse duration in a corridor was based on the presumption that corridors are an “active” space where individuals are moving into the required light pattern created by the strobe (direct view of the strobe device). A brighter light or shorter, more noticeable pulse of the strobe isn’t needed since the individual is active and alert at the time of the notification.

Supporting information was based from three different studies addressing pulse duration. One report by the NFPA Research Foundation and two studies by Ken Savage of Tyco Fire Protection Products. The technical committees actions where approved by a vote of 19 affirmative to 6 negative.

Since the second revision meeting the technical committee has not met or conferenced called to address this issue. The SIG-NAS technical does not have an “official” statement concerning this issue other than the actions that were taken at the second revision with majority vote supporting the change.

Respectfully,
David Lowrey
Boulder Fire Rescue
SIG_NAS Chair
Subject: Appeal to Overturn the Association Action on CAM 72-2

I have received a copy of the subject appeal and request that the Standards Council deny the appeal.

I do not represent any party or interests related to this matter. I have no financial or other interests in the issue other than wanting the right thing done. Although I am a member of the SIG-NAS Technical Committee and past chair of that committee, I am not representing the interests of any TC other members.

Before you can evaluate the statements of either proponents or opponents in this matter, you need to know a few basic facts and bit of history. I will not address all of the “scientific” statements made the appellant – I can, but it is not necessary. By the time you reach the end of the next page, you will understand what the Technical Committee has done and why it is important to support the TC action and deny this appeal.

Stanley Kravontka, for the New York City Board of Education, studied the use of high intensity strobes for alerting hearing impaired and deaf children. His work was published in Fire Technology in 1975. Mr. Kravontka then chaired an NFPA Subcommittee that wrote the 1985 NFPA 72G, Guide for the Installation, Maintenance and Use of Notification Appliances for Protective Signaling Systems. A key point is that the guide suggested that a 10% increase in illuminance to achieve notification. In other words, the “signal” needed to be 10% higher than the background “noise”.

In the early 1990s Underwriters Laboratories conducted research and in 1991 UL published the data in “Research on Emergency Signaling Devices for Use by the Hearing Impaired”. That report indicated that the next step, Phase 2, was to be analysis of the results and the development of requirements for a UL product standard and an NFPA code. A 3rd Phase was to get industry and expert review of the Phase 2 report. A UL Task Group did work and eventually all new material, completely different from that in the 1985 NFPA 72G, was put into the 1993 NFPA 72 National Fire Alarm Code. No Phase 2 report was ever published. The new material can be found in the Technical Committee Report (TCR = today’s 1st Draft) without any explanation, without any committee statement and without any substantiation.

A key change was to simplify the code by doing away with consideration of ambient light levels and signal-to-noise ratios. Instead, the size of the coverage area determined the required intensity of the light. But, how should the light intensity be specified? The Illuminating Engineering Society of North America used something called “effective intensity” as a metric for the perception of flashing lights. Effective intensity (in units of candelas = cd eff.) is related to the area under the flash curve, not the peak intensity. The equation is referred to as the Blondel-Rey equation:

\[ I_{eff} = \frac{\int_{t_1}^{t_2} I(t) dt}{(0.2 + t_2 - t_1)} \]
Thus, two lights with the same effective intensity are treated as equal by NFPA 72, regardless of the actual peak intensity and, hence, regardless of the actual signal-to-noise ratio. From 1993 through the 2013 edition, NFPA 72 has allowed the pulse width between the 10% values shown in the figure, to be up to 200 milliseconds (ms). In reality, all strobe lights, until recently, have used Xenon flash tubes that all have very short (<1 ms) durations and very similar pulse curves. Unfortunately, the Blondel-Rey equation was never intended to be used for indirect signaling – where an occupant is to be alerted by seeing the light effect on their surroundings and not necessarily by directly viewing the light source. In 2005 the FPRF Detection and Alarm Research Council began a multi-year effort to research and improve emergency signaling and notification. (I chaired the Research Planning Comm.) In 2010 we began formulating an RFP to study LEDs and lights other than Xenon strobes. Eventually, the project was awarded to the Lighting Research Center, Rensselaer Polytechnic Institute and headed by John Bullough, a Fellow in the Illuminating Engineering Society of North America.

From their 2012 FPRF report regarding the Blondel-Rey equation: “The calculation method is subjective and does not produce an exact comparison and is intended only to approximate the perceived brightness for direct viewing of the light source. It has worked because all of the lights approved using the standard have all had relatively similar and short pulse durations. Thus, the peak intensities have been relatively similar.” This is a fact agreed to by both proponents and opponents (and their surrogates) in this matter. The next question was what metric should NFPA 72 use to assure indirect notification that would equate different light technologies? We already knew from literature reviews that longer duration pulses are actually easier to detect even at lower peak intensities. But, there seemed to be a limit. And, all work continued to point to the signal-to-noise ratio as the most relevant factor for indirect notification. In other words, there needs to be some minimum peak intensity to produce some minimum level of change in illumination on the surroundings. In June of 2013 the SIG-NAS TC met and had only one public input related to the subject: reduce the allowable pulse duration to 20 ms for effective intensity as a metric used by the NFPA 72 tables. This would force a higher peak intensity for the same level of effective intensity.

The FPRF project continued and resulted in a recommendation that the performance metric be changed from effective intensity using the Blondel-Rey equation. The new work showed that, up to a point, LED pulse durations longer than the Xenon strobes could be equally detectable at slightly lower peak intensities. But, there still must be a minimum change in illumination in the space – between 7% and 16% increase. (Remember the original guide for a 10% change in 1985 NFPA 72G?) The report recommended a new performance metric called the Indirect Effectiveness Quantity, IEQ, which accounts for all these factors. Two problems with that: 1) the report was not published until after the NFPA 72 1st draft; and 2) it should be studied by others, reproduced and get further peer review.

What could or should the NFPA SIG-NAS TC do? The FPRF research and others all conclude that IF the Blondel-Rey equation for effective intensity is used, that a 200 ms pulse duration would allow a product to be listed with a very low peak intensity that WOULD NOT produce a detectable signal-to-noise ratio in the space. All of the requirements in NFPA 72 are based on the use of the Blondel-Rey equation for effective intensity. The only part of the code open for change at the second draft stage was the paragraph that addressed the allowable pulse duration. The research does show that if effective intensity is used, a pulse duration of 20 ms produces a high enough peak intensity to result in a sufficient change in illumination (in average ambient light) to be detected. Hence, the TC chose to reduce the allowable pulse duration from 200 ms to 20 ms so that tables of NFPA 72 would continue to produce a detectable light flash.
The TC recognizes that it is NOT the 20 ms pulse duration by itself that is important for detection of the flash. There must be a minimum level of peak intensity.

There is nothing stopping a manufacturer from using a pulse duration greater than the new 20 ms limit. If a light has a longer pulse and a higher peak than that required by the Blondel-Rey equation it can be used per the Equivalency provisions of section 1.5 of NFPA 72.

UL does have a Task Group on the subject and, per the appeal letter “is mustering support for independent human factors research by Oklahoma State University, with results expected about 16 months after work begins.” In the meantime, the work by John Bullough and the Lighting Research Center, Rensselaer Polytechnic Institute has undergone additional peer review and has been published in Fire Technology and a paper was submitted, accepted and presented at the Commission Internationale de l'Eclairage, the International Commission on Illumination this past spring.

If the UL work validates the FPRF work the TC will have a firm foundation for change to the next edition of the code and for a TIA to the 2016 edition. If it differs from the FPRF work, then additional study is needed.

It is important that we use the tried and true scientific and engineering method of validation and verification. Validation asks: What does the product need to do? What is the required performance? This is what must be approved and put in a code or standard such as NFPA 72. Verification asks: Are we building the right product? Does the product meet the specified performance requirement? Verification is the realm of the testing laboratories.

Dan Grosch of UL, in an email attached to the appeal, states “UL 1971 is a product certification Standard and that NFPA 72 is the installation Standard”. Actually, per 1.2.3 of NFPA 72: “This Code establishes minimum required levels of performance, extent of redundancy, and quality of installation but does not establish the only methods by which these requirements are to be achieved”. The first point here is that the NFPA TC will define (validate) the required level of performance. Second, the Nationally Recognized Testing Laboratories (NRTLs) product standards will verify that the products meet the performance requirements of NFPA 72. If they do not, then they cannot be used to comply with NFPA 72.

The appeal lists all sorts of unintended consequences and dire medical effects if the 20 ms requirement does not revert back to 200 ms. There are no such problems and each can be addressed if you want a longer report. But, to keep it short, remember that if the requirements is a maximum of 200 ms, then 20 ms is also permitted. Hence, their argument fails since the “hazards”, if they really existed, would still be present.

The appeal also points to a possible conflict because the changed paragraph still allows a duty cycle of 40%. They state that “Medical risks may be inherent in the requirement. A 20 ms flash duration and a 40% duty cycle can lead to installation of strobes with 20 Hz flash rates that may induce seizures in susceptible occupants”. The code does not require a duty cycle of 40% - it allows a maximum of 40%. The preceding paragraph, 18.5.3.1, states that the flash rate shall not exceed two flashes per second (2 Hz) nor be less than one flash every second (1 Hz). Hence, the duty cycle for a 20 ms light with a flash rate of 2 Hz (1 flash per 0.5 s) would be 0.02 s pulse / 0.5 s cycle = 0.04 duty cycle = 4% duty cycle, which, last I checked, is less than 40%. The requirement for a maximum duty cycle of 40% is redundant, but not a conflict, since the pulse duration and the period (flash rate per second in Hertz, Hz) are specified.

By the way, the 40% duty cycle results when the pulse duration is 0.2 s (200 ms, NFPA 2013 max.): 0.2 s pulse / 0.5 s period = 0.4 duty cycle = 40%. And, it is still relevant since the 2016 language changed by the TC requires a max. of 20 ms only for indirect viewing, but still allows 200 ms for direct viewing applied per a different table in NFPA 72.
Similarly, the appeal’s argument that synchronization would be a problem is also invalid since reverting to maximum 200 ms pulse width allows a 20 ms pulse width. Synchronization becomes more challenging with shorter pulse widths. And, manufacturers and UL have met the challenge with Xenon pulses that are less than 1 ms. NFPA 72 has a considerable factor-of-safety in the requirement that the flash rate not exceed 2 Hz and that there be no more than two unsynchronized strobes (or groups) visible at one point. With the flash rate per strobe limited to 2 Hz or less, you would never experience more than 4 Hz (two strobes or groups unsynchronized), which is about half of the threshold deemed problematic when viewed at a very high intensity. Thus, we have several factors of safety at play.

With respect to various liability claims in the appeal, the real problem would be if NFPA 72 allowed 200 ms, low peak lights to be used. They do not produce the signal-to-noise ratio needed for alerting. Contractors and Owners may be faced with product recall because low peak intensity strobes might not perform their intended function.

This is a very complicated issue. One that the SIG-NAS Technical Committee has been working on for several years and one that the Fire Protection Research Foundation started work on back in 2010. The UL Task Group started work on this only in October of 2013 after the NFPA 72 1st Draft. All of this debate has taken place at the TC meetings and the TC acted in a way consistent with an open NFPA process. More work needs to be done. But, the change made by the TC is the only way, given other requirements in the Code, to prevent the application and use of lights that will not do their intended job.

Please uphold the work of the TC and the membership floor vote on CAM 72-2 by denying this appeal.

Respectfully submitted,
R.P. Schifiliti Associates, Inc.

Robert P. Schifiliti, P.E., FSFPE
President
Item 15-8-7
TO: Linda Fuller, Secretary Standards Council

NFPA
1 Battery March Park
Quincy, MA, 02269

July 15, 2015

Dear Linda,

I hereby want to appeal the action of the Annual 2015 Technical Meeting regarding three certified amending motions I made, namely 33-1 (to accept public comment 14), 33-2 (to accept public comments 10, 11, 12 and 13) and 520-1 (to accept public comments 1 and 2).

All three motions dealt with issues associated with the NFPA Manual of Style and I believe that Standards Council needs to ensure that the Manual of Style is adhered to. I will provide some short details regarding each motion.

I. 33-1: The language proposed by the comment was as follows:

3.3.19.1 Limited Finishing Workstation. An apparatus that is capable of confining the vapors, mists, residues, dusts, or deposits that are generated by a spray application process and that meets the requirements of Section 14.3, but does not meet the requirements of a spray booth or spray room, as herein defined.

A.3.3.19.1 Limited finishing workstations meet the requirements of Section 14.3 of this standard.

The committee stated: The deletion as suggested changes the meaning of the definition completely. A limited finishing workstation is a very specific type of ventilation enclosure and it must meet the requirements listed in Chapter 14. Without the reference to Chapter 14 the definition simply states that it is not a spray booth or spray room but is ANY apparatus that confines vapors. This could mean that it is any portable ventilation system including a flexible ventilation duct. No alternative wording was suggested by the submitter. The committee would consider alternative wording if suggested but there must be a reference to the requirements in Chapter 14.

The following are five sections from the NFPA Manual of Style

1. Definitions shall not be written in mandatory language (2.3.1.4).
2. A definition shall only describe the term being defined (2.3.2.1).
3. Definitions shall be in the format of a bold term followed by the definition phrase to form a single paragraph unit (2.3.2.2).
4. Definitions shall not contain requirements (2.3.2.3).
5. References to other documents or sections of a document, notes, lists, footnotes, cautions, warnings, or figures shall not be permitted in definitions (2.3.2.4).

The technical committee wants to continue using a definition that does not comply with more than one of the clauses in the Manual of Style and the solution proposed is simple and clear and eliminates the conflicts with the Manual of Style.

II. 33-2: The existing definitions of “limited combustible” and “Noncombustible Material” within NFPA 33 read as follows:

3.3.9 Limited Combustible. A building construction material not complying with the definition of noncombustible material that, in the form in which it is used, has a potential heat value not exceeding 8140 kJ/kg (3500 Btu/lb), where tested in accordance with NFPA 259 and complies with (a) or (b): (a) materials
having a structural base of noncombustible material, with a surfacing not exceeding a thickness of 3 mm (1/8 in.) that has a flame spread index not greater than 50; and (b) materials, in the form and thickness used, other than as described in (a), having neither a flame spread index greater than 25 nor evidence of continued progressive combustion and of such composition that surfaces that would be exposed by cutting through the material on any plane would have neither a flame spread index greater than 25 nor evidence of continued progressive combustion. (Materials subject to increase in combustibility or flame spread index beyond the limits herein established through the effects of age, moisture, or other atmospheric condition shall be considered combustible.)

3.3.11.2 Noncombustible (Material). A material that, in the form in which it is used and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat. Materials that are reported as passing ASTM E 136, Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750° C, are considered noncombustible materials.

Once again, the definitions contain requirements and references to standards, in contravention with the NFPA Manual of Style. As you can see, limited combustible refers to NFPA 259 and (indirectly) to ASTM E84 when it calls for a specific flame spread index and smoke developed index and “noncombustible” refers to ASTM E136.

The solution proposed simply puts a pointer into section 3 on definitions for both limited combustible material and noncombustible material and places the definitions (as extracted from NFPA 5000) into a place within the body of the standard where they can be referenced and made into a requirement. The reason there are 4 comments is that the comments refer to individual sections. NFPA staff recommended that the 4 comments be combined in one motion to complete the action. This approach has been adopted by a whole series of NFPA documents, including the following key documents (not a complete list):

- NFPA 1, Fire Code
- NFPA 5000, Building Code
- NFPA 52, Vehicular Gases Code
- NFPA 55, Compressed Gases Code
- NFPA 90A, Air Conditioning Standard
- NFPA 90B, Standard for Warm Air HVAC
- NFPA 99, Health Care Code
- NFPA 130, Rail Standard
- NFPA 220, Types of Building Construction
- NFPA 285, ISMA test (new edition)
- NFPA 501, Manufactured Housing Standard
- NFPA 502, Standard on Tunnels
- NFPA 909, Code for Cultural Resources
- NFPA 914, Code for Historic Structures
- NFPA 1124, Code for Fireworks

I. 520.1 The existing definitions of “Noncombustible Material” within NFPA 520 reads as follows:

3.3.8 Noncombustible (Material). A material that, in the form in which it is used and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat. Materials that are reported as passing ASTM E 136, Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750° C, shall be considered noncombustible materials.
Once again, the definition in NFPA 520 contains requirements and references to standards, in contravention with the NFPA Manual of Style. As you can see, “noncombustible” refers to ASTM E136. The solution proposed is the same as for NFPA 33. It simply puts a pointer into section 3 on definitions for noncombustible material and places the definition into a place within the body of the standard where it can be referenced and made into a requirement.

In summary, Standards Council should override the action of the technical committees (and the assembly) and ensure that the documents are issued in a fashion that is consistent with the NFPA Manual of Style.

I will not attend the Standards Council meetings.

Yours sincerely,

[Signature]

Marcelo M. Hirschler
We will proceed in the order of the motion sequence number presented. Mr. Poole?

MR. POOLE: Madam Chair, ladies and gentlemen, the report of the Technical Committee on Subterranean Spaces is presented for adoption and can be found in the First and in the Second Draft of the 2014 Fall Meeting Revision Cycle.

The Technical Committee has published a First and Second Draft consisting of revisions of NFPA 520, Standard on Subterranean Spaces. These reports were submitted to letter ballot to the responsible Technical Committee. The reports and ballot results can be found in the next edition tab of the document information page for NFPA 520 at www.nfpa.org\520next.

MS. MANLEY: Thank you, Mr. Poole. Let's now proceed with the discussion on the Certified Amending Motion on NFPA 520. Microphone 1, please.

MR. HIRSCHLER: Marcelo Hirschler, GBH International, and I hereby move to accept Amending Motion 520-1 to accept Public Comments Number 1 and Number 2.

A VOICE: Second.

MS. MANLEY: We do have a second. Please
proceed with the discussion on the motion.

MR. HIRSCHLER: This --

MS. MANLEY: Let me just restate the motion.

I'm sorry. The motion is to accept Public Comments Number 1 and 2. Thank you.

MR. HIRSCHLER: At this time, you can actually see the text on the screen. You can see that the definition says "The material is reported as passing shall be considered noncombustible materials." At the previous discussion which was a similar item, the Committee said that the word "shall" was not included. Well, as you can see, the word "shall" is included.

The Manual of Style says "Definitions shall not be written in mandatory language." This is clearly mandatory language, "shall". "Definitions shall not contain requirements." It clearly contains a requirement. "Reported as passing ASTM E136." Definitions shall not have -- refer to other documents. This refers to ASTM E136. That clearly is another document.

The Technical Committee wants to continue using definitions that does not comply with several of the clauses of the Manual of Style. This
solution proposes a pointer. I wanted to point out again NFPA 1, NFPA 101, 5000, and a whole slew of other documents, the vast majority of the documents use these -- that define the terms limited combustible, noncombustible have done this to comply with the Manual of Style.

I understand that the previous motion failed. I hope you will consider and reconsider because this is what the Manual of Style says, and if we're not going to follow the Manual of Style, what's the point in having a Manual of Style?

MS. MANLEY: Mr. Poole, would you like to offer the Committee's position?

MR. POOLE: Yes. Thank you. The Technical Committee considered Mr. Hirschler's comment on their second draft meeting. During the review, the Technical Committee determined that Mr. Hirschler's comments violated the NFPA Manual of Style and, upon balloting, rejected Public Comments Number 1 and 2.

Mr. Hirschler contends that the definition of noncombustible within NFPA 520 conflicts with the current editions within the 2015 edition of NFPA 5000 and includes requirements. Nowhere in
the definition contained in NFPA 520 does it state.

that the materials shall consist of something. The

t example of the definitions stated that a

noncombustible material shall be made of metal,
then the requirement would exist within the
definition.

In the opinion of the Technical Committee,
the definition of noncombustible material is not a requirement.

Further, the Technical Committee during
the review believes further that Mr. Hirschler's
proposed text violates the NFPA Manual of Style.
For these reasons, the Technical Committee urges you to reject 520-1.

MS. MANLEY: Thank you, Mr. Poole. With that, we will open up debate on the motion. Please provide your name and affiliation and whether you are speaking in support of or against the motion. Microphone 1, please.

MR. HIRSCHLER: Marcelo Hirsch,
GBH International, in support of the motion.

How can taking out the definition in Chapter 3 and putting it elsewhere in the document violate the Manual of Style? Manual of Style --
and I read you all of the sections that are relevant to this -- does not say anything about definitions that are not there. This refers to a definition that I'm taking it out just like we've done in the other documents.

And this is clearly a requirement.

"Materials that pass E136 shall be considered." We use throughout the NFPA system "shall" for requirements. ASTM E136 is clearly a document that is different from the document NFPA 520 where we are in here. There's no way this complies with the Manual of Style.

MS. MANLEY: Is there any further discussion on Group Amending Motion 520-1 to accept Public Comment Numbers 1 and 2? Mr. Chair, would you like to make a closing?

MR. POOLE: No, thanks.

MS. MANLEY: Seeing none, we will move to a vote. Before the vote, let me restate the motion. The Group Amending Motion on the floor is to accept Public Comment Numbers 1 and 2. To vote, please touch the vote button. If you wish to vote in favor of the motion and recommend the text on screen one, touch yes. If you wish to vote against...
the motion and recommend text on screen two, touch no. Please record your vote. Five seconds.
Balloting is closed. Thank you.
The results of the vote are 141 against the motion and recommend the text on screen two and 95 for the motion and recommend the text on screen one. The motion has failed.
Is there any further discussion on NFPA 520? Seeing none, we will move on to the next document. Thank you, Mr. Poole.

MR. POOLE: Thank you.

MS. MANLEY: Before we move on to the last document, I would like to remind everyone to remain in the room for an informal discussion regarding the process.

The last report under consideration this afternoon is that of the Technical Committee on Foam. Here to present the committee report is the Committee Chair Fay Purvis of Vector Fire Technology, Incorporated, Coatesville, Pennsylvania. The committee report, that is, the Second and Draft Reports, are located on the document information page for NFPA 11 on the NFPA website. The Certified Amending Motions are
July 31, 2015

Linda Fuller  
NFPA  
1 Batterymarch Park  
Quincy, MA, 02169

RE: Appeal of Marcelo Hirschler with respect to NFPA 520, Standard on Subterranean Spaces, dated July 15, 2015

Dear members of the NFPA Standards Council,

As Chair of the technical committee on Subterranean Spaces, which is responsible for NFPA 520, *Standard on Subterranean Spaces*, I respectfully request that the Council deny Mr. Hirschler’s appeal with respect to NFPA 520.

After looking at how the same issue was managed in NFPA 1, NFPA 101 and NFPA 5000 for the 2012 editions, it is my opinion that the committee needs to take another look at the definition of “non-combustible”. My plan is to appoint a task group to look at the term, determine how it is used in NFPA 520 and to provide recommendations as to how we can move forward. The proposed solution from Mr. Hirschler is one possible solution. Splitting the definition between Chapter 3 and an annex note is another possibility and there may be some other solutions to consider.

Once the task group has completed their work, I will recommend processing a TIA for the 2016 edition so as to allow us to fully comply with the NFPA MOS.

I am happy to address any other questions on this appeal.

Sincerely,

Jack Poole, PE, FSFPE  
Principal  
Chair, Technical Committee on Subterranean Spaces
Item 15-8-10
MEMORANDUM
(AMENDMENT)

TO: Technical Committee on Fire Department Apparatus

FROM: Yvonne Smith, Project Administrator

DATE: July 21, 2015


At the NFPA Technical Meeting (Tech Session), held June 25, 2015, NFPA 1901 was amended by the acceptance of the following:

Amendment 1901-1: Accept Public Comment No. 154

The final results of balloting are as follows:

30 Members Eligible to Vote
2 Ballots not Returned (Kelker, Tull)
3 Agree (Piechura, Pietsch, Kuntz)
25 Disagree (Alexander, Caldwell, Chestnut, Cranfill, Darley, Durstine, Fenwick, Frazeur, Garver, Haston, Hillenbrand, Juneau, Lackore, McCullough, McDonald, Metheny, Mettler, Peters, Pope, Rice, Salmi, Shivers, Stalnaker, Terefinko, Wilde)
0 Abstentions

According to 4.6 of the Regulations Governing the Development of NFPA Standards (Regs), the final results show the Amendment HAS NOT achieved the 2/3 majority vote needed to recommend the Public Comment text. The Committee has voted not to support Amendment 1901-1. As a result, the recommendation to the Standards Council will be to incorporate previous edition text in the NFPA Standard.

The number of votes needed to recommend approval of the Association Action is 19.

(30 eligible to vote - 2 not returned - 0 abstentions = 28 × 0.66 = 18.48)

Note: Please remember that the return of ballots is required in accordance with Section 3.1.3.1 of the Regulations Governing the Development of NFPA Standards.
NFPA 1901, Standard for Automotive Fire Apparatus
June 2015 Amendment 1901-1 Ballot Form
For the Technical Committee on Fire Department Apparatus

Amendment 1901-1: Accept Public Comment No. 154.

Instructions:

Vote Agree to support the Amendment and as a result recommend the Public Comment text.

Vote Disagree to not support the Amendment and as a result recommend previous edition text. Note: where no previous edition text exists the text is simply deleted.

☐ Agree

I support the Amendment and as a result recommend the Public Comment text which reads as follows (changes shown legislatively to the Second Draft):

14.1.8.1 Each seating space shall have a minimum width of 22 28 in. (560 711 mm) at the shoulder level and 27 in. (686 mm) at the hip level.

☒ Disagree*

I do not support the Amendment and as a result recommend previous edition text which reads as follows (text shown clean):

14.1.8.1 Each seating space shall have a minimum width of 22 in. (560 mm) at the shoulder level.

☐ Abstain*

*Please give reasons for voting "Disagree" or "Abstain":

This is a minimum standard. If the builder desires a larger seat there is nothing preventing them from doing so. Increasing the minimum standard will have a negative effect on the agencies that use commercial chassis.

Signature: /S/ Elden L. Alexander

Name - Please Print: Elden L. Alexander

Date: July 10, 2015

Please return as soon as possible, but no later than July 13, 2015 to:

Yvonne Smith, Administrator, Technical Projects
National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169
EMAIL: YSmith@nfpa.org
FAX: 617-984-7056
Amendment 1901-4: Accept Public Comment No. 154.

Instructions:
Vote *Agree* to support the Amendment and as a result recommend the Public Comment text.
Vote *disagree* to not support the Amendment and as a result recommend previous edition text. Note: where no previous edition text exists the text is simply deleted.

☐ Agree

☐ Disagree* I do not support the Amendment and as a result recommend previous edition text which reads as follows (text shown clean):

14.1.8.1 Each seating space shall have a minimum width of 22 in. (560.71 mm) at the shoulder level and 25 in. (635 mm) at the hip level.

☐ Abstain*

*Please give reasons for voting “Disagree” or “Abstain”:

NPFPA is a minimum. Many departments for whatever reason desire 8 seats in the back. This change would not allow a chassis manufacturer to do this, unless the Department signed a waiver. The standard should remain as is, and if a Department desires more room, they can put it in their specs.

Signature: [Signature]

Name - Please Print: [Signature]

Date: 7-6-15

Please return as soon as possible, but no later than July 13, 2015 to:

Yvonne Smith, Administrator, Technical Projects
National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169
E-MAIL: YSmith@nfpa.org
FAX: 617-984-7056
Supplemental Agenda Standards Council Meeting August 17-19, 2015

NFPA 1901, Standard for Automotive Fire Apparatus
June 2015 Amendment 1901-1 Ballot Form
For the Technical Committee on Fire Department Apparatus

Amendment 1901-1: Accept Public Comment No. 154.

Instructions:
Vote Agree to support the Amendment and as a result recommend the Public Comment text.
Vote Disagree to not support the Amendment and as a result recommend previous edition text. Note: where no previous edition text exists the text is simply deleted.

☐ Agree
I support the Amendment and as a result recommend the Public Comment text which reads as follows (changes shown legislatively to the Second Draft):

14.1.8.1 Each seating space shall have a minimum width of 23 3/8 in. (594 mm) at the shoulder level and 27 in. (686 mm) at the hip level.

☒ Disagree:
I do not support the Amendment and as a result recommend previous edition text which reads as follows (text shown clean):

14.1.8.1 Each seating space shall have a minimum width of 22 in. (560 mm) at the shoulder level.

☐ Abstain*

*Please give reasons for voting “Disagree” or “Abstain”.

See Attached

Signature: Wesley D. Chestnut

Name - Please Print: Wesley D. Chestnut

Date: 7/19/2015

Please return as soon as possible, but no later than July 13, 2015 to:

Yvonne Smith, Administrator, Technical Projects
National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169
EMAIL: YSmith@nfpa.org
FAX: 617-984-7056
1901_A2015_FDA-AAA_1901 amend ballot

Reason for Disagreement

Wesley D. Chestnut

During the comment period that will lead to forthcoming revisions to NFPA® 1901 Standard for Automotive Fire Apparatus (The Standard), a proposal was made to change the minimum seat width from 22 inches to 28 inches at the shoulder level, and 27 inches at the hip level at each seating place. (See ballot information and Public Comment #154) The commenter references an anthropometric study which may indicate, in general, individuals who may serve as a fire fighter may be larger in size than previous studies and may have more difficulty wearing seat belts. While the commenter may express valid points, I do not agree with the proposed amendment based on the following explanations.

The Standard is intended to be minimum design and performance requirements for various apparatus types defined therein in general. There does not appear to be information within the Standard that would prohibit the increased dimensions as it relates to seats. Not all operators of, or personnel riding in, the apparatus addressed by The Standard, would be donning proper protective equipment or more commonly known, turn out gear, while the vehicle is in motion. For example, those individuals driving, or operating, a "command unit" may not have a need to don turnout gear.

Federal and Canada's Motor Vehicle Safety Standards prescribe certain requirements that must be followed. This may include a manufacturer of motor vehicles determining the designated seating positions and requirements that are applicable to those positions such as seat belt accommodations, protection from injury criteria, and seat pull force. As required by federal rule, seat belts must accommodate an individual ranging from the 5th percentile female to a 95th percentile male. There are several factors which may be involved when implementing a seat and seat belt assembly into a motor vehicle. A manufacturer could choose to consider the larger profile range as a worst case scenario for the purpose of its design and testing. This could lead to a non-compliance that might not easily be overcome for the smaller profile individuals. Additionally, a safety defect could be alleged for the individual that is smaller than the individual at the 95th percentile even though the system itself is determined to be compliant.

Should a manufacturer be required to implement wider seats at the designated seating positions in cab over vehicles, such as custom fire apparatus, the width of the engine tunnel and cab must be considered. To gain the necessary space for wider seats, the engine may need to be moved which drives new design and cooling tests. Wider seats might only be available in custom fire apparatus with smaller engines. Generally speaking, vehicle widths are not to exceed a width of 102.36 inches. In the United States, there may be some level of exemption for fire apparatus as it relates to the National Network. However, there may be states, provinces, or more local jurisdictions that do not provide such an exemption except by way of permit if at all.

Implementing wider seats into a custom fire apparatus may seem relatively simple. However, there are several significant considerations a manufacturer has to take into account for design and testing. The amount of work would take a significant amount of time to implement. There would also be an economic impact on the manufacturers and end users: Implementing such a change may not be possible in the given time frame for when revised standard would be effective. Even federal regulators allow for implementation time when creating new standards.
for motor vehicles. Certain rules require a three year implementation. At face value, a wider seat seems to accommodate a larger profile individual who might wear turnout gear. This may not mean increasing the seat width improves safety of the occupant.

The commenter indicates increasing seat dimensions may accommodate a 95th percentile individual wearing turn out gear. However, what has not been presented by the commenter is what the impact could be to the 5th percentile female or smaller male, without turn out gear. Nor has information been provided which shows an improvement in occupant protection from today's base line as it relates to seat width. To increase the seat width may improve comfort but the commenter did not provide enough information to show the added safety benefit for the dimensions a manufacturer of fire apparatus must meet based on Federal Motor Vehicle Safety Standards (5th percentile female to 95th percentile male). Fire apparatus are required to be equipped with seat belts and certain laws require seat belts to be worn. It does not appear the current, minimum seat dimensions in The Standard prohibit the use of a seat belt. Further, should officials from a fire department recognize its members are at the larger end of the anthropometric scale, they could request larger seat dimensions. However, a manufacturer would still be required to meet the federal regulations.
NFPA 1901, Standard for Automotive Fire Apparatus  
June 2015 Amendment 1901-1 Ballot Form  
For the Technical Committee on Fire Department Apparatus

Amendment 1901-1: Accept Public Comment No. 154.

Instructions:

Vote **Agree** to support the Amendment and as a result recommend the Public Comment text.

Vote **Disagree** to not support the Amendment and as a result recommend previous edition text. Note: where no previous edition text exists the text is simply deleted.

☐ **Agree**  
I support the Amendment and as a result recommend the Public Comment text which reads as follows (changes shown legislatively to the Second Draft):

14.1.8.1 Each seating space shall have a minimum width of 22.28 in. (560.71 mm) at the shoulder level and 27 in. (686 mm) at the hip level.

☐ **Disagree**  
I do not support the Amendment and as a result recommend previous edition text which reads as follows (text shown clean):

14.1.8.1 Each seating space shall have a minimum width of 22 in. (560 mm) at the shoulder level.

☐ **Abstain**

*Please give reasons for voting “Disagree” or “Abstain”:

"22" is a minimum. If purchasers need more space — it can be specified

Signature: 

Name - Please Print:  Jeff E. Carol

Date: 7/23/15

Please return as soon as possible, but no later than July 13, 2015 to:

Yvonne Smith, Administrator, Technical Projects  
National Fire Protection Association  
1 Batterymarch Park  
Quincy, MA 02169  
EMAIL: ysmith@nfpa.org  
FAX: 617-984-7056
Supplemental Agenda Standards Council Meeting August 17-19, 2015

Amendment 1901-1: Accept Public Comment No. 154.

Instructions:
Vote Agree to support the Amendment and as a result recommend the Public Comment text.
Vote Disagree to not support the Amendment and as a result recommend previous edition text. Note: where no previous edition text exists the text is simply deleted.

☐ Agree  I support the Amendment and as a result recommend the Public Comment text which reads as follows (changes shown legislatively to the Second Draft):

14.1.8.1 Each seating space shall have a minimum width of 22 28 in. (560 711 mm) at the shoulder level and 27 in. (686 mm) at the hip level.

☒ Disagree*  I do not support the Amendment and as a result recommend previous edition text which reads as follows (text shown clean):

14.1.8.1 Each seating space shall have a minimum width of 22 in. (560 mm) at the shoulder level.

☐ Abstain*

*Please give reasons for voting “Disagree” or “Abstain”:
This is not practical - There are a lot of ideal changes that could benefit some users but fire trucks can’t be a one size fits all - departments can specify this when wanted. Some departments place a higher safety value on other criteria, EMS compartments for gear, more fight-fighters, compact overall design, etc. So, wider seats would not always mean additional safety. Should be or remain in annex.

Signature: ____________________________
Name - Please Print: Peter Darley
Date: 6/26/15

Please return as soon as possible, but no later than July 13, 2015 to:

Yvonne Smith, Administrator, Technical Projects
National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169
EMAIL: YSmith@nfpa.org
FAX: 617-984-7056
Amendment 1901-1: Accept Public Comment No. 154.

Instructions:

Vote Agree to support the Amendment and as a result recommend the Public Comment text.

Vote Disagree to not support the Amendment and as a result recommend previous edition text. Note: where no previous edition text exists the text is simply deleted.

☐ Agree  

I support the Amendment and as a result recommend the Public Comment text which reads as follows (changes shown legislatively to the Second Draft):

14.1.8.1 Each seating space shall have a minimum width of 22 28 in. (560 711 mm) at the shoulder level and 27 in. (686 mm) at the hip level.

☒ Disagree*  

I do not support the Amendment and as a result recommend previous edition text which reads as follows (text shown clean):

14.1.8.1 Each seating space shall have a minimum width of 22 in. (560 mm) at the shoulder level.

☐ Abstain*

*Please give reasons for voting “Disagree” or “Abstain”:

FAMA does not support the Amendment and as a result recommend previous edition text.

As the Fire Apparatus Manufacturers Association (FAMA), our members take very seriously the importance of apparatus safety features and fire fighter ergonomics. When it became clear in 2003 that the industry did not have accurate data on fire fighter size and weight, FAMA stepped forward and completed a measurement study of 800 fire fighters that lead to new seat belt length standards in the 2009 edition of NFPA 1901. We at FAMA are enthusiastic about the new scientific data provided by the NIOSH study on fire fighter anthropometry.

Fire apparatus cab designers are painfully aware of the fire services desire for maximum seating width, as well as the fire services desires for maximum seating capacities in cabs and we can assure that the industries apparatus manufactures do everything possible to maximize the room for all the positions in the apparatus while not sacrificing safety.

We feel that there has been no change in our current position as well as our position previously during the NFPA apparatus committee’s review when we considered all the various factors involved extensively during the deliberations within the revision cycle and determined that as a minimum standard, the current seating mandates most effectively serve the fire industry. The necessary trade-offs between ergonomic comfort and
firefighting capabilities is currently left to the discretion of fire department leadership, and in deference to regional needs of individual communities it should remain that way.

Signature: ____________________________

Name - Please Print:  David Durstine

Date:  July 13, 2015

Please return as soon as possible, but no later than July 13, 2015 to:

Yvonne Smith, Administrator, Technical Projects
National Fire Protection Association
1 Battery March Park
Quincy, MA 02169
EMAIL: YSmith@nfpa.org
FAX: 617-984-7056
NFPA 1901, *Standard for Automotive Fire Apparatus*
June 2015 Amendment 1901-1 Ballot Form
For the Technical Committee on Fire Department Apparatus

Amendment 1901-1: Accept Public Comment No. 154.

Instructions:
Vote Agree to support the Amendment and as a result recommend the Public Comment text.
Vote Disagree to not support the Amendment and as a result recommend previous edition text. Note: where no previous edition text exists the text is simply deleted.

☐ Agree  
I support the Amendment and as a result recommend the Public Comment text which reads as follows *(changes shown legislatively to the Second Draft)*:

14.1.8.1 Each seating space shall have a minimum width of 22 28 in. (560 711 mm) at the shoulder level and 27 in. (686 mm) at the hip level.

☐ Disagree*  
I do not support the Amendment and as a result recommend previous edition text which reads as follows *(text shown clean)*:

14.1.8.1 Each seating space shall have a minimum width of 22 in. (560 mm) at the shoulder level.

☐ Abstain*

*Please give reasons for voting “Disagree” or “Abstain”:

*The proposed amendment has not been thoroughly researched in relationship to manufacturing options and may cause an undue hardship on both end-users as well as builders.*

Signature:  

[Signature]

Name - Please Print:  
Clay Fenwick

Date:  
07/13/2015

Please return as soon as possible, but no later than July 13, 2015 to:

Yvonne Smith, Administrator, Technical Projects
National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169
E-MAIL: YSmith@nfpa.org
FAX: 617-984-7056
Amendment 1901-1: Accept Public Comment No. 154.

Instructions:

Vote Agree to support the Amendment and as a result recommend the Public Comment text.

Vote Disagree to not support the Amendment and as a result recommend previous edition text. Note: where no previous edition text exists the text is simply deleted.

☐ Agree

I support the Amendment and as a result recommend the Public Comment text which reads as follows (changes shown legislatively to the Second Draft):

14.1.8.1 Each seating space shall have a minimum width of 22 28 in. (569 711 mm) at the shoulder level and 27 in. (686 mm) at the hip level.

☒ Disagree*  

I do not support the Amendment and as a result recommend previous edition text which reads as follows (text shown clean).

14.1.8.1 Each seating space shall have a minimum width of 22 in. (560 mm) at the shoulder level.

☐ Abstain*

*Please give reasons for voting “Disagree” or “Abstain”:

This is a minimum standard. As currently written, the standard allows the A145 to specify wider seating configurations if necessary.

Signature: [Signature]

Name - Please Print: Donald Frazier

Date: 7-13-15

Please return as soon as possible, but no later than July 13, 2015 to:

Yvonne Smith, Administrator, Technical Projects
National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169
EMAIL: YSmith@nfpa.org
FAX: 617-984-7056

August 7, 2015
Supplemental Agenda Standards Council Meeting August 17-19, 2015
Page 275 of 536
Supplemental Agenda Standards Council Meeting August 17-19, 2015

**NFPA 1901, Standard for Automotive Fire Apparatus**
June 2015 Amendment 1901-1 Ballot Form
For the Technical Committee on Fire Department Apparatus

Amendment 1901-1: Accept Public Comment No. 154.

**Instructions:**

**Vote Agree** to support the Amendment and as a result recommend the Public Comment text.

**Vote Disagree** to not support the Amendment and as a result recommend previous edition text. Note: where no previous edition text exists the text is simply deleted.

☐ Agree

I support the Amendment and as a result recommend the Public Comment text which reads as follows *(changes shown legislatively to the Second Draft)*:

14.1.8.1 Each seating space shall have a minimum width of 29 7/8 in. (759.71 mm) at the shoulder level and 27 in. (686 mm) at the hip level.

☒ Disagree*

I do not support the Amendment and as a result recommend previous edition text which reads as follows *(text shown clean)*:

14.1.8.1 Each seating space shall have a minimum width of 22 in. (560 mm) at the shoulder level.

☐ Abstain*

*Please give reasons for voting “Disagree” or “Abstain”:

Manufacturers already provide the maximal seating width available while installing the engines of a size required to deliver the necessary power to provide the functions of fire fighting vehicles, while maintaining a vehicle which can be operated on public roads and highways. Increasing the seating width, as requested, would either (1) remove the front passenger seat, (2) require moving the engine out of the cab space, or (3) reconfiguration of the cab in a way that adversely affects other functions of the vehicle. All situations that would require total redesigns of vehicles, which in some cases, aerial trucks specifically would not be possible.

It’s in each vehicle manufacturer’s own best interest to provide the most capable vehicle possible to their customer. In some vehicle types the requested requirement is possible, while still fulfilling the requirements of the rest of the vehicle.

It is common to arrange seating along the rear cab wall of fire trucks to allow four seats. This would no longer be possible, with the proposed minimum standard, thus negatively impacting manpower requirements of some fire departments.

Nothing in the current text prevents the customer from requiring more seat width, if they require it.

Signature: __________________________

August 7, 2015
Name - Please Print: James R. Garner
Date: 7/10/2015

Please return as soon as possible, but no later than July 13, 2015 to:

Yvonne Smith, Administrator, Technical Projects
National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169
EMAIL: YSmith@nfpa.org
FAX: 617-984-7056
Amendment 1901-1: Accept Public Comment No. 154.

Instructions:

**Vote Agree** to support the Amendment and as a result recommend the Public Comment text.

**Vote Disagree** to not support the Amendment and as a result recommend previous edition text. Note: where no previous edition text exists the text is simply deleted.

☐ **Agree**

☐ **Disagree**

☐ **Abstain**

*Please give reasons for voting “Disagree” or “Abstain“:

**THIS IS A MINIMUM STANDARD AND IS ADEQUATE AS WRITTEN. WIDER SEATS CAN BE SPECIFIED BY THE PURCHASER.**

Signature:  

Name - Please Print:  DAVID HASTON  

Date:  1 JULY 2015  

Please return as soon as possible, but no later than July 13, 2015 to:

Yvonne Smith, Administrator, Technical Projects  
National Fire Protection Association  
1 Batterymarch Park  
Quincy, MA 02169  
EMAIL: YSmith@nfpa.org  
FAX: 617-984-7056
Amendment 1901-1: Accept Public Comment No. 154.

Instructions:
Vote Agree to support the Amendment and as a result recommend the Public Comment text.
Vote Disagree to not support the Amendment and as a result recommend previous edition text. Note: where no previous edition text exists the text is simply deleted.

☐ Agree

I support the Amendment and as a result recommend the Public Comment text which reads as follows (changes shown legibly in the Second Draft):

14.1.8.1 Each seating space shall have a minimum width of 22 in. (560 mm) at the shoulder level and 27 in. (686 mm) at the hip level.

☒ Disagree

I do not support the Amendment and as a result recommend previous edition text which reads as follows (text shown clean):

14.1.8.1 Each seating space shall have a minimum width of 22 in. (560 mm) at the shoulder level.

☐ Abstain*

*Please give reasons for voting "Disagree" or "Abstain":

Need to hold for further study, The Amendment would require major re-design in the majority of fire apparatus classes, implementing such re-design by the January 1, 2016 effective date is not feasible.

Signature: 

Name - Please Print: Tom Hill

Date: July 16, 2015

Please return as soon as possible, but no later than July 13, 2015 to:

Yvonne Smith, Administrator, Technical Projects
National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169
EMAIL: YSmith@nfpa.org
FAX: 617-984-7056
Amendment 1901-1: Accept Public Comment No. 154.

Instructions:
- **Vote Agree** to support the Amendment and as a result recommend the Public Comment text.
- **Vote Disagree** to not support the Amendment and as a result recommend previous edition text. Note: where no previous edition text exists the text is simply deleted.

- [ ] Agree
  
  I support the Amendment and as a result recommend the Public Comment text which reads as follows (changes shown legislatively to the Second Draft):

  14.1.8.1 Each seating space shall have a minimum width of 22 28 in. (560 711 mm) at the shoulder level and 27 in. (686 mm) at the hip level.

- [x] Disagree*
  
  I do not support the Amendment and as a result recommend previous edition text which reads as follows (text shown clean):

  14.1.8.1 Each seating space shall have a minimum width of 22 in. (560 mm) at the shoulder level.

- [ ] Abstain*

*Please give reasons for voting “Disagree” or “Abstain”:

The wider seat dimensions proposed by the submitter would necessarily eliminate the availability of four-across seating configurations in 95-100 inch-wide custom cabs. While the proposed wider seats may well be desirable, if that is what the purchaser wants to specify, the purchaser's option to select other seating configurations, should not be precluded by the standard.

Signature: [Signature]

Name - Please Print: JAMES J. JUNEAU

Date: 08 JUL 15

Please return as soon as possible, but no later than July 13, 2015 to:

Yvonne Smith, Administrator, Technical Projects
National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169
EMAIL: ysmith@nfpa.org FAX: 617-984-7056
NFFA 1901, Standard for Automotive Fire Apparatus
June 2015 Amendment 1901-L Ballot Form
For the Technical Committee on Fire Department Apparatus

Amendment 1901-L: Accept Public Comment No. 154.

Instructions:

Vote Agree to support the Amendment and as a result recommend the Public Comment text.

Vote Disagree to not support the Amendment and as a result recommend previous edition text. Note: where no previous edition text exists the text is simply deleted.

☐ Agree

I support the Amendment and as a result recommend the Public Comment text which reads as follows (changes shown legislation to the Second Draft):

14.1.8.1 Each seating space shall have a minimum width of 22 28 in. (560 711 mm) at the shoulder level and 27 in. (686 mm) at the hip level.

☒ Disagree

I do not support the Amendment and as a result recommend previous edition text which reads as follows (text shown clean):

14.1.8.1 Each seating space shall have a minimum width of 22 in. (560 mm) at the shoulder level.

☐ Abstain

*Please give reasons for voting "Disagree" or "Abstain".

Signature: ________________________________

Name – Please Print: Robert LACROZE

Date: June 29, 2015

Please return as soon as possible, but no later than July 13, 2015 to:

Yvonne Smith, Administrator, Technical Projects
National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169
EMAIL: YSmith@nfpa.org
FAX: 617-984-7056
### NEPA 1901, Standard for Automotive Fire Apparatus
June 2015 Amendment 1901-1 Ballot Form
For the Technical Committee on Fire Department Apparatus

**Amendment 1901-1: Accept Public Comment No. 154.**

**Instructions:**
- **Vote Agree** to support the Amendment and as a result recommend the Public Comment text.
- **Vote Disagree** to not support the Amendment and as a result recommend previous edition text. Note: where no previous edition text exists the text is simply deleted.

<table>
<thead>
<tr>
<th></th>
<th>Agree</th>
<th>I support the Amendment and as a result recommend the Public Comment text which reads as follows [changes shown where necessary to the Second Draft]:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>14.1.3.1 Each seating space shall have a minimum width of 22 in. (560 mm) at the shoulder level and 27 in. (686 mm) at the hip level.</strong></td>
</tr>
<tr>
<td></td>
<td>Disagree*</td>
<td>I do not support the Amendment and as a result recommend previous edition text which reads as follows [text shown clean]:</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>14.1.3.1 Each seating space shall have a minimum width of 22 in. (560 mm) at the shoulder level.</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Abstain*</th>
</tr>
</thead>
</table>

*Please give reasons for voting "Disagree" or "Abstain":

**NEPA 1901 is a minimum standard, as such, any organization that has a need to specify seating of 18" are free to do so.**

Signature: [Signature]

Name: Please Print: **Thomas H. McCallough, Jr.**

Date: **6-29-15**

Please return as soon as possible, but no later than July 13, 2015.

Yvonne Smith, Administrator, Technical Projects
National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169
EMAIL: YSmith@nfpa.org
FAX: 617-994-7056
NFFA 1901, Standard for Automotive Fire Apparatus
June 2015 Amendment 1901-1 Ballot Form
For the Technical Committee on Fire Department Apparatus

Amendment 1901-1: Accept Public Comment No. 154.

Instructions:
Vote Agree to support the Amendment and as a result recommend the Public Comment text.
Vote Disagree to not support the Amendment and as a result recommend previous edition text. Note: where no previous edition text exists the text is simply deleted.

☐ Agree

I support the Amendment and as a result recommend the Public Comment text which reads as follows (changes shown legislatively to the Second Draft):

14.1.8.1 Each seating space shall have a minimum width of 22.28 in. (560.711 mm) at the shoulder level and 27 in. (686.247 mm) at the hip level.

XXXX Disagree*

I do not support the Amendment and as a result recommend previous edition text which reads as follows (text shown clean):

14.1.8.1 Each seating space shall have a minimum width of 22 in. (560 mm) at the shoulder level.

☐ Abstain*

*Please give reasons for voting “Disagree” or “Abstain”:

1901 is a minimum standard, it does not prevent users from specifying seating space widths larger than 22 inches

Signature: __________________________________________

Name - Please Print: John McDonald

Date: 10 July 2015

Please return as soon as possible, but no later than July 13, 2015 to:

Yvonne Smith, Administrator, Technical Projects
National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169
EMAIL: ysmith@nfpa.org
FAX: 617-984-7056

August 7, 2015
Supplemental Agenda Standards Council Meeting August 17-19, 2015
Page 283 of 536
NFPA 1901, Standard for Automotive Fire Apparatus
June 2015 Amendment 1901-1 Ballot Form
For the Technical Committee on Fire Department Apparatus

Amendment 1901-1: Accept Public Comment No. 154.

Instructions:

Vote Agree to support the Amendment and as a result recommend the Public Comment text.

Vote Disagree to not support the Amendment and as a result recommend previous edition text. Note: where no previous edition text exists the text is simply deleted.

☐ Agree

I support the Amendment and as a result recommend the Public Comment text which reads as follows (changes shown legislatively to the Second Draft):

14.1.8.1 Each seating space shall have a minimum width of 22 28 in. (660 711 mm) at the shoulder level and 27 in. (686 mm) at the hip level.

☒ Disagree*

I do not support the Amendment and as a result recommend previous edition text which reads as follows (text shown clean):

14.1.8.1 Each seating space shall have a minimum width of 22 in. (560 mm) at the shoulder level.

☐ Abstain*

*Please give reasons for voting “Disagree” or “Abstain”:

I DISAGREE BECAUSE THERE IS INSUFFICIENT TIME FOR THE MANUFACTURERS TO MAKE THE NECESSARY CHANGES TO THE CAB STRUCTURE.

Signature: [Signature]

Name - Please Print: J. Allen Metheny, SA

Date: 7-7-15

Please return as soon as possible, but no later than July 13, 2015 to:

Yvonne Smith, Administrator, Technical Projects
National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169
EMAIL: YSmith@nfpa.org
FAX: 617-984-7056
NEPA 1901, Standard for Automotive Fire Apparatus
June 2015 Amendment 1901-1 Ballot Form
For the Technical Committee on Fire Department Apparatus

Amendment 1901-1: Accept Public Comment No. 154.

Instructions:
Vote Agree to support the Amendment and as a result recommend the Public Comment text.
Vote Disagree to not support the Amendment and as a result recommend previous edition text. Note: where no previous edition text exists the text is simply deleted.

☐ Agree

I support the Amendment and as a result recommend the Public Comment text which reads as follows (changes shown legislatively to the Second Draft):

14.1.8.1 Each seating space shall have a minimum width of 22 28 in. (560 711 mm) at the shoulder level and 27 in. (686 mm) at the hip level.

☒ Disagree*

I do not support the Amendment and as a result recommend previous edition text which reads as follows (text shown clean):

14.1.8.1 Each seating space shall have a minimum width of 22 in. (560 mm) at the shoulder level.

☐ Abstain*

*Please give reasons for voting "Disagree" or "Abstain":

See Attached

Signature:  

Name - Please Print: Tom Mettler

Date: 7/9/2015

Please return as soon as possible, but no later than July 13, 2015 to:

Yvonne Smith, Administrator, Technical Projects
National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169
EMAIL: YSmith@nfpa.org
FAX: 617-984-7056
Tom Mettler ballot for June 2015 Amendment 1901-1:

Reason for Disagree ballot:

The Amendment to 14.1.8.1 would require a significant redesign of current fire apparatus crew compartments and the implementation of such a redesign and the required design verification testing requires more time than the current revision cycle for the 2015 edition of 1901 provides. NFPA is a minimum standard and purchasers have the ability to specify wider seating space than that specified in the draft of 1901 moving through the revision process.

Tom Mettler
7/9/15
NFPA 1901, Standard for Automotive Fire Apparatus
June 2015 Amendment 1901-1 Ballot Form
For the Technical Committee on Fire Department Apparatus

Amendment 1901-1: Accept Public Comment No. 154.

Instructions:

Vote Agree to support the Amendment and as a result recommend the Public Comment text.

Vote Disagree to not support the Amendment and as a result recommend previous edition text. Note: where no previous edition text exists the text is simply deleted.

14.1.8.1 Each seating space shall have a minimum width of 22 28 in. (569.71 mm) at the shoulder level and 27 in. (686 mm) at the hip level.

[Box marked with an X]

Disagree

I do not support the Amendment and as a result recommend previous edition text which reads as follows (text shown clean):

14.1.8.1 Each seating space shall have a minimum width of 22 in. (560 mm) at the shoulder level.

[Box unchecked]

Abstain

*Please give reasons for voting “Disagree” or “Abstain”:

This issue was discussed extensively in committee work. It would require extensive redesign of the cabs of most standard apparatus to accommodate the additional width for the driver and officer, and would most likely result in an increase in the height of the cab to get the seating above the engine height. If the cabs had to be redesigned, they would also have to undergo crash test certification as well as engine cooling certification. The manufacturers do not have time to accomplish this by the effective date of the standard. This would also have an impact on the number of seating positions in the crew cab as well. This could limit some commercial cabs to only 2 seats on the rear wall. Higher and wider cabs will have an impact fitting in older fire stations. This is a minimum standard. Some manufacturers have models that will comply with the additional seating width but everyone should not be forced to purchase these limited models.

Signature: ____________________________

Name - Please Print: William C. Peters

Date: 7/8/15

Please return as soon as possible, but no later than July 13, 2015 to:

Yvonne Smith, Administrator, Technical Projects
National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169
EMAIL: Y.smith@nfpa.org
FAX: 617-964-7036
NFPA 1901, Standard for Automotive Fire Apparatus
June 2015 Amendment 1901-1 Ballot Form
For the Technical Committee on Fire Department Apparatus

Amendment 1901-1: Accept Public Comment No. 154.

Instructions:
- **Vote Agree** to support the Amendment and as a result recommend the Public Comment text.
- **Vote Disagree** to not support the Amendment and as a result recommend previous edition text. Note: where no previous edition text exists the text is simply deleted.

☐ **Agree**

I support the Amendment and as a result recommend the Public Comment text which reads as follows (changes shown legislatively to the Second Draft):

14.1.8.1 Each seating space shall have a minimum width of 23 28 in. (560 711 mm) at the shoulder level and 27 in. (686 mm) at the hip level.

☐ **Disagree**

I do not support the Amendment and as a result recommend previous edition text which reads as follows (text shown clean):

14.1.8.1 Each seating space shall have a minimum width of 22 in. (560 mm) at the shoulder level.

☐ **Abstain**

*Please give reasons for voting "Disagree" or "Abstain":

See attached

Signature: [Signature]

Name - Please Print: [Name]

Date: [Date]

Please return as soon as possible, but no later than July 13, 2015 to:

Yvonne Smith, Administrator, Technical Projects
National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169
EMAIL: YSmith@nfpa.org
FAX: 617-984-7056
From: Gary Pope pope4life@msn.com
Subject: June 2015 Amendment 1901-1 Ballot Voting Substantiation
Date: July 11, 2015 12:41 PM
To: pope4life@msn.com

June 2015 Amendment 1901-1 Ballot Voting Substantiation

I disagree with the proposed amendment (public comment No. 154) for the following reasons:
- I support the actions taken by the 1901 Technical Committee and agree with the philosophy and principles supporting their action.
- NFPA 1901 is a minimum standard. Fire Departments who feel that the current minimum seat dimensions specified in the current proposed standard are not sufficient for their application can specify dimensions to meet their requirements.
- The dimensions specified in the Public Comment No. 154 would eliminate some of the most widely used chassis for fire apparatus. There are rear engine and mid engine chassis that can provide the seating space the comment requires. However, most departments do not choose those rear engine and mid engine designs as a result of other problems those chassis designs create (altered hose beds, compartment limitations, engine access issues, chassis handling issues, etc.). Fire apparatus design is a series of choices for the end user. Additional space for the firefighters would be desirable but other factors are also important. Leaving the current dimensions as they are gives the choices to the departments and does not eliminate some currently viable chassis designs.
- The firefighter "szer" issue is not solely a fire apparatus design issue. The submitter may want to examine the other side of the issue by promoting healthier lifestyles to the many firefighters that do not keep themselves physically fit and become overweight which results in needing additional seating space. We routinely see firefighters deaths as a result of heart attacks that may have been prevented with healthier lifestyles. I do not remember ever hearing about a firefighter fatally as a result of inadequate seating space.

Sent from my iPad

[Signature]

Gary Pope
Amendment 1901-1: Accept Public Comment No. 154.

Instructions:

Vote Agree to support the Amendment and as a result recommend the Public Comment text.

Vote Disagree to not support the Amendment and as a result recommend previous edition text. Note: where no previous edition text exists the text is simply deleted.

[ ] Agree

I support the Amendment and as a result recommend the Public Comment text which reads as follows (changes shown legislatively to the Second Draft):

14.1.8.1 Each seating space shall have a minimum width of 22 2/8 in. (564.711 mm) at the shoulder level and 27 in. (686 mm) at the hip level.

[ ] Disagree

I do not support the Amendment and as a result recommend previous edition text which reads as follows (text shown clean):

14.1.8.1 Each seating space shall have a minimum width of 22 in. (560 mm) at the shoulder level.

[ ] Abstain*

*Please give reasons for voting “Disagree” or “Abstain”:

There are unintended consequences if this passes. The impact on vehicle size will mean they will have to get larger in length, width, and height. This may cause vehicles not to fit in existing older firehouses, present operational issues for tight and narrow streets and rear alleys restricting access to a rear position or getting into a block. There are already cars that are manufactured that are too wide to fit into old firehouses. Different geographic areas have different operational concerns based on their response area. There will be other firefighter safety and public safety issues created if this passes.

Signature: [Signature]

Name - Please Print: [Name]

Date: 07/09/15

Please return as soon as possible, but no later than July 13, 2015 to:
NEPA 1901, Standard for Automotive Fire Apparatus  
June 2015 Amendment 1901-1 Ballot Form  
For the Technical Committee on Fire Department Apparatus

Amendment 1901-1: Accept Public Comment No. 154.

Instructions:
Vote Agree to support the Amendment and as a result recommend the Public Comment text.
Vote Disagree to not support the Amendment and as a result recommend previous edition text. Note: where no previous edition text exists the text is simply deleted.

☐ Agree  I support the Amendment and as a result recommend the Public Comment text which reads as follows (changes shown legislatively to the Second Draft):

14.1.8.1 Each seating space shall have a minimum width of 32 28 in. (560.71 mm) at the shoulder level and 27 in. (686 mm) at the hip level.

☒ Disagree*  I do not support the Amendment and as a result recommend previous edition text which reads as follows (text shown clean):

14.1.8.1 Each seating space shall have a minimum width of 22 in. (560 mm) at the shoulder level.

☐ Abstain*

*Please give reasons for voting “Disagree” or “Abstain”:

Commercial cabs (e.g. Navistar Durastar) are 74” in width at the rear seats, at shoulder level. Three occupants will require 84” in width at shoulder level, at the proposed shoulder width (28” each) dimension. This change will therefore eliminate three-occupant seating in the second row for commercial cabs. The total allowable number of occupants will be restricted to four for commercial cabs with four doors. Since most four-door commercial cabs are ordered today with five occupants (three across in the 2nd row), we believe this change to be undesirable for many fire departments.

Also, certain vehicle configurations, such as tiller trucks, provide almost no opportunities to arrange the seating in the chassis cab to meet the increased seat width requirements.

There are custom cab configurations that meet the proposed 28” shoulder / 27” hip width requirement at all seating positions (4 to 8 occupant configurations). These are currently available for sale, and can be ordered by the customer if so desired.

Since this standard establishes the minimum requirement, the current 22” shoulder width requirement should remain.
Signature: James A. Salmi
Name - Please Print: James A. Salmi
Date: 7/10/15

Please return as soon as possible, but no later than July 13, 2015 to:

Yvorine Smith, Administrator, Technical Projects
National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169
EMAIL: YSmith@nfpa.org
FAX: 617-984-7056
NFFA 1901, Standard for Automotive Fire Apparatus
June 2015 Amendment 1901-1 Ballot Form
For the Technical Committee on Fire Department Apparatus

Amendment 1901-1: Accept Public Comment No. 154.

Instructions:

Vote Agree to support the Amendment and as a result recommend the Public Comment text.

Vote Disagree to not support the Amendment and as a result recommend previous edition text. Note: where no previous edition text exists the text is simply deleted.

☐ Agree

I support the Amendment and as a result recommend the Public Comment text which reads as follows (changes shown legislatively to the Second Draft):

14.1.8.1 Each seating space shall have a minimum width of 22 28 in. (560 711 mm) at the shoulder level and 27 in. (686 mm) at the hip level.

☒ Disagree*

I do not support the Amendment and as a result recommend previous edition text which reads as follows (text shown clean):

14.1.8.1 Each seating space shall have a minimum width of 22 in. (560 mm) at the shoulder level.

☐ Abstain* *Please give reasons for voting “Disagree” or “Abstain”:

I do not agree with the proposal. The current standard is appropriate for today’s American fire service. The national habit of ever increasing various seating areas and vessels for the purpose of accommodating larger and larger individuals is only serving to enable a health crisis and the fire service certainly does not need to follow suit. The cab of a fire apparatus can only be as wide as physics allows while maintaining the necessities. Beyond the health argument the manufacturers have a finite amount of space to work with. Many fire departments, mine included, require big-block, high horsepower engines that limit the spare space available in a cab. We cannot afford to sacrifice that available space or tool storage to accommodate the concern for larger seating needs. Thank you. RJS

Signature: 

Name - Please Print: Shivers, Jason; Division Chief, Forsyth County, Georgia

Date: 06 July 2015 Monday

Please return as soon as possible, but no later than July 13, 2015 to:

Yvonne Smith, Administrator, Technical Projects
National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169
FMAIL: YSmith@nfpa.org
FAX: 617-984-7056
NEPA 1901, Standard for Automotive Fire Apparatus
June 2015 Amendment 1901-1 Ballot Form
For the Technical Committee on Fire Department Apparatus

Amendment 1901-1: Accept Public Comment No. 154.

Instructions:
- **Vote Agree** to support the Amendment and as a result recommend the Public Comment text.
- **Vote Disagree** to not support the Amendment and as a result recommend previous edition text. Note: where no previous edition text exists the text is simply deleted.

☐ Agree

I support the Amendment and as a result recommend the Public Comment text which reads as follows *(changes shown legislatively to the Second Draft)*:

14.1.8.1 Each seating space shall have a minimum width of **22.28** in. (560.711 mm) at the shoulder level and **27** in. (686 mm) at the hip level.

☐ Disagree*

I do not support the Amendment and as a result recommend previous edition text which reads as follows *(text shown clean)*:

14.1.8.1 Each seating space shall have a minimum width of **22** in. (560 mm) at the shoulder level.

☐ Abstain*

*Please give reasons for voting “Disagree” or “Abstain”:

While this seems like a good idea, it would create many problems, including eliminating most custom fire truck chassis in use today. There is not enough space to fit today’s engines, cooling, two 27” seat spaces, and two cab walls within a 98” or even 102” wide cab. Our making it a requirement would not change the facts of geometry.

Signature: [Signature]

Name - Please Print: Thomas A. Stalnaker

Date: 6/29/15

Please return as soon as possible, but no later than July 13, 2015 to:

Yvonne Smith, Administrator, Technical Projects
National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169
EMAIL: YSmith@nfpa.org
FAX: 617-984-7056
Amendment 1901-1: Accept Public Comment No. 154.

Instructions:

Vote Agree to support the Amendment and as a result recommend the Public Comment text.

Vote Disagree to not support the Amendment and as a result recommend previous edition text. Note: where no previous edition text exists the text is simply deleted.

☐ Agree

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☒ Disagree

I do not support the Amendment and as a result recommend previous edition text which reads as follows (text shown clean):

14.1.8.1 Each seating space shall have a minimum width of 22 in. (560 mm) at the shoulder level.

☐ Abstain*

*Please give reasons for voting “Disagree” or “Abstain”:

The reason for rejecting Amendment 1901-1: Public Comment No. 154 can best be summarized by the wording in the study “Seat and seatbelt accommodation in fire apparatus: Anthropometric Aspects” written by Hongwei Hsiao, Jennifer Whitestone, Michael Wilbur, J. Roger Lackore, J. Gordon Routley.

"Changing the mandated minimum seat spacing from 560 mm to 796 mm represents a major dilemma between the cab seating configurations desired by fire departments on one hand, and firefighter comfort and ease of fastening seatbelts on the other. Additionally, wider seats or seat spacing will not physically fit between the cab side and the engine tunnel in most custom and commercial apparatus cab configurations."

Changing the requirement to reflect the 95th percentile dimensional requirement as defined in the study eliminates choices that a typical NFPA 1901 customer currently has as they specify the configuration of their apparatus. Cab configuration, number of seating positions, cab floor height from ground, number of steps for egress and ingress into the cab, engine location, and engine horsepower are just some of the items that will be restricted if the amendment were incorporated into the 2016 edition of NFPA 1901.
Signature: ____________________________

Name - Please Print: John M. Terefonko

Date: 07/07/2015

Please return as soon as possible, but no later than July 13, 2015 to:

Yvonne Smith, Administrator, Technical Projects
National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169
EMAIL: YSmith@nfpa.org
FAX: 617-984-7036
Supplemental Agenda Standards Council Meeting August 17-19, 2015

Amendment 1901-1: Accept Public Comment No. 154.

Instructions:

**Vote Agree** to support the Amendment and as a result recommend the Public Comment text:

**Vote Disagree** to not support the Amendment and as a result recommend previous edition text. Note: where no previous edition text exists the text is simply deleted.

☐ Agree  
I support the Amendment and as a result recommend the Public Comment text which reads as follows *(changes shown legislatively to the Second Draft)*:

14.1.8.1 Each seating space shall have a minimum width of 22 28 in. (560 711 mm) at the shoulder level and 27 in. (686 mm) at the hip level.

☒ Disagree*  
I do not support the Amendment and as a result recommend previous edition text which reads as follows *(text shown clean)*:

14.1.8.1 Each seating space shall have a minimum width of 22 in. (560 mm) at the shoulder level.

☐ Abstain*

*Please give reasons for voting “Disagree” or “Abstain”:

I think that the work the committee did on the seats was the best balance of design and safety.

__________________________________________________________

Signature:  

Name - Please Print:  

Date:  

July 8, 2015

Please return as soon as possible, but no later than July 13, 2015 to:

Yvonne Smith, Administrator, Technical Projects
National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169
EMAIL: YSmith@nfpa.org
FAX: 617-984-7056

August 7, 2015  Supplemental Agenda Standards Council Meeting August 17-19, 2015  Page 297 of 536
results can be found on the next edition tab of the
document information page for NFPA 1901 at
www.nfpa.org/1901next.

The presiding officer will now proceed
with the Certified Amending Motions.

MR. O'CONNOR: Thank you, Chief Frazeur. Let's
now proceed with the discussion on the Certified
Amending Motions on NFPA 1901. Microphone
Number 1, please.

MR. ROUTLEY: Good morning. My name is
Gordon Routley. I am the division chief with the
Montreal Fire Department, but I'm here speaking as
an individual member participating in a
double-header, it appears. The motion I'm
presenting is 1901-1.

MR. O'CONNOR: There's a motion on the floor to
accept Public Comment Number 154. Is there a
second?

A VOICE: Second.

MR. O'CONNOR: Thank you. We do have a second.
Please proceed.

MR. ROUTLEY: Thank you. The background to
this motion begins with research that was being
conducted for the National Fallen Firefighters
Foundation and the Safety Health and Survival
Section of the International Association of Fire
Chiefs in 2005 and 2006. It was directed toward
the question of why firefighters often don't fasten
their seat belts when riding in fire apparatus.

One of the significant problems that we
discovered was that many firefighters cannot fasten
their seat belts because the seating spaces in the
apparatus are so constrained that they cannot sit
properly while wearing protective clothing much
less manipulate the restraint systems in order to
fasten their seat belts. This was an a-ha moment
for many of us because we had all complained about
the tight spaces and severely limited spaces, but
we had not connected the dots with respect to seat
belt use.

We determined that the current minimum
dimensions for seating spaces which have been in
the standards for decades were derived from
50-year-old data for military personnel and made no
allowance for firefighters wearing protective
clothing. We went on to consult with
anthropometric experts who measure the human body
and confirmed that each successor generation of
Americans is larger and heavier than the previous generation and that firefighters tend to be larger and heavier than the general population and wear bulky protective clothing.

We took the problem to NIOSH and succeeded in having the project approved to conduct a detailed anthropometric analysis of the U.S. firefighter population to address this issue and, at the same time, create a database that can be used for a long list of additional purposes. The project involved obtaining detailed measurements of almost a thousand firefighters at four different locations across the United States, carefully selected to be represented of the actual firefighter population in terms of race, gender, and every other manageable variable. The cost of the study was somewhere between 2 and $3 million, and it was timed to develop the data to be submitted for the 2015 Revision Cycle for 1901.

At the appropriate time, I submitted a series of public proposals to incorporate the data into the next edition of the standard. To be polite, I would say that the Technical Committee summarily rejected those proposals on the first
round with very little discussion. I then
resubmitted the key proposal as a public comment.
I attended the next Technical Committee meeting
where again it was rejected. And, basically, the
committee's actions on rejecting it was to say that
it doesn't work with the way we build fire
apparatus today. So the committee's action was to
hold for further study which said maybe we'll take
another look at it five years down the road.

Our final option is to make this motion to
move the proposal that we made to change the
dimensions for seating areas and fire apparatus.

MR. O'CONNOR: Thank you, sir. Chief Frazer,
would you like to comment?

MR. FRAZER: Yes. The committee, by a vote of
23 to 0, unanimous, recommends a no vote on this
proposal. The anthropometric study that the
submitter referenced was not published until April
of 2015, two months ago. That was not available
for the committee's First Draft and Second Draft
meetings.

Furthermore, this proposal is not
straightforward and simple. To add 6 inches to
each seating position where there is no space would
require that something must give. Either the apparatus would become wider, it would become taller, longer or some combination to make that space available to firefighters. Changes to the apparatus would mean that the apparatus would have to give up some of the systems that are mission critical to the fire service. Things like maneuverability, turning radius, and the amount of water-carrying might be things that could be reduced as a result of this proposal. It could impact the ability to actually park the rigs in the fire station.

As a minimum specification, users already have the ability to specify wider seats to seat their population of firefighters or take alternative steps to deal with this issue.

The committee is hesitant to prescribe a one-size-fits-all approach when there are so many alternatives available to deal with the issue.

The issue of seating space needs to go back to the committee so that it can be fully vetted now that we have the information from the anthropometric study. The NFPA process allows for this to happen between document cycle through the
TIA, the Tentative Interim Agreement process.

Again, the committee recommends a no vote on this issue.

MR. O’CONNOR: Thank you, Chief Frazeur. With that, we will open up the debate on the motion. Please provide your name, affiliation, and whether you are speaking in support or against the motion. Microphone Number 4, please.

MR. REIDY: Good morning again, my name is Jim Reidy. I am for the motion. I am representing the IAFF, and I’m from the San Antonio Fire Department. I’m a 27-year firefighter and I’m currently a ladder and truck officer. I also participate in the Apparatus Specification Committee for the San Antonio Fire Department. I have some experience in this area.

To address some of the concerns, I’m kind of dismayed that we’re more worried about the apparatus than we are the firefighters. Our main concern should be the safety of the firefighters. The biggest complaint that firefighters in this country have is the space inside those vehicles. The biggest problem we have getting our guys to wear seat belts is access to those seat belts.
Widening these seats would make that a lot easier.

I can tell you, I get up and down off that rig every third day, and I have to pre-position that seat belt halfway deployed to get it on. And I'm not alone. Every single fire truck is like that. Firefighters are the ones that ride on these fire trucks. Okay. And it can't be the apparatus or the firefighter. The current seats are not designed for use with bunker gear, pure and simple; and they need to be designed that way because when we go screaming down the road, we need to have those seat belts on and it needs to be easy.

It's not a training issue. It's an access issue. And it's just like the general public, it needs to be easy for us to use. If you increase the use of the seat belts, increase the space, increase the use of the seat belts, increase the safety of the firefighter.

And as far as that stuff about too wide for the station and a turning radius, I've been spec'ing apparatuses for years. It's easy for a large department to spec apparatuses, but 80 percent of the fire departments in this country probably buy off the "lot". They don't have that
buying power and that ability to spec those
apparatuses the way they want. I'm for the motion.

Thank you.

MR. O’CONNOR: Thank you, sir. I will go to
Microphone Number 3, please.

MR. LACKORE: Thank you. My name is
Roger Lackore. I represent the Fire Apparatus
Manufacturers Association, and I'm speaking in
opposition of the motion.

When it became clear in 2003 that the
industry did not have accurate data on the
firefighter size and weight, FAMA measured
800 firefighters that led to new seatbelt length
standards. We, at FAMA, are enthusiastic about the
new scientific data provided by the NIOSH study and
I'm personally proud to be a co-author.

With that said, I must urge a no vote on
the motion being considered. I can personally
assure you that during my 30 years as a design
engineer designing apparatus, we did everything we
could to maximize the room for cab occupants. The
industry does not need a mandate for something that
is a prime market driver already.

Seating width, while the prime driver for
1 cab design, is not in itself a safety issue.
2 Failing to wear your seat belt is a safety issue,
3 and the current 1901 standard has addressed seat
4 belt use by mandating high visibility seat belts,
5 longer seat belts, longer belt length, seat belt
6 warning devices, and vehicle data recorders to
7 track seat belt use.

8 In a perfect world, we would all have
9 first-class seats for everyone in every vehicle on
10 the road. The problem is that most practical --
11 the most practical location for a custom apparatus
12 engine is between the driver and the officer. The
13 physics of this configuration limit the amount of
14 room left over for occupants.

15 The only way to improve seat width in the
16 front of a traditional custom cab is to move the
17 engine back or significantly raise the cab. The
18 trade-offs of moving the engine or raising the cab
19 cause problems. Higher cabs with an aerial over
20 the top means fire departments with historic low
21 fire stations or low bridges cannot use them
22 Moving the engine rearward occupies space that is
23 otherwise used for crew members, water tanks,
24 pumps, hose storage, and other firefighting
necessities.

Trucks in these configurations are available but have not been embraced by the vast majority of U.S. fire departments who continue to vote with their checkbooks for the traditional cab-over-engine apparatus. The impact of the motion on the floor would be significant. The traditional low cab-over-engine apparatus which represents upwards of 90 percent of the current custom fleet would become noncompliant. Many configurations currently built on commercial chassis would also become noncompliant.

The NCA Apparatus Committee considered all these factors extensively during their deliberations and determined that as a minimum standard the current seating mandates most effectively serve the fire industry. The necessary trade-offs between ergonomic comfort and firefighting capabilities is currently left to the discretion of the fire department leadership and in deference to regional needs of individual communities. We believe it should stay that way.

For these reasons, I strongly urge the Technical Committee not to adopt this motion.
Thank you.

MR. O'CONNOR: Thank you, sir. Is there somebody back there at Microphone 5? Please.

MR. WILBUR: My name is Michael Wilbur. I am speaking in favor of the motion. I'm a retired lieutenant from the New York City Fire Department.

The first thing I would like to do is read from the Ph.D. -- double Ph.D. who did this study from NIOSH. He couldn't be here with us today. He writes, Safety implications of the study on seat belt and seat accommodations and fire apparatus prepared by Dr. Hongwei Hsiao, National Institutes for Occupational Safety and Health. This came from NIOSH. This is a summary of findings from a recent study published in the Scientific Journal of Applied Ergonomics with implications for the design of fire apparatus seats and seat belts. This summary was prepared by the lead author Dr. Hongwei Hsiao, researcher with the National Institute for Occupational Safety and Health. As part of the scientific process, the article was reviewed by independent scientists prior to the publication by the journal. One of the co-authors, J. Roger Lackore, is a member of the NFPA Technical
Committee on Fire Apparatus.

The study overview. This study collected body dimensional data on representative samples of 951 U.S. firefighters and applied the science code anthropology to assess how well fire apparatus seat and seat belt designs accommodate current firefighters. An important finding from this study is that today's firefighters, on average, are much larger and have much different body dimensions than data from previous generations that were used in the design of fire apparatus as well as the NFPA standard on fire apparatus.

Based on the results from this study, there are three primary safety issues which deserve consideration for enhancing firefighter safety while traveling in fire apparatus. Three key findings impacting firefighter safety: The seat belt length is too short. The length of the seat belt is too short to allow a substantial portion of firefighters to buckle up especially when wearing turnout gear.

The NFPA Technical Committee on Fire Apparatus has proposed longer seat belt lengths in the pending revisions in the NFPA Standard for Fire
Apparatus.

Two seats do not adequately fit firefighters' turnout gear. A firefighter would with turnout gear increases their body mass by a full 30 percent. Confining seat spaces makes it difficult for the driver to reach and operate controls. There's an increased potential for injuries during a crash to the occupants who may be compressed together impacting each other.

The study offers ideas for how these challenges might be addressed. This issue was not addressed in the pending revisions of the NFPA standard. Head supports can reduce neck injuries. Head supports have the potential to reduce risk for neck whiplash injuries in rear impact crashes. This study provides data that can be used to design appropriate level head supports. This issue is not addressed in the pending revisions of the NFPA Standard for Fire Apparatus.

Dr. Hsiao would like to convey that it has been a privilege to conduct the research with potential to improve firefighter safety. On behalf of the research team, he would like to express the appreciation to the NFPA for the opportunity to
highlight the findings that this study goes to.

And in finality, I agree with the brother, this is about firefighter safety.

MR. O'CONNOR: Time is up.

MR. WILBUR: If the NFPA can accommodate an NFPA engine, then the NFPA and the apparatus committee can safely accommodate firefighters.

Thank you. Please support this motion.

MR. O'CONNOR: Microphone Number 1, please.

MR. ROUTLEY: Thank you. Gordon Routley, again, speaking as an individual.

I would like to emphasize that the documentation that we provided with this proposal is probably the most complete scientifically validated data that has ever been provided to this committee on any subject. And I was taken aback when the chairman said that the data only became available three months ago because, over the past five years, we've made numerous presentations, written articles, provided data as it was collected along the way; and when I made the proposal more than a year ago, I provided a complete copy of all of the data.

The peer-reviewed paper only became
available three months ago, but all of the data was provided to the committee with the original proposal and with the subsequent comment.

This is a safety issue. The committee had plenty of opportunity to look at it. And I can tell you that the basic reaction was while this just doesn't work with the way we built fire trucks, so let's just put it off for five years. We can't afford to put off a safety issue for firefighters for five years. This requires attention now.

It is a significant engineering challenge. We're asking for the fire apparatus industry to go back and figure out how it can be done. We got to the moon. We figured out a lot of other things. Surely we can figure out how to build seats big enough for firefighters wearing protective clothing in a fire apparatus that works. Thank you.

MR. O'CONNOR: Thank you. I'll go back to the back of the room. Microphone 5.

MR. BRINKLEY: Good morning. Jim Brinkley, Director of Health and Safety for the International Association of Firefighters, and I rise to support this motion.
With all respect to the Technical Committee, I realize this study was not available during the first and second revisions. However, it is available now. And while it may seem logical to return this to the Technical Committee so they can consider it and come with recommendations to the full body, I ask the members in this room to consider that 25 percent of all firefighter line of duty deaths are attributed to responding to, returning from, and operating at roadway incidents.

To return this to the Technical Committee and allow more firefighters to die when seat belt use or a lack thereof has been an identifying cause of line of duty deaths is incomprehensible. And if there are any manufacturers in this room who claim that they do not have the knowledge, talent, and expertise to design a fire truck that will protect firefighters, please rise and announce that so we can guide our members in the right direction.

Thank you.

MR. O'CONNOR: Thank you, sir. Microphone Number 3.

MR. LACKORE: Roger Lackore from the Fire Apparatus Manufacturers Association again. And I
want to make sure that we're really clear. There are -- you can buy fire apparatus today that will meet the test up here, the 28 inches at the shoulder and the 27 inches at the hip. The Fire Apparatus Manufacturers Association in no way wants to say that wider seats are not good. If you want wide seats, there are some apparatus manufacturers, including my own at Pierce Manufacturing, we have two models that will meet this. Our other models will frankly not.

If you want to get under a low bridge out East, the two apparatus are the Dash CF and the Quantum. You can build on either one of those and it will meet the 28 inches today. But if you want any one of the other models that can get underneath an overpass out East or get into a historic fire district, those apparatus won't work and for the reasons that I explained earlier.

So I'm all for wider seats. The Apparatus Manufacturers Association, we're all for wider seats. It's just we're working with physics. So if you decide on a yes vote today, you are limiting yourselves as an industry to a very limited number of apparatus, and that's the trade-offs that you
have to work with.

I also did want to point out that as a committee, the 1901 Committee, we did acknowledge the NIOSH work. It's in the annex in this next revision, and I quote, it says, "The NIOSH data suggests the optimum seating position to accommodate 95th percentile firefighters would be 31.3 inches at the shoulder and 26.7 inches at the hip." And our annex text explains that you should consider firefighter width of your department when you're spec'ing out your trucks. So thank you and I encourage a no vote.

MR. O'CONNOR: Thank you. Microphone 2, please.

MR. COOK: Steven Cook, Birmingham Fire Rescue Service speaking on behalf of myself and against the motion.

Between January 8, 2014, and December 25 -- excuse me, January 8, 2004, and December 25, 2013, 1,047 firefighters died in the line of duty. Almost 500 of those, 46.6 percent, died from heart attacks. We do have a problem with overweight firefighters and oversized firefighters in this country.
A CDC study in 2011 found 70 percent of firefighters are overweight. We have a problem with fat firefighters, not a problem with small seats. I measured my crew. I'm a driver of a ladder truck. Our shoulder widths were between 16 and 20 inches, and our seat widths were between 16 and 18 inches. One of those firefighters, our captain, weighs almost 300 pounds. If we keep making the seats better, we're only giving positive reinforcement to fat firefighters. Fat firefighters are killing us, not not wearing seatbelts.

MR. O'CONNOR: Thank you, sir. I will go to Microphone Number 4.

MR. RAY: My name is Rich Ray. I am with Cybor Fire Protection, a fire sprinkler contractor in Chicago. I'm certainly not a firefighter. I'm a fire protection engineer and a big supporter of the fire service. And while I was listening to the debate, I looked on the NFPA website --

MR. O'CONNOR: Sir, are you for?

MR. RAY: I am speaking in favor of the motion. In 2013, over 4,000 firefighter injuries occurred while firefighters were responding to or returning
from an incident. That's more than ten a day. Maybe we could do something together as the body of NFPA to minimize those injuries by letting them put their seat belts on, it would be a good idea. Thank you.

MR. O'CONNOR: I see one more person at the mic back at Microphone 5.

MR. ROSS: Yes. Good morning. My name is Chris Ross. I'm a lieutenant with the Montreal Fire Department. I'm speaking on my own behalf and I'm in favor of the motion.

As we mentioned before, we might have a problem with fat firefighters. I would like to point out, at 170 pounds, I'm far from being that problem however, at 20 years on the job, putting the seat belt on has always been hard even at my size. Our latest 35 engine companies that we bought in Montreal, I'm very appreciative of the extra long seat belts and not because I need it to get around my stomach, but I'm going to have to be partially standing up when the truck is rolling out of the station in order to find the rest of the seat belt and click it in before I sit down.

The problem that arises is I take the
effort. A lot of firefighters don't take the
effort. As the gentleman mentioned, over 4,000
injuries while on the road. I think it's time that
we do something together. We've gone forward with
a crew guard, the little buzzer that makes sure the
firefighter is sitting down and belted in. Our
department has developed a problem with squirrels.
The wires get chewed and the system stopped working
because the guys cannot wear the belts and they're
tired of hearing the bells.

So I think we need to move forward. I'm
in favor of this motion, and I would ask everyone
to support the firefighters and vote for it.

MR. O'CONNOR: Thank you, sir. Microphone 4.

MR. MCLEAN: Shawn McLean with the Cleveland
Fire Department, almost 25 years and 28 weeks, but
who's counting. I'm in favor of the motion.

I heard the man -- with all due respect to
the manufacturer, I heard him stand up here and
rattle a number of upgrades that we can provide to
these apparatus in order to meet this requirement.
This committee, this process has asked the fire
service to bring data to the process. The fire
service has brought data to the process. We
brought data to support this motion. I urge the group to support the motion and support the data.

As to the notion that fat firefighters are dying of heart attacks, unfortunately, the brother didn't bring any data because what we're seeing in our cardiovascular studies is that many of these fatalities are due to an electrical conduction problem within the heart. It's not necessarily a fat issue.

Don't confuse these issues here. We're talking about the ergonomic safety of firefighters responding to and returning from alarms. We provided the data to support the motion. I urge the committee here, the group to support this motion.

MR. O'CONNOR: Okay. Is there any further discussion on Motion 1901-1 to accept Public Comment Number 154?

Chair, do you have any final comments?

MR. FRAZEUR: I do. This is an emotional issue, and I would ask the body to recall the words of Harold Schaitberger who talked about the process that we have. We bring experts from across industry, both users, manufacturers, and subject
matter experts. They formed the committee that fully vetted the issue.

Again, the study that was provided by the submitter on this was not published fully until April of this year. This body should not and the committee should not use the information where the full force, in this case, NIOSH, is not behind the study that is being reviewed. I encourage you to vote no on this submission.

MR. O'CONNOR: Thank you. Before we vote, let me restate the motion. The motion on the floor is to accept Public Comment Number 154. To vote, touch the vote button, please. If you wish to vote in favor of the motion and recommend the text on screen one, touch yes. If you wish to vote against the motion and recommend the text on screen two, touch no. Please record your vote. Balloting will be closed in five seconds. Balloting is closed. Thank you.

The results of the vote are 186 for the motion and recommend the text on screen one. The motion has passed.

Is there any further discussion on NFPA 1901?
August 7, 2015

Dawn Bellis
Secretary of the Standards Council
1 Batterymarch Park
Quincy, MA 02169-7471

Dear Secretary Bellis,

I am writing to notify the Standards Council on behalf of the International Association of Fire Fighters to file a written appeal on the issuance of NFPA 1901, Standard for Automotive Fire Apparatus. As you are aware, the membership at the annual technical session approved Certified Amending Motion 1901-1 to accept Public Comment No. 154. NFPA 1901 was sent back to the technical committee for balloting and the results will effectively override the action taken by the membership at the annual meeting. Not only does the decision of the technical committee place lives in danger, it is also disappointing that their rationale lacks merit.

Vehicle-related incidents are the second leading cause of line of duty fatalities among United States fire fighters. According to NFPA statistics, 148 fire fighters were killed in 133 vehicle incidents in a ten year period from 1998 – 2007. More recently, in 2013, there were 12,350 fire department vehicle collisions, resulting in 730 fire fighter injuries.

Seatbelt non-compliance is identified as a major contributing factor to vehicle related on-duty deaths and injuries. According to the NFPA, of the 114 fire fighter vehicle crash victims for whom information on seatbelt use was reported, 67% were not wearing seatbelts or restraint systems. In a report from the NIOSH Fire Fighter Fatality Investigation Program, 25% of fire departments stated that their fire fighters were not able to use their seatbelts comfortably while wearing their turnout gear in emergency vehicles.

The current fire apparatus seat dimensions specified in NFPA 1901 were not based on data from fire fighters. Most of the values were based on anthropometric studies of military personnel; however these values are not applicable to fire apparatus design because there are significant differences between military and fire fighter body measurements. Anthropometric measurements of military personnel also fail to take into account the added bulk of fire fighter turn out gear and PPE. As a result, the seat dimensions specified in NFPA 1901 are too small to accommodate fire fighters safely and the seats
are spaced too close together. Fire fighters are unable to reach back for their seatbelts and are forced to sit in positions that do now allow the seatbelt to fit over their gear. This safety hazard can be eliminated by changing seating dimensions of the apparatus.

The Safety Task Force of the NFPA Fire Apparatus Standards Committee, along with several fire service partners and industry representatives, advocated for an anthropometric study of United States fire fighters to update the dimensions specified by NFPA 1901. The goal of the study, conducted by NIOSH, was to provide guidance for seat configuration that reduces impediments to seatbelt usage. The current proposed values are the results of that study; a stratified sample of 863 male and 88 female fire fighters from across the United States. The proposed seat dimensions and spacing will allow fire fighters to easily access their seatbelts and wear them properly, which will lead to a reduction of injuries and line of duty fatalities related to vehicle incidents.

The main argument for rejecting the proposed change in seat spacing from 22 inches to 28 inches in the ballot responses is that NFPA 1901 is intended to be minimum standard, and that there is nothing preventing departments from requesting larger seating space widths if they want. However, data from the study show that the seating space width of 22 inches does not allow fire fighters to sit next to one another when wearing their PPE. Instead, fire fighters are forced to sit sideways or lean forwards to accommodate the fire fighter sitting next to them, which means they are unable to wear their seatbelts and therefore put themselves at unnecessary risk of injury or death in the event of vehicle accident. The data clearly shows that 22 inches is not a safe seating width, and therefore should no longer be used as the minimum standard. NPFA 1901 should specify the minimum seating width that is needed to safely fit fire fighters together in a cab, and given anthropometric data from actual fire fighters, that width should be 28 inches.

Another argument given by the technical committee in the ballot responses for rejecting the proposal is that changing the seating space width would require major changes to cab and engine configuration. This would create an economic burden and negatively impact vehicle manufactures, who will not be able to make the changes within the timeline specified by NFPA. However, the authors of the NIOSH study recommended a seating space width 28 inches because this would NOT require major changes to the cab and engine configuration. Per federal safety standards, vehicle seat dimensions should be designed to accommodate a
5th percentile adult female up to a 95th percentile adult male. However, spacing the seats wide enough to accommodate the 5th percentile female fire fighter and the 95th percentile male fire fighter with bunker gear would not be practical given the space constraints inside the apparatus. These dimensions would not allow all necessary seats to fit inside the cab space and would require changes to engine configuration. As a compromise, the authors of the study recommended using values to accommodate the 67th percentile male shoulder breadth with turn out gear (28 inches) and the 95th percentile male hip breadth with turn out gear (27 inches). This configuration would allow up to three seats in a row along the rear wall given the width of current custom cabs. Three fire fighters would be able to sit next to one another without turning sideways or leaning forward, and although their bunker may still touch the person next to them, there would still be enough space for a fire fighter to reach back for his or her seatbelt. This configuration does not require any major changes in cab configuration or engine placement.

This three-seat configuration also addresses the concerns expressed by the committee about possible negative effects on crew size. Per NPFA 1710, truck and engine companies require a minimum of four on-duty personnel. Increasing the seat spacing from 22 inches to 28 inches at shoulder level will not result in smaller crew sizes. This seat spacing allows for four regular seats (two in the front and two rear-facing seats) and up to three flip down seats, all adding to a total of seven maximum seats. A company will still be able to have the crew size needed to safely and effectively fight fires even if the seat spacing is increased to 28 inches.

During the annual technical meeting, the Chair and several members of the Technical Committee on Fire Department Apparatus argued that the NIOSH study wasn’t available at the time the committee voted on Public Comment No. 154, and therefore wasn’t considered. On June 24th the members gathered in Chicago voted to support Public Comment No. 154, and based on the ballots and substantiations the technical committee began voting as early as July 1st to override the members voting in Chicago. This appears to be a very short time-frame to consider such an important issue. Additionally, not only does it appear that a meeting wasn’t held to discuss the merits of the NIOSH study, but little to no reference is included in the substantiations.

Increasing the seat spacing width is not only about improving comfort. It is not enabling poor eating habits or endorsing the trend of obesity in the United States.
as one committee member suggested. It is about designing fire apparatus interiors to best meet the physical needs of the end user, the firefighter, while taking into account the space constraints within the apparatus. The proposed changes to the seating space accommodate the majority of U.S. male and female firefighters and the added bulk of turnout gear. While it is true that some firefighters may not wear their gear on the apparatus, the majority of firefighters are trained to don their PPE before entering the apparatus.

When firefighters are able to fit in their seats properly, they will no longer have difficulties putting their seatbelts on, and therefore dramatically reduce their risk of injury or death in the event of a vehicle incident. The latest firefighter fatality report from NFPA shows that vehicle crashes continue to be the second leading cause of on duty deaths, accounting for 14% of all on duty deaths in 2014. Given the number of deaths that could be prevented, the IAFF respectfully requests that the Standards Council place the safety of firefighters ahead of the wishes of the manufacturers and reverse the decision of the technical committee and adopt Public Comment No. 154.

Sincerely,

Jim Brinkley
Director of Occupational Health and Safety

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Item 15-8-13
NFPA 2-Proposed 2016 Edition
Hydrogen Technologies Code
TIA Log No.: 1178
Reference: 18.3.3
Comment Closing Date: May 15, 2015
Submitter: Spencer Quong, Toyota/Quong & Associates, Inc.

1. Revise 18.3.3 to read as follows:

18.3.3 Gas Detection System. Major repair garages shall be provided with an approved hydrogen gas detection system such that gas can be detected where vehicle hydrogen fuel storage systems are serviced or indoor defueling occurs.

Substantiation:
The intent of 18.3.3 is to require a gas detection in major repair garages (see definition below) as discussed in FR-121-NFPA 2-2013 of the First Draft Public Input Report.

“Gas Detection: NFPA 30A requires gas detection systems, however, the Task Group felt the location and distribution of these systems should only be required in major repair garages where vehicle fuel storage systems are serviced or indoor defueling occurs.”

The current language could be misinterpreted by AHJ that minor repair garages must also meet this requirement. Inserting the word “Major” at the start of this section clarifies this requirement.

The existing definitions are provided below for convenience:

3.3.101.1 Major Repair Garage
Hydrogen Fuel Cell Vehicle. A building or portions of a building for major repairs, such as work on the hydrogen storage system, the fuel cell system, the propulsion system, and repairs that require defueling of the hydrogen fuel cell vehicle, and maintenance or repairs that require open-flame cutting or welding.

3.3.101.2 Minor Repair Garage
Hydrogen Fuel Cell Vehicle. A building or portions of a building not used for work required to be performed in a major repair garage, such as lubrication, inspection, and minor automotive maintenance work, fluid changes (e.g., brake fluid, air conditioning refrigerants), brake system repairs, tire rotation, and similar routine maintenance work.

Emergency Nature:
The NFPA Standard contains an error or an omission that was overlooked during a regular revision process.
MEMORANDUM

TO: NFPA Technical Committee on Hydrogen Technology

FROM: Kelly Carey, Project Administrator

DATE: May 18, 2015

SUBJ: NFPA 2 Proposed TIA No. 1178 FINAL TC BALLOT RESULTS

According to 5.6(a) in the NFPA Regs, the final results show this TIA HAS achieved the ¾ majority vote needed on both Question 1 (Technical Merit) and Question 2 (Emergency Nature).

29 Eligible to Vote
3 Not Returned (M. Kazarians, G. Milewski, J. Plati)

<table>
<thead>
<tr>
<th>Technical Merit:</th>
<th>Emergency Nature:</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 Abstentions</td>
<td>0 Abstentions</td>
</tr>
<tr>
<td>23 Agree (2 w/comment: R. Boyd, B. Ladds)</td>
<td>22 Agree (2 w/ comment: R. Boyd, A. Unione)</td>
</tr>
<tr>
<td>3 Disagree (F. Gavelli, D. Horne, R. Wichert)</td>
<td>4 Disagree (F. Gavelli, S. Goyette, D. Horne, R. Wichert)</td>
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There are two criteria necessary to pass ballot [(1) simple majority (2) affirmative ¾ vote]. Both questions must pass ballot in order to recommend that the Standards Council issues this TIA.

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

\[ \frac{29 \text{ eligible}}{2} = 14.5 = (15) \]

(2) The number of affirmative votes needed to satisfy the ¾ requirement is rounded up to 20.
(29 eligible to vote - 3 not returned - 0 abstentions = \(26 \times 0.75 = 19.5\))

An appeal relating to a proposed Tentative Interim Amendment shall be filed no later than 5 days after the notice of the Technical Committee TIA ballot results are published in accordance with 1.6.2 (c) and 4.2.6. In the case that a Correlating Committee is also being balloted, appeals need to be filed 5 days after the notice of the Correlating Committee TIA ballot results are published.
Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA to revise Section 18.3.3.

_____ X _____ AGREE  ________ DISAGREE*  ________ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.

The current language is vague and the intent of the Garage (chapter 18) task force was that section 18.3.3 should apply only to major Garages... and without this correction is easily misinterpreted. Later in the chapter at 18.5.5 we specifically call out “Major Garages” regarding open flame heaters

---

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.

The omission of the words “Major Garages” in section 18.3.3 is a major oversight of the committee and should be corrected before publication of the next edition

Signature

__Robert W. Boyd______ 19 March 2015

Please return the ballot on or before **Friday, March 27, 2015.**

**PLEASE RETURN TO:**
Joanne Goyette, Administrator, Technical Projects
NFPA
1 Batterymarch Park
Quincy, MA 02169    FAX: (617) 984-7110

E-mail: jgoyette@nfpa.org
Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA to revise Section 18.3.3.

X AGREE  _____ DISAGREE*  _____ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.

I BELIEVE THIS TO BE OF URGENT NATURE, THAT THE LACK OF CLEAR INTENT CHANGES THE POSSIBLE CODE APPLICATION.

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

BRIAN LANDS
Name (Please Print)

25 MARCH 2015
Date

Please return the ballot on or before Friday, March 27, 2015.

PLEASE RETURN TO:
Joanne Goyette, Administrator, Technical Projects
NFPA
1 Batterymarch Park
Quincy, MA 02169  FAX: (617) 984-7110  E-mail: jgoyette@nfpa.org
Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA to revise Section 18.3.3.

______ 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.

___ Do believe this qualifies as an emergency measure; since NFPA Standards Directory supports this interpretation

__________________________________________

__________________________________________

__________________________________________

Signature

Alfred J. Unione

Name (Please Print)

March 27, 2015

Date

Please return the ballot on or before **Friday, March 27, 2015**.

PLEASE RETURN TO:

Joanne Goyette, Administrator, Technical Projects

NFPA

1 Batterymarch Park

Quincy, MA 02169

FAX: (617) 984-7110

E-mail: jguarino@nfpa.org
TECHNICAL COMMITTEE LETTER BALLOT
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1178
To Revise Section 18.3.3 of the Proposed 2016 Edition of NFPA 2,
Hydrogen Technologies Code

Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA to revise Section 18.3.3.

________ AGREE  

________ DISAGREE*  

________ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.
Section 18.3.3 already requires gas detection in garages "where vehicle hydrogen fuel storage systems are serviced or indoor defueling occurs", which is also within the proposed definition of "major" garage. Therefore, the distinction is already present in the code. I believe that adding the word "major" may only make matters more confusing.

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.
In my opinion the current wording is adequate so there is no emergency need to revise it.


Signature

Filippo Gavelli
Name (Please Print)

3/26/2015
Date

Please return the ballot on or before **Friday, March 27, 2015.**

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

FAX: (617) 984-7110  

E-mail: jgoyette@nfpa.org
Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA to revise Section 18.3.3.

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.

The existing text may cause some inconvenience for some minor repair station operators but it does not reduce the safety of the minor repair station. This error can be addressed in the next revision.

Stephen Goyette
Signature

Stephen Goyette
Name (Please Print)

2015-03-17
Date

Please return the ballot on or before Friday, March 27, 2015.

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

FAX: (617) 984-7110   E-mail: jgoyette@nfpa.org
TECHNICAL COMMITTEE LETTER BALLOT
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1178
To Revise Section 18.3.3 of the Proposed 2016 Edition of NFPA 2,
Hydrogen Technologies Code

Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA to revise Section 18.3.3.

_______ AGREE  _X_______ DISAGREE*  _________ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.

_ Since hydrogen releases can only be detected by gas detectors any indoor storage or maintenance facilities must have gas detection systems operational at all times. There is no difference in minor and major repair garages as far as hydrogen is concerned._

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 an emergency issue since is is only a question of cost of the gas detection system._

Signature

Douglas B Horne
Name (Please Print)

3/20/2015
Date

Please return the ballot on or before Friday, March 27, 2015.

PLEASE RETURN TO:
Joanne Goyette, Administrator, Technical Projects
NFPA
1 Batterymarch Park
Quincy, MA 02169  FAX: (617) 984-7110  E-mail: jgoyette@nfpa.org
TECHNICAL COMMITTEE LETTER BALLOT
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1178
To Revise Section 18.3.3 of the Proposed 2016 Edition of NFPA 2,
Hydrogen Technologies Code

Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA to revise Section 18.3.3.

__________ AGREE  ______ X ______ DISAGREE*  ________ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.

I believe that any time a hydrogen vehicle is serviced, regardless of the type of service, if that service is undertaken in a closed building, a hydrogen sensor is necessary. The leak does not have to be caused by the service, the leak can be there when the vehicle comes in for service. Lacking a hydrogen sensor puts the service facility at risk and a hydrogen sensor should be required.

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.

Since I disagree with the change, I disagree with the Emergency Nature as well.

Signature

Robert Wichert
Name (Please Print)

March 21, 2015
Date

Please return the ballot on or before Friday, March 27, 2015.

PLEASE RETURN TO:
Joanne Goyette, Administrator, Technical Projects
NFPA
1 Batterymarch Park
Quincy, MA 02169  FAX: (617) 984-7110  E-mail: jgoyette@nfpa.org
Item 15-8-14
1. Revise section 17.2.3.5.6 to read as follows:

17.2.3.5.6 The minimum operating pressure shall be either 30 psi (2.0 bar) or 60 psi (4.1 bar) based upon the applicable storage and ceiling height for the installation as follows:

   a) 30 psi (2.0 bar) for storage heights up to 25 ft (7.6 m) with a maximum ceiling height of 30 ft (9.1 m)
   b) 60 psi (4.1 bar) for storage heights up to 25 ft (7.6 m) with a maximum ceiling height of 40 ft (12.2 m).

2. Revise section A.17.2.3.5 to read as follows:

A.17.2.3.5 The Fire Protection Research Foundation conducted a series of full-scale fire tests at Underwriters Laboratories to develop protection criteria for the rack storage of exposed expanded Group A plastic commodities. The tests are documented in the report, “Protection of Rack Stored Exposed Expanded Group A Plastics with ESFR Sprinklers and Vertical Barriers.” The criteria for exposed expanded plastics are based on Tests 2, 3, 7 and 8 of the series, which investigated a 40 ft (12.2 m) ceiling with a range of storage heights. The tests used K-25.2 intermediate-temperature ESFR sprinklers with vertical barriers attached to the rack uprights at nominal 16 ft (4.9 m) apart. Vertical barriers of sheet metal and 3/8 -in. plywood were both investigated. In Tests 1 through 6, transverse flue spaces between commodities were blocked. Comparing the results of Test 6 with blocked transverse flue spaces and Test 7 with no blocking of transverse flue spaces, the number of operated sprinklers decreased from 11 to 7 and improved suppression of the fire. The criteria for exposed expanded plastics are based on Tests 9 and 10 of the series, which investigated a 30 ft (9.1 m) ceiling with a range of storage heights. The tests used K-25.2 intermediate-temperature ESFR sprinklers with vertical barriers attached to the rack uprights at 16 ft (4.9 m) (nominal) apart. Vertical barriers of 3.8 -in. plywood was investigated.

The area limitation between the vertical barriers and aisles indicated in 17.3.3.5.9.2 will limit the depth of a multiple-row rack arrangement. The hose stream allowance and water supply duration requirements considered the burning characteristics of the exposed expanded plastic commodity that generates a high rate of heat release very quickly, but the commodity involved in the combustion process is then quickly consumed after fire suppression or control is achieved. While the resulting criteria is available to be used for ceiling heights up to 40 ft (12.2 m), more cost-efficient protection criteria could be available from other sources for ceiling heights of 30 ft (9.1 m) and less. The research planning was based on the availability of design criteria from other sources for ceiling heights of 30 ft (9.1 m) and less.

3. Revise section A.17.3.3.5 to read as follows:

A.17.3.3.5 The Fire Protection Research Foundation conducted a series of full-scale fire tests at Underwriters Laboratories to develop protection criteria for the rack storage of exposed expanded Group A plastic commodities. The tests are documented in the report, “Protection of Rack Stored Exposed Expanded Group A Plastics with ESFR Sprinklers and Vertical Barriers.” The criteria for exposed expanded plastics are based on Tests 2, 3, 7 and 8 of the series, which investigated a 40 ft (12.2 m) ceiling with a range of storage heights. The tests used K-25.2 intermediate-temperature ESFR sprinklers with vertical barriers attached to the rack uprights at nominal 16 ft (4.9 m) apart. Vertical barriers of sheet metal and 3.8 -in. plywood were both investigated. In Tests 1 through 6, transverse flue spaces between commodities were blocked. Comparing the results of Test 6 with blocked transverse flue spaces and Test 7 with no blocking of transverse flue spaces, the number of operated sprinklers decreased from 11 to 7 and improved suppression of the fire.
The area limitation between the vertical barriers and aisles indicated in 17.3.3.5.9.2 will limit the depth of a multiple-row rack arrangement. The hose stream allowance and water supply duration requirements considered the burning characteristics of the exposed expanded plastic commodity that generates a high rate of heat release very quickly, but the commodity involved in the combustion process is then quickly consumed after fire suppression or control is achieved. While the resulting criteria is available to be used for ceiling heights up to 40 ft (12.2 m), more cost-efficient protection criteria could be available from other sources for ceiling heights of 30 ft (9.1 m) and less. The research planning was based on the availability of design criteria from other sources for ceiling heights of 30 ft (9.1 m) and less.

Substantiation:
The Fire Protection Research Foundation coordinated additional full scale fire tests at 30 ft ceilings for the protection of Exposed Expanded Plastic storage on racks. Previous testing by the Foundation demonstrated protocol for 40 ft ceiling protection at a higher design pressure. This new 30 ft ceiling information was not available to the technical committee during the Annual 2015 cycle of the NFPA 13 document. The reduction of design pressure from 60 psi (the design pressure for 40 ft ceilings) to 30 psi is significant to the cost of the design and installation.

Emergency Nature:
Multiple concerns were raised in the technical committee debate that without 30 ft ceiling data, excessive pressure would be mandated rather than relying on other industry standards that had 30 ft ceiling design options. This additional testing provides the requested design protocol for 30 ft and lower ceilings in the NFPA 13 document.
MEMORANDUM

TO:            NFPA Correlating Committee on Automatic Sprinkler Systems
FROM:       Colleen Kelly, Administrator – Technical Projects
DATE:       April 30, 2015
SUBJ:        NFPA 13 Proposed TIA No. 1165 Final CC Ballot Results after Public Comment

There WERE NO changes to the ballot results after the circulation of the received Public Comment(s). According to 5.5(a) in the NFPA Regs, the final results show this TIA HAS achieved the ¾ majority vote needed on both Question 1 (Technical Merit) and Question 2 (Emergency Nature).

22    Eligible to Vote
4    Not Returned (Bellamy, Fleming, Kim, Mitchell)

<table>
<thead>
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<th>Technical Merit:</th>
<th>Emergency Nature:</th>
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<tr>
<td>0    Abstentions</td>
<td>0    Abstentions</td>
</tr>
<tr>
<td>18   Agree (Sheppard, w/comment)</td>
<td>16   Agree (Lowrey, w/comment)</td>
</tr>
<tr>
<td>0    Disagree</td>
<td>2    Disagree (Grill, Thompson)</td>
</tr>
</tbody>
</table>

There are two criteria necessary to pass ballot [(1) simple majority (2) affirmative ¾ vote]. Both questions must to pass ballot in order to recommend that the Standards Council issues this TIA.

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

\[
\frac{22 \text{ eligible} \div 2 = 11 + 1 = (12)}
\]

2. The number of affirmative votes needed to satisfy the ¾ requirement is rounded up to 14.

\[
(22 \text{ eligible to vote} - 4 \text{ not returned} - 0 \text{ abstentions} = 18 \times 0.75 = 13.5)
\]

An appeal relating to a proposed Tentative Interim Amendment shall be filed no later than 5 days after the notice of the Technical Committee TIA ballot results are published in accordance with 1.6.2 (c) and 4.2.6. In the case that a Correlating Committee is also being balloted, appeals need to filed 5 days after the notice of the Correlating Committee TIA ballot results are published.

Final ballot comments are attached for your review. Ballots received from alternate members are not included, unless the ballot from the principal member was not received.

Attachment
CORRELATING COMMITTEE
LETTER BALLOT
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1165
To Revise Sections 17.2.3.5.6, A.17.2.3.5, and A.17.3.3.5 of the Proposed 2016 Edition of NFPA 13, Standard for the Installation of Sprinkler Systems

Question 1: I agree that there are no correlation issues in accordance with 3.4.2 and 3.4.3 (copy enclosed) of the NFPA Regs.

___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.

Based on Section 5.4 of the Regulations governing the Development of NFPA Standards this isn’t a basis to consider this change of an emergency nature.

____________________________________________________________________
____________________________________________________________________

Signature

Raymond A. Grill

Name (Please Print)

3/15/2-15

Date

Please return the ballot on or before March 27, 2015.

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

FAX: (617) 984-7110   E-mail: ecarroll@nfpa.org
Question 1: I agree that there are no correlation issues in accordance with 3.4.2 and 3.4.3 (copy enclosed) of the NFPA Regs.

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 personally don't see this to be emergency in nature particularly with the primary substantiation being a reduction in installation cost. The proposed TIA does not appear to correct an error or omission, conflict, correction of unknown existing hazard, or any of the other factors associated with NFPA's defining emergency in nature that would require emergency correction. No doubt this is a huge installation benefit for 30 foot ceilings. However, the current Annex note along with the Chapter 1 administrative provisions would still provide a user with the ability to use the new test results.

Signature
Mike Thompson

Name (Please Print)
3/25/2015

Date

Please return the ballot on or before March 27, 2015.

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

FAX: (617) 984-7110
E-mail: ecarroll@nfpa.org
Question 1: I agree that there are no correlation issues in accordance with 3.4.2 and 3.4.3 (copy enclosed) of the NFPA Regs.

____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.

Answered based on Section 5.4 (e)

____________________________________________________

____________________________________________________

______________________________
Signature

______________________________
Name (Please Print)

3/13/15

Date

Please return the ballot on or before March 27, 2015.

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

FAX: (617) 984-7110

E-mail: ccarroll@nfpa.org
CORRELATING COMMITTEE
LETTER BALLOT
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1165
To Revise Sections 17.2.3.5.6, A.17.2.3.5, and A.17.3.3.5 of the Proposed 2016 Edition of NFPA
13, Standard for the Installation of Sprinkler Systems

Question 1: I agree that there are no correlation issues in accordance with 3.4.2 and 3.4.3 (copy
enclosed) of the NFPA Regs.

________ 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.

_____________________________________________________________________

I agree with Larry Keeping’s comments regarding the annex material and the need to add
the sentences as he suggested for 40’ and 30’ heights to better clarify the two situations.

_____________________________________________________________________

_____________________________________________________________________

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.

_____________________________________________________________________

_____________________________________________________________________

_____________________________________________________________________

__ J William Sheppard_______________________________
Signature
__ J William Sheppard_______________________________
Name (Please Print)
__March 13, 2015_______________________________
Date

Please return the ballot on or before March 27, 2015.

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

FAX: (617) 984-7110

E-mail: ecarroll@nfpa.org
MEMORANDUM

TO: NFPA Technical Committee on Sprinkler System Discharge Criteria

FROM: Colleen Kelly, Administrator – Technical Projects

DATE: April 30, 2015

SUBJ: NFPA 13 Proposed TIA No. 1165 Final TC Ballot Results after Public Comment

There WERE NO changes to the ballot results after the circulation of the received Public Comment(s). According to 5.5(a) in the NFPA Regs, the final results show this TIA HAS achieved the ¾ majority vote needed on both Question 1 (Technical Merit) and Question 2 (Emergency Nature).

32 Eligible to Vote
1 Not Returned (Ackley)

Technical Merit:  Emergency Nature:
0 Abstentions 0 Abstentions
30 Agree (Baker, Keeping, Schwab w/comment) 30 Agree
1 Disagree (Mosberian) 1 Disagree (Mosberian)

There are two criteria necessary to pass ballot [(1) simple majority (2) affirmative ¾ vote]. Both questions must to pass ballot in order to recommend that the Standards Council issues this TIA.

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

   \[
   \frac{32 \text{ eligible}}{2} = 16 + 1 = 17
   \]

2. The number of affirmative votes needed to satisfy the ¾ requirement is rounded up to 24.

   \[
   32 \text{ eligible to vote} - 1 \text{ not returned} - 0 \text{ abstentions} = 31 \times 0.75 = 23.25
   \]

An appeal relating to a proposed Tentative Interim Amendment shall be filed no later than 5 days after the notice of the Technical Committee TIA ballot results are published in accordance with 1.6.2 (c) and 4.2.6. In the case that a Correlating Committee is also being balloted, appeals need to filed 5 days after the notice of the Correlating Committee TIA ballot results are published.

Final ballot comments are attached for your review. Ballots received from alternate members are not included, unless the ballot from the principal member was not received.

Attachment
1. To revise Sections 17.2.3.5.6, A.17.2.3.5, and A.17.3.3.5.

Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA Log. 1165.

___________ AGREE ________ DISAGREE* ___________ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.

The technical committee has to review the test result for 30 ft ceiling, otherwise there is no rational to use 30 psi for 30 ft. Providing an arbitrary number in the Standard without any test results, engineering calculations, or fire modeling supports is not justifiable.

_________________________________________________________________

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.

This issue is not urgent, the committee has to address this subject when the data is available for 30 ft ceiling.

_________________________________________________________________

________ Brian Mosberian
Signature

Name (Please Print)

Date

Please return the ballot on or before Wednesday, March 4, 2015.

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

August 7, 2015  Supplemental Agenda Standards Council Meeting August 17-19, 2015  Page 345 of 536
TECHNICAL COMMITTEE ON SPRINKLER SYSTEM DISCHARGE CRITERIA
LETTER BALLOT ON NFPA 13
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1165

1. To revise Sections 17.2.3.5.6, A.17.2.3.5, and A.17.3.3.5.

Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA Log. 1165.

____ X _____ AGREE ___________ DISAGREE* ___________ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.
I believe that the metric value for 30 psi is “2.1” bar as opposed to “2.0” bar. Also, I would have preferred to have seen Test 10 conducted with the sprinkler spacing on 8’ x 12’ with the on line spacing being the 12 ft length, which is the maximum linear distance allowed for a 30 ft high ceiling, as this would have generated the greatest linear distance between the two sprinklers closest to the ignition location.

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)

_04-Mar-2015_
Date

Please return the ballot on or before Wednesday, March 4, 2015.

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

FAX: (617) 984-7110     E-mail: ecarroll@nfpa.org

August 7, 2015
Supplemental Agenda Standards Council Meeting August 17-19, 2015
TECHNICAL COMMITTEE ON SPRINKLER SYSTEM DISCHARGE CRITERIA
LETTER BALLOT ON NFPA 13
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1165

1. To revise Sections 17.2.3.5.6, A.17.2.3.5, and A.17.3.3.5.

Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA Log. 1165.

☑ AGREE       _______ DISAGREE*       _______ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.

SEE ATTACHED SHEET FOR COMMENT

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

LARRY KEENIG
Name (Please Print)

2015-02-19
Date

Please return the ballot on or before Wednesday, March 4, 2015.

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

FAX: (617) 984-7110     E-mail: ecarroll@nfpa.org
Consideration should be given to editing the text of A.17.2.3.5 and A.17.3.3.5 a bit further.

For better clarity, the 2nd sentence of those two sections should read something such as: “The criteria for exposed expanded plastics under a 40 ft (12.2 m) ceiling are based on Tests 2, 3, 7 and 8 of the series, which investigated a range of storage heights.”

Similarly, the 5th sentence of A.17.2.3.5 should say something such as: “The criteria for exposed expanded plastics under a 30 ft (9.1 m) ceiling are based on Tests 9 and 10 of the series, which investigated a range of storage heights.”
1. To revise Sections 17.2.3.5.6, A.17.2.3.5, and A.17.3.3.5.

Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA Log. 1165.

____ AGREE  ______ DISAGREE*  ______ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.

I APPLAUD THE ADDITIONAL TESTING AND WOULD ENCOURAGE FURTHER TESTING FOR LOWER CEILING & STORAGE HEIGHTS.

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

Peter J. Schum

Name (Please Print)

2/18/15

Date

Please return the ballot on or before Wednesday, March 4, 2015.

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

FAX: (617) 984-7110  E-mail: ecarroll@nfpa.org
Could you please include a very basic illustration to show what you are trying to explain in words. It would work to clarify this document before confusion sets in.

Sent from Windows Mail
NFPA 13—Proposed 2016 Edition
Standard for the Installation of Sprinkler Systems
TIA Log No.: 1180
Reference: 2.3.1, 2.3.2, 3.11.9, A.3.11.9, 9.3.5.12, A.9.3.5.12, A.9.3.5.12.1 and E.7
Comment Closing Date: June 19, 2015
Submitter: Daniel C. Duggan, Fire Sprinkler Design

1. Revise the references in 2.3.1 and 2.3.2 to read as follows:

2.3.1 ACI Publications.
American Concrete Institute, P.O. Box 9094, Farmington Hills, MI 48333.
ACI 318-14, Building Code Requirements for Structural Concrete and Commentary, 2014.

2.3.2 ASCE Publications.
American Society of Civil Engineers, 1801 Alexander Bell Drive, Reston, VA 20191-4400.

2. Add a new definition on Prying Factor and corresponding annex to read as follows:

3.11.9* Prying Factor. A factor based on fitting geometry and brace angle from vertical that results in an increase in tension load due to the effects of prying between the upper seismic brace attachment fitting and the structure.

A. 3.11.9 Prying factors in NFPA 13 are utilized to determine the design loads for attachments to concrete. Prying is a particular concern for anchorage to concrete because the anchor may fail in a brittle fashion.
3. Revise section 9.3.5.12 as follows:

9.3.5.12* Fasteners.

9.3.5.12.1 The designated angle category for the fastener(s) used in the sway brace installation shall be determined in accordance with Figure 9.3.5.12.1.

![Diagram of Fasteners and Sway Brace Installation]

Figure 9.3.5.12.1 Maximum Loads for Various Types of Structures and Maximum Loads for Various Types of Fasteners to Structures Designation of Angle Category Based on Angle of Sway Brace and Fastener Orientation.

9.3.5.12.12 For individual fasteners, unless alternate allowable loads are determined and certified by a registered professional engineer, the loads determined in 9.3.5.9 shall not exceed the allowable loads provided in Figure 9.2.4.12.1 Tables 9.3.5.12.2(a) through 9.3.5.12.2(i).
Table 9.3.5.12.2 (a) Maximum Load for Wedge Anchors in 3000 psi (207 bar) Lightweight Cracked Concrete on Metal Deck.

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* Pr = Prying Factor Range. (Refer to Annex for additional information.)
1 lb = 0.45 kg
Table 9.3.5.12.2 (b) Maximum Load for Wedge Anchors in 3000 psi (207 bar) Lightweight Cracked Concrete

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*Pr = Prying Factor Range. (Refer to Annex for additional information.)

1 lb = 0.45 kg
Table 9.3.5.12.2 (c) Maximum Load for Wedge Anchors in 3000 psi (207 bar) Normal Weight Cracked Concrete

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* Pr = Prying Factor Range. (Refer to Annex for additional information.)

1 lb = 0.45 kg
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*Pr = Prying Factor Range. (Refer to Annex for additional information.)

1 lb = 0.45 kg
Table 9.3.5.12.2(e) Maximum Load for Wedge Anchors in 6000 psi (414 bar) Normal Weight Cracked Concrete

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* Pr = Prying Factor Range. (Refer to Annex for additional information.)

1 lb = 0.45 kg
Table 9.3.5.12.2(f) Maximum Load for Undercut Anchors in 3000 psi (207 bar) Normal Weight Cracked Concrete

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<td>407</td>
<td>570</td>
<td>701</td>
</tr>
<tr>
<td>5/8</td>
<td>9 1/2</td>
<td>456</td>
<td>806</td>
<td>1263</td>
<td>739</td>
<td>806</td>
<td>781</td>
<td>859</td>
<td>931</td>
<td>1145</td>
</tr>
<tr>
<td>3/4</td>
<td>12</td>
<td>670</td>
<td>1223</td>
<td>1955</td>
<td>1146</td>
<td>1223</td>
<td>1147</td>
<td>1035</td>
<td>1444</td>
<td>1778</td>
</tr>
</tbody>
</table>

*Pr = Prying Factor Range. (Refer to Annex for additional information.)

1 lb = 0.45 kg

Table 9.3.5.12.2(g) Maximum Load for Connections to Steel Using Unfinished Steel Bolts
Table 9.3.5.12.2(h) Maximum Load for Through-Bolts in Sawn Lumber or Glue-Laminated Timbers

<table>
<thead>
<tr>
<th>Bolt Diameter (in.)</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8</td>
<td>115</td>
<td>140</td>
<td>165</td>
<td>190</td>
<td>215</td>
<td>240</td>
<td>265</td>
<td>290</td>
<td>315</td>
<td>340</td>
</tr>
<tr>
<td>3/16</td>
<td>175</td>
<td>190</td>
<td>205</td>
<td>220</td>
<td>235</td>
<td>250</td>
<td>265</td>
<td>280</td>
<td>295</td>
<td>310</td>
</tr>
<tr>
<td>5/32</td>
<td>235</td>
<td>250</td>
<td>265</td>
<td>280</td>
<td>295</td>
<td>310</td>
<td>325</td>
<td>340</td>
<td>355</td>
<td>370</td>
</tr>
</tbody>
</table>

Note: Wood fastener maximum capacity values are based on the 2001 National Design Specifications (NDS) for wood with a specific gravity of 0.35. Values for other types of wood can be obtained by multiplying the above values by the following factors in Table 9.3.5.12.2(j).

Table 9.3.5.12.2(i) Maximum Load for Lag Screws and Lag Bolts in Wood

<table>
<thead>
<tr>
<th>Lag Bolt Diameter (in.)</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/16</td>
<td>160</td>
<td>165</td>
<td>170</td>
<td>175</td>
<td>180</td>
<td>185</td>
<td>190</td>
<td>195</td>
<td>200</td>
<td>205</td>
</tr>
<tr>
<td>1/2</td>
<td>220</td>
<td>225</td>
<td>230</td>
<td>235</td>
<td>240</td>
<td>245</td>
<td>250</td>
<td>255</td>
<td>260</td>
<td>265</td>
</tr>
<tr>
<td>5/8</td>
<td>325</td>
<td>330</td>
<td>335</td>
<td>340</td>
<td>345</td>
<td>350</td>
<td>355</td>
<td>360</td>
<td>365</td>
<td>370</td>
</tr>
</tbody>
</table>

Note: Wood fastener maximum capacity values are based on the 2001 National Design Specifications (NDS) for wood with a specific gravity of 0.35. Values for other types of wood can be obtained by multiplying the above values by the following factors in Table 9.3.5.12.2(i).

Table 9.3.5.12.2(j) Factors for Wood Based on Specific Gravity

<table>
<thead>
<tr>
<th>Specific Gravity of Wood</th>
<th>Multiplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.36 thru 0.49</td>
<td>1.17</td>
</tr>
<tr>
<td>0.50 thru 0.65</td>
<td>1.25</td>
</tr>
<tr>
<td>0.66 thru 0.73</td>
<td>1.50</td>
</tr>
</tbody>
</table>

9.3.5.12.23* The type of fasteners used to secure the bracing assembly to the structure shall be limited to those shown in Tables 9.3.5.12.2(a) through 9.3.5.12.2(i) Figure 9.3.5.12.1 or to listed devices.

A.9.3.5.12.3 Listed devices may have accompanying software that performs the calculations to determine the allowable load.

9.3.5.12.34* For connections to wood, through-bolts with washers on each end shall be used, unless the requirements of 9.3.5.12.45 are met.

9.3.5.12.45 Where it is not practical to install through-bolts due to the thickness of the wood member in excess of 12 in. (305 mm) or inaccessibility, lag screws shall be permitted and holes shall be pre-drilled 1/8 in. (3.2 mm) smaller than the maximum root diameter of the lag screw.

9.3.5.12.56 Holes for through-bolts and similar listed attachments shall be 1/16 in. (1.6 mm) greater than the diameter of the bolt.
9.3.5.12.67 The requirements of 9.3.5.12 shall not apply to other fastening methods, which shall be acceptable for use if certified by a registered professional engineer to support the loads determined in accordance with the criteria in 9.3.5.9.

9.3.5.12.67.1 Calculations shall be submitted where required by the authority having jurisdiction.

9.3.5.12.78 Concrete Anchors.

9.3.5.12.78.1* Concrete anchors shall be prequalified for seismic applications in accordance with ACI 355.2, *Qualification of Post-Installed Mechanical Anchors in Concrete and Commentary*, and installed in accordance with the manufacturer's instructions.

A.9.3.5.12.78.1 Concrete anchors included in current Evaluation Service Reports conforming to the requirements of acceptance criteria AC193 or AC308 as issued by ICC Evaluation Service, Inc. should be considered to meet ACI 355.2, *Qualification of Post-Installed Mechanical Anchors in Concrete & Commentary*.

9.3.5.12.78.2 Unless the requirements of 9.3.5.12.8.3 are met, concrete anchors shall be selected from Table 9.3.5.12.2(a) through Table 9.3.5.12.2(f) based on concrete strength, anchor type, designated angle category A through I, prying factor (Pr) range, and allowable maximum load.

9.3.5.12.8.2.1 Sway brace manufacturers shall provide prying factors (Pr) based on geometry of the structure attachment fitting and the designated angle category A through I as shown in Figure 9.3.5.12.1.

9.3.5.12.8.2.2 Where the prying factor for the fitting is unknown, the largest prying factor range in Tables 9.3.5.12.2(a) through 9.3.5.12.2(f) for the concrete strength and designated angle category A through I shall be used.

9.3.5.12.8.3 In lieu of using the concrete anchor loads in Tables 9.3.5.12.2(a) through 9.3.5.12.2(f), the allowable maximum load may be calculated.

(A) Allowable concrete anchor loads shall be permitted to be determined using approved software that considers the effects of prying for concrete anchors.

(B) Anchors shall be seismically prequalified per 9.3.5.12.8.1.

(C) Allowable maximum loads shall be based on the anchor capacities given in approved evaluation service reports, where the calculation of ASD allowable shear and tension values are determined in accordance with ACI 318, Chapter 17 and include the effects of prying, brace angle, and the over strength factor (from ASCE 7).

(D)* The shear and tension values determined in 9.3.5.12.8.3(C) using ACI 318, Chapter 17 shall be multiplied by 0.43.

A.9.3.5.12.8.3(D) The values from ACI 318, Chapter 17 are strength (LRFD) values that must be divided by 1.4 in order to convert them to ASD values. In addition, ASCE 7 requires an over strength factor (Ω₀) of 2.0 and also permits a factor of 1.2 as an allowable stress increase in Section 12.4.3.3. The factor of 0.43 was created to simplify the steps needed to account for the
strength capacities and the ASD method of calculation. The 0.43 is a rounded value determined by 1.2 divided by the quantity of 2.0 times 1.4 (i.e. 0.4286 = 1.2/(2.0*1.4)).

9.3.5.12.78.2-4 Concrete anchors other than those shown in Tables 9.3.5.12.2(a) through 9.3.5.12.2(f) Figure 9.3.5.12.1 shall be acceptable for use where designed in accordance with the requirements of the building code and certified by a registered professional engineer.

4. Revise A.9.3.5.12 to read as follows:

A.9.3.5.12
Current fasteners for anchoring to concrete are referred to as post-installed anchors. There are several types of post-installed anchors, including expansion anchors, chemical or adhesive anchors, and undercut anchors. The criteria in Figure 9.3.5.12.1 Tables 9.3.5.12.2(a) through 9.3.5.12.2(f) are based on the use of wedge expansion anchors and undercut anchors. Use of other anchors in concrete should be in accordance with the listing provisions of the anchor. Anchorage designs are usable under allowable stress design (ASD) methods.

Values in Tables 9.3.5.12.2(a) through 9.3.5.12.2(f) Figure 9.3.5.12.1 are based on an 8 to 1 safety factor in tension and a 4 to 1 safety factor in shear for allowable loadsultimate strength values obtained using the procedures in ACI 318-11, Appendix D, which are then adjusted for ASD. Wedge anchors are torque-controlled expansion anchors that are set by applying a torque to the anchor's nut, which causes the anchor to rise while the wedge stays in place. This causes the wedge to be pulled onto a coned section of the anchor and presses the wedge against the wall of the hole. Undercut anchors might or might not be torque-controlled. Typically, the main hole is drilled, a special second drill bit is inserted into the hole, and flare is drilled at the base of the main hole. Some anchors are self-drilling and do not require a second drill bit. The anchor is then inserted into the hole and, when torque is applied, the bottom of the anchor flares out into the flared hole, and a mechanical lock is obtained. Consideration should be given with respect to the position near the edge of a slab and the spacing of anchors. Typically, the edge distance should be 1½ times the embedment and 3 times the embedment for spacing between anchors and thickness of concrete should conform to the anchor manufacturer’s recommendations.

Calculation of ASD Shear and Tension Values to be used in A.9.3.5.12.1 calculations should be performed in accordance with ACI 318, Chapter 17 formulas using the variables and recommendations obtained from the approved evaluation service reports (such as ICC-ES Reports) for a particular anchor, which should then be adjusted to ASD values. All post-installed concrete anchors must be prequalified in accordance with ACI 355.2 or other approved qualification procedures (ASCE/SEI 7 Section 13.4.2.3). This information is usually available from the anchor manufacturer.

The variables below are among those contained in the approved evaluation reports for use in ACI 318, Chapter 17 calculations. These variables do not include the allowable tension and shear capacities, but provide the information needed to calculate them. The strength design capacities must be calculated using the appropriate procedures in ACI 318 Chapter 17, and then converted to allowable stress design capacities.
$D_a = \text{Anchor diameter}$

$h_{nom} = \text{Nominal Embedment}$

$h_{ef} = \text{Effective Embedment}$

$h_{min} = \text{Min. Concrete Thickness}$

$C_{ac} = \text{Critical Edge Distance}$

$N_{sa} = \text{Steel Strength in Tension}$

$l_e = \text{Length of Anchor in Shear}$

$N_{p,cr} = \text{Pull-Out Strength Cracked Concrete}$

$K_{cp} = \text{Coefficient for Pryout Strength}$

$V_{sa,eq} = \text{Shear Strength Single Anchor Seismic Loads}$

$V_{st,deck,eq} = \text{Shear Strength Single Anchor Seismic Loads installed through the soffit of the metal deck}$

5. Replace A.9.3.5.12.1 with the following (retain and renumber all figures):

**A.9.3.5.12.1** The values for the wedge anchor tables and the undercut anchor tables have been developed using the following formula:

$$
\left( \frac{T}{T_{allow}} \right) + \left( \frac{V}{V_{allow}} \right) \leq 1.2
$$

where:

- $T = \text{applied service tension load including the effect of prying (} F_{pw} \times Pr \text{)}$
- $F_{pw} = \text{Horizontal Earthquake Load}$
- $Pr = \text{prying factor based on fitting geometry and brace angle from vertical}$
- $T_{allow} = \text{allowable service tension load}$
- $V = \text{applied service shear load}$
- $V_{allow} = \text{allowable service shear load}$

$T / T_{allow}$ shall not be greater than 1.0.
$V / V_{allow}$ shall not be greater than 1.0.

The necessary tension and shear loads come from the anchor manufacturer’s published data. As the prying factor is also necessary to develop appropriate load values, the equation for prying varies with the orientation of the fastener in relationship to the brace. The letters $A$ through $D$ in the following equations are dimensions of the anchors as indicated in Figure A.9.3.5.12.1(a) through Figure A.9.3.5.12.1(e). For anchor orientations A, B, and C, the prying factor is as follows:

The allowable tension and shear loads come from the anchor manufacturer’s published data. As required in ASCE/SEI 7-16, the design loads have been amplified by an over-strength factor of 2.0, and the allowable strength of the anchors has been increased by a factor of 1.2. The effect of prying on the tension applied to the anchor is considered when developing appropriate capacity values. The applied tension equation includes the prying effect which varies with the orientation of the fastener in relationship to the brace necessary at various brace angles. The letters $A$
through D in the following equations are dimensions of the attachment geometry as indicated in Figures A.9.3.5.12.2(a) through A.9.3.5.12.2(c).

where:

\( Cr \) = critical angle at which prying flips to the toe or the heel of the structure attachment fitting.

\( Pr \) = Prying factor for service tension load effect of prying

\( Tan \theta \) = Tangent of Brace Angle from vertical

\( Sin \theta \) = Sine of Brace Angle from vertical

The greater \( Pr \) value calculated in Tension or Compression applies.

The \( Pr \) value cannot be less than \( 1.000/Tan \theta \) for designated angle category A, B and C, 1.000 for designated angle category D, E and F or 0.000 for designated angle category G, H, and I.

For designated angle category A, B and C, the Applied Tension including the effect of prying \((Pr)\) is as follows:

\[
Cr = Tan^{-1} \left( \frac{C}{D} \right)
\]

For braces acting in **TENSION**:

If \( Cr > \) Brace angle from vertical

\[
Pr = \left( \frac{C + A}{Tan \theta} - D \right)/A
\]

If \( Cr < \) Brace angle from vertical

\[
Pr = \left( D - \frac{C - B}{Tan \theta} \right)/B
\]

For braces acting in **COMPRESSION**:

If \( Cr > \) Brace angle from vertical

\[
Pr = \left( \frac{C - B}{Tan \theta} - D \right)/B
\]

If \( Cr < \) Brace angle from vertical

\[
Pr = \left( D - \frac{C + A}{Tan \theta} \right)/A
\]

For designated angle category D, E and F, the Applied Tension including the effect of prying \((Pr)\) is as follows:

\[
Cr = Tan^{-1} \left( \frac{D}{C} \right)
\]

For braces acting in **TENSION**:

If \( Cr > \) Brace angle from vertical

\[
Pr = \left( \frac{D}{Tan \theta} - (C - B) \right)/B
\]

If \( Cr < \) Brace angle from vertical

\[
Pr = \left( (C + A) - \frac{D}{Tan \theta} \right)/A
\]

For braces acting in **COMPRESSION**:
If \( Cr > \) Brace angle from vertical

\[
Pr = \left( \frac{D}{\tan \theta} \right) - (C + A) / A
\]

If \( Cr < \) Brace angle from vertical

\[
Pr = ((C - B) - \left( \frac{D}{\tan \theta} \right)) / B
\]

For designated angle category G, H and I the Applied Tension including the effect of prying \((Pr)\) is as follows:

For braces acting in TENSION:

\[
Pr = \left( \frac{D}{B} \right) / \sin \theta
\]

For braces acting in COMPRESSION:

\[
Pr = \left( \frac{D}{A} / \sin \theta \right)
\]

The lightweight concrete anchor tables 9.3.5.12.2(a) and (b) were based on sand lightweight concrete which represents a conservative assumption for the strength of the material. For seismic applications cracked concrete was assumed.

6. Add a new Annex E.7 to read as follows:

**E.7 Allowable Loads for Concrete Anchors.** The following sections provide step-by-step examples of the procedures for determining the allowable loads for concrete anchors as they are found in Tables 9.3.5.12.2(a) through 9.3.5.12.2(f). Tables 9.3.5.12.2(a) through (f) were developed using the prying factors found in Table E.7(a) and the representative strength design seismic shear and tension values for concrete anchors found in Table E.7(b).

<table>
<thead>
<tr>
<th>Pr Range</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lowest</strong></td>
<td>2.0</td>
<td>1.1</td>
<td>0.7</td>
<td>1.2</td>
<td>1.1</td>
<td>1.1</td>
<td>1.4</td>
<td>0.9</td>
<td>0.8</td>
</tr>
<tr>
<td><strong>Low</strong></td>
<td>3.5</td>
<td>1.8</td>
<td>1.0</td>
<td>1.7</td>
<td>1.8</td>
<td>2.0</td>
<td>1.9</td>
<td>1.3</td>
<td>1.1</td>
</tr>
<tr>
<td><strong>High</strong></td>
<td>5.0</td>
<td>2.5</td>
<td>1.3</td>
<td>2.2</td>
<td>2.5</td>
<td>2.9</td>
<td>2.4</td>
<td>1.7</td>
<td>1.4</td>
</tr>
<tr>
<td><strong>Highest</strong></td>
<td>6.5</td>
<td>3.2</td>
<td>1.6</td>
<td>2.7</td>
<td>3.2</td>
<td>3.8</td>
<td>2.9</td>
<td>2.1</td>
<td>1.7</td>
</tr>
</tbody>
</table>
Table E.7(b) Representative Strength Design Seismic Shear and Tension Values Used for Concrete Anchors

### Wedge Anchors in 3000 psi LW Sand Concrete on Metal Deck

<table>
<thead>
<tr>
<th>Anchor Dia. (in.)</th>
<th>Nominal Embedment (in.)</th>
<th>LRFD Tension (lbs.)</th>
<th>LRFD Shear (lbs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8</td>
<td>2</td>
<td>573</td>
<td>1172</td>
</tr>
<tr>
<td>1/2</td>
<td>3.625</td>
<td>804</td>
<td>1616</td>
</tr>
<tr>
<td>5/8</td>
<td>3.875</td>
<td>1102</td>
<td>1744</td>
</tr>
</tbody>
</table>

### Wedge Anchors in 3000 psi LW Sand Concrete

<table>
<thead>
<tr>
<th>Anchor Dia. (in.)</th>
<th>Nominal Embedment (in.)</th>
<th>LRFD Tension (lbs.)</th>
<th>LRFD Shear (lbs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8</td>
<td>2</td>
<td>637</td>
<td>550</td>
</tr>
<tr>
<td>1/2</td>
<td>3.625</td>
<td>871</td>
<td>745</td>
</tr>
<tr>
<td>5/8</td>
<td>3.875</td>
<td>1403</td>
<td>1140</td>
</tr>
<tr>
<td>3/4</td>
<td>4.125</td>
<td>1908</td>
<td>1932</td>
</tr>
</tbody>
</table>

### Wedge Anchors in 3000 psi NW Concrete

<table>
<thead>
<tr>
<th>Anchor Dia. (in.)</th>
<th>Nominal Embedment (in.)</th>
<th>LRFD Tension (lbs.)</th>
<th>LRFD Shear (lbs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8</td>
<td>2</td>
<td>1063</td>
<td>917</td>
</tr>
<tr>
<td>1/2</td>
<td>3.625</td>
<td>2639</td>
<td>2052</td>
</tr>
<tr>
<td>5/8</td>
<td>3.875</td>
<td>3004</td>
<td>2489</td>
</tr>
<tr>
<td>3/4</td>
<td>4.125</td>
<td>3179</td>
<td>3206</td>
</tr>
</tbody>
</table>

### Wedge Anchors in 4000 psi NW Concrete

<table>
<thead>
<tr>
<th>Anchor Dia. (in.)</th>
<th>Nominal Embedment (in.)</th>
<th>LRFD Tension (lbs.)</th>
<th>LRFD Shear (lbs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8</td>
<td>2</td>
<td>1226</td>
<td>1088</td>
</tr>
<tr>
<td>1/2</td>
<td>3.625</td>
<td>2601</td>
<td>2369</td>
</tr>
<tr>
<td>5/8</td>
<td>3.875</td>
<td>3469</td>
<td>2586</td>
</tr>
<tr>
<td>3/4</td>
<td>4.125</td>
<td>3671</td>
<td>3717</td>
</tr>
</tbody>
</table>
### Wedge Anchors in 6000 psi NW Concrete

<table>
<thead>
<tr>
<th>Anchor Dia. (in.)</th>
<th>Nominal Embedment (in.)</th>
<th>LRFD Tension (lbs.)</th>
<th>LRFD Shear (lbs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8</td>
<td>2.25</td>
<td>1592</td>
<td>1322</td>
</tr>
<tr>
<td>1/2</td>
<td>3.625</td>
<td>3186</td>
<td>2902</td>
</tr>
<tr>
<td>5/8</td>
<td>3.875</td>
<td>4249</td>
<td>3167</td>
</tr>
<tr>
<td>3/4</td>
<td>4.125</td>
<td>4497</td>
<td>4553</td>
</tr>
</tbody>
</table>

### Undercut Anchors in 3000 psi NW Concrete

<table>
<thead>
<tr>
<th>Anchor Dia. (in.)</th>
<th>Nominal Embedment (in.)</th>
<th>LRFD Tension (lbs.)</th>
<th>LRFD Shear (lbs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8</td>
<td>5</td>
<td>4096</td>
<td>1867</td>
</tr>
<tr>
<td>1/2</td>
<td>7</td>
<td>5322</td>
<td>2800</td>
</tr>
<tr>
<td>5/8</td>
<td>9.5</td>
<td>6942</td>
<td>5675</td>
</tr>
<tr>
<td>3/4</td>
<td>12</td>
<td>10182</td>
<td>9460</td>
</tr>
</tbody>
</table>

**E.7.1 Procedure for Selecting a Wedge Anchor Using Tables 9.3.5.12.2(a) through 9.3.5.12.2(f).**

**Step 1.** Determine the ASD Horizontal Earthquake Load $F_{pw}$.

- **Step 1a.** Calculate the weight of the water-filled pipe within the Zone of Influence of the brace.
- **Step 1b.** Find the applicable Seismic Coefficient $C_p$ in Table 9.3.5.9.3.
- **Step 1c.** Multiply the Zone of Influence weight by $C_p$ to determine the ASD Horizontal Earthquake Load $F_{pw}$.

**Step 2.** Select a concrete anchor from Tables 9.3.5.12.2(a) through 9.3.5.12.2(f) with a maximum load capacity that is greater than the calculated horizontal earthquake load $F_{pw}$ from Step 1.

- **Step 2a.** Locate the table for the applicable concrete strength.
- **Step 2b.** Find the column in the selected table for the applicable designated angle category (A thru I) and the appropriate prying factor $P_r$ range.
- **Step 2c.** Scan down the category column to find a concrete anchor diameter, embedment depth, and maximum load capacity that is greater than the calculated horizontal earthquake load $F_{pw}$ from Step 1.

**(ALTERNATIVE) Step 2.** As an alternative to using the maximum load values in Tables 9.3.5.12.2(a) through 9.3.5.12.2(f), select an AC355.2 seismically pre-qualified concrete anchor with a load-carrying capacity that exceeds the calculated $F_{pw}$, with calculations, including the effects of prying, based on seismic shear and tension values taken from an ICC-ES Report and calculated in accordance with ACI 318, Chapter 17 and adjusted to ASD values by multiplying by 0.43 per 9.3.5.12.8.3(D).
EXAMPLE

Step 1. Zone of Influence $F_{pw}$.

Step 1a. 40 ft. of 2½” Sch. 10 pipe plus 15% Fitting Allowance
40 x 5.89 lbs/ft x 1.15 = 270.94 lbs

Step 1b. Seismic Coefficient $C_p$ from Table 9.3.5.9.3
$C_p = 0.35$

Step 1c. $F_{pw} = 0.35 \times 270.94 = 94.8$ lbs.

Step 2. Select a concrete anchor from Tables 9.3.5.12.2(a) through 9.3.5.12.2(f).

Step 2a. Using the table for 4000 psi Normal Weight Concrete.

Step 2b. Fastener Orientation “A” – assume the manufacturers prying factor is 3.0 for the fitting. Use the $Pr$ range of 2.1 – 3.5.

Step 2c. Allowable $F_{pw}$ on 3/8” dia. with 2” embedment = 135 lbs and is greater than the Calculated $F_{pw}$ of 94.8 lbs.

E.7.2 Calculation Procedure for Maximum Load Capacity of Concrete Anchors. This example shows how the effects of prying and brace angle are calculated.

Step 1. Determine the Allowable Seismic Tension Value ($T_{allow}$) and the Allowable Seismic Shear Value ($V_{allow}$) for the anchor, based on data found in the anchor manufacturer’s approved evaluation report. Note that, in this example, it is assumed the evaluation report provides the allowable tension and shear capacities. If this is not the case, then the strength design anchor capacities must be determined using the procedures in ACI 318, Chapter 17, which are then converted to ASD values by dividing by a factor of 1.4. As an alternative to calculating the Allowable Seismic Tension Value ($T_{allow}$) and the Allowable Seismic Shear Value ($V_{allow}$) for the anchor, the seismic tension and shear values that were used to calculate the Figure 9.3.5.12.1 for anchor allowable load tables may be used.

Step 1a. Find the ASD Seismic Tension capacity ($T_{allow}$) for the anchor according to the strength of concrete, diameter of the anchor, and embedment depth of the anchor. Divide the ASD tension value by 2.0 and then multiply by 1.2.

Step 1b. Find the ASD Seismic Shear capacity ($V_{allow}$) for the anchor according to the strength of concrete, diameter of the anchor, and embedment depth of the anchor. Divide the ASD shear value by 2.0 and then multiply by 1.2.

Step 2. Calculate the Applied Seismic Tension ($T$) and the Applied Seismic Shear ($V$) based on the Calculated Horizontal Earthquake Load $F_{pw}$.

Step 2a. Calculate the designated angle category Applied Tension Factor Including the Effects of Prying ($Pr$) using the following formulas:

Category “A”, “B” and “C”

$$Pr = \left(\frac{C + A}{\tan \theta} - D\right)/A$$

Category “D”, “E” and “F”

$$Pr = \left((C + A) - \left(\frac{D}{\tan \theta}\right)\right)/A$$
Step 2b. Calculate the ASD Applied Seismic Tension \( (T) \) on the anchor, including the effects of prying, and when applied at the applicable brace angle from vertical and the designated angle category (A thru I) using the following formula:

\[
T = F_{pw} \times Pr
\]

Step 2c. Calculate the ASD Applied Seismic Shear \( (V) \) on the anchor, when applied at the applicable brace angle from vertical and the designated angle category (A thru I) using the following formulas:

Category “A”, “B” and “C”

\[
V = F_{pw}
\]

Category “D”, “E” and “F”

\[
V = F_{pw}/\tan\theta
\]

Category “G”, “H” and “I”

\[
V = F_{pw}/\sin\theta
\]

Step 3. Check the anchor for combined tension and shear loads using the formula:

\[
\left(\frac{T}{T_{allow}}\right) + \left(\frac{V}{V_{allow}}\right) \leq 1.2
\]

Confirm \( T/T_{allow} \) and \( V/V_{allow} \) \( \leq 1.0 \)

**EXAMPLE**

Sample Calculation, Maximum Load Capacity of Concrete Anchors as Shown in Tables 9.3.5.12.2(a) through 9.3.5.12.2(f)

In this example, a sample calculation is provided showing how the values in Tables 9.3.5.12.2(a) through 9.3.5.12.2(f) were calculated.

Step 1. Determine the Allowable Seismic Tension Value \( (T_{allow}) \) and the Allowable Seismic Shear Value \( (V_{allow}) \) for a concrete anchor in Figure 9.3.5.12.1.

**Step 1a.** The Table E.7(b) Strength Design Seismic Tension Value \( (T_{allow}) \) for a 1/2” Carbon Steel Anchor with 3 5/8” Embedment Depth in 4,000 psi Normal Weight Concrete is 2601 lbs. Therefore, the Allowable Stress Design Seismic Tension Value \( (T_{allow}) \) is \( 2601 / 1.4 / 2.0 \times 1.2 \) = 1115 lbs.

**Step 1b.** The Table E.7(b) Strength Design Seismic Shear Value \( (V_{allow}) \) for a 1/2” Carbon Steel Anchor with 3 5/8” embedment is 2369 lbs. Therefore, the Allowable Stress Design Seismic Shear Value \( (V_{allow}) \) is \( 2369 / 1.4 / 2.0 \times 1.2 \) = 1015 lbs.
**Step 2.** Using the Applied Seismic Tension Value \((T)\) and the Applied Seismic Shear Value \((V)\) based on an ASD Horizontal Earthquake Load \((F_{pw})\) of 170 lbs, a 30° brace angle from vertical and designated angle category “A”.

**Step 2a.** Calculate the ASD Applied Seismic Tension Value \((T)\) on the anchor, including the effects of prying, using the formula:

\[
T = \left( F_{pw} \left( \frac{C + A}{\tan \theta} - D \right) \right) / A
\]

**Anchor Orientation A, B, C**

(C > B)

\[
\begin{align*}
A &= 0.7500 \\
B &= 1.5000 \\
C &= 2.6250 \\
D &= 1.0000 \\
T &= F_{pw} \times Pr \\
T &= \left( F_{pw} \left( \frac{2.625 + 0.75}{0.5774} - 1.0 \right) \right) / 0.75 \\
T &= \left( F_{pw} \left( 5.8452 - 1.0 \right) \right) / 0.75 \\
T &= \left( F_{pw} \left( 4.8451 \right) \right) / 0.75 \\
T &= F_{pw} \times 6.46 \\
T &= 170 \text{ lbs} \times 6.46 = 1098.2 \text{ lbs}
\end{align*}
\]

**Step 2b.** The ASD Applied Seismic Shear Value \((V)\) on the anchor for anchor orientations “A”, “B” & “C” is equal to the ASD Horizontal Earthquake Load \((F_{pw}) = 170 \text{ lbs.}\)

**Step 3** Calculate the maximum Allowable Horizontal Earthquake Load \(F_{pw}\) using the formula:
\[
\left(\frac{T}{T_{allow}}\right) + \left(\frac{V}{V_{allow}}\right) \leq 1.2
\]
\[
\left(\frac{1098.2}{1115}\right) + \left(\frac{170}{1015}\right) = 0.9849 + 0.1675 = 1.1524 \leq 1.2
\]

Substantiation:
This proposal is the first significant revision to the NFPA 13 requirements for concrete anchors since the 2007 edition. It accounts for significant changes in the design of attachment to concrete for nonstructural components that were adopted with Supplement 1 of ASCE/SEI 7-10 in 2013. The most significant change is the requirement that loads for attachment of nonstructural components to concrete or masonry be amplified by a factor of 2.0, which accounts for the over strength factor, \(\Omega_0\) (Although the supplement references 2.5, ASCE/SEI 7 has made changes for the 2016 edition to use \(\Omega_0\) as 2.0). In addition, the load factor used in NFPA 13 for converting from strength design to allowable stress design forces required updating. Finally, the current allowable loads for concrete anchors do not correctly account for a load factor for attachments of 1.3 that was required even when the modifications were made to the tables in the 2007 edition, which is now accounted for with the \(\Omega_0\) value of 2.0 as noted above.

Addressing these issues results in substantially lower allowable load carrying capacities of the concrete anchors in the Table 9.3.5.12.2(a) through Table 9.3.5.12.2(f), but it must be done in order to ensure that NFPA 13 preserves its recognition as a deemed to comply standard within ASCE/SEI 7. To mitigate the effects of these changes, a more refined design approach is offered, that allows the user to take advantage of connection hardware with favorable geometry, which reduces the prying factor applied to tension loads. In prior editions of NFPA 13, a worst-case prying factor was assumed when generating the allowable loads in the current Figure 9.3.5.12.1. In this proposal, allowable anchor loads are provided for four ranges of prying factors. By selecting of efficient connection hardware, the allowable anchor loads can be substantially greater.

The new concrete anchor tables were calculated using the procedures found in Annex E.7. The generic ASD tension and shear values used to perform those calculations were determined by comparing the anchor capacities determined using ACI 318 Chapter 17 for representative seismically prequalified concrete anchors that are readily available from several manufactures. The selected anchors were judged to bound the likely range of anchor capacities. For each anchor, the capacities were calculated using different concrete strengths and anchor diameters, as shown in Table 9.3.5.12.2(a) through (f) anchor tables. Anchor capacities were determined using the critical edge distance and minimum concrete thickness given in their approved evaluation reports, along with other parameters required for the capacity calculation. The edge distance of the anchor is a critical variable, and must be checked in both directions. The thickness of the concrete section must also be considered. In order to arrive at conservative but reasonable generic anchor capacities, one edge distance was equal to the Critical Edge Distance and the other three edge distances were assumed to be equal to 1.5 times the Critical Edge Distance. The generic anchor capacities in the Annex E tables were determined by comparing the calculated
results and selecting Tension, Shear and embedment depths that would be safe for any of the seismically prequalified wedge type anchors considered.

**Emergency Nature:**
The building code references ASCE/SEI 7 *Minimum Design Loads for Buildings and Other Structures* for structural design criteria. Following the hierarchy of the codes, NFPA 13 is adopted as a reference standard by the building codes and by ASCE/SEI 7. The seismic design provisions of NFPA 13 are deemed to comply with the requirements of ASCE/SEI 7 in recent editions. This is a great advantage, as it means the prescriptive designs per NFPA 13 may be accepted by building officials as code compliant. To maintain this status, the seismic provisions of NFPA 13 must be periodically reexamined to verify that modifications in ASCE/SEI 7 with regard to seismic provisions are accounted for in NFPA 13. This TIA brings NFPA 13 into alignment with ASCE/SEI 7-16. Failure to bring the standard into alignment will result in loss of “deemed to comply” status of NFPA 13.
MEMORANDUM

TO: NFPA Correlating Committee on Automatic Sprinkler Systems
FROM: Elena Carroll, Project Administrator
DATE: June 10, 2015
SUBJ: NFPA 13 Proposed TIA No. 1180 FINAL CC BALLOT RESULTS

No comments were received on this TIA, therefore, according to 5.6(b) in the NFPA Regs, the final results show this TIA HAS achieved the ¾ majority vote needed on both Question 1 (Correlation Issues) and Question 2 (Emergency Nature).

22 Eligible to Vote
4 Not Returned (Bellamy, Grill, Ketner, Mitchell)

Correlation Issues:  
0 Abstentions
18 Agree (Huggins, w/ comment)
0 Disagree

Emergency Nature:  
0 Abstentions
16 Agree (Linder, Sheppard w/ comments)
2 Disagree (Hilton, Lowrey, Pirro)

There are two criteria necessary to pass ballot [(1) affirmative ¾ vote and (2) simple majority] with both questions needing to pass ballot in order to recommend that the Standards Council issues this TIA.

(1) The number of affirmative votes needed is 14.
   (22 eligible to vote - 4 not returned - 0 abstentions = 18 × 0.75 = 13.5)

(2) In all cases, 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:
   [22 eligible ÷ 2 = 11 + 1 = (12)]

The Regs at 1.6.2.(c) state: An appeal relating to a proposed Tentative Interim Amendment that has been submitted for processing pursuant to Section 5.2 shall be filed no later than 5 days after the notice of the TIA final ballot results are published in accordance with 4.2.6.

Appeal Closing Date for this TIA is June 27, 2015.

Attachments
CORRELATING COMMITTEE
LETTER BALLOT
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1180
To Revise the references in 2.3.1 and 2.3.2, add a new definition on Prying Factor and Corresponding Annex, Revise sections 9.3.5.12, A.9.3.5.12, Replace A.9.3.5.12.1, and Add a new Annex E.7 of the Proposed 2016 Edition of NFPA 13, Standard for the Installation of Sprinkler Systems

Question 1: I agree that there are no correlation issues in accordance with 3.4.2 and 3.4.3 (copy enclosed) of the NFPA Regs.

_________ 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.

No correlating issue.

__________________________________________________________

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.
While this is not a correlating issue, it is noted that ASCE 7-16 will not be open for Public Comment until August 2015, and the Change Proposal Form for the 2016 edition of ASCE 7 includes an update to reference the 2013 edition of NFPA 13. The fact that there are negative comments regarding Technical Merit of the proposed changes from two Principal members of the TC is also a concern.

Signature
Luke Hilton
Name (Please Print)
05-28-2015
Date

Please return the ballot on or before June 9, 2015.

PLEASE RETURN TO:
Elena Carroll, Project Administrator
NFPA
1 Batterymarch Park
Quincy, MA 02169
FAX: (617) 984-7110 E-mail: ecarroll@nfpa.org
Question 1: I agree that there are no correlation issues in accordance with 3.4.2 and 3.4.3 (copy enclosed) of the NFPA Regs.

_____ 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 don’t see where this meets the explanation under 5.4 of the Regulations Governing the Development of NFPA Standards.

_____________________________________________________________

Signature
David Lowrey

Name (Please Print)
5/26/15

Date

Please return the ballot on or before June 9, 2015.

PLEASE RETURN TO:
Elena Carroll, Project Administrator
NFPA
1 Batterymarch Park
Quincy, MA 02169  FAX: (617) 984-7110  E-mail: ecarroll@nfpa.org
CORRELATING COMMITTEE
LETTER BALLOT
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1180
To Revise the references in 2.3.1 and 2.3.2, add a new definition on Prying Factor and Corresponding Annex, Revise sections 9.3.5.12, A.9.3.5.12, Replace A.9.3.5.12.1, and Add a new Annex E.7 of the Proposed 2016 Edition of NFPA 13, Standard for the Installation of Sprinkler Systems

Question 1: I agree that there are no correlation issues in accordance with 3.4.2 and 3.4.3 (copy enclosed) of the NFPA Regs.

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.

This issue should be addressed after publication of ASCE 7-16 during next revision cycle of NFPA-13.

_____________________________________________________

Signature
Donato Pirro
Name (Please Print)
May 26, 2015
Date

Please return the ballot on or before June 9, 2015.

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

FAX: (617) 984-7110
E-mail: ecarroll@nfpa.org
RECIRCULATION
CORRELATING COMMITTEE
LETTER BALLOT
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1180
To Revise the references in 2.3.1 and 2.3.2, add a new definition on Prying Factor and Corresponding Annex, Revise sections 9.3.5.12, A.9.3.5.12, Replace A.9.3.5.12.1, and Add a new Annex E.7of the Proposed 2016 Edition of NFPA 13, *Standard for the Installation of Sprinkler Systems*

**Question 1:** I agree that there are no correlation issues in accordance with 3.4.2 and 3.4.3 (copy enclosed) of the NFPA Regs.

___XX___ 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.

I agree with Mr. Linder’s ballot comment and am also concerned regarding a revision. This issue was addressed by the technical committee three times and had substantial differences every time. There are many on the committee that still have questions as to whether it is ready for publication. The concern regarding the consequences of not making an immediate change is driving 100% acceptance despite the questions on accuracy. There is an expectation that there will be a revision. The question is whether or not the revision can be ignored until next cycle. If it can’t wait, then NFPA needs to decide if the value of having this change in the first printing of NFPA 13 warrants accepting this TIA.

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

___XX___ AGREE  ____________ DISAGREE*  ____________ ABSTAIN*

**EXPLANATION OF VOTE** - Please type or print your comments:

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

__________________________________________

Signature
_________________ Roland Huggins

Name (Please Print)  
_________________ 6/17/15

Date

Please return the ballot on or before **June 17, 2015**.

**PLEASE RETURN TO:**
Elena Carroll, Project Administrator
NFPA
Re: NFPA 13 TIA Log Nos. 1180 - CC Ballot

Elena,

On TIA 1180 for NFPA 13, please record me as voting as follows:

Q1 - Correlation - I agree there are no correlations issues.

Q2 -- Emergency Nature. Record me as voting Affirmative. Comment: While I support the committee vote that this is an emergency nature, it is not clear to me why the changes were not made at the second draft meeting or if we are trying to be in compliance with ASCE 7-10 Supplement 1 or 7-16 as both are referenced. I do not believe ASCE 7-16 has been finalized and it certainly has not been published yet so we may be premature in making changes. I don't think NFPA 13 can be at fault for being in compliance with the latest published edition available when we balloted our document. Finally this seems to be a very complicated subject that has been revised several times, and I hate to see changes made via TIA at the last minute unless we are certain they are correct. There was no disagreement on the technical committee ballots on technical merit, so I assume it is, but this does make me a little nervous that is will need to be revised again.

Regards,
Ken Linder
Subject: FW: NFPA 13, Proposed TIA Log No. 1180 Ballot Circulation - CC

Elena, I thought I responded on this, but my vote would match Mr. Linder's comments.

Thanks.

Bill

J William Sheppard, FSFPE
Sheppard & Associates, LLC
MEMORANDUM

TO: NFPA Technical Committee on Hanging and Bracing of Water-Based Fire Protection Systems
FROM: Elena Carroll, Project Administrator
DATE: June 22, 2015
SUBJ: NFPA 13 Proposed TIA No. 1180 FINAL TC BALLOT RESULTS

No comments were received on this TIA, therefore, according to 5.6(a) in the NFPA Regs, the final results show this TIA HAS achieved the ¾ majority vote needed on both Question 1 (Technical Merit) and Question 2 (Emergency Nature).

32 Eligible to Vote
7 Not Returned (Caputo, Dannaway, Laguna, Lindley, Nieraeth, Sanchez, Thacker)

<table>
<thead>
<tr>
<th>Technical Merit:</th>
<th>Emergency Nature:</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 Abstentions (names, if any)</td>
<td>1 Abstention (Berry)</td>
</tr>
<tr>
<td>25 Agree (Kirschner, Wagoner, Wellen, w/comment)</td>
<td>22 Agree</td>
</tr>
<tr>
<td>0 Disagree</td>
<td>2 Disagree (Forsythe, Wellen)</td>
</tr>
</tbody>
</table>

There are two criteria necessary to pass ballot [(1) simple majority (2) affirmative ¾ vote]. Both questions must pass ballot in order to recommend that the Standards Council issue this TIA.

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

   \[32 \text{ eligible} \div 2 = 16 + 1 = (17)\]

2. The number of affirmative votes needed to satisfy the ¾ requirement is:
   - Technical Merit: (32 eligible to vote - 7 not returned - 0 abstentions = 25 \times 0.75 = 18.75) 19
   - Emergency Nature: (32 eligible to vote - 7 not returned - 1 abstentions = 24 \times 0.75 = 18) 18

The Regs at 1.6.2.(c) state: An appeal relating to a proposed Tentative Interim Amendment that has been submitted for processing pursuant to Section 5.2 shall be filed no later than 5 days after the notice of the TIA final ballot results are published in accordance with 4.2.6.

Appeal Closing Date for this TIA is June 27, 2015.

Attachment
1. To Revise the references in 2.3.1 and 2.3.2, add a new definition on Prying Factor and Corresponding Annex, Revise sections 9.3.5.12, A.9.3.5.12, Replace A.9.3.5.12.1, and Add a new Annex E.7

Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA Log. 1180.

        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            DISAGREE*          ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.

        Based on my review of the documentation, I do not perceive this issue to be "of an emergency nature requiring prompt action", and therefore believe it should not be the subject of a TIA, but rather processed as a standard proposal during the upcoming cycle.

____________________________________________________________________

Signature

Thomas J. Forsythe

Name (Please Print)

May 8, 2015

Date

Please return the ballot on or before **Friday, May 15, 2015.**

**PLEASE RETURN TO:**
Elena Carroll, Project Administrator
NFPA
1 Batterymarch Park
Quincy, MA 02169

**FAX:** (617) 984-7110  **E-mail:** ecarroll@nfpa.org
1. To Revise the references in 2.3.1 and 2.3.2, add a new definition on Prying Factor and Corresponding Annex, Revise sections 9.3.5.12, A.9.3.5.12, Replace A.9.3.5.12.1, and Add a new Annex E.7

Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA Log. 1180.

[ ] AGREE [ ] DISAGREE* [ ] ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.

See the explanation of my vote attached on the next page.

_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________

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 understand that ASCE 7-16 has not been processed through the standards making process. NFPA 13 is trying to be in compliance with ASCE 7-16, a document that does not yet exist. Why would ASCE expect NFPA 13 to be in compliance with their document that they have not finished? Since the ASCE 7-16 document is not finished and not published, my opinion is that this TIA action is premature. This should be addressed after the publication of ASCE 7-16. An intent to comply through a memorandum of understanding seems to be an appropriate course of action at this time.

__________________________
Signature

__________________________
Thomas G. Wellen
Name (Please Print)

5-15-2015
Date

Please return the ballot on or before Friday, May 15, 2015.

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

FAX: (617) 984-7110   E-mail: ecarroll@nfpa.org
I agree with the concept to be in compliance with the ASCE 7 standard. That is the only reason for my affirmative vote. From the discussions, this is to avoid contractors from being required to hire a professional engineer to use concrete anchors.

It appears that the some of the anchor capacities are to the point of being rendered useless for seismic bracing. This will require contractors to select larger sized anchors or use brackets with 2 or more anchors thus increasing the cost of installation to the building owner. The fire protection industry is not given any examples of failures to the current criteria. The numbers have changed, the fire protection industry has to take it, and has no say. The fire protection installations will be more difficult and more costly.

From what I understand, the load values established in these tables are far too conservative. I heard the load values were based on the manufacturer that produced the lowest rated loads for each size of an anchor. This approach unfairly penalizes a manufacturer that produces an anchor that can handle higher load values. I don’t understand this approach and seems to be in error. Each manufacturer of seismic bracing equipment can have their own listed load ratings for their seismic equipment and attachments. Why can’t anchor manufacturers have the same approach?

There was also much confusion on this issue and errors have been identified throughout this change. I don’t understand it, the contractors won’t understand it, and the AHJs reviewing plans won’t understand it. The confidence level that this information is correct is low due to the constant corrections made. I suspect future TIAs will be necessary when this new criteria is implemented.

I recommend a 3rd party review should take place by an independent team of structural engineers with seismic expertise to verify the accuracy of this information and validate this approach (i.e. funded by the NFPA Research Foundation Project).
TECHNICAL COMMITTEE ON HANGING AND BRACING OF WATER-BASED FIRE PROTECTION SYSTEMS
LETTER BALLOT ON NFPA 13
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1180

1. To Revise the references in 2.3.1 and 2.3.2, add a new definition on Prying Factor and Corresponding Annex, Revise sections 9.3.5.12, A.9.3.5.12, Replace A.9.3.5.12.1, and Add a new Annex E.7

Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA Log. 1180.

_____ X _____ AGREE  _______ DISAGREE*  _______ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.
I am voting affirmative on ONE and TWO but have reservations regarding some technical merits. Proposed language in 9.3.5.12.2 requires alternate allowable loads that conflict with 9.3.5.12.8.2 and 9.3.5.12.8.3(a) loads. Annex E.7.2 lacks information on whether to use the minimum prying factor (Pr) or the worst case value of EITHER tension or compression when evaluating the angle of the brace vs. the critical angle (Cr).

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

[Signature]

Name (Please Print)

[Name]

Date

5-7-15

Please return the ballot on or before Friday, May 15, 2015.

PLEASE RETURN TO:
Elena Carroll, Project Administrator
NFPA
1 Batterymarch Park
Quincy, MA 02169
August 7, 2015

FAX: (617) 984-7110  E-mail: ecarroll@nfpa.org
Supplemental Agenda Standards Council Meeting August 17-19, 2015
1. To Revise the references in 2.3.1 and 2.3.2, add a new definition on Prying Factor and Corresponding Annex, Revise sections 9.3.5.12, A.9.3.5.12, Replace A.9.3.5.12.1, and Add a new Annex E.7

**Question 1:** I agree with the TECHNICAL MERITS of the Proposed TIA Log. 1180.

- ✔️ AGREE
- ☐ DISAGREE*
- ☐ ABSTAIN*

**EXPLANATION OF VOTE** - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.

_____________________________________________________________________

See attached document

_____________________________________________________________________

**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

Kenneth W. Wagoner
Name (Please Print)

May 12, 2015
Date

Please return the ballot on or before **Friday, May 15, 2015.**

**PLEASE RETURN TO:**
Elena Carroll, Project Administrator
NFPA
1 Batterymarch Park
Quincy, MA 02169

**FAX:** (617) 984-7110
**E-mail:** ecarroll@nfpa.org
I am voting affirmatively for technical merit of this TIA as the committee was assured that if anchor capacities and prying effect were not accounted for in the body of the standard NFPA 13 would lose its cross-reference as an equivalent guideline to ASCE7 for providing seismic protection for sprinkler systems. If the TIA fails to pass this ballot, the standard would revert to the previous edition on this issue, potentially forfeiting that status, and that consequence is unacceptable.

Having noted the above, I have no confidence that the conclusions noted in the tables reflect the results of precisely applied procedures and equations. The information provided to the committee has been revised with every subsequent document transmitted, beginning in August of 2013 in Nashville and continuing through “typos” found in March of this year which reversed equations after the TIA was sent on March 13th. The impact of that lack of oversight raises doubts as to the reliability of the process generating the values in the tables, particularly when following the “example” provided in the new annex material.

I would hope during the next cycle that a task group could produce a document with less confusion and a more meticulous process than what has been presented here.
1. To Revise the references in 2.3.1 and 2.3.2, add a new definition on Prying Factor and Corresponding Annex, Revise sections 9.3.5.12, A.9.3.5.12, Replace A.9.3.5.12.1, and Add a new Annex E.7

Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA Log. 1180.

_____ 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 ____________ DISAGREE*  ______X____ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.

I find some of the changes are test changes and not an emergency in nature

_____________________________________________________________________

_____________________________________________________________________

________________________________

Signature

Steve Berry
Name (Please Print)

May 5, 2015
Date

Please return the ballot on or before Friday, May 15, 2015.

PLEASE RETURN TO:
Elena Carroll, Project Administrator
NFPA
1 Batterymarch Park
Quincy, MA 02169
FAX: (617) 984-7110  E-mail: ecarroll@nfpa.org
NFPA 13-Proposed 2016 Edition

Standard for the Installation of Sprinkler Systems

TIA Log No.: 1183

Reference: 5.6.3.3, Figure 5.6.3.4.2, Figure 5.6.3.3.2(new), 5.6.3.4, 5.6.4, A.5.6 and Table A.5.6.1.1

Comment Closing Date: June 19, 2015

Submitter: Weston Baker, FM Global

1. Revise Subsection 5.6.3.3 to read as follows:

5.6.3.3* Class III.

5.6.3.3.1 A Class III commodity shall be defined as a product fashioned from wood, paper, natural fibers, or Group C plastics with or without cartons, boxes, or crates and with or without pallets.

5.6.3.3.2* A Class III commodity shall be permitted to contain a limited amount (5 percent or less by weight of unexpanded plastic or 5 percent or less by volume of expanded plastic) of Group A or Group B plastics.

A.5.6.3.3.2 Where the commodity includes a single type of plastic, the five percent limit applies to the unexpanded or expanded type, but not both. For commodities with a mixture of expanded and unexpanded plastics, see 5.6.3.3.3 and the associated figures.

5.6.3.3.3 Class III commodities containing a mix of both Group A expanded and unexpanded plastics shall comply with Figure 5.6.3.4.2-3.3.1 where they are within cartons, boxes, or crates, or Figure 5.6.3.3.2 where they are exposed.
2. Revise Figure 5.6.3.4.2 to read as follows:

Figure 5.6.3.4.2.1 Commodities, Cartoned or Within a Wooden Container, Containing a Mixture of Expanded and Unexpanded Group A Plastics

<table>
<thead>
<tr>
<th>Percentage by Weight of Group A Unexpanded Plastic</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>15</td>
</tr>
<tr>
<td>IV</td>
</tr>
</tbody>
</table>

Class III Commodity, commodities shall be permitted to contain a limited amount (5 percent by weight of unexpanded plastic or 5 percent by volume of expanded plastic or less) of Group A. Refer to 5.6.2.3 if a plastic pallet is used.

Class IV Commodity, commodities shall be permitted to contain within itself or its packaging an appreciable amount (5 percent to 15 percent by weight of Group A unexpanded plastic, or 5 percent to 25 percent by volume of expanded Group A plastic) of Group A plastics as indicated in Figure 5.6.3.4.2. Refer to 5.6.2 if a plastic pallet is used.

Class I, II, III or IV commodities shall be protected or one of the following Group A plastic commodities, depending upon on the packaging and plastic material characteristics:

1. Cartoned commodities containing greater than 25 percent and up to 45 percent by volume of expanded Group A plastic shall be protected as cartoned unexpanded Group A plastic.

2. Cartoned commodities containing more than 40 percent by volume of expanded Group A plastic shall be protected as cartoned expanded Group A plastic.

3. Exposed commodities containing greater than 25 percent and up to 55 percent by volume of expanded Group A plastic shall be protected as exposed unexpanded Group A plastic.

4. Exposed commodities containing greater than 25 percent by volume of expanded Group A plastic should be protected as exposed expanded Group A plastic commodity.
3. Add a new Figure 5.6.3.3.2 to read as follows:

![Figure 5.6.3.3.2 Exposed Commodities Containing a Mixture of Expanded and Unexpanded Group A Plastics](image)

**Percentage by Weight of Group A Unexpanded Plastic**

- **Group A Unexpanded**
- **Group A Expanded**

**Percentage by Volume of Group A Expanded Plastic**

- **III** - Class III Commodity. Refer to 5.6.2 if a plastic pallet is used.
- **IV** - Class IV Commodity. Refer to 5.6.2 if a plastic pallet is used.
4. Revise Subsection 5.6.3.4 to read as follows:

5.6.3.4* Class IV.
5.6.3.4.1 A Class IV commodity shall be defined as a product, with or without pallets, that meets one of the following criteria:

1. Constructed partially or totally of Group B plastics
2. Consists of free-flowing Group A plastic materials
3. Cartoned, or within a wooden container, that contains within itself or its packaging an appreciable amount (greater than 5 percent and up to 15 percent by weight of Group A unexpanded plastic, or greater than 5 percent and up to 25 percent by volume of expanded Group A plastics) of Group A plastics.
4. Cartoned, or within a wooden container, that contains greater than 5 percent and up to 25 percent by volume of expanded Group A plastics.
5. Cartoned, or within a wooden container, that contains a mix of Group A expanded and unexpanded plastics and complies with Figure 5.6.3.3.1.
6. Exposed, that contains greater than 5 percent and up to 15 percent by weight of Group A unexpanded plastic.
7. Exposed, that contains a mix of Group A expanded and unexpanded plastics and complies with Figure 5.6.3.3.2.

5.6.3.4.2 Commodities containing a mix of both Group A expanded and unexpanded plastics shall comply with Figure 5.6.3.4.2.

5.6.3.4.32 The remaining materials shall be permitted to be metal noncombustible, wood, paper, natural or synthetic fibers, or Group B or Group C plastics.

5. Revise Subsection 5.6.4 to read as follows:

5.6.4* Classification of Plastics, Elastomers, and Rubber. Plastics, elastomers, and rubber shall be classified as Group A, Group B, or Group C.

5.6.4.1* Group A. The following materials shall be classified as Group A:

1. ABS ((acrylonitrile-butadiene-styrene copolymer)
2. Acetal (polyformaldehyde)
3. Acrylic (polymethyl methacrylate)
4. Butyl rubber
5. Cellulosics (cellulose acetate, cellulose acetate butyrate, ethyl cellulose)
6. EPDM (ethylene-propylene rubber)
7. FRP (fiberglass-reinforced polyester)
8. Natural rubber
9. Nitrile-rubber (acrylonitrile-butadiene-rubber)
10. Nylon (nylon 6, nylon 66)
11. PET (thermoplastic polyester)
12. Polybutadiene
13. Polycarbonate
14. Polyester elastomer
15. Polyethylene
16. Polypropylene
17. Polystyrene
18. Polyurethane
5.6.4.1.1* Group A plastics shall be further subdivided as either expanded or unexpanded.

5.6.4.1.1.1 If a cartoned commodity is more than 40 percent (by volume) expanded plastic, it shall be protected as a cartoned expanded plastic.
A Group A expanded plastic commodity shall be defined as a product, with or without pallets, that meets one of the following criteria:
(1) Cartoned, or within a wooden container, that contains greater than 40 percent by volume of Group A expanded plastic.
(2) Exposed, that contains greater than 25 percent by volume of Group A expanded plastic.

5.6.4.1.1.2 Exposed commodities containing greater than 25 percent by volume expanded plastic shall be protected as an exposed expanded plastic.
A Group A unexpanded plastic commodity shall be defined as a product, with or without pallets, that meets one of the following criteria:
(1) Cartoned, or within a wooden container, that contains greater than 15 percent by weight of Group A unexpanded plastic.
(2) Cartoned, or within a wooden container, that contains greater than 25 percent and up to 40 percent by volume of Group A expanded plastic.
(3) Cartoned, or within a wooden container, that contains a mix of Group A unexpanded and expanded plastics, in compliance with Figure 5.6.3.3.1.
(4) Exposed, that contains greater than 15 percent by weight of Group A unexpanded plastic.
(5) Exposed, that contains greater than 5 percent and up to 25 percent by volume of Group A expanded plastic.
(6) Exposed, that contains a mix of Group A unexpanded and expanded plastics, in compliance with Figure 5.6.3.3.2.

5.6.4.1.1.3 The remaining materials shall be permitted to be noncombustible, wood, paper, natural or synthetic fibers, or Group A, Group B, or Group C plastics.

5.6.4.2 Group B.
The following materials shall be classified as Group B:
(1) Chloroprene rubber
(2) Fluoro plastics (ECTFE – ethylene-chlorotrifluoro-ethylene copolymer; ETFE – ethylene-tetrafluoroethylene-copolymer; FEP – fluorinated ethylene-propylene copolymer)
(3) Silicone rubber

5.6.4.3 Group C.
The following materials shall be classified as Group C:
(1) Fluoro plastics (PCTFE – polychlorotrifluoroethylene; PTFE – polytetrafluoroethylene)
(2) Melamine (melamine formaldehyde)
(3) Phenolic
(4) PVC (polyvinyl chloride – flexible – PVC’s with plasticizer content up to 20 percent)
(5) PVDC (polyvinylidene chloride)
(6) PVDF (polyvinylidene fluoride)
6. Revise A.5.6 to read as follows:

A.5.6 Specification of the type, amount, and arrangement of combustibles for any commodity classification is essentially an attempt to define the potential fire severity, based on its burning characteristics, so the fire can be successfully controlled by the prescribed sprinkler protection for the commodity class. In actual storage situations, however, many storage arrays do not fit precisely into one of the fundamental classifications; therefore, the user needs to make judgments after comparing each classification to the existing storage conditions. Storage arrays consist of thousands of products, which makes it impossible to specify all the acceptable variations for any class. As an alternative, a variety of common products are classified in this annex based on judgment, loss experience, and fire test results. Table A.5.6 provides examples of commodities not addressed by the classifications in Section 5.6. The commodities listed in Table A.5.6 are outside the scope of NFPA 13 protection. Table A.5.6.3 is an alphabetized list of commodities with corresponding classifications. Tables A.5.6.3.1, A.5.6.3.2, A.5.6.3.3, through Table A.5.6.3.4, and Table A.5.6.4.1 provide examples of commodities within a specific class.

7. Revise Table A.5.6.1.1 to read as follows:

**Table A.5.6.1.1 General Guide to Identifying the Commodity Class for Solid Combustibles**

<table>
<thead>
<tr>
<th>Characteristics of Unit Load</th>
<th>Commodity Class</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Material Used to Construct Product</strong></td>
<td><strong>Packaging Material</strong></td>
</tr>
<tr>
<td>Noncombustible Product</td>
<td>None or single-layer corrugated cartons</td>
</tr>
<tr>
<td>Entirely noncombustible</td>
<td>None or single-layer corrugated cartons</td>
</tr>
<tr>
<td>Entirely noncombustible</td>
<td>Multiple-layered corrugated cartons, wooden crates, or wood boxes</td>
</tr>
<tr>
<td>Entirely noncombustible</td>
<td>Multiple-layered corrugated cartons, wooden crates, or wood boxes</td>
</tr>
<tr>
<td>Noncombustible with Group A plastic components</td>
<td>None or single-layer corrugated cartons</td>
</tr>
<tr>
<td>Entirely noncombustible or noncombustible with plastic components</td>
<td>Corrugated cartons, wooden crates, or wood boxes, with internal plastic packaging</td>
</tr>
<tr>
<td>Entirely noncombustible or noncombustible with plastic components</td>
<td>Corrugated cartons, wooden crates, or wooden boxes, with internal plastic packaging</td>
</tr>
</tbody>
</table>

**Wood, Paper, Natural Fibers, or Group C Plastics** |
<table>
<thead>
<tr>
<th>Material Used to Construct Product</th>
<th>Packaging Material</th>
<th>Pallet Material</th>
<th>Commodity Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entirely wood, paper, natural fibers, or Group C plastics, or a mix of these with noncombustible materials.</td>
<td>None, corrugated cartons, wooden crates, or wood boxes</td>
<td>None, metal, or wood</td>
<td>Class III</td>
</tr>
<tr>
<td>Entirely wood, paper, natural fibers, or Group C plastics, or a mix of these with noncombustible materials.</td>
<td>Corrugated cartons, wooden crates, or wood boxes, with internal plastic packaging</td>
<td>None, metal, or wood</td>
<td>See Figure 5.6.3.4.2-3.3.1</td>
</tr>
<tr>
<td>Entirely wood, paper, natural fibers, or Group C plastics, or a mix of these with noncombustible materials.</td>
<td>None, corrugated cartons, wooden crates, or wood boxes</td>
<td>Plastic</td>
<td>Class III, IV or cartoned unexpanded Group A plastic; see Section 5.6.2</td>
</tr>
<tr>
<td>Entirely wood, paper, natural fibers, or Group C plastics, or a mix of these with noncombustible materials.</td>
<td>Corrugated cartons, wooden crates, or wood boxes, with internal plastic packaging</td>
<td>Plastic</td>
<td>See Figure 5.6.3.4.2-3.3.1 and Section 5.6.2</td>
</tr>
<tr>
<td>Wood, paper, natural fibers, or Group C plastics, with Group A plastic components</td>
<td>None, corrugated cartons, wooden crates, or wood boxes, with or without plastic packaging</td>
<td>None, metal, or wood</td>
<td>See Figure 5.6.3.4.2</td>
</tr>
<tr>
<td>Wood, paper, natural fibers, or Group C plastics, with or without Group A plastic components</td>
<td>Any type</td>
<td>Plastic</td>
<td>See Figure 5.6.3.4.2</td>
</tr>
</tbody>
</table>

**Group B Plastics**

<p>| Entirely Group B plastics, or a mix of these with noncombustible, wood, paper, natural fibers, or Group C plastics materials. | None, corrugated cartons, wooden crates, or wood boxes                             | None, metal, or wood             | Class IV        |
| Entirely Group B plastics, or a mix of these with noncombustible, wood, paper, natural fibers, or Group C plastics materials. | Corrugated cartons, wooden crates, or wood boxes                                  | Plastic                          | Group A, Cartoned Unexpanded Class IV or cartoned unexpanded Group A plastic; see Section 5.6.2 |
| Entirely Group B plastics, or a mix of these with noncombustible, wood, paper, natural fibers, or Group C plastics materials. | None                                                                               | Plastic                          | Group A, Cartoned Unexpanded Class IV or cartoned unexpanded Group A plastic; see Section 5.6.2 |
| Entirely Group B plastics, or a mix of these with noncombustible, wood, paper, natural fibers, or Group C plastics materials, or free-flowing plastic materials | Corrugated cartons, wooden crates, or wood boxes, with plastic internal packaging | None, metal, or wood             | See Figure 5.6.3.4.2-3.3.1 |
| Entirely Group B plastics, or a mix of these with noncombustible, wood, paper, natural fibers, or Group C plastics materials, or free-flowing plastic materials | Corrugated cartons, wooden crates, or wood boxes, with plastic internal packaging | Plastic                          | See Figure 5.6.3.3.3.1 and Section 5.6.2 |</p>
<table>
<thead>
<tr>
<th>Material Used to Construct Product</th>
<th>Packaging Material</th>
<th>Pallet Material</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group B plastics with Group A plastic components</td>
<td>None, corrugated cartons, wooden crates, or wood boxes, with or without plastic packaging</td>
<td>None, metal, or wood</td>
<td>See Figure 5.6.3.4.2</td>
</tr>
<tr>
<td>Entirely Group B plastics or free-flowing plastic materials, or Group B plastics with Group A plastic components</td>
<td>Any type</td>
<td>Plastic</td>
<td>See Figure 5.6.2 and Figure 5.6.3.4.2</td>
</tr>
<tr>
<td>Group A Plastics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Free-flowing Group A plastic materials</td>
<td>Corrugated cartons, wooden crates, wood boxes, or bagged</td>
<td>None, metal, wood</td>
<td>Class IV</td>
</tr>
<tr>
<td>Entirely unexpanded Group A plastic</td>
<td>Corrugated cartons, wooden crates, wood boxes, without expanded Group A plastic packaging</td>
<td>None, metal, wood, or plastic</td>
<td>Cartoned unexpanded Group A plastic</td>
</tr>
<tr>
<td>Entirely unexpanded Group A plastic</td>
<td>None</td>
<td>None, metal, wood, or plastic</td>
<td>Exposed unexpanded Group A plastic</td>
</tr>
<tr>
<td>Entirely unexpanded Group A plastic</td>
<td>Corrugated cartons, wooden crates, or wood boxes, with internal expanded Group A plastic packaging</td>
<td>None, metal, wood, or plastic</td>
<td>See Figure 5.6.3.4.2-3.3.1</td>
</tr>
<tr>
<td>Entirely expanded Group A plastic</td>
<td>Corrugated cartons, wooden crates, or wood boxes, with or without expanded Group A plastic packaging</td>
<td>None, metal, wood, or plastic</td>
<td>Cartoned expanded Group A plastic</td>
</tr>
<tr>
<td>Entirely expanded Group A plastic</td>
<td>None</td>
<td>None, metal, wood, or plastic</td>
<td>Exposed expanded Group A plastic</td>
</tr>
<tr>
<td>Unexpanded Group A plastic with expanded Group A plastic components</td>
<td>Corrugated cartons, wooden crates, or boxes, with or without expanded Group A plastic packaging</td>
<td>None, metal, wood, or plastic</td>
<td>See Figure 5.6.3.4.2</td>
</tr>
<tr>
<td>Mix of Group A plastics, noncombustible, wood, paper, natural fibers, Group B or C plastics materials.</td>
<td>Corrugated cartons, wooden crates, or wood boxes, with or without internal plastic packaging</td>
<td>None, metal or wood</td>
<td>See Figure 5.6.3.3.3.1</td>
</tr>
<tr>
<td>Mix of Group A plastics, noncombustible, wood, paper, natural fibers, Group B or C plastics materials.</td>
<td>Corrugated cartons, wooden crates, or wood boxes</td>
<td>Plastic</td>
<td>See Figure 5.6.3.3.3.2</td>
</tr>
</tbody>
</table>
### Substantiation:

Note that there are no technical changes associated to this TIA.

The language in the notes associated with the second draft Figure 5.6.3.4.2 resulted in an inconsistency between the guidelines for Class IV commodities and those for exposed unexpanded Group A plastics. In addition, there was concern that the guidelines provided in second draft Figure 5.6.3.4.2, which were only intended for cartoned commodities, could lead to an incorrect commodity classification if the user did not read or properly apply the notes that were associated with the figure.

To rectify this situation, a second figure was created that represents commodity classification when exposed materials are mixed with Group A plastics. In addition, the language from the second draft Figure 5.6.3.4.2 was removed from the figure and placed as text within the body of the standard. Lastly, additional language was added to the body of the standard to clarify commodity classification that would have had to be inferred previously as well as to provide consistent formatting throughout the section.

The second draft Figure 5.6.3.4.2 was moved into Section 5.6.3.3.3, where it is first referenced, and renumbered as Figure 5.6.3.3.3.1.

### Additional clarifications to sections:

#### 5.6.3.3.3  Action: Added “Class III” at the beginning of the sentence for consistency and provided guidance on which figure to use when Class III commodities are mixed with Group A plastics.

Figure 5.6.3.3.3.1 Actions:

1) Renumbered the figure because it will now be in Section 5.6.3.3.3.1.
2) Added “Cartoned and wooden containers” to the title to clarify its application.
3) Added “Unexpanded” to “Group A” in the Figure’s graph because the Figure now only applies to Cartoned commodities.
4) Added “Group A Expanded” to the Figure’s graph beyond 40% by volume because the Figure now only applies to Cartoned commodities.
5) Removed wording from III and IV for simplicity since covered in text.
6) Removed Group A notes 1 and 2 from the Figure because they are addressed by the graph.
7) Removed Group A notes 3 and 4 from the Figure because they applied to exposed commodities.

Figure 5.6.3.3.3.2 Actions: Added a Figure for exposed commodities containing a mix of plastics to provide explicit guidance for exposed commodities as well as avoid confusion with the guidelines for cartoned commodities.

#### 5.6.3.4* Class IV  Action: Provided clear guidance on what constitutes a Class IV commodity when Group A plastic is present, whether expanded or unexpanded as well as when the product is exposed or cartoned:
- Separated sentence (3) into two sentences (3 and 4) to break up the limitations for unexpanded and expanded plastics for cartoned commodities.
- Added sentences (5) and (7) to account for a mix of unexpanded and expanded plastics.
- Added sentence (6) to provide limitations on exposed commodities containing unexpanded plastic.

5.6.3.4.2 Action: Deleted existing Section 5.6.3.4.2 above because it is covered in the new Sections 5.6.3.4.1(5) and 5.6.3.4.1(7).

[Note: Figure 5.6.3.4.2 was moved, modified and renumbered as Figure 5.6.3.3.3.1]

5.6.3.4.3 Action: Modified and renumbered Section 5.6.3.4.3 above. Replaced “metal” with “noncombustible” to be all encompassing of all materials that do not burn. Removed “synthetic”, see action for Table A5.6.3, in TIA #2.

5.6.4.1.1.1 Action: Deleted the sentence describing cartoned expanded plastic because it is covered in Figure 5.6.3.3.1 and sentence (1) above (this was Note 2 for Group A Plastics from second draft Figure 5.6.3.4.2). Also, added clarification on Group A expanded plastic in sentence (2), by explicitly stating that >25% by volume of exposed expanded plastic results in Group A expanded plastic (this was Note 4 for Group A Plastics from second draft Figure 5.6.3.4.2).

5.6.4.1.1.2 Action: Deleted the sentence describing exposed expanded plastic because it is covered in sentence 5.6.4.1.1.1(2). Also, added clarification on Group A unexpanded plastic in sentences (1)-(6). Sentence (2) was Note 1 for Group A Plastics from second draft Figure 5.6.3.4.2 and sentence (5) was Note 3 for Group A Plastics in second draft Figure 5.6.3.4.2. There are no technical changes.

5.6.4.1.1.3 Action: Section 5.6.4.1.1.3 was added to be consistent with Section 5.6.3.4.2 for Class IV commodities.

A.5.6 Action: Included the list of Tables associated to Class I, II, III, IV, and Plastics to provide a link for the electronic version of the Standard. Also, indicated A.5.6.4.1 link does not work.

Table A.5.6.1.1 Action: Updated Table A5.6.1.1 for consistency with the text in the body of Section 5.6.

**Emergency Nature:** Based on the language accepted at the second draft meeting, a user could assign the incorrect commodity classification to a specific product. Specifically, a Group A Plastic could be categorized as a Class IV commodity incorrectly. This could lead to an insufficient amount of water being delivered to the fire which could have a catastrophic result.
MEMORANDUM

TO: NFPA Correlating Committee on Automatic Sprinkler Systems

FROM: Elena Carroll, Project Administrator

DATE: June 22, 2015

SUBJ: NFPA 13 Proposed TIA No. 1183 FINAL CC BALLOT RESULTS

No comments were received on this TIA, therefore, according to 5.6(b) in the NFPA Regs, the final results show this TIA HAS achieved the ¾ majority vote needed on both Question 1 (Correlation Issues) and Question 2 (Emergency Nature).

<table>
<thead>
<tr>
<th>Correlation Issues:</th>
<th>Emergency Nature:</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 Abstentions (names, if any)</td>
<td>0 Abstentions</td>
</tr>
<tr>
<td>18 Agree</td>
<td>18 Agree</td>
</tr>
<tr>
<td>0 Disagree</td>
<td>0 Disagree</td>
</tr>
</tbody>
</table>

There are two criteria necessary to pass ballot [(1) affirmative 3/4 vote and (2) simple majority] with both questions needing to pass ballot in order to recommend that the Standards Council issue this TIA.

1. The number of affirmative votes needed is **14**.
   
   (22 eligible to vote - 4 not returned - 0 abstentions = 18 × 0.75 = 13.5)

2. In all cases, 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:
   
   [22 eligible ÷ 2 = 11 + 1 = (12)]

The Regs at 1.6.2.(c) state: An appeal relating to a proposed Tentative Interim Amendment that has been submitted for processing pursuant to Section 5.2 shall be filed no later than 5 days after the notice of the TIA final ballot results are published in accordance with 4.2.6.

Appeal Closing Date for this TIA is **June 27, 2015**.

Attachments
MEMORANDUM

TO:    NFPA Technical Committee on Sprinkler System Discharge Criteria
FROM: Elena Carroll, Project Administrator
DATE: June 22, 2015
SUBJ: NFPA 13 Proposed TIA No. 1183 FINAL TC BALLOT RESULTS

No comments were received on this TIA, therefore, according to 5.6(a) in the NFPA Regs, the final results show this TIA **HAS** achieved the ¾ majority vote needed on both Question 1 (Technical Merit) and Question 2 (Emergency Nature).

32 Eligible to Vote
5 Not Returned (Dockrill, Hjorth, Keeping, Schneider, Thomas)

<table>
<thead>
<tr>
<th>Technical Merit:</th>
<th>Emergency Nature:</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 Abstentions</td>
<td>0 Abstentions</td>
</tr>
<tr>
<td>27 Agree (Klausbruckner, w/comment)</td>
<td>27 Agree</td>
</tr>
<tr>
<td>0 Disagree</td>
<td>0 Disagree</td>
</tr>
</tbody>
</table>

There are two criteria necessary to pass ballot [(1) simple majority (2) affirmative ¾ vote]. Both questions must pass ballot in order to recommend that the Standards Council issue this TIA.

1. In all cases, an affirmative vote of at least a simple majority of the total membership eligible to vote is required.
   \[
   \frac{32}{2} = 16 + 1 = 17
   \]

2. The number of affirmative votes needed to satisfy the ¾ requirement is **21**.
   \[
   (32 \text{ eligible to vote} - 5 \text{ not returned} - 0 \text{ abstentions} = 27 \times 0.75 = 20.25)
   \]

The Regs at 1.6.2.(c) state: An appeal relating to a proposed Tentative Interim Amendment that has been submitted for processing pursuant to Section 5.2 shall be filed no later than 5 days after the notice of the TIA final ballot results are published in accordance with 4.2.6.

Appeal Closing Date for this TIA is **June 27, 2015**.

Attachment
TECHNICAL COMMITTEE ON SPRINKLER SYSTEM DISCHARGE CRITERIA
LETTER BALLOT ON NFPA 13
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1183

1. To Revise Subsection 5.6.3.3, Figure 5.6.3.4.2, Add Figure 5.6.3.3.2(new), Revise Subsection 5.6.3.4, 5.6.4, A.5.6 and Table A.5.6.1.1

Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA Log. 1183.

____X______ AGREE ___________ DISAGREE* ___________ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.

This particular change is specifically addressing a conflict between the text and the Figures, as well as a conflict between classifications for synthetic fabrics. It is my understanding that the task group will continue to work on the Commodities Classifications in future cycles to further improve on the definitions, lists, and figures.

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

Elley Klausbruckner
Name (Please Print)

5/12/15
Date

Please return the ballot on or before **Monday, May 18, 2015.**

**PLEASE RETURN TO:***
Elena Carroll, Project Administrator
NFPA
1 Batterymarch Park
Quincy, MA 02169

**FAX: (617) 984-7110**

**E-mail: ecarroll@nfpa.org**
1. Revise Table A.5.6.3 to read as follows:

<table>
<thead>
<tr>
<th>Textile Materials/Products</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cloth; natural fibers; baled</td>
<td>Class III</td>
</tr>
<tr>
<td>Cloth; synthetic cloth</td>
<td>Class IV</td>
</tr>
<tr>
<td>Clothing; natural fibers (e.g. wool, cotton) and viscose</td>
<td>Class III</td>
</tr>
<tr>
<td>Cotton; cartoned</td>
<td>Class III</td>
</tr>
<tr>
<td>Diapers; cotton or linen</td>
<td>Class III</td>
</tr>
<tr>
<td>Diapers; plastic or nonwoven fabric; cartoned</td>
<td>Class IV</td>
</tr>
<tr>
<td>Diapers; plastic or nonwoven fabric; plastic-wrapped; uncartoned</td>
<td>Group A Nonexpanded</td>
</tr>
<tr>
<td>Fabric; rayon and nylon</td>
<td>Class IV</td>
</tr>
<tr>
<td>Fabric; synthetic (except rayon and nylon); greater than 50/50 blend</td>
<td>Class IV Group A Nonexpanded</td>
</tr>
<tr>
<td>Fabric; synthetic (except rayon and nylon); up to 50/50 blend</td>
<td>Class III</td>
</tr>
<tr>
<td>Fabric; vinyl-coated (e.g. tablecloth); cartoned</td>
<td>Group A Nonexpanded</td>
</tr>
<tr>
<td>Fibers; rayon and nylon; baled</td>
<td>Class IV</td>
</tr>
<tr>
<td>Fibers; synthetic (except rayon and nylon); baled</td>
<td>Group A Nonexpanded</td>
</tr>
<tr>
<td><strong>Fibers; synthetic; baled</strong></td>
<td>Class IV</td>
</tr>
<tr>
<td>Thread or yarn; rayon and nylon; wood or paper spools</td>
<td>Class IV</td>
</tr>
<tr>
<td>Thread or yarn; rayon or nylon; plastic spools</td>
<td>Group A Nonexpanded</td>
</tr>
<tr>
<td>Thread or yarn; synthetic (except rayon and nylon); greater than 50/50 blend; paper or wood spools</td>
<td>Class IV</td>
</tr>
<tr>
<td>Thread or yarn; synthetic (except rayon and nylon); greater than 50/50 blend; plastic spools</td>
<td>Group A Nonexpanded</td>
</tr>
</tbody>
</table>
Thread or yarn; synthetic (except rayon and nylon); up to 50/50 blend; plastic spools

Thread or yarn; synthetic (except rayon and nylon); up to 50/50 blend; wood or paper spools

2. Revise Table A.5.6.4 to read as follows:

<table>
<thead>
<tr>
<th>Textile Materials/Products</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cloth; synthetic cloth</td>
<td></td>
</tr>
<tr>
<td>Diapers; plastic or nonwoven fabric; cartoned</td>
<td></td>
</tr>
<tr>
<td>Fabric; rayon and nylon</td>
<td></td>
</tr>
<tr>
<td>Fabric; synthetic (except rayon and nylon); greater than 50/50 blend</td>
<td></td>
</tr>
<tr>
<td>Fibers; rayon and nylon; baled</td>
<td></td>
</tr>
<tr>
<td>Fibers; synthetic; baled</td>
<td></td>
</tr>
<tr>
<td>Thread or yarn; rayon and nylon; wood or paper spools</td>
<td></td>
</tr>
<tr>
<td>Thread or yarn; synthetic (except rayon and nylon); greater than 50/50 blend; paper or wood spools</td>
<td></td>
</tr>
<tr>
<td>Thread or yarn; synthetic (except rayon and nylon); up to 50/50 blend; plastic spools</td>
<td></td>
</tr>
</tbody>
</table>

3. Revise Table A.5.6.4.1 to read as follows:

<table>
<thead>
<tr>
<th>Textile Materials/Products</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diapers; plastic or nonwoven fabric; plastic-wrapped; uncartoned</td>
<td>Nonexpanded</td>
</tr>
<tr>
<td>Fabric; vinyl-coated (e.g. tablecloth); cartoned</td>
<td>Nonexpanded</td>
</tr>
<tr>
<td>Fabric; synthetic (except rayon and nylon); greater than 50/50 blend</td>
<td>Nonexpanded</td>
</tr>
<tr>
<td>Fibers; synthetic (except rayon and nylon); baled</td>
<td>Nonexpanded</td>
</tr>
<tr>
<td>Thread or yarn; rayon or nylon; plastic spools</td>
<td>Nonexpanded</td>
</tr>
<tr>
<td>Thread or yarn; synthetic (except rayon and nylon); greater than 50/50 blend; plastic spools</td>
<td>Nonexpanded</td>
</tr>
<tr>
<td>Thread or yarn; synthetic (except rayon and nylon); up to 50/50 blend; plastic spools</td>
<td>Nonexpanded</td>
</tr>
</tbody>
</table>
**Substantiation:** First, there were three entries for the commodity classification of synthetic fibers; one of which was the original entry, and the other two which were new entries for 2016. Unfortunately the original listing was not removed, thus leaving a commodity classification conflict outlined below. This TIA recommends the removal of the original listing provided for “Fibers; synthetic; baled”.

Second, the changes implemented for synthetic fibers were not implemented for synthetic fabric. This TIA recommends the change in commodity classification of “Fabric; synthetic (except rayon and nylon); greater than 50/50 blend” from Class IV to Group A Unexpanded plastic to be consistent with the entry for “Fibers; synthetic (except rayon and nylon); baled”.

Thirdly, the instructions in the comment section of Table A5.6.3.3 were not implement for the commodity classification for “Thread or yarn; synthetic (except rayon and nylon); up to 50/50 blend; plastic spools”. This TIA recommends changing the indicated commodity classification from Class 4 to Group A Unexpanded plastic.

**Emergency Nature:** Based on the language accepted at the second draft meeting, there is a conflict on how textile materials can be classified. The current language could allow a user to classify certain textiles as a Class IV commodity when it should be considered a Group A Plastic. This could lead to an insufficient amount of water being delivered to the fire which could have a catastrophic result.
MEMORANDUM

TO: NFPA Correlating Committee on Automatic Sprinkler Systems
FROM: Elena Carroll, Project Administrator
DATE: June 22, 2015
SUBJ: NFPA 13 Proposed TIA No. 1184 FINAL CC BALLOT RESULTS

No comments were received on this TIA, therefore, according to 5.6(b) in the NFPA Regs, the final results show this TIA HAS achieved the ¾ majority vote needed on both Question 1 (Correlation Issues) and Question 2 (Emergency Nature).

22 Eligible to Vote
5 Not Returned (Hilton, Ketner, LeBlanc, Mitchell, Palenske)

<table>
<thead>
<tr>
<th>Correlation Issues</th>
<th>Emergency Nature</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 Abstentions (names, if any)</td>
<td>0 Abstentions</td>
</tr>
<tr>
<td>17 Agree</td>
<td>17 Agree</td>
</tr>
<tr>
<td>0 Disagree</td>
<td>0 Disagree</td>
</tr>
</tbody>
</table>

There are two criteria necessary to pass ballot [(1) affirmative ¾ vote and (2) simple majority] with both questions needing to pass ballot in order to recommend that the Standards Council issue this TIA.

(1) The number of affirmative votes needed is 13.
   (22 eligible to vote - 5 not returned - 0 abstentions = 17 × 0.75 = 12.75)

(2) In all cases, 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:
   [22 eligible ÷ 2 = 11 + 1 = (12)]

The Regs at 1.6.2.(c) state: An appeal relating to a proposed Tentative Interim Amendment that has been submitted for processing pursuant to Section 5.2 shall be filed no later than 5 days after the notice of the TIA final ballot results are published in accordance with 4.2.6.

Appeal Closing Date for this TIA is June 27, 2015.

Attachments
MEMORANDUM

TO: NFPA Technical Committee on Sprinkler System Discharge Criteria
FROM: Elena Carroll, Project Administrator
DATE: June 22, 2015
SUBJ: NFPA 13 Proposed TIA No. 1184 FINAL TC BALLOT RESULTS

No comments were received on this TIA, therefore, according to 5.6(a) in the NFPA Regs, the final results show this TIA HAS achieved the ¾ majority vote needed on both Question 1 (Technical Merit) and Question 2 (Emergency Nature).

<table>
<thead>
<tr>
<th>Technical Merit:</th>
<th>Emergency Nature:</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 Abstentions</td>
<td>0 Abstentions</td>
</tr>
<tr>
<td>26 Agree</td>
<td>26 Agree</td>
</tr>
<tr>
<td>0 Disagree</td>
<td>0 Disagree</td>
</tr>
</tbody>
</table>

There are two criteria necessary to pass ballot [(1) simple majority (2) affirmative ¾ vote]. Both questions must pass ballot in order to recommend that the Standards Council issue this TIA.

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

\[
\text{[32 eligible ÷ 2} = 16 + 1 = (17)]
\]

(2) The number of affirmative votes needed to satisfy the ¾ requirement is 20.

\[
(32 \text{ eligible to vote} - 6 \text{ not returned} - 0 \text{ abstentions} = 26 \times 0.75 = 19.5)
\]

The Regs at 1.6.2.(c) state: An appeal relating to a proposed Tentative Interim Amendment that has been submitted for processing pursuant to Section 5.2 shall be filed no later than 5 days after the notice of the TIA final ballot results are published in accordance with 4.2.6.

Appeal Closing Date for this TIA is June 27, 2015.

Attachment
Item 15-8-18
1. Revise Table 9.2.6.3.1 to read as follows:

<table>
<thead>
<tr>
<th>System Pipe Diameter c</th>
<th>Pipe Stand Diameter b</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1-1/2 in.</td>
</tr>
<tr>
<td>1-1/2 in.</td>
<td>6.6 ft</td>
</tr>
<tr>
<td>2 in.</td>
<td>4.4 ft</td>
</tr>
<tr>
<td>2-1/2 in.</td>
<td></td>
</tr>
<tr>
<td>3 in.</td>
<td></td>
</tr>
<tr>
<td>4 in. up to and including 8 in.</td>
<td></td>
</tr>
</tbody>
</table>

a. For SI units, 1 in. = 25.4 mm; 1 ft = 0.305 m.
b. Pipe stands are Schedule 40 pipe.
c. System piping is assumed to be Schedule 40 (8-in. is Schedule 30).

2. Revise section A.9.2.6.3.1 to read as follows:

A.9.2.6.3.1 When a pipe stand does not resist lateral (e.g., earthquake or wind) forces, its maximum height and the weight of pipe it can support are based primarily on a limiting slenderness ratio (Kl/r), and on the axial and bending stresses caused by the vertical load applied at a specified eccentricity.

The pipe stand heights presented in Table 9.2.6.3.1 have been calculated using a “K” of 2.1 (i.e., assuming the pipe stand is an individual cantilever column) and a slenderness ratio limit of 300, except where combined axial and bending stresses caused by the vertical load at an eccentricity of 12 in. (0.30 m) controls the design. In these cases, the pipe stand height is reduced such that the allowable axial stress (Fa) is sufficient to limit the combined axial stress ratio (fa/Fa, i.e., actual axial stress divided by allowable axial stress) plus the bending stress ratio (fb/Fb, i.e., actual bending stress divided by allowable bending stress) to 1.0. Two cases are considered, a vertical load at a 12 in. (0.30 m) eccentricity equal to: a) 5 times the weight of the water-filled pipe plus 250 lb (114 kg) using a bending stress allowable of 28,000 psi (193 MPa), and b) the weight of the water-filled pipe plus 250 lb (114 kg) using a bending stress allowable of 15,000 psi (103 MPa). No drift limit was imposed.

When an engineering analysis is conducted, different pipe stand heights could be calculated if other assumptions are warranted based on actual conditions. For example, K=1.0 can be used if the pipe at the top of the pipe stand is braced in both horizontal directions, or a shorter cantilever column could be used to limit drift.
The slenderness ratio \( (l/r) \) for pipe stands should not exceed 200. The values presented in Table 9.2.6.3.1 have been calculated so as not to exceed this. Pipe stands are intended to be a single piece of pipe. For lengths that require joining pipes they should be welded to ensure the strength is maintained.

3. Revise Table 9.2.6.5.3 and replace the Note to read as follows:

<table>
<thead>
<tr>
<th>Nominal Diameter of Pipe Being Supported (in.)</th>
<th>1</th>
<th>1-1/4</th>
<th>1-1/2</th>
<th>2</th>
<th>2-1/2</th>
<th>3</th>
<th>3-1/2</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section Modulus – Schedule 10 Steel</td>
<td>0.22</td>
<td>0.23</td>
<td>0.24</td>
<td>0.25</td>
<td>0.30</td>
<td>0.36</td>
<td>0.42</td>
<td>0.49</td>
<td>0.66</td>
<td>0.85</td>
<td>1.40</td>
</tr>
<tr>
<td>Section Modulus – Schedule 40 Steel</td>
<td>0.22</td>
<td>0.24</td>
<td>0.24</td>
<td>0.27</td>
<td>0.36</td>
<td>0.45</td>
<td>0.54</td>
<td>0.63</td>
<td>0.86</td>
<td>1.13</td>
<td>1.64</td>
</tr>
</tbody>
</table>

For SI units, 1 in. = 25.4 mm.

Note: The table is based on the controlling section modulus determined for a concentrated load at a 1 ft (0.3 m) cantilever using: a) a maximum bending stress of 15 ksi (103 MPa) and a concentrated load equal to the weight of 15 ft (4.6 m) of water-filled pipe plus 250 lb (114 kg), or 2) a maximum bending stress of 28 ksi (193 MPa) and a concentrated load equal to five times the weight of 15 ft (4.6 m) of water-filled pipe plus 250 lb (114 kg).

Substantiation:
Pipe Stand Heights (Table 9.2.6.3.1 and Paragraph A.9.2.6.3.1). Pipe stands in Section 9.2.6 are allowed to be used as individual cantilever columns. When used in this manner, the heights currently allowed in Table 9.2.6.3.1 result, for several pipe stands, in stresses significantly exceeding those allowed by building codes and ASCE/SEI 7 Minimum Design Loads for Buildings and Other Structures. In addition, the information currently provided in A.9.2.6.3.1 is technically incorrect, stating that the slenderness ratio is the column length divided by its least radius of gyration \( (l/r) \), implying a “K” factor of 1.0 in the common slenderness ratio formula \( (Kl/r) \). In fact, the value for “K” is 2.1 for a cantilever column.

The slenderness ratio \( (Kl/r) \) is a key factor for design of a column. In this formula, “K” is an effective length factor, “l” is the length of the column (inches) and “r” is the least radius of gyration (inches). The American Institute of Steel Construction (AISC) Manual of Steel Construction Allowable Stress Design 9th Edition, Table C-C2.1 shows axially loaded columns and the theoretical and recommended values of “K.” The loading case that applies to a free-standing pipe stand, cantilevered from the base, where the pipe is not restrained from translation and the top can rotate is Case (e) from that table, with a theoretical value of “K” equal to 2.0 and a recommended value of K=2.1.
Section 9.2.6 has no requirement that the tops of pipe stands be braced in two orthogonal horizontal directions as would be needed to justify a value of 1.0 for “K” in the slenderness ratio formula. There is also no requirement that the pipe stands be limited in their application to looped systems having adequate detailing such that multiple pipe stands act, with the supported pipe, as a pseudo-moment-resisting frame system to limit sway in two orthogonal horizontal directions, thus potentially justifying a “K” factor less than 2.1.

Since Section 9.2.6 allows pipe stands to be used as individual cantilever columns, a worst case value for “K” equal to 2.1 (not 1.0) should be used to develop Table 9.2.6.3.1. In addition, Paragraph 9.2.6.1.2 states (as has always been the case) that pipe stands are to be designed for five times the weight of water-filled pipe plus 250 lbs. and their spacing should not exceed that given in Table 9.2.2.1(a) – which for most cases will be 15 ft. Paragraph 9.2.6.5.2 and its Annex material allow the pipe to be supported up to 1 ft. away from the centerline of the pipe stand. Using the required vertical load at the allowed eccentricity and the correct “K” factor results in significant overstresses of the 1-1/2 inch and 2 inch diameter pipe stands for heights currently allowed in Table 9.2.6.3.1.

Limiting Kl/r to 200 is common in structural design, however, the AISC Manual of Steel Construction (9th edition) states it is a preferable (i.e., not an absolute) requirement. Kl/r=300 is a commonly used limitation for tension members to prevent excessive flexibility. Because the vertical forces used for design of pipe stands are very conservative, and because most pipe stands will support a pipe that is part of a piping system that will usually provide some degree of lateral restraint, a limit on Kl/r of 300 was used to develop revisions to Table 9.2.6.3.1. However, it should be noted that as the height increases, the lateral deflection for even a small horizontal force at the top of a pipe stand that truly acts as an individual cantilever can become large. Using the heights currently allowed in Table 9.2.6.3.1, the horizontal force at the top of the pipe stand needed to cause a deflection of 1 inch ranges from only 16 lbs. (10 foot tall 1-1/2 inch diameter stand) to 52 lbs. (30 foot tall 6 inch diameter stand). Using a Kl/r of 300, the pipe stand horizontal stiffnesses are increased by a factor of about 1.4 to 2.6; using a Kl/r of 200 would increase the stiffnesses by a factor of 4.8 to 9. If drift is a significant concern, a further reduction of the heights might be appropriate.

The revised pipe stand heights were thus determined based on a limitation of Kl/r=300 (which controls in most cases for which a height is specified in the Table 9.2.6.3.1 revision) or based on the height calculated such that the allowable axial stress (Fa) is sufficient to limit the combined axial stress ratio (fa/Fa, i.e., actual axial stress divided by allowable axial stress) plus the bending stress ratio (fb/Fb, i.e., actual bending stress divided by allowable bending stress) to 1.0. Fb used was 28,000 psi as allowed by AISC 360-10, Specification for Structural Steel Buildings when the vertical load was taken as 5 times the weight of the water-filled pipe plus 250 lbs. at a 12 inch eccentricity. Pipe stands were also checked using an Fb of 15,000 psi (as commonly allowed in NFPA 13) when the vertical load was taken as the weight of the water-filled pipe plus 250 lbs. at a 12 inch eccentricity. Where a pipe stand is not allowed to be used to support a particular system pipe diameter, this is due to stress limitations. Additionally, heights of the 1-1/2 inch pipe stands, the 2 inch pipe stands supporting 2-1/2 inch or 3 inch system pipe, and the 4 inch diameter pipe stand supporting up to 8 inch diameter pipe are based on stress limitations.
Pipe Stand Horizontal Support Arms (Table 9.2.6.5.3). Section moduli in the current Table 9.2.6.5.3 were determined based on the weight of the water-filled pipe plus 250 lbs. and thus are not in accordance with Paragraph 9.2.6.1.2, which requires that five times the weight of the water-filled pipe plus 250 lbs. be used.

As discussed above, Paragraph 9.2.6.1.2 states that pipe stands are to be designed for five times the weight of water-filled pipe plus 250 lbs. and their spacing should not exceed that given in Table 9.2.2.1(a) – which for most cases will be 15 ft. (the spacing for 1 inch and 1-1/4 inch pipe is 12 ft. but 15 ft. has been used for simplicity in the table since the effect is small). Paragraph 9.2.6.5.2 and its Annex material allow the pipe to be supported up to 1 ft. away from the centerline of the pipe stand. As part of the pipe stand, the horizontal support arm should be designed for five times the weight of water-filled pipe plus 250 lbs. vs. a bending stress allowable of 28,000 psi as discussed above. Although not explicitly stated, the horizontal support arm bending stresses should also not exceed the usual 15,000 psi allowed in NFPA 13 when the load equals the weight of water-filled pipe plus 250 lbs. This condition controls for some of the smaller pipes.

Emergency Nature:
Paragraph 9.2.6.1.2 states that pipe stands are to be designed for five times the weight of water-filled pipe plus 250 lbs. but the individual cantilever pipe stand heights in the current Table 9.2.6.3.1 and required section moduli for pipe stand horizontal support arms in the current Table 9.2.6.5.3 do not comply with building code stress limitations for these loads. Additionally, the information currently provided in A.9.2.6.3.1 is technically incorrect, implying a “K” factor of 1.0 in the common slenderness ratio formula \((KL/r)\) when, in fact, the correct value for “K” is 2.1 for a cantilever column.

The slenderness factor in Paragraph A.9.2.6.3.1 is demonstrably incorrect for the allowed cantilever column condition and using this annex information may lead users to incorrectly design pipe stands not covered in the table, potentially causing an unsafe condition. Additionally, publication of pipe stand heights currently in Table 9.2.6.3.1 and horizontal support arm section moduli currently in Table 9.2.6.5.3 would create a conflict within the same section of NFPA 13 in which provided tables do not comply with the stated requirements of Paragraph 9.2.6.1.2. This will only serve to confuse users. Since these new tables and the Annex paragraph have not yet been published in NFPA 13, making these changes now will provide consistency within Section 9.2.6, and will prevent several years of confusion and misapplication of the standard.
MEMORANDUM

TO: NFPA Correlating Committee on Automatic Sprinkler Systems  
FROM: Elena Carroll, Project Administrator  
DATE: June 22, 2015  
SUBJ: NFPA 13 Proposed TIA No. 1185 FINAL CC BALLOT RESULTS

No comments were received on this TIA, therefore, according to 5.6(b) in the NFPA Regs, the final results show this TIA HAS achieved the ¾ majority vote needed on both Question 1 (Correlation Issues) and Question 2 (Emergency Nature).

22 Eligible to Vote  
3 Not Returned (Ketner, Kim, Mitchell)

**Correlation Issues:**  
- 0 Abstentions (names, if any)  
- 18 Agree  
- 1 Disagree (Sheppard)

**Emergency Nature:**  
- 0 Abstentions  
- 17 Agree (Lowrey, w/ comments)  
- 2 Disagree (Palenske, Stultz)

There are two criteria necessary to pass ballot [(1) affirmative 3/4 vote and (2) simple majority] with both questions needing to pass ballot in order to recommend that the Standards Council issue this TIA.

1. The number of affirmative votes needed is **15**.  
   \[(22 \text{ eligible to vote} - 3 \text{ not returned} - 0 \text{ abstentions} = 19 \times 0.75 = 14.25)\]

2. In all cases, 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:  
   \[\frac{22 \text{ eligible}}{2} = 11 + 1 = (12)\]

The Regs at 1.6.2.(c) state: An appeal relating to a proposed Tentative Interim Amendment that has been submitted for processing pursuant to Section 5.2 shall be filed no later than 5 days after the notice of the TIA final ballot results are published in accordance with 4.2.6.

Appeal Closing Date for this TIA is **June 27, 2015**.

Attachments
Question 1: I agree that there are no correlation issues in accordance with 3.4.2 and 3.4.3 (copy enclosed) of the NFPA Regs.

__________ 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.

There will be correlating issues going forward for the various water based NFPA standards, as there needs to be a separation of the Hanging & Bracing chapter from NFPA 13 to a stand-alone document to address these issues as well as many others where those existing standards do not address hanging and bracing issues. This will result in an extract process for each of the documents from NFPA 13 and assure a common approach to the subject of hanging and bracing issues for all the affected documents.

____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

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

______ xx____ AGREE ____________ DISAGREE* ____________ ABSTAIN*  

EXPLANATION OF VOTE - Please type or print your comments:

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

In the absence of data elsewhere, the proposed TIA is a proper step to assure that the data is published with the remainder of the Hanging & Bracing information now contained in the current edition of NFPA 13.

____________________________________________________________________
____________________________________________________________________

_J William Sheppard_______________________________
Signature
_J William Sheppard_______________________________
Name (Please Print)
_May 29, 2015 _________________________________
Date

Please return the ballot on or before June 11, 2015.

PLEASE RETURN TO:
CORRELATING COMMITTEE
LETTER BALLOT
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1185

1. To Revise Table 9.2.6.3.1, Section A.9.2.6.3.1, and Table 9.2.6.5.3 of the Proposed 2016 Edition of NFPA 13, Standard for the Installation of Sprinkler Systems

Question 1: I agree that there are no correlation issues in accordance with 3.4.2 and 3.4.3 (copy enclosed) of the NFPA Regs.

_____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 know of any data regarding the failure of pipe stands which would warrant this change being considered emergency in nature. This issue should be submitted through the standard process.

_____________________________________________________________________

Signature
Garner Palenske, P.E
Date
6.4.15

Please return the ballot on or before June 11, 2015.

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

FAX: (617) 984-7110 E-mail: ecarroll@nfpa.org
CORRELATING COMMITTEE
LETTER BALLOT
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1185

1. To Revise Table 9.2.6.3.1, Section A.9.2.6.3.1, and Table 9.2.6.5.3 of the Proposed 2016 Edition of NFPA 13, Standard for the Installation of Sprinkler Systems

Question 1: I agree that there are no correlation issues in accordance with 3.4.2 and 3.4.3 (copy enclosed) of the NFPA Regs.

_____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 simply do not see this issue as meeting the definition of "emergency nature."

_____________________________________________________________________

Signature  Douglas P. Stultz, P.E.
Name (Please Print)  01 June 2015
Date

Please return the ballot on or before June 11, 2015.

PLEASE RETURN TO:
Elena Carroll, Project Administrator
NFPA
1 Batterymarch Park
Quincy, MA 02169  FAX: (617) 984-7110  E-mail: ecarroll@nfpa.org
CORRELATING COMMITTEE
LETTER BALLOT
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1185
1. To Revise Table 9.2.6.3.1, Section A.9.2.6.3.1, and Table 9.2.6.5.3 of the Proposed 2016
Edition of NFPA 13, Standard for the Installation of Sprinkler Systems

Question 1: I agree that there are no correlation issues in accordance with 3.4.2 and 3.4.3 (copy
enclosed) of the NFPA Regs.

___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 agree that its emergency in nature based on the substantiation stating that the
current (2016) language is technical incorrect.

____________________
David Lowrey

Signature

Name (Please Print)

Date

6/2/2015

Please return the ballot on or before June 11, 2015.

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

FAX: (617) 984-7110

E-mail: ecarroll@nfpa.org
MEMORANDUM

TO: NFPA Technical Committee on Hanging and Bracing of Water-Based Fire Protection Systems

FROM: Elena Carroll, Project Administrator

DATE: June 22, 2015

SUBJ: NFPA 13 Proposed TIA No. 1185 FINAL TC BALLOT RESULTS

No comments were received on this TIA, therefore, according to 5.6(a) in the NFPA Regs, the final results show this TIA HAS achieved the ¾ majority vote needed on both Question 1 (Technical Merit) and Question 2 (Emergency Nature).

<table>
<thead>
<tr>
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<th>Not Returned</th>
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</thead>
<tbody>
<tr>
<td>32</td>
<td>4 (Berry, Caputo, Dannaway, Laguna)</td>
</tr>
</tbody>
</table>

**Technical Merit:**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>0</td>
<td>Abstentions</td>
</tr>
<tr>
<td>27</td>
<td>Agree</td>
</tr>
<tr>
<td>1</td>
<td>Disagree (Duggan)</td>
</tr>
</tbody>
</table>

**Emergency Nature:**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Abstentions</td>
</tr>
<tr>
<td>25</td>
<td>Agree (Nieraeth, w/ comments)</td>
</tr>
<tr>
<td>3</td>
<td>Disagree (Duggan, Forsythe, Hebenstreit)</td>
</tr>
</tbody>
</table>

There are two criteria necessary to pass ballot [(1) simple majority (2) affirmative ¾ vote]. Both questions must pass ballot in order to recommend that the Standards Council issue this TIA.

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

\[
\frac{32 \text{ eligible}}{2} + 1 = 16 + 1 = (17) \]

2. The number of affirmative votes needed to satisfy the ¾ requirement is 21.

\[
(32 \text{ eligible to vote} - 4 \text{ not returned} - 0 \text{ abstentions} = 28 \times 0.75 = 21) \]

The Regs at 1.6.2.(c) state: An appeal relating to a proposed Tentative Interim Amendment that has been submitted for processing pursuant to Section 5.2 shall be filed no later than 5 days after the notice of the TIA final ballot results are published in accordance with 4.2.6.

Appeal Closing Date for this TIA is **June 27, 2015**.

Attachment
TECHNICAL COMMITTEE ON HANGING AND BRACING OF WATER BASED FIRE PROTECTION SYSTEMS
LETTER BALLOT ON NFPA 13
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1185

1. To Revise Table 9.2.6.3.1, Section A.9.2.6.3.1, and Table 9.2.6.5.3

Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA Log. 1185.

AGREE  DISAGREE*  ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.

While I agree with the calculation procedures, I think that the assumption of a 12 inch cantilevered arm will be used may be unrealistic. From a practical standpoint it is virtually impossible to U-bolt a horizontal piece of angle iron, channel or strut to a pipe stand and tighten it sufficiently to maintain it in the horizontal position and to keep it from slipping. It is more likely that the sprinkler pipe would be U-bolted directly to the pipe stand, which would be a much shorter arm. So, I think this needs further consideration.

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.

The use of pipe stands to provide vertical support of NFPA-13 sprinkler system piping is an obscure possibility, other than at risers which are covered elsewhere. This is an issue that should be more thoroughly resolved in the next change cycle.

Signature

Daniel C. Duggan
Name (Please Print)

5/19/15
Date

Please return the ballot on or before Wednesday, May 20, 2015.

PLEASE RETURN TO:
Elena Carroll, Project Administrator
NFPA
1 Batterymarch Park
Quincy, MA 02169  FAX: (617) 984-7110  E-mail: ecarroll@nfpa.org
1. To Revise Table 9.2.6.3.1, Section A.9.2.6.3.1, and Table 9.2.6.5.3

Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA Log. 1185.

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.

Based on my review of the documentation, and my lack of experience with pipe stand horizontal support arms, as well as discussion during our teleconference presenting the relative rarity of these specific applications, I do not perceive this issue to be "of an emergency nature requiring prompt action", and therefore believe it should not be the subject of a TIA, but rather processed as a standard proposal during the upcoming cycle, when any technical inconsistencies in these requirements should be addressed.

____________________________________________________________________

Signature

Thomas J. Forsythe
Name (Please Print)

May 18, 2015
Date

Please return the ballot on or before **Wednesday, May 20, 2015**.

**PLEASE RETURN TO:**
Elena Carroll, Project Administrator
NFPA
1 Batterymarch Park
Quincy, MA 02169     FAX: (617) 984-7110     E-mail: ecarroll@nfpa.org
1. To Revise Table 9.2.6.3.1, Section A.9.2.6.3.1, and Table 9.2.6.5.3

**Question 1:** I agree with the TECHNICAL MERITS of the Proposed TIA Log. 1185.

**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.

__ Based on the discussion during the last HBS Conference Call about this TIA, it sounded as if this approach was rarely used for NFPA 13 systems. There was no evidence presented of pipe stands failing under current practice. In addition it sounded like many on the committee felt that this issue needs to be further vetted by a working group to refine the proposal.

_____________________________________________________________________

Signature

Jeff Hebenstreit

Name (Please Print)

05/14/2015

Date

Please return the ballot on or before **Wednesday, May 20, 2015**.

**PLEASE RETURN TO:**

Elena Carroll, Project Administrator

NFPA

1 Batterymarch Park

Quincy, MA 02169

FAX: (617) 984-7110  E-mail: ecarroll@nfpa.org
TECHNICAL COMMITTEE ON HANGING AND BRACING OF WATER-BASED FIRE PROTECTION SYSTEMS
LETTER BALLOT ON NFPA 13
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1185

1. To Revise Table 9.2.6.3.1, Section A.9.2.6.3.1, and Table 9.2.6.5.3

**Question 1:** I agree with the **TECHNICAL MERITS** of the Proposed TIA Log. 1185.

______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.

_We need to provide some type of guidance to the sprinkler contractors._

_____________________________________________________________________

_____________________________________________________________________


 Marco R. Nieraeth  
Signature

 Marco Nieraeth  
Name (Please Print)

 May 13, 2015  
Date

Please return the ballot on or before **Wednesday, May 20, 2015**.

**PLEASE RETURN TO:**  
Elena Carroll, Project Administrator  
NFPA  
1 Batterymarch Park  
Quincy, MA 02169  
FAX: (617) 984-7110  
E-mail: ecarroll@nfpa.org
Item 15-8-19
1. Revise C.2.1 to read as follows:

C.2.1 Minimum Explosive Concentration (MEC).
Specifications available from the manufacturers of coating powders can be used to establish the MEC. If that specification is not available (or if the system is projected for use with a variety of coating powders), a figure of 30 g/m³ (0.015 oz/ft³) can be used. This is considered representative of the lowest MEC to be found among common coating powders. (See Table C.2.1.)

Substantiation:
The MEC value to be used when manufacturer’s information is not available is 30 g/m³. This was in the 2011 edition of NFPA 33 but was inadvertently changed to 15 g/m³ at second draft. The enforceable language in Chapter 15 states the MEC requirements correctly. Section 15.8.1.1 states that if the MEC of the powder has not been established then the concentration of powder in the duct shall be maintained at 50 percent of the MEC (below 15 g/m³) which is half of 30 g/m³. The application of 15 g/m³ would mean the user would have to provide twice the ventilation rate as currently required in the standard in 15.8.1.1.

Related section:
15.8.1.1*
Where nondeposited, air-suspended powder (powder overspray) is conveyed by ductwork to a recovery system, sufficient airflow shall be provided in the ductwork to maintain the powder concentration in the ductwork at not more than 50 percent of the minimum explosive concentration (MEC) of the powder in use. If the MEC of the powder has not been established, then the exhaust duct powder concentration shall be maintained below 15 g/m³ (0.015 oz/ft³).

Emergency Nature:
The NFPA Standard contains a conflict within the NFPA Standard.
MEMORANDUM

TO: NFPA Technical Committee on Finishing Processes
FROM: Kelly Carey, Project Administrator
DATE: May 18, 2015
SUBJ: NFPA 33 Proposed TIA No. 1179 FINAL TC BALLOT RESULTS

According to 5.6(a) in the NFPA Regs, the final results show this TIA HAS achieved the ¾ majority vote needed on both Question 1 (Technical Merit) and Question 2 (Emergency Nature).

26 Eligible to Vote
2 Not Returned (L. Durand, D. Scarbrough)

<table>
<thead>
<tr>
<th>Technical Merit:</th>
<th>Emergency Nature:</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 Abstentions</td>
<td>0 Abstentions</td>
</tr>
<tr>
<td>24 Agree (1 w/ comment: T. Euson)</td>
<td>24 Agree (1 w/ comment: T. Euson)</td>
</tr>
<tr>
<td>0 Disagree</td>
<td>0 Disagree</td>
</tr>
</tbody>
</table>

There are two criteria necessary to pass ballot [(1) simple majority (2) affirmative ¾ vote]. Both questions must pass ballot in order to recommend that the Standards Council issue this TIA.

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

\[
[26 \text{ eligible} \div 2 = 13 + 1 = (14)]
\]

(2) The number of affirmative votes needed to satisfy the ¾ requirement is 18.

\[
(26 \text{ eligible to vote} - 2 \text{ not returned} - 0 \text{ abstentions} = 24 \times 0.75 = 18)
\]

An appeal relating to a proposed Tentative Interim Amendment shall be filed no later than 5 days after the notice of the Technical Committee TIA ballot results are published in accordance with 1.6.2 (c) and 4.2.6. In the case that a Correlating Committee is also being balloted, appeals need to be filed 5 days after the notice of the Correlating Committee TIA ballot results are published.
1. 1. Revise C.2.1 to read as follows:

**C.2.1 Minimum Explosive Concentration (MEC).**
Specifications available from the manufacturers of coating powders can be used to establish the MEC. If that specification is not available (or if the system is projected for use with a variety of coating powders), a figure of $30 \pm 5\text{g/m}^3$ ($30 \pm 5\text{ oz/1000 ft}^3$) can be used. This is considered representative of the lowest MEC to be found among common coating powders. (See Table C.2.1.)

**Question 1:** I agree with the TECHNICAL MERITS of the Proposed TIA Log. 1179.

____ X ______ AGREE _______ DISAGREE* _______ ABSTAIN*

**EXPLANATION OF VOTE** - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.

___Editorial correction to eliminate a direct conflict within the document.____

________________________________________

**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.

________________________________________

___Must be corrected as soon as possible to avoid confusion with users of our ____
__document.________________________________________

______________________________
Signature

__ Tom Euson ____________________________
Name (Please Print)

April 5, 2015 ____________________________
Date

Please return the ballot on or before **Friday, April 17, 2015**.

**PLEASE RETURN TO:**
Kelly Carey, Project Administrator
NFPA, 1 Batterymarch Park, Quincy, MA 02169  **FAX: (617) 984-7110**  **E-mail:** kcarey@nfpa.org
Item 15-8-20
NFPA 59A-Proposed 2016 Edition
Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG)
TIA Log No.: 1187
Reference: Various
Comment Closing Date: June 19, 2015
Submitter: Adnan Ezzarhouni, GTT

1. Add new entry to Subsection 2.3.12 to read as follows:

EN14620-1 through 5, (2006) Design and manufacture of site built, vertical, cylindrical, flat-bottomed, steel tanks for the storage of refrigerated, liquefied gases with operating temperatures between 0 °C and -165 °C PARTS 1 - 5

2. Add new 3.3.4.3.3* and Annex to read as follows (renumber current 3.3.4.3.3 as 3.3.4.3.4):

3.3.4.3.3* Membrane Containment Tank System. A tank system consisting of a thin metal liquid barrier and load-bearing thermal insulation supported by a self-standing outer concrete container jointly forming an integrated composite tank structure which provides liquid and vapor containment during tank operating as well as LNG containment in the event of leakage from the liquid barrier, and where the vapor-containing roof of the outer container is either steel or concrete configured such that the excess vapor caused by a spill of LNG from the liquid barrier will discharge through the relief valves.

A.3.3.4.3.3 A membrane containment tank system comprises a thin metal liquid- and vapor-tight barrier acting against load-bearing thermal insulation and supported by a free-standing outer pre-stressed concrete container. In normal conditions primary liquid containment is afforded by a thin metallic barrier which is structurally supported via load-bearing insulation and an outer pre-stressed concrete container. Under these conditions primary vapor containment is afforded by the thin metallic barrier which is connected to the metallic roof liner. In emergency conditions secondary liquid and vapor containment is afforded by an outer pre-stressed concrete container and metallic roof liner. The outer container must be capable of both containing the liquid product and controlling the vapor resulting from evaporation. In this instance the vapor generated from the leakage is discharged through pressure relief valves located in the roof. Vapor losses due to permeability through the outer pre-stressed concrete are acceptable while containing liquid in the event of leakage from the thin metal barrier and insulation system. The roof of the outer pre-stressed concrete container may be concrete or steel. Significant design issues arise at the monolithic base-to-wall connection due to the mechanical restraint offered by the base. To mitigate these issues, a secondary liquid containment barrier inside the insulation system across the entire bottom and part of the wall in the vicinity of the base-to-wall joint is to be provided to protect and thermally isolate this area from the cold liquid and provide liquid tightness.

3.3.4.3.34* Single Containment Tank System.
A single wall container or a double wall tank system in which only the self-supporting primary or inner container is designed to contain LNG.
3. Revise 5.3.1.1(4) to read as follows:

5.3.1.1 Provisions shall be made to minimize the potential of accidental discharge of LNG at containers, pipelines containing LNG, and other equipment such that a discharge from any of these does not endanger adjoining property or important process equipment and structures or reach waterways. LNG containers shall be provided with one of the following methods to contain any release:

1. An impounding area surrounding the container(s) that is formed by a natural barrier, dike, impounding wall, or combination thereof complying with 5.3.2 and 5.3.3
2. An impounding area formed by a natural barrier, dike, excavation, impounding wall, or combination thereof complying with 5.3.2 and 5.3.3, plus a natural or man-made drainage system surrounding the container(s) that complies with 5.3.2 and 5.3.3
3. Where the container is constructed below or partially below the surrounding grade, an impounding area formed by excavation complying with 5.3.2 and 5.3.3
4. Secondary containment as required for double, or full, or membrane containment tank systems complying with 5.3.2 and 5.3.3.

4. Revise 5.3.2.5* and add Annex to read as follows:

5.3.2.5* Dikes and impounding walls shall meet the following requirements:

1. Dikes, impounding walls, drainage systems, and any penetrations thereof shall be designed to withstand the full hydrostatic head of impounded LNG or flammable refrigerant, the effect of rapid cooling to the temperature of the liquid to be confined, any anticipated fire exposure, and natural forces, such as earthquakes, wind, and rain.
2. Where the outer shell of a double wall tank complies with the requirements of 5.3.1.1, the dike shall be either the outer shell or as specified in 5.3.1.1.

A.5.3.2.5 Section 7.2.1.1 requires compliance with API 625. API 625 paragraph 5.6 requires the selection of storage concept to be based on a risk assessment. API 625 Annex C discusses implications of a release of liquid from the primary liquid container and provides specific discussion related to each containment type. API 625 Annex D provides guidance for selection of storage concepts as part of the risk assessment including external and internal events and hazards to be evaluated. Paragraph D.3.2.2 discusses the possibility of sudden failure of the inner tank and advises “if extra protection from brittle fracture” (or unabated ductile crack propagation) “is desired, the general practice is to increase the primary container toughness.” Available materials meeting the required specifications of API 620 Appendix Q (and this standard) for LNG service are considered to have crack-arrest properties at LNG service temperature and stress levels. Therefore, rapid failure of a steel primary container meeting this standard is not considered credible. In membrane containment tank systems, due to primary membrane specific construction, rapid failure is not considered credible as well.

5. Add new 5.3.2.7 to read as follows:
5.3.2.7 Double, full, and membrane containment tank systems shall be designed and constructed such that in the case of a fire in an adjacent tank, the secondary container shall retain sufficient structural integrity to prevent collapse, which can cause damage to and leakage from the primary container.

6. Renumber 5.3.2.7 and revise to read as follows:

5.3.2.78 Double, full, and membrane containment tank systems shall have no pipe penetrations below the liquid level.

7. Revise 5.3.4.2 and add new 5.3.4.2.1 to read as follows:

5.3.4.2 Double, full, and membrane containment tank systems of greater than 70,000 gal (265 m³) water capacity shall be separated from adjacent LNG storage containers such that a fire in an adjacent single or double containment impoundment or from a design spill will not cause loss of containment from adjacent containers. This shall be accomplished by ensuring that no part of the adjacent storage container roof, walls, or its impoundment structure reaches a temperature at which the strength of the material of the container roof, wall, or its impoundment is reduced to a level where the LNG tank, roof, or impoundment loses its structural integrity….

5.3.4.2.1 The outer concrete container shall be designed for the external fire in accordance with ACI376-11 unless the fire protection measures are provided. The outer tank thermal analysis shall be performed to determine temperature distribution for the heat flux and duration of exposure as specified in the fire risk assessment.

(1) The applicable load components and the ultimate state load factors for the fire load combinations shall be in accordance with ACI376-11 Table 7.3. For membrane tanks an additional liquid pressure load in accordance with ACI376-11 Table 7.2 shall be included.

(2) The design of the outer concrete container shall take into account the following factors:

(a) Reduction in the wall post-tensioning due to the difference in the coefficient thermal expansion of post-tensioning steel and wall concrete at the temperature post-tensioning steel is exposed. The effects of the concrete aggregate type on the concrete coefficient thermal expansion shall be considered;

(b) Reduction in strength and modulus of elasticity of the outer tank concrete, reinforcing and post-tensioning steel due to elevated temperature;

(c) Reduction in the wall post-tensioning due to prestressing steel softening and relaxation at elevated temperature;

(3) Concrete shall be designed to avoid explosive spalling.

8. Revise 7.2.1.1 to read as follows:

7.2.1.1 Storage tank systems shall comply with the requirements of API 625, Tank Systems for Refrigerated Liquefied Gas Storage or, for membrane containment tank systems, EN 14620, and the additional provisions of this chapter. The API 625 risk assessment shall be approved by the AHJ.
9. **Add new 7.2.1.4 and 7.2.1.5 and renumber current 7.2.1.4 to read as follows:**

**7.2.1.4** The metallic membrane, load bearing insulation, and the outer container moisture barrier specific to the membrane tank system shall comply with EN 14620 parts 1-5 for material selection, design, installation, examination, and testing and further requirements of 7.4. All other components of the membrane tank system shall comply with API625, API620, ACI376 and additional requirements in 7.4.

**7.2.1.5** Requirements for openings, internals, roof, and suspended deck shall follow API 625.

**7.2.1.46** Should any conflict exist between the above requirements, the most stringent requirement shall apply.

10. **Revise 7.3.1.2 (A) to read as follows:**

**7.3.1.2** All piping that is a part of an LNG tank system shall comply with requirements in this chapter and requirements within API 625.

(A) Tank system piping shall include all piping internal to the container, within insulation spaces and within void spaces, external piping attached or connected to the container up to the first circumferential external joint of the piping, and external piping serving only tank instrumentation (including tank pressure relief valves). All liquid piping with a source of external line pressure shall be designed for the external line relief valve setting but not less than 50 psi (345 kPa). Double, and full, and membrane containment tank systems shall have no pipe penetrations below the liquid level….

11. **Revise 7.3.3.2 and 7.3.3.2(A) and add new (D) to read as follows:**

**7.3.3.2** The space between the inner container and the outer container shall contain insulation that is compatible with LNG and natural gas and that is noncombustible as installed for normal service and abnormal conditions.

(A) A fire external to the outer tank shall not cause a reduction of the insulation thermal conductivity due to melting or settling to the internal containment system performance due to damage to any component of the insulation systems.

(B) The load-bearing bottom insulation shall be designed and installed so that cracking from thermal and mechanical stresses does not jeopardize the integrity of the container.

(C) Only materials used between the inner and outer tank bottoms (floors) shall not be required to meet the combustibility requirements, where the material and the design of the installation comply with all of the following:

1. The flame spread index of the material shall not exceed 25, and the material shall not support continued progressive combustion in air.
2. The material shall be of such composition that surfaces that would be exposed by cutting through the material on any plane shall have a flame spread index not greater than 25 and shall not support continued progressive combustion.
(3) It shall be shown by test that the combustion properties of the material do not increase significantly as a result of long-term exposure to LNG or natural gas at the anticipated service pressure and temperature.

(4) The materials in the installed condition shall be demonstrated to be capable of being purged of natural gas.

(5) The natural gas remaining after purging shall not be significant and shall not increase the combustibility of the material.

(D) For membrane containment tank systems, the insulation system block shall include a non-foam cover (underneath the primary membrane) and shall include a welding thermal protection system in order to withstand all heat from welding during installation and during maintenance, if any.

12. Add a new 7.4.2.3 to read as follows:

**7.4.2.3** For membrane containment tank systems, weld procedure and production weld testing shall comply with EN14620 part 2 and the following requirements:

**7.4.2.3.1 Qualification of Welders.** All personnel associated with the welding fabrication of the membrane system shall be qualified by the manufacturer per an agreed upon schedule between the purchaser, the AHJ, and the fabricator. All records shall be available for review.

**7.4.2.3.2 Inspection.** 100% of all welding shall be visually inspected for workmanship and conformance to the fabrication requirements. Bead placement and consistency shall be, at a minimum, documented by digital means for review by supervisory personnel.

The personnel performing this visual inspection shall be qualified to an accepted standard for this inspection work.

Upon cooldown of the welds to room temperature, provisions shall be made to perform a penetrant inspection (PT) of at least 5% of each weld type each day. The selection factors include orientation, welding direction, and complexity of welding being performed.

a) All profiles and configurations of welds shall be subjected to this 5% requirement. The selection of this 5% sample shall be agreed upon by the fabricator, customer’s representative, and the AHJ.

b) The acceptance standard for this inspection technique shall be agreed upon by all parties.

c) Any indications require an additional 5% penetrant inspection of the total distance welded by each welder.

Inspection after completion of membrane shall be performed at the completion of the installation of the membrane, and represents the last step prior to the cooldown of the tank to service temperature. After completion of the membrane, a leakage test shall be performed. Leakage shall be determined as agreed upon by the fabricator and customer.

Tracer gas for this leak test shall be in accordance with approved procedure. All areas where leakage exceeds limit shall be repaired per 7.4.2.3.2, the manufacturer’s approved procedure and re-inspected.

In parallel, mechanical stress testing of the welding joints shall be performed by applying 3 cycles from atmospheric pressure to +20 mbarg inside the insulation space, with the pressure maintained, for a minimum time of 30 minutes. Data shall be recorded.

**7.4.2.3.3 Post-Repair Inspection.** Additional tracer gas testing shall be performed if more than 4 leaks per 1,000 m² of membrane are identified.

All repaired areas shall be visually inspected (VT), vacuum box (VB) tested, and dye penetrant (PT) tested.
7.4.2.3.4 Final Global Test and Control During Dismantling Work.
This testing shall be in agreement with the approved test procedure and witnessed by all parties. This represents the final acceptance testing of the completed membrane structure following completion of its installation in the structural outer shell/container.

a) The overall tightness of the membrane shall be determined by establishing a pressure difference between the tank and the insulation space.
b) This pressurization allows gas flow through the membrane representative of potential leaks on the membrane.
c) The potential leak(s) shall be characterized by measuring the oxygen content increase in the primary insulated space as the tank is pressurized with dry air.
d) The primary insulated space shall be regulated slightly above the atmospheric pressure.
e) All test data, all records, documentation, and witness records shall be submitted to all parties for their review and final acceptance.

Daily tightness check/monitoring shall be performed during dismantling work by pulling vacuum inside insulated spaces. Any pressure rise is indicative of a leak and must be reported and correction action taken.

13. Add a new 7.4.4.12 to read as follows:

7.4.4.12 The outer concrete tank analysis and design for the major leak and major leak plus ALE aftershock event shall take into account any damage that may have occurred to the outer concrete tank due to prior events including the SSE earthquake. The outer concrete tank shall be considered as undamaged during the prior SSE event if the following conditions are met:

(1) Tensile stresses in the reinforcing steel do not exceed 90% of the reinforcing steel yield
(2) Maximum concrete compressive stresses do not exceed 85% of the concrete design compressive strength.

Otherwise, the prior damage shall be taken into account in the spill analysis.

14. Add new 7.4.6.5 and Annex to read as follows:

7.4.6.5* Membrane containment tank systems shall be tested in accordance with EN 14620 Part 5 Table 1. The leakage test, as defined in the Note under EN 14620 Part 5 paragraph 4.1.1, shall be performed. Leakage through the membrane to the insulation space during service must be controlled in order to maintain gas concentration level below 30% of the LEL by sweeping the insulated space with N2. If the gas concentration cannot be maintained below 30% LEL the tank must be decommissioned and retested. For purposes of evaluating this level, the flow of purge gas within the annular space shall not be increased above the normal operating rate.

A.7.4.6.5 EN 14620 Part 5 Table 1 requires the outer concrete tank to be hydrostatically tested prior to installing insulation and the membrane. The membrane is leak tested after all welding is completed. A retest is required following repairs to close leaks. An insulation space monitoring system is required by EN 14620 Part 1 paragraph 7.2.1.8 which is intended to identify any leaks of LNG gas or vapor into the space between the membrane and the wall.
15. Add new 7.4.6.6 and 7.4.6.7 to read as follows:

**7.4.6.6** All the membrane system components, including insulation, primary membrane, and the secondary barrier of the thermal protection system, shall be designed in such a way that they can withstand all possible static and dynamic actions throughout the tank lifetime.

**7.4.6.7** Verification of all components of the membrane tank design by experimental data from model tests shall be carried out.

16. Add a new Subsection 7.4.7 to read as follows:

**7.4.7** Additional Requirements for Membrane containment tank system.

**7.4.7.1** A thermal corner protection system functionally identical to the thermal corner protection system for concrete tanks defined in API625 Section 6 shall be provided for the outer concrete tank of the membrane tank system. The thermal corner protection shall protect the outer tank entire bottom and at least lower 16.5 feet (5m) of the wall from thermal shock and shall be liquidtight when it is in contact with LNG and vapor tight in all conditions. The thermal corner protection system shall be permitted to be either metallic or from nonmetallic materials compatible with LNG and shall maintain structural integrity and liquid/gas tightness under all applicable mechanical and thermal loads. The membrane tank supplier shall provide tests independently witnessed and verified by a third party agency clearly demonstrating the leak tightness of all the thermal corner system under spill conditions. Historical tests shall be acceptable provided that construction processes and materials of construction are the same as those proposed. NDE performed on the secondary barrier and NDE acceptance criteria shall ensure that provided tightness is equivalent to the tightness provided by the metallic TCP system of the full containment tank.

**7.4.7.2** The outer concrete tank of the membrane tank system shall meet all requirements of ACI376 for the secondary concrete container including materials, design, construction, inspection, and testing and the additional requirements specified below:

**7.4.7.2.1** The product liquid pressure shall be a design load for the outer concrete tank. Liquid product pressure ULS load factors for operating and abnormal loading conditions shall be in accordance with Table 7.2 of ACI376-11.

**7.4.7.2.2** The outer concrete tank wall and slab-to-wall junction shall be checked for fatigue assuming four full load-unload cycles a week for the expected life of the tank. Performance criteria of ACI376 Appendix C shall apply.

**7.4.7.2.3** The outer concrete tank wall shall resist the specified impact load without perforation and scabbing.
   A) The concrete wall thickness shall be at least 40% greater than the scabbing depth calculated per CEB 187 Section 4.1.2.2.
   B) The concrete wall thickness shall be at least 20% greater than the perforation thickness calculated per CEB 187 Section 4.1.1.1.
   C) The tank shall be designed so that either one of the following is satisfied:
1. The distance between the outer face of the concrete tank measured to the centroid of the pre-stressing tendons shall be greater than the penetration depth calculated as per CEB 187 Section 4.1.2.1 with the following allowances for uncertainty:
   - 20% thicker than the penetration depth when $z > 0.75$
   - 50% thicker than the penetration depth when $\leq 0.75$

2. The tank shall be designed to be able to resist normal operating loads with any one horizontal tendon completely ineffective.

7.4.7.2.4 At a minimum, the outer concrete tank for the membrane tank system shall meet the construction tolerances specified in ACI376. Where more stringent tolerances are required by the membrane and insulation systems, the more stringent tolerances shall be specified by the membrane tank engineer and be met by the tank contractor.

7.4.7.2.5 The outer concrete tank shall be hydrotested prior to membrane and insulation installation following primary container hydrotest requirements of API625 Section 10.

17. Revise the title of Figure 10.7.2(e) to read as follows:

**FIGURE 10.7.2(e) Full and Membrane Containment Container Tank Systems.**

18. Add a (4) to the Atmospheric Cryogenic Tanks section of Table 15.6.1 to read as follows:

<table>
<thead>
<tr>
<th>Atmospheric Cryogenic Tanks</th>
<th>Annual Probability of Failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Instantaneous failure of primary container and outer shell, release of entire contents (single containment tank)</td>
<td>5E-07</td>
</tr>
<tr>
<td>(2) Instantaneous failure of primary container and outer shell, release of entire contents (double containment tank)</td>
<td>1.25E-08</td>
</tr>
<tr>
<td>(3) Instantaneous failure of primary and secondary container, release of entire contents (full containment tank)</td>
<td>1E-08</td>
</tr>
<tr>
<td>(4) Instantaneous failure of primary and secondary container, release of entire contents (membrane tank)</td>
<td>1E-08</td>
</tr>
</tbody>
</table>

19. Revise B.3.4 to read as follows:

**B.3.4** The impounding system must, as a minimum, be designed to withstand the SSE level of loading while empty (or while full if a membrane containment tank system) and the ALE level of loading while
holding the volume, \( V \), as specified in 7.4.4.7. The rationale is that should the LNG container fail following an SSE, the impounding system must remain intact and be able to contain the contents of the LNG container when subjected to an aftershock.

**Substantiation:**

In terms of technical substantiation, membrane containment system tank is a full integrity system. This means the performance of the tank system shall be similar to what is required of a full containment system:

- Able to store LNG and natural gas inside the tank in all normal operating conditions.
- Able to retain LNG and natural gas inside the tank, in all abnormal design conditions (seismic, release of the LNG to the secondary container, external & internal hazards, etc.)

In order to do so, all the safety and performance requirements for a full containment shall be also applicable to membrane containment system.

LNG tank storage has to comply with other tank design codes. Currently, NFPA59A refers to API625 for LNG tank overall design, ACI376 for civil tank design and API620 for mechanical design. Membrane containment tank systems are fully addressed in EN14520 and partially in ACI376. Relevant references to these standards have to be made in the proposed standards. Currently, ACI376 does not fully include the membrane containment system, so additional requirements have been added to close the gap. For membrane components exclusive to the technology, the language refers to EN14620, but additional prescriptive requirements are added as agreed within the task group, in order to be more conservative for membrane tanks in a first release.

Finally, all components in membrane containment tank systems which are similar to other systems (roof, suspended deck, etc.) will be referred to the same American standard.

**Emergency Nature:** During March 2014 NFPA59A meeting, public inputs were reviewed. The Public Input No. 50-NFPA 59A-2013 put alert on Membrane containment tank system, which was addressed on the Definition clause only. During the meeting, TC agreed to remove the Membrane definition. However, in order not to send the wrong signal to the LNG industry (such as the technology is not allowed), the technical committee decided to create, on an urgent basis, a subcommittee to prepare wording for inclusion of a full treatment of membrane containment tank for issuance as a TIA coincidently with the 2016 version. This subcommittee has now completed its work and agreed wording is proposed as a TIA. Acceptance of this TIA on an emergency basis is consistent with the following bases as prescribed in the standard:

(f) The proposed TIA intends to correct a circumstance in which the revised NFPA Standard has resulted in an adverse impact on a product or method that was inadvertently overlooked in the total revision process or was without adequate technical (safety) justification for the action. In the absence of a TIA (expected to be released concurrently with 2016 edition), membrane containment systems will not be in NFPA59A 2016 edition and will be deferred until the next
revision in 2018 (or 2019). From a practical standpoint, the absence of a TIA will restrict competition in an important timeframe when LNG as fuel, particularly in marine applications, is driving the development of LNG distribution and delivery systems. Proponents who are seeking options are facing a significant barrier in terms of regulatory uncertain without specific treatment of membrane tanks in NFPA 59A.

Moreover, the timeframe for project development is such that developers cannot practically consider membrane alternatives without using European Norms, Canadian or other standards for references to membrane tanks.
MEMORANDUM

TO:          NFPA Technical Committee on Liquefied Natural Gas
FROM:        Kimberly Shea
DATE:        July 1, 2015
SUBJ:        NFPA 59A Proposed TIA No. 1187 FINAL TC BALLOT RESULTS

There were NO changes received during the circulation of public comments. According to 5.5(a) in the NFPA Regs, the final results show this TIA HAS achieved the ¾ majority vote needed on both Question 1 (Technical Merit) and Question 2 (Emergency Nature).

29 Eligible to Vote
8 Not Returned (Butler, DelNogal, Gaughan, Helm, Humes, Nicotra, Raj, Sawchuk)

<table>
<thead>
<tr>
<th>Technical Merit:</th>
<th>Emergency Nature:</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 Abstentions</td>
<td>1 Abstentions Kohout</td>
</tr>
<tr>
<td>17 Agree (w/comment Legatos, Micciche)</td>
<td>15 Agree</td>
</tr>
<tr>
<td>4 Disagree (Blanchard, Brightwell, Kohout, Ritz)</td>
<td>5 Disagree (Blanchard, Brightwell, Gieskes, Micciche, Ritz)</td>
</tr>
</tbody>
</table>

There are two criteria necessary to pass ballot [(1) simple majority (2) affirmative ¾ vote]. Both questions must to pass ballot in order to recommend that the Standards Council issues this TIA.

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

\[
29 \text{ eligible} \div 2 = 14.5 = 15
\]

(2) The number of affirmative votes needed to satisfy the ¾ requirement is:
  Technical Merit: 29 eligible to vote - 8 not returned - 0 abstentions = 21× 0.75 = 15.75 = 16
  Emergency Nature: 29 eligible to vote - 8 not returned - 1 abstentions = 20× 0.75 = 15

An appeal relating to a proposed Tentative Interim Amendment shall be filed no later than 5 days after the notice of the Technical Committee TIA ballot results are published in accordance with 1.6.2 (c) and 4.2.6. In the case that a Correlating Committee is also being balloted, appeals need to filed 5 days after the notice of the Correlating Committee TIA ballot results are published.

Final ballot comments are attached for your review. Ballots received from alternate members are not included, unless the ballot from the principal member was not received.

Attachment
Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA Log No. 1187

_____ AGREE  X _____ DISAGREE*  _____ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.
I was an active member of the task group that wrote the proposed changes in this TIA. I feel the task group did a thorough job of writing provisions which are consistent with provisions for other tank types. I also feel the provisions proposed address gaps in other industry standards which are difficult to identify when establishing equivalency with the 59A standard. The work done by the task group is therefore valuable for identifying risks for a project and for use in evaluating equivalency. However, I do not feel the provisions are ready to be fully adopted as part of standard 59A for the following reasons:
1) The probability of failure in Table 15.6.1 for instantaneous failure of primary and secondary containment is NOT correct for membrane tanks. While the membrane tank type can be designed to have the same risk level as full containment type tanks for any one individual load case to satisfy liquid containment, there is no lateral load carrying redundancy in the membrane tank concept. Thus the risk cannot be the same for the simultaneous loss of containment. I reviewed several risk assessments comparing membrane and full containment type tanks and did not find this risk in the evaluation.
2) Two changes drafted by the task group (for paragraphs 7.4.4.6 (3)(c) and 7.4.4.7) were inadvertently left out of the TIA. These changes are important.

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.

The basis presented is not persuasive. Membrane tanks are currently allowed under clause 1.3 of the standard (equivalency). Removal of the old definition does not change this.

Pass or Fail, the publication of this TIA for this vote provides a basis which aids in the evaluation of equivalency until provisions can be adopted through the full standard revision process.

Signature  
John Blanchard

Name (Please Print)  
John Blanchard

May 26, 2015
SUPPLEMENTAL AGENDA
STANDARDS COUNCIL MEETING
AUGUST 17-19, 2015

QUESTION 1: I agree with the TECHNICAL MERITS of the Proposed TIA Log No. 1187

__________ AGREE  __________ DISAGREE*  __________ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.
Based on comments by other TC members and one of the TIA task force members, I agree
the TC needs more time to adequately consider the full impact of these changes. I agree in
principle with improving this area of the code but I'm concerned that premature adoption
of these changes could result in unintended consequences that need to be dealt with in
future revisions.

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.
The need to include these changes in the current revision is not a compelling reason for
emergency nature. Therefore, there is time available for the task force to complete its
work and present the results for consideration by the entire TC before finalizing the TIA.

Signature

Jeff Brightwell
Name (Please Print)

6/1/15
Date

Please return the ballot on or before Wednesday, June 3, 2015 at 11:59 PM Eastern.

PLEASE RETURN TO:
Colleen Kelly, Project Administrator
NFPA
1 Batterymarch Park
Quincy, MA 02169  FAX: (617) 770-0700  E-mail: ckelly@nfpa.org
TECHNICAL COMMITTEE LETTER BALLOT
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1187
Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG)

Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA Log No. 1187

   X AGREE          DISAGREE*          ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

________________________________________________________________________
________________________________________________________________________

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 type of change is related to adding in another tank type – not fixing a critical error

Signature
Constantyn Gieskes
Name (Please Print)

5/19/15
Date

Please return the ballot on or before Tuesday, May 26, 2015 at 11:59 PM Eastern.

PLEASE RETURN TO:
Colleen Kelly, Project Administrator
NFPA
1 Batterymarch Park
Quincy, MA 02169

FAX: (617) 770-0700      E-mail: ckelly@nfpa.org
Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA Log No. 1187

__________ AGREE __________ DISAGREE* ____________ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.
While we fully support the efforts of creating a standard for membrane tanks and providing similar performance requirements to full containment tanks, there is some question as to whether the proposed changes and additions includes all of the discussed changes and additions during the subcommittee meetings that would be relevant to equitable performance requirements of the membrane tank system. In addition, we feel as though the substantial changes would benefit from a public review and comment period to ensure no other requirements would be needed or changed.

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.
It is not clear if the lack of requirements in NFPA 59A would be a detriment to the proposal of membrane tanks as there are equivalency clauses in NFPA 59A and alternative approval methods in most federal regulations that could be invoked. Moreover, inclusion into NFPA 59A would need to be incorporated in the federal regulations before it could be used.

/s/ Andrew Kohout
Signature
Andrew Kohout
Name (Please Print)

May 21, 2015
Date

Please return the ballot on or before Tuesday, May 26, 2015 at 11:59 PM Eastern.

PLEASE RETURN TO:
Colleen Kelly, Project Administrator
NFPA
1 Batterymarch Park
Quincy, MA 02169

FAX: (617) 770-0700 E-mail: ckelly@nfpa.org
TECHNICAL COMMITTEE LETTER BALLOT
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1187
Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG)

Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA Log No. 1187

______ AGREE  __________ DISAGREE*  __________ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

* An explanation must accompany a disagreement or abstaining position.
ON the technical merits, I support adopting changes that will allow membrane technology to compete with other options, but there are still some technical definitions to work out - not the least of which is how to classify a system that offers dual liquid containment but not fully redundant structural systems.

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 do not believe that the GTT change proposal meets the NFPA criteria for a tentative interim amendment of emergency nature.

Signature

[Signature]

Name (Please Print)

[Name]

Date

08/07/15

Please return the ballot on or before Tuesday, May 26, 2015 at 11:59 PM Eastern.

PLEASE RETURN TO:
Colette Kelly, Project Administrator
NFPA
1 Batterymarch Park
Quincy, MA 02169

FAX: (617) 770-0700

E-mail: ckelly@nfpa.org
TECHNICAL COMMITTEE LETTER BALLOT
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1187
Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG)

Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA Log No. 1187

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

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position. This is a significant TIA bringing in membrane tanks into NFPA 59A. While I can agree with the intent of the TIA and the need to recognize membrane tanks in NFPA 59A, I am concerned because of the amount of new content being added that without additional vetting within the full TC that there is a risk that gaps may exist. This effort was discussed during the Second Draft Technical Committee meeting in March of 2015 but the task group was not fully prepared to present the details at that time. Additionally mentioned at that Second Draft meeting was that the membrane tank task group was planned to finalize their details and a conference call was to be scheduled to introduce the new material to the full TC well ahead of any TIA. That call was not provided. It is for these reasons I vote to disagree with this TIA.

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. The fact that the task groups’ work in developing the requirements for membrane tanks was not completed within the guidelines of the revision making process should not be the rationale for making a TIA of an emergency nature. Additionally, if a proponent of membrane tank systems wishes to construct such a tank systems, it can still be proposed to the applicable AHJ’s for their consideration.

_______________________________
Signature

_______________________________
_Name_ (Please Print)

_______________________________
_Date_

Please return the ballot on or before **Tuesday, May 26, 2015 at 11:59 PM Eastern.**

PLEASE RETURN TO:
Colleen Kelly, Project Administrator
NFPA
1 Batterymarch Park
Quincy, MA 02169

**FAX: (617) 770-0700  E-mail: ckelley@nfpa.org**
TECHNICAL COMMITTEE LETTER BALLOT
PROPOSED TENTATIVE INTERIM AMENDMENT LOG NO. 1187
Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG)

Question 1: I agree with the TECHNICAL MERITS of the Proposed TIA Log No. 1187

☑️ AGREE ☐ DISAGREE* ☐ ABSTAIN*

EXPLANATION OF VOTE - Please type or print your comments:

*An explanation must accompany a disagreement or abstaining position.

NOTE: Agree subject to the attached comments

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.


\[Signature\]

Nicholas A. Legatos
Name (Please Print)

May 26, 2015
Date

Please return the ballot on or before Tuesday, May 26, 2015 at 11:59 PM Eastern.

PLEASE RETURN TO:
Colleen Kelly, Project Administrator
NFPA
1 Batterymarch Park
Quincy, MA 02169  FAX: (617) 770-0700  E-mail: ekelly@nfpa.org
1. Add new entries to Subsection 2.3.12 to read as follows:

EN14620-1 through 5, (2006) Design and manufacture of site built, vertical, cylindrical, flat-bottomed, steel tanks for the storage of refrigerated, liquefied gases with operating temperatures between 0 °C and -165 °C PARTS 1 – 5


2. Add new 3.3.4.3.3* and Annex to read as follows (renumber current 3.3.4.3.3 as 3.3.4.3.4):

3.3.4.3.3* Membrane Containment Tank System. A tank system consisting of a thin metal liquid barrier and load-bearing thermal insulation supported by a self-standing outer concrete container jointly forming an integrated composite tank structure which provides liquid and vapor containment during tank operating as well as LNG containment in the event of leakage from the liquid barrier, and where the vapor-containing roof of the outer container is either steel or concrete configured such that the excess vapor caused by a spill of LNG from the liquid barrier – or from any other excess vapor generation - will discharge through the relief valves.

Substantiation: For example, excess vapor generated during roll-over.

A.3.3.4.3.3 A membrane containment tank system comprises a thin metal liquid-tight and vapor-tight barrier acting resting (suggested editorial comment) against load-bearing thermal insulation and supported by a free-standing outer pre-stressed concrete container. The thin metal barrier may be internally vapor-tight or may be open to the insulation space in the same manner as a single, double or full containment system.

Substantiation: There are in service membrane-type LNG storage tanks where the primary membrane container is liquid tight but is open at the top to the insulation space in the same manner as a single, double or full containment system.

In normal conditions, primary liquid containment is afforded by a thin metallic barrier which is structurally supported via load-bearing insulation and-on (suggested editorial comment) an outer pre-stressed concrete container. Under these conditions, primary vapor containment is afforded by the thin metallic barrier which is connected to the metallic roof liner. In emergency conditions secondary liquid and vapor containment is afforded by an outer pre-stressed concrete container and metallic roof liner. The outer container must be capable of both containing the liquid product and controlling the vapor resulting from evaporation. In this instance the vapor generated from the leakage is discharged through pressure relief valves located in the roof. Vapor losses due to permeability through the outer pre-stressed concrete are acceptable while the wall is containing (suggested editorial comment) liquid in the event of leakage from the thin metal barrier and insulation system.
The roof of the outer pre-stressed concrete container may be concrete or steel. In the case of affixed-base outer wall rigidly connected to and monolithic with the foundation base, significant design issues arise at the monolithic base-to-wall connection due to the mechanical restraint offered by the base. To mitigate these issues, a secondary liquid containment barrier inside the insulation system across the entire bottom and part of the wall in the vicinity of the base-to-wall joint is to be provided to protect and thermally isolate this area from the cold liquid and provide liquid tightness.

Substantiation: To account for the fact that there are also other outer concrete wall types — such as the free-base wall — which do not experience the kind of mechanical-restraint issues cited above.

3.3.4.3.34* Single Containment Tank System.

A single wall container or a double wall tank system in which only the self-supporting primary or inner container is designed to contain LNG.

3. Revise 5.3.1.1(4) to read as follows:

5.3.1.1 Provisions shall be made to minimize the potential of accidental discharge of LNG at containers, pipelines containing LNG, and other equipment such that a discharge from any of these does not endanger adjoining property or important process equipment and structures or reach waterways. LNG containers shall be provided with one of the following methods to contain any release:

(1) An impounding area surrounding the container(s) that is formed by a natural barrier, dike, impounding wall, or combination thereof complying with 5.3.2 and 5.3.3

(2) An impounding area formed by a natural barrier, dike, excavation, impounding wall, or combination thereof complying with 5.3.2 and 5.3.3, plus a natural or man-made drainage system surrounding the container(s) that complies with 5.3.2 and 5.3.3

(3) Where the container is constructed below or partially below the surrounding grade, an impounding area formed by excavation complying with 5.3.2 and 5.3.3

(4) Secondary containment as required for double, or full, or membrane containment tank systems complying with 5.3.2 and 5.3.3.

4. Revise 5.3.2.5* and the Annex to read as follows:

5.3.2.5* Dikes and impounding walls shall meet the following requirements:

(1) Dikes, impounding walls, drainage systems, and any penetrations thereof shall be designed to withstand the full hydrostatic head of impounded LNG or flammable refrigerant, the effect of rapid cooling to the temperature of the liquid to be confined, any anticipated fire exposure, and natural forces, such as earthquakes, wind, and rain.

(2) Where the outer shell of a double wall tank complies with the requirements of 5.3.1.1, the dike shall be either the outer shell or as specified in 5.3.1.1.

A.5.3.2.5 Section 7.2.1.1 requires compliance with API 625. API 625 paragraph 5.6 requires the selection of storage concept to be based on a risk assessment. API 625 Annex C discusses implications of a release of liquid from the primary liquid container and provides specific discussion related to each containment type. API 625 Annex D provides guidance for selection of storage concepts as part of the risk assessment including external and internal events and hazards to be evaluated. Paragraph D.3.2.2 discusses the possibility of sudden failure of the inner tank and advises "if extra protection from brittle
fracture” (or unabated ductile crack propagation) “is desired, the general practice is to increase the” primary container toughness. Available materials meeting the required specifications of API 620 Appendix Q (and this standard) for LNG service are considered to have crack-arrest properties at LNG service temperature and stress levels. Therefore, rapid failure of a steel primary container meeting this standard is not considered credible. In membrane containment tank systems, due to primary-membrane-specific construction, where the materials are considered to possess crack-arresting properties, (suggested editorial comment) rapid failure is not considered credible as well.
5.3.2.7 Double, and full, and membrane containment tank systems shall be designed and constructed such that in the case of a fire in an adjacent tank, the secondary container shall retain sufficient structural integrity to prevent collapse, which can cause damage to and leakage from the primary container.

6. Renumber 5.3.2.7 and revise to read as follows:

5.3.2.78 Double, and full, and membrane containment tank systems shall have no pipe penetrations below the liquid level.

7. Revise 5.3.4.2 and add new 5.3.4.2.1 to read as follows:

5.3.4.2 Double, full, and double membrane containment tank systems of greater than 70,000 gal (265 m³) water capacity shall be separated from adjacent LNG storage containers such that a fire in an adjacent single or double containment impoundment or from a design spill will not cause loss of containment from adjacent containers. This shall be accomplished by ensuring that no part of the adjacent storage container roof, walls, or its impoundment structure reaches a temperature at which the strength of the material of the container roof, wall, or its impoundment is reduced to a level where the LNG tank, roof, or impoundment loses its structural integrity...

5.3.4.2.1 The outer concrete container shall be designed for the external fire in accordance with ACI 376 unless the fire protection measures are provided. The outer tank thermal analysis shall be performed to determine temperature distribution for the heat flux and duration of exposure as specified in the fire risk assessment.

(1) The applicable load components and the ultimate state load factors for the fire load combinations shall be in accordance with ACI 376 Table 7.3. For membrane tanks an additional liquid pressure load in accordance with ACI 376 Table 7.2 shall be included.

COMMENT: Since Table 7.2 of ACI 376 pertains to an inner primary concrete tank, referring to this Table in connection with the outer wall design might be confusing. A more logical approach would be to revise Table 7.3 of ACI 376 (which applies to secondary concrete tanks) to introduce loading provisions for the membrane tank system - including liquid pressure and (where applicable) vapor pressure. Such a proposal has already been submitted to ACI 376 for the next revision cycle of that code.

(2) The design of the outer concrete container shall take into account the following factors:
   (a) Reduction in the wall post-tensioning due to the difference in the coefficient thermal expansion of post-tensioning steel and wall concrete at the temperature to which the post-tensioning steel is exposed (suggested editorial comment). The effects of the concrete aggregate type on the concrete coefficient thermal expansion shall be considered;
   (b) Reduction in strength and modulus of elasticity of the outer tank concrete, reinforcing and post-tensioning steel due to elevated temperature;
   (c) Reduction in the wall post-tensioning due to prestressing steel softening and relaxation at elevated temperature;
   (d) Concrete shall be designed to avoid explosive spalling.
8. Revise 7.2.1.1 to read as follows:

**7.2.1.1** Refrigerated Liquefied Gas Storage or, for membrane containment tank systems, EN 14620, and the additional provisions of this chapter. The API 625 risk assessment shall be approved by the AHJ.

9. Add new 7.2.1.4 and 7.2.1.5 and renumber current 7.2.1.4 to read as follows:

**7.2.1.4** The metallic membrane, load bearing insulation, and the outer container moisture barrier specific to the membrane tank system shall comply with EN 14620 parts 1-5 for material selection, design, installation, examination, and testing and further requirements of 7.4. All other components of the membrane tank system shall comply with API625, API620, ACI376 and additional requirements in 7.4.

**7.2.1.5** Requirements for openings, internals, roof, and suspended deck shall follow API 625.

**7.2.1.46** Should any conflict exist between the above requirements, the most stringent requirement shall apply.

10. Revise 7.3.1.2 (A) to read as follows:

**7.3.1.2** All piping that is a part of an LNG tank system shall comply with requirements in this chapter and requirements within API 625.

(A) Tank system piping shall include all piping internal to the container, within insulation spaces and within void spaces, external piping attached or connected to the container up to the first circumferential external joint of the piping, and external piping serving only tank instrumentation (including tank pressure relief valves). All liquid piping with a source of external line pressure shall be designed for the external line relief valve setting but not less than 50 psi (345 kPa). Double, and full, and membrane containment tank systems shall have no pipe penetrations below the liquid level….

11. Revise 7.3.3.2 and 7.3.3.2(A) and add new (D) to read as follows:

**7.3.3.2** The space between the inner container and the outer container shall contain insulation that is compatible with LNG and natural gas and that is noncombustible as installed for normal service and abnormal conditions.

(A) A fire external to the outer tank shall not cause a reduction of the insulation thermal conductivity due to melting or settling to the internal containment system performance due to damage to any component of the insulation systems.

(B) The load-bearing bottom insulation shall be designed and installed so that cracking from thermal and mechanical stresses does not jeopardize the integrity of the container.

(C) Only materials used between the inner and outer tank bottoms (floors) shall not be required to meet the combustibility requirements, where the material and the design of the installation comply with all of the following:

(1) The flame spread index of the material shall not exceed 25, and the material shall not support continued progressive combustion in air.

(2) The material shall be of such composition that surfaces that would be exposed by cutting through the material on any plane shall have a flame spread index not greater than 25 and shall not support continued progressive combustion.
(3) It shall be shown by test that the combustion properties of the material do not increase significantly as a result of long-term exposure to LNG or natural gas at the anticipated service pressure and temperature.

(4) The materials in the installed condition shall be demonstrated to be capable of being purged of natural gas.

(5) The natural gas remaining after purging shall not be significant and shall not increase the combustibility of the material.

(D) For membrane containment tank systems, the insulation system block shall include a non-foam cover (underneath the primary membrane) and shall include a welding thermal protection system in order to withstand all heat from welding during installation and during maintenance, if any.

12. Add a new 7.4.2.3 to read as follows:

7.4.2.3 For membrane containment tank systems, weld procedure and production weld testing shall comply with EN14620 part 2 and the following requirements:

7.4.2.3.1 Qualification of Welders. All personnel associated with the welding fabrication of the membrane system shall be qualified by the manufacturer per an agreed upon schedule between the purchaser, the AHJ, and the fabricator. All records shall be available for review.

7.4.2.3.2 Inspection. 100% of all welding shall be visually inspected for workmanship and conformance to the fabrication requirements. Bead placement and consistency shall be, at a minimum, documented by digital means for review by supervisory personnel.

The personnel performing this visual inspection shall be qualified to an accepted standard for this inspection work.

Upon cooldown of the welds to room temperature, provisions shall be made to perform a penetrant inspection (PT) of at least 5% of each weld type each day. The selection factors include orientation, welding direction, and complexity of welding being performed.

a) All profiles and configurations of welds shall be subjected to this 5% requirement. The selection of this 5% sample shall be agreed upon by the fabricator, customer’s representative, and the AHJ.

b) The acceptance standard for this inspection technique shall be agreed upon by all parties.

c) Any indications require an additional 5% penetrant inspection of the total distance welded by each welder.

Inspection after completion of membrane shall be performed at the completion of the installation of the membrane, and represents the last step prior to the cooldown of the tank to service temperature. After completion of the membrane, a leakage test shall be performed. Leakage shall be determined as agreed upon by the fabricator and customer.

Tracer gas for this leak test shall be in accordance with approved procedure. All areas where leakage exceeds limit shall be repaired per 7.4.2.3.2, the manufacturer’s approved procedure and re-inspected.

In parallel, mechanical stress testing of the welding joints shall be performed by applying 3 cycles from atmospheric pressure to +20 mbarg inside the insulation space, with the pressure maintained, for a minimum time of 30 minutes. Data shall be recorded.

7.4.2.3.3 Post-Repair Inspection. Additional tracer gas testing shall be performed if more than 4 leaks per 1,000 m² of membrane are identified.

All repaired areas shall be visually inspected (VT), vacuum box (VB) tested, and dye penetrant (PT) tested.

7.4.2.3.4 Final Global Test and Control During Dismantling Work.

This testing shall be in agreement with the approved test procedure and witnessed by all parties. This represents the final acceptance testing of the completed membrane structure following completion of its installation in the structural outer shell / container.
a) The overall tightness of the membrane shall be determined by establishing a pressure difference between the tank and the insulation space.
b) This pressurization allows gas flow through the membrane representative of potential leaks on the membrane.
c) The potential leak(s) shall be characterized by measuring the oxygen content increase in the primary insulated space as the tank is pressurized with dry air.
d) The primary insulated space shall be regulated slightly above the atmospheric pressure.
e) All test data, all records, documentation, and witness records shall be submitted to all parties for their review and final acceptance.

Daily tightness check / monitoring shall be performed during dismantling work by pulling vacuum inside insulated spaces. Any pressure rise is indicative of a leak and must be reported and correction action taken.

13. Add a new 7.4.4.12 to read as follows:

7.4.4.12 The outer concrete tank analysis and design for the major leak and major leak plus ALE aftershock event shall take into account any damage that may have occurred to the outer concrete tank due to prior events including the SSE earthquake. The outer concrete tank shall be considered as undamaged during the prior SSE event if the following conditions are met:

(1) Tensile stresses in the reinforcing steel do not exceed 90% of the reinforcing steel yield
(2) Maximum concrete compressive stresses do not exceed 85% of the concrete design compressive strength.

Otherwise, the prior damage shall be taken into account in the spill analysis.

14. Add new 7.4.6.5 and Annex to read as follows:

7.4.6.5* In the case of a vapor-tight inner container system, the membrane containment tank systems shall be tested in accordance with EN 14620 Part 5 Table 1. The leakage test, as defined in the Note under EN 14620 Part 5 paragraph 4.1.1, shall be performed. Leakage through the membrane to the insulation space during service must be controlled in order to maintain gas concentration level below 30% of the LEL by sweeping the insulated space with N2. If the gas concentration cannot be maintained below 30% LEL the tank must be decommissioned and retested. For purposes of evaluating this level, the flow of purge gas within the annular space shall not be increased above the normal operating rate.

Substantiation: To account for the fact that there are in service membrane-type LNG storage tanks where the primary membrane container is liquid tight but is open at the top to the insulation space in the same manner as a single, double or full containment (see also the same as for Article A.3.3.4.3.3)

A.7.4.6.5 EN 14620 Part 5 Table 1 requires the outer concrete tank to be hydrostatically tested prior to installing insulation and the membrane. The membrane is leak tested after all welding is completed. A retest is required following repairs to close leaks. An insulation space monitoring system is required by EN 14620 Part 1 paragraph 7.2.1.8 which is intended to identify any leaks of LNG gas or vapor into the space between the membrane and the wall.
15. Add new 7.4.6.6 and 7.4.6.7 to read as follows:

7.4.6.6 All the membrane system components, including insulation, primary membrane, and the secondary barrier of the thermal protection system, shall be designed in such a way that they can withstand all possible static and dynamic actions throughout the tank lifetime.
7.4.6.7 Verification of all components of the membrane containment tank system design by experimental data from model tests shall be carried out.

16. Add a new Subsection 7.4.7 to read as follows:

7.4.7 Additional Requirements for Membrane containment tank system.
7.4.7.1 In the case of an outer concrete wall rigidly connected toand monolithic with the foundation base, thermal corner protection system functionally identical to the thermal corner protection system for concrete tanks defined in API625 Section 6 shall be provided for the outer concrete tank of the membrane tank system. The thermal corner protection shall protect the outer tank entire bottom and at least lower 16.5 feet (5m) of the wall from thermal shock and shall be liquidtight when it is in contact with LNG and vaportight in all conditions. The thermal corner protection system shall be permitted to be either metallic or from nonmetallic materials compatible with LNG and shall maintain structural integrity and liquid/gas tightness under all applicable mechanical and thermal loads. The membrane containment tank system supplier shall provide tests independently witnessed and verified by a third party agency clearly demonstrating the leak tightness of all the thermal corner system under spill conditions. Historical tests shall be acceptable provided that construction processes and materials of construction are the same as those proposed. Nondestructive examination (NDE) performed on the secondary barrier and NDE acceptance criteria shall ensure that provided tightness is equivalent to the tightness provided by the metallic thermal corner protection system of the full containment tank system.

Substantiation: To account for the fact that there are other outer concrete wall types – such as the free-base wall – which do not require a thermal corner protection system.

7.4.7.2 The outer concrete container of the membrane containment tank system shall meet all requirements of ACI376 for the secondary concrete container including materials, design, construction, inspection, and testing and the additional requirements specified below:
7.4.7.2.1 In addition, the outer concrete container shall be designed for the product liquid pressure shall be a design load for the outer concrete tank. Liquid product pressure ultimate limit state (ULS) load factors for operating and abnormal loading conditions shall be in accordance with Table 7.2 of ACI376.

COMMENT: Please see the comment under Article 5.3.4.2.1 above.

7.4.7.2.2 The outer concrete container wall and - in the case of an outer concrete wall rigidly connected to and monolithic with the foundation base – the slab-to-wall junction shall be checked for fatigue, assuming four full load-unload cycles a week for the expected life of the tank. Performance criteria of ACI376 Appendix C shall apply.

Substantiation: To account for the fact that there are other outer concrete wall types – specifically the free-base wall – which do not use a rigid wall-to-slab connection.
7.4.7.2.3 The outer concrete container wall shall resist the specified impact load without perforation and scabbing.

A) The concrete wall thickness shall be at least 40% greater than the scabbing depth calculated per CEB 187 Section 4.1.2.2.
B) The concrete wall thickness shall be at least 20% greater than the perforation thickness calculated per CEB 187 Section 4.1.1.1.
C) The tank concrete wall (suggested editorial comment) shall be designed so that either one of the following is satisfied:

1. The distance between the outer face of the concrete container measured to the centroid of the pre-stressing tendons shall be greater than the penetration depth calculated as per CEB 187 Section 4.1.2.1 with the following allowances for uncertainty:
   - 20 % thicker than the penetration depth when \( z > 0.75 \)
   - 50% thicker than the penetration depth when \( <= 0.75 \).

2. The tank concrete wall (suggested editorial comment) shall be designed to be able to resist normal operating loads with any one horizontal tendon even when the affected horizontal prestressing tendons, strands or wires become completely ineffective.

**Substantiation:** (a) To acknowledge that there are horizontal prestressing systems other than tendons.
   (b) To account for the fact that there may be more than one prestressing element damaged and still maintain the wall’s ability to resist the normal operating loads.

7.4.7.2.4 At a minimum, the outer concrete container for the membrane tank system shall meet the construction tolerances specified in ACI376. Where more stringent tolerances are required by the membrane and insulation systems, the more stringent tolerances shall be specified by the membrane tank engineer and be met by the tank contractor.

7.4.7.2.5 The outer concrete container shall be hydrotested prior to membrane and insulation installation following primary container hydrotest requirements of API625 Section 10.

**COMMENT:** This proposed article is the same as A7.4.6.5 above.

17. Revise the title of Figure 10.7.2(e) to read as follows:

**FIGURE 10.7.2(e) Full and Membrane Containment Container tank systems.**

18. Revise Item (3) to the Atmospheric Cryogenic Tanks section of Table 15.6.1 to read as follows:

<table>
<thead>
<tr>
<th>Table 15.6.1 Example Component Failure Database</th>
</tr>
</thead>
<tbody>
<tr>
<td>Component</td>
</tr>
<tr>
<td>Atmospheric Cryogenic Tanks</td>
</tr>
<tr>
<td>(1) Instantaneous failure of primary container and outer shell, release of entire contents (single containment tank)</td>
</tr>
<tr>
<td>(2) Instantaneous failure of primary container and outer shell, release of entire contents (single containment tank)</td>
</tr>
</tbody>
</table>

August 7, 2015 Supplemental Agenda Standards Council Meeting August 17-19, 2015 Page 454 of 536
shell, release of entire contents (double containment tank)

(3) Instantaneous failure of primary and secondary container, release of entire contents (full and membrane containment tanks)

1E-08
19. Revise B.3.4 to read as follows:

**B.3.4** The impounding system must, as a minimum, be designed to withstand the SSE level of loading while empty (or while full if a membrane containment tank system) and the ALE level of loading while holding the volume, $V$, as specified in 7.4.4.7. The rationale is that should the LNG container fail following an SSE, the impounding system must remain intact and be able to contain the contents of the LNG container when subjected to an aftershock.

**Substantiation:**

In terms of technical substantiation, membrane containment system tank is a full integrity system. This means the performance of the tank system shall be similar to what is required of a full containment system:

- Able to store LNG and natural gas inside the tank in all normal operating conditions.
- Able to retain LNG and natural gas inside the tank, in all abnormal design conditions (seismic, release of the LNG to the secondary container, external & internal hazards, etc.)

In order to do so, all the safety and performance requirements for a full containment shall be also applicable to membrane containment system.

LNG tank storage has to comply with other tank design codes. Currently, NFPA59A refers to API625 for LNG tank overall design, ACI376 for civil tank design and API620 for mechanical design. Membrane containment tank systems are fully addressed in EN14520 and partially in ACI376. Relevant references to these standards have to be made in the proposed standards. Currently, ACI376 does not fully include the membrane containment system, so additional requirements have been added to close the gap. For membrane components exclusive to the technology, the language refers to EN14620, but additional prescriptive requirements are added as agreed within the task group, in order to be more conservative for membrane tanks in a first release.

Finally, all components in membrane containment tank systems which are similar to other systems (roof, suspended deck, etc.) will be referred to the same American standard.

**Emergency Nature:** During March 2014 NFPA59A meeting, public inputs were reviewed. The Public Input No. 50-NFPA 59A-2013 put alert on Membrane containment tank system, which was addressed on the Definition clause only. During the meeting, TC agreed to remove the Membrane definition. However, in order not to send the wrong signal to the LNG industry (such as the technology is not allowed), the technical committee decided to create, on an urgent basis, a subcommittee to prepare wording for inclusion of a full treatment of membrane containment tank for issuance as a TIA coincidentally with the 2016 version. This subcommittee has now completed its work and agreed wording is proposed as a TIA. Acceptance of this TIA on an emergency basis is consistent with the following bases as prescribed in the standard:
(f) The proposed TIA intends to correct a circumstance in which the revised NFPA Standard has resulted in an adverse impact on a product or method that was inadvertently overlooked in the total revision process or was without adequate technical (safety) justification for the action. In the absence of a TIA (expected to be released concurrently with 2016 edition), membrane containment systems will not be in NFPA59A 2016 edition and will be deferred until the next revision in 2018 (or 2019). From a practical standpoint, the absence of a TIA will restrict competition in an important timeframe when LNG as fuel, particularly in marine applications, is driving the development of LNG distribution and delivery systems. Proponents who are seeking options are facing a significant barrier in terms of regulatory uncertain without specific treatment of membrane tanks in NFPA 59A.

Moreover, the timeframe for project development is such that developers cannot practically consider membrane alternatives without using European Norms, Canadian or other standards for references to membrane tanks.

Anyone may submit a comment by the closing date indicated above. To submit a comment, please identify the number of the TIA and forward to the Secretary, Standards Council, 1 Batterymarch Park, Quincy, MA 02169-7471.
Comments on NFPA 59A, TIA No. 1187

I support the proposed TIA for the following reasons:

1) Failure frequencies given in figure 10.7.2(e) are commonly referenced for risk assessments. They attest that the current membrane tank design is equivalent to a full containment tank design.

2) The membrane tank has inherent economic advantage due to greater storage efficiency. The ability to build a bigger membrane tank than a full containment tank facilitates storage layout on small footprints.

3) There are no valid reasons why NFPA 59A, an international standard, should exclude the membrane tank already adopted in most jurisdictions outside the US. Its adoption in the 2016 edition will finally offer LNG developers in the US and elsewhere another proven and safe storage option.

4) Through extensive due diligence by divers stakeholders, the membrane tank has already been adopted on an urgent basis in both the Canadian LNG Standard CSA Z276-2015 and the British Columbia LNG Regulations. An early adoption in NFPA 59A will maintain continuity of ongoing alignment of US and Canadian LNG standards.

5) Page 12, third paragraph under substantiation: should read EN 14620 in lieu of EN 14520.

6) 7.4.6.7: already well covered in EN 14620, part 2.

Zoher Meratla, P.Eng (BC)
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Foran, Rosanne

From: Laurent Ducoup <laurent.ducoup@mareal.eu>
Sent: Thursday, May 28, 2015 5:17 AM
To: TIAs
Subject: Comments on TIA n° 1187

Good morning,

I would like to comment on the TIA n° 1187. First of all, I think it is a great initiative, to finally have such an old and proven technology addressed in the most popular LNG standard. As a specialist of cryogenic storage, I feel the proposed requirements are quite detailed and very prescriptive, and most of them are already addressed in EN14620 which you already reference. Nevertheless, if that is the only way to start with the technology inclusion in the standard, this is a good first step. I also encourage to update ACI and API Standards in order also to encourage the technology, so that there is no further doubt on the possibility to use this technology.

Some few comments:
- In B3.4 : 14520 is wrong. This should be 14620
- Statement of Paragraph 7.4.2.3.3 “Post-Repair Inspection. Additional tracer gas testing shall be performed if more than 4 leaks per 1,000 m² of membrane are identified”
  Statement of paragraph A.7.4.6.5 "....The membrane is leak tested after all welding is completed. A retest is required following repairs to close leaks.... »
  In order to avoid misunderstanding, I propose to modify the paragraph A.7.4.6.5 as follows:
  "....The membrane is leak tested after all welding is completed (except as stated through paragraph 7.4.2.3.3), A retest is required following repairs to close leaks...."

Hoping this will help.

Best regards,

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Dear Sirs,

As a worldwide designer and contractor of LNG storage tanks, VINCI CONSTRUCTION is an end user of NFPA 59A and, as such, we are very keen to find in regulations and standards all the technical informations and recommendations relative to the latest and up-to-date technologies.

We therefore fully appreciate the effort of the NFPA Technical Committee on Liquefied Natural Gas to address membrane tanks technology in the Standard as soon as it is possible.

After thoroughly reading the Proposed Tentative Interim Amendment (TIA) No.1187 of NFPA 59A, we have no major comments to raise.

Best regards,

Thierry GRUBER
Project Engineer
LNG Storage Tanks Department
VINCI CONSTRUCTION Grands Projets
Recognition of membrane tanks by NFPA 59A and setting requirements for their design and construction is very beneficial for the industry. It allows the industry an additional alternative besides 9% Ni tanks and all-concrete tanks. Having options recognized by Codes and Standards, reduces the influence and market share of a handful of fabricators and constructors, opens up the field to new players, and encourages innovation and competition.

Europe, Asia, and now Canada recognize membrane tanks in their LNG related codes. I support NFPA 59A’s effort in doing the same and look forward to seeing membrane tanks in the code as another alternative for on-shore LNG storage.

Regards,

Gus Taborda, P.E
Senior Civil/Structural Engineer
EMDC Marine, Civil, and Materials Engineering

Off: +1 832 625 6013
Dear Sirs,

I am a voting member of ACI committee 376. Our Chair distributed the NFPA 59A-Proposed 2016 Edition modifications with the request for comments. I am also member in the German group / committee revising the EN 14620.

My comments are based on 15 years of solely design (and construction) of concrete outer tank of LNG containers.

(See attached file: Roetzer Josef - Comments to NFPA 59A Proposed 2016 Edition.pdf)

I hope that comments are understandable and helpful.

best regards
Dr.-Ing. Josef Roetzer
Head of Engineering

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Confidentiality Notice:
This message may contain privileged and confidential information. If you think, for any reason, that this message may have been addressed to you in error, you must not disseminate, copy or take any action in reliance on it, and we would ask you to notify us immediately by return email.
**Item 5.3.4.2.1 (3) Concrete shall be designed to avoid explosive spalling**

The meaning is clear. Nevertheless the transformation is not possible. There are no explicit definitions of “explosive spalling” or calculation methods.

Given the fact that an “explosive spalling” effect is related to the water content of the concrete and the velocity of the concrete temperature development it is rather a concrete mix issue than a structural engineering one. A proper way to increase the resistance against spalling is to increase the content of entrained air. Therefore limitation of water content, air content, etc. should be defined in the concrete requirements for the tanks.

**Item 7.4.7.2.2 The outer concrete container shall be checked for four full load-unload cycles a week**

The meaning is not clear.

**Item 7.4.7.2.3 C.2 The tank shall be designed to be able to resist normal operating loads with any one horizontal tendon completely ineffective.**

My intention is not to affront anyone. But this requirement is “political” and far away from reality.

It would mean that for a tank with 70 horizontal tendons, additional to a standard calculation (with all regular tendons) the structural engineer should have to perform 70 additional calculations, for the failure of each different tendon.

There is no such requirement for bridges, buildings, water tanks or any other structure. Thus, this request should be deleted entirely.
Dear Sir / Madam,

First Gen is a private company in the Philippines developing an LNG import terminal with an initial capacity of approximately 5 MTPA and with the potential to be expanded to approximately 7 MTPA. Our project is a particularly challenging one because of the lack of Philippines-specific regulations; rather than trying to define a Philippines standard the national government has instead taken the view that so long as the terminal is designed, built and operated in accordance with well-established and widely recognised international codes and standards then the government is willing to license the operation.

Throughout the FEED design stage First Gen sought multiple expert views from consultants, designers and experienced operators on whether we should prefer 9% Ni tanks or membrane tanks of the type licensed by the French company GTT. The end result of this consultation was that neither technology is over-whelmingly preferable to the other, and that ultimately so long as both meet the required safety criteria and functional criteria the choice should be purely economic i.e. will depend on the specific capabilities and pricing power of the EPC company proposing that technology.

The one area where there is a substantial difference between the two technologies is in the coverage of the two dominating codes: The European codes - especially EN 1473 and the associated EN 14620 - cover both 9% Ni and membrane tanks, whereas NFPA 59A covers (currently) only 9% Ni tanks. Accordingly First Gen has pre-qualified 5 potential EPC contractors and instructed them that they may choose to offer a 9% Ni tank in accordance with NFPA 59A or a GTT membrane tank in accordance with EN 1473 and EN 14620.

First Gen believes that NFPA 59A’s lack of coverage of membrane tanks is a weakness in the code since it prevents any company that prefers to work exclusively under NFPA 59A from even offering a membrane tank. As such, the lack of coverage of membrane tanks under NFPA 59A reduces the level of competition for constructing our tanks.

First Gen believes that it would a benefit for LNG users around the world if they could freely choose between 9% Ni and membrane tank technologies knowing that both would be covered by NFPA 59A - and consequently the full spectrum of other American codes and standards that integrate to NFPA 59A. We understand that NFPA is considering modifications to NFPA 59A that would cover the design and construction of membrane tanks, and thus we write to express our support for this initiative.

Yours sincerely,

Adrian Traves
Asset Management General Manager

First Gen Corporation,
Manila,
Philippines
Dear sirs,

By means of this mail ACCIONA would like to convey the technical committee our interest and support that membrane containment solution is included under the NFPA-59A considerations.

ACCIONA develops alliances with mainstream companies in the Oil & Gas sector, in order to provide as EPC contractors the best solution that fits to every client. For membrane solution, we are currently licensees for the construction of tanks for liquefied gases with the membrane solution, considering it a possible alternative to traditional 9%Ni system in on-shore tanks, as it is already a standard in vessels.

We have reviewed the proposed wording for the review of NFPA-59A in order to include membrane system and agree with it. We consider it will be very positive to include this system in the standard in order to assure that it complies with highest demanding standards as the NFPA.

We are open to make any further reviews and comments in case they are needed in order to proceed with the text final revision.

For your reference, ACCIONA Industrial acts as EPC contractor belonging to the ACCIONA Corporation. We have the aim to be the company in the group in charge of developing Energy and Oil&Gas Projects, with great expertise in different types of contracts but mainly as EPC (LSTK) Contractor.

ACCIONA has extensive experience in natural gas - liquefied gas, LNG full containment tanks projects, as EPC main contractor and as civil subcontractor. ACCIONA has worked for companies such as ExxonMobile, The Ras Laffan LNG, AKER Solutions, Enagas, Repsol, etc., and we have executed several full containment LNG tanks in terminals like Huelva, Cartagena, Mugardos, etc.

ACCIONA is an international company that develops and manages all its activities focused on contributing to social welfare and sustainable growth, basically in renewable energies, civil and industrial infrastructures, water cycle and processes and general services. The companies belonging to our Group share a policy of Project Management aimed at maximizing profitability while at the same time contributing to the referred sustainable growth. The Company, with its origins reaching well over 100 years back, employs currently a total staff over 30,000, and it is present in more than 30 countries worldwide. ACCIONA reached revenues of 6,500 million € in 2014, and is present in the Madrid stock exchange market.

We remain at your disposal for any further communication.

Regards,

Manuel Moral Bonet
Deputy Oil&Gas Manager
ACCIONA Industrial
From: John Lieb <lieb@tankindustry.com>
Sent: Monday, June 15, 2015 12:06 PM
To: TIAs
Cc: Jack Blanchard; Rama Challa; Sabrina Fleming
Subject: Comment on TIA - NFPA News Jan 2015

Secretary, Standards Council,

I am submitting my comments on the proposed changes to NFPA 59A.

Please contact me if there are any questions.

John Lieb Comments on:
NFPA 59A-Proposed 2016 Edition
Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG)
TIA Log No.: 1187
Reference: Various
Comment Closing Date: June 19, 2015
Submitter: Adnan Ezzarhouni, GTT

1) **A.5.3.2.5:** The proposed new sentence, “In membrane containment tank systems, due to primary membrane specific construction, rapid failure is not considered credible as well” does not make sense. The phrase “due to primary membrane specific construction” should be re-worded to more clearly convey the intent.

2) **7.2.1.5:** Recommend that the sentence, “Requirements for openings, internals, roof, and suspended deck shall follow API 625” be revised to read “Requirements for openings, internals, roof, and suspended deck are specified in API 625”. Also, the re-numbered 7.2.1.6 should come before the proposed new 7.2.1.5 because it refers to the requirements in 7.2.1.4 but not 7.2.1.5.

3) **7.3.3.2(A):** The phrase “shall not cause a reduction to the internal containment system performance due to damage to any component of the insulation systems” is confusing and should be revised to read, “shall not compromise the internal containment system performance” or similar.

4) **7.4.3.2.1:** The phrase, “...per an agreed upon schedule between...” should be changed to read “...per an agreed upon process between...” to clarify that it is the process that should be agreed upon rather than (or in addition to) the time schedule.

5) **7.4.2.3.2:** The phrase, “Inspection after completion of membrane shall be performed at the completion of the installation of the membrane, and represents the last step...” is redundant and should be changed to, “Inspection after completion of the installation of the membrane represents the last step...”.

6) **7.4.6.7:** The sentence, “Verification of all components of the membrane containment tank system design by experimental data from model tests shall be carried out” is confusing. The wording should be revised to, “Experimental data from model tests shall be used to verify the design of all components of the membrane containment tank system”, or similar.

7) **7.4.7.1:** The phrase “A thermal corner protection system functionally identical to...” should be changed to “A thermal corner protection system functionally equivalent to...”.

8) **7.4.7.2.3:** Is “scabbing” the correct terminology or should it be “scabbling”?

John M. Lieb, P.E.
Chief Engineer
Tank Industry Consultants

August 7, 2015
Foran, Rosanne

From: John Powell <John.Powell@arup.com>
Sent: Monday, June 15, 2015 6:07 PM
To: TIAs
Subject: TIA1187 - Comments by John Powell, Arup

Comment No. 9

Dear Sirs,

I welcome the opportunity to provide the following comments on the proposed changes to NFPA 59A, to cover the requirements for membrane tanks. With reference to the clause numbering in “ProposedTIA1187_NFPA59A.pdf”.

General
I’d like to offer my support to the proposed changes. I have recently completed the detailed designs of two membrane tanks in the absence of clear recommendations in codes or standards. The proposed changes to NFPA59A, in conjunction with ACI376, provides a much better basis for design and should ensure that the membrane tank is more readily acceptable to the market.

Specific
A.3.3.4.3.3. I do not think that a metallic roof liner is an essential component of the membrane tanks system. Polymeric vapor barriers are used on the walls, and requirements are covered by EN14620. I think it is better to concentrate on performance wherever possible and not be too prescriptive of the solution or form.

5.3.4.2.1. Ideally ACI376 Table 7.3 will be updated to include the requirements for membrane tanks and, therefore, avoid any potential ambiguity in the application of this cause.

7.4.4.12. I think the proposed clause has taken a very pragmatic approach to one of the key issues relating to the design of the concrete container for a membrane tank. Unlike a traditional secondary container, the membrane tank concrete container must resist both SSE in a non-spill condition as well as the Spill+AFE. It is essential that the performance of the concrete tank in the spill condition is not compromised by the SSE event. NFPA has provided practical and reasonable guidance on performance criteria relating to no-damage, as well as reserving the option for the designer to consider damage explicitly while still demonstrating compliance with the Spill+AFE requirements.

A.7.4.6.5. I do not think that a hydrotest of the concrete tank is required. See below.

7.4.7.1. I do not think it is appropriate to set a minimum height for the TCP. This should be set to suit construction methods and the structural behavior of the concrete wall to concrete base slab joint. I think it would be more appropriate to say that any construction access opening should be located both behind and beneath the TCP. All other performance requirements will be addressed through the normal process of analysis and design.

7.4.7.2. The fatigue requirements for 4 full load cycles per week seem a little arbitrary, unreasonable and may be in conflict with ACI376 App C. It would seem better to rely on ACI376 to set the performance standard in terms of damage fatigue life as a function of design life. ACI376 currently targets TWO. This was probably developed for non-membrane tanks, but I am not sure. Nevertheless, the tank purchaser should be allowed to set the design life and operational criteria. The codes and standards should then set the “factor of safety”.

7.4.7.2.5. I do not believe that the hydrotest of the concrete container for a membrane tank is necessary. There is a growing body opinion (CSA Z276-15, C7.5.1) that is questioning the relevance of this test. In the case of a membrane, I do not see the relevance of testing the foundation, nor to I see the benefit of a load test on the pre-stressed concrete wall when this is NOT a critical load condition for the concrete and only results in very small strain increases in the prestressed tendons. Further the concrete does NOT provide primary containment, that is the membrane which is tested separately. Lastly, the secondary concrete container for a 9% Ni steel tank is NOT hydrotested to prove liquid
tightness in the spill condition. I strongly recommend that the requirements for hydrotesting mem-
brane tanks be left to the owner and regulator to determine the relevance and or value.

Kind regards

JOHN

Regards

JOHN POWELL

____________________________________________________________

Arup
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electronic mail messages entering and leaving Arup business systems are scanned for acceptability of content and viruses
I have the following comments regarding Proposed TIA 1187:

5.3.2.5*(2) should be revised to read:
(2) Where the outer shell of an LNG storage tank system complies with the requirements of 5.3.1.1, the dike shall be either the outer shell or as specified in 5.3.1.1.

5.3.4.2.1
In the second sentence of this proposed addition, "the fire risk assessment" is mentioned. What is the fire risk assessment? Nowhere is this term defined. Within the context of 5.3.4.2, this must be the impoundment-to-storage tank fire calculation that is required for tank spacing purposes. However, that calculation is not a risk assessment. Thus, the phrase "the fire risk assessment" is not only undefined, but incorrect. I suggest a direct reference to "the fire radiation calculation specified in 5.3.4.2"

7.4.2.3.4
- In the first sentence, the procedure should be "witnessed by all parties." Who are all parties? This should be better defined or deleted.
- Suggest re-wording last sentence to read "...must be reported and corrective action taken."

7.4.4.12
This proposed new paragraph has several problems:
- "the major leak" and "major leak plus ALE aftershock event" do not appear to be defined within NFPA 59A.
- How is it to be determined that either the 90% reinforcing steel yield or the 85% concrete design compressive strength have been exceeded (or not)? The yield and compressive strengths will be known values, but the forces placed on the storage tank at the time of a seismic event can only be estimated. This does not seem to be a definitive test.
- "...taken into account in the spill analysis." What spill analysis? This term, again, seems to be undefined.

Suggest deleting this paragraph until it can be revised to be more clear.

Table 15.6.1
The inclusion of membrane tanks with full containment tanks seems to be appropriate. There was a comment by a committee member suggesting that membrane storage tanks have a higher catastrophic failure rate than full containment storage tanks. Failure rates presented by OGP show these two technologies to have equal catastrophic failure rates. The TNO purple book suggests that failures of membrane tanks should be estimated (on a case-by-case basis?) by comparison to other tank technologies. Comparison of other full integrity storage tanks in TNO's presented values shows that a value of 1E-8 per year for catastrophic failure is a reasonable approximation for a membrane tank. Overall, there is no real-world event data and little supporting information for catastrophic failure rates for any type of LNG storage tank. Thus, the placement of membrane tank systems
into the same category as full containment systems is appropriate unless a different, reasonable estimate by a credible party is published.

Regards,

Jeff

Jeff Marx, P.E., Senior Engineer
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I would like to add my support to adding Membrane Tanks to the NFPA 59A standard. I agree with the contents of TIA 1187.

I was a member of the NFPA 59A Technical Committee until about three months ago when I retired from the committee. Until that time I was also a member of the Membrane Tank Task Group that was charged to investigate the addition of membrane tanks to the standard. Some of my support for the inclusion of membrane tanks include:

- Membrane tanks have been used safely and successfully throughout the world for about 50 years and are continued to be used presently.
- The design, construction and operation are well developed and mature and being applied by many engineers, constructors and operators.
- The design and use of membrane tanks are covered by numerous national and international codes and standards.
- The Task Group has prepared a safe and complete guideline for using membrane tanks for the storage of LNG.

Because of the present use of membrane tanks I encourage NFPA to include them in the standard as soon as possible.

Don Coers
Sr VP Engineering
Venture Global LNG LLC
1-630-476-9273
dcoers@vglng.com
To whom it may concern!

Having read subject detailed Tentative Interim Amendment, I am very pleased to learn that finally this safe and mature technology, being offered by multiple suppliers, is being properly and comprehensively introduced into NFPA 59A. The detailed technical wording, used in combination with respective references to existing standards (API, ACI, EN. etc.), if required, provides for a clear and unambiguous description of the membrane containment tank system. At the same it ensures that the respective safety requirements are to be followed and latest technical advancements are also considered.

By its proper introduction the industry thereby will receive another option to the full containment tank system, providing for a similar performance, especially regarding process and environmental safety aspects, such as liquid containment and controlled vapor release.

Understanding the nature of a proper membrane design will provide for stress free welds, i.e. corrugation allowing for shrinking and expansion, potential failures in the weld will not result in crack propagation being a great benefit of the inherent design.

Having been in the industry for more than a decade and closely following the latest discussions and developments, also as a Committee Associate of AGA's Supplemental Gas Committee, I can only the support the efforts taken.

Sincerely yours,

Georg H. Breuer

LNG Product Manager
Technology and Sales

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NFPA 59A-Proposed 2016 Edition
*Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG).*
TIA Log n. 1187

I was asked to provide a feedback on the proposed changes to NFPA 59A-Proposed 2016 Edition, TIA Log n. 1187.

I am an Engineer with Fermi National Accelerator Laboratory, in Batavia, IL. While I have no experience with membrane cryostat technology for LNG applications, I am particularly interested in the possible use of membrane cryostat technology for the construction of cryostats containing thousands of cubic meters of liquid Argon, housing highly sensitive particle physics experiments. Our detectors require an extreme purity of the liquid Argon (at the level of parts per trillion of Oxygen contamination).

We have studied the membrane cryostat technology and built a small prototype that successfully achieve the technical requirements of safe liquid Argon operation and met the purity requirements of the physics detector. The results of our work have been presented at the most relevant cryogenic engineering conferences during the last two years: CEC 2013, Cryogenics 2014, ICEC 2014.

This code does not directly cover the design and installation of membrane cryostats for liquid Argon use. However, it would be extremely valuable for us to have a standardized approach for the design, production and installation of membrane cryostats and to be able to point to a nationally recognized standard to be used as a reference.

We understand the differences between liquid Argon and LNG. Liquid Argon is heavier and the tank might need insulation with a higher load bearing capacity. At the same time, our applications are shorter and the hydrostatic load might end being the same.

With this letter I fully support the proposed changes to NFPA 59A – Proposed 2016 Edition, TIA Log n. 1187 to include membrane cryostat technology in the code.

David Montanari

David Montanari
*Engineer, PMP*

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To whom it may concern

Comment on TIA1187

My name is Alain GOY, I am Head of Technical department in ELENGY, French company which owns and operates 3 LNG terminals since 1965, pioneering the LNG industry. And I am chairman of Technical committee TC 282, in charge of LNG standards in European standardization body.

I am quite positively surprised to finally see such an old and proven technology proposed on the world most used LNG standard. I must confess that within the LNG industry, there is a lot of doubt about why US never addressed this technology in any API/ACI/NFPA Standard.

Being myself in LNG industry since more than 30 years, and Membrane above tank being developed in France, I would like you to share my views. Actually, we own and operate above ground full containment tanks, both self-supporting and Membrane tank types since 1980. Our tanks are designed with the same requirements for the prestressed concrete outer tank.

Today, the membranes tanks are still in service, in normal operation conditions, without malfunction, and they offer even technical merits that we even did not think when we selected them in 1977. Particularly, Membrane tank offers a huge flexibility in operation, compared to self-supported structure.

For example, putting a tank on hold if no LNG is operated, to avoid keeping the LNG tank cold and to save boil off gas flaring can be easily done with Membrane tank, and with no cycling limit. (same procedures as the membrane LNG tankers). We used recently this advantage in our terminal

Same in case of some maintenance or improvement on piping inside, or work on piping or structure outside on the roof: work can be also easily considered with membrane type, mainly because the insulation space is under nitrogen atmosphere. The said nitrogen “shield” on bottom and wall, inside the concrete, provides comfort to operators working on the top of the roof of the tank or in its vicinity. It is quite known in the LNG industry that the concrete outer tank metallic liner could not be purely tight. In the case of membrane type, mainly thanks to the nitrogen system, the concrete outer tank and liner would not be better than other self-supporting tanks, but at least, one fugitive emission would be then only nitrogen and not boil off gas. We used this advantage during revamping work on structures and support.

In the language side, compared to what has been done in the Canadian Standard, I see the proposed change quite detailed and prescriptive, compared to the other tank types. However, I understand that it could be the only way to address the technology for the first time in the American Standard.

I do encourage as a next step to homogenize the requirements for membrane tanks similar to other technologies, with only safety and performance requirements, and just refers to EN14620 for design manual (unless API 625 and ACI 376 include membrane tank).
To sum-up, I fully support this great initiative. This will allow more option in the storage systems and also will avoid developers to address two Standard for the projects.

I see a lot of projects where the main plant is designed under NFPA59 A and the tanks designed under EN14620 (for instance to consider Membrane tank option).

With this proposed changes, the full plant can be design using NFPA59 A.

Regards

Alain GOY | chef du Service Technique
head of Technical Department

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This note is in support of acceptance of the emergency nature of the TIA to NFPA 59A to include membrane tanks and final approval of the TIA as a means of incorporating membrane LNG tanks into the NFPA 59A standard.

Inclusion of membrane tanks into the standard will allow project developers to consider a wider range of options for LNG storage in future projects. Additional options will allow the developer to better optimize tank selection to reflect specific project considerations, including labor availability and costs, project schedule, plant site conditions, local construction capabilities, and requirements for local labor and material content. LNG storage tanks are a critical component of any LNG liquefaction or import project.

Tank selection, design, engineering, and construction are typically on the critical path of these large, complex, and integrated projects. As such, selection of the type of tank often occurs very early in the development of a project to allow for project permitting and the engineering of this fundamental aspect of a project. Furthermore, the type of tank to use in a project is just one of many strategic decisions a project developer will need to make during the feasibility phase. Given these conditions, developers select tank designs that are specifically described within standards such as NFPA 59A. Such a selection also reduces the risk of permitting delay or rejection that could result from choosing a design that is not specifically incorporated into NFPA 59A. The extra cost and time required to confirm such a design is almost always impossible to undertake when the project is so uncertain to progress to completion and time is so critical to venture success.

For the reasons above, I strongly recommend incorporating language into NFPA 59A regarding membrane LNG storage tanks.
In the 2013 Edition, NFPA 59A, Standard for Production, Storage and Handling of Liquefied Natural Gas includes the definition of Membrane Tank System in §3.3.5.3.3. However, this containment system is not specifically addressed in the document nor in the other codes applicable in the US. As a result, there is a risk of non compliance for a project to design a membrane type containment system.

LNG storage is a critical part of any LNG plant and, from industrial point of view, any system providing safe and reliable containment should be addressed in the codes. Full Containment system (FC) and membrane system are providing liquid and gas tightness in normal operation but are also able to contain liquid in degraded situation while excess vapor will discharge to the relief valves. Competition between these two system will bring to the industry both a higher level of safety and economic benefits.

**TOTAL is fully supporting the proposal to include new clauses addressing the membrane system in the next revision NFPA 59A.** This will clarify the status of membrane containment systems.

The substantiation of this position is mainly based on the following:

- It has been demonstrated that the global probability of accident is equivalent between FC and membrane and assessed at 10^-8 for major events.
- Membrane have been operating in France for cryogenic continuous service (Ethylene) for more than 40 years and since early 1980’s for LNG with no problem.
- Membrane is more flexible to operate and reduces the risk of collapse during cool down (risk remains and cool down requires strict procedures). There is an extensive experience of cooling down operation based on the LNG carrier fleet.
- During construction, the thermal corner protection gas tightness is tested for the membrane. This test of Thermal corner protection is not required for FC, although it is a complex part of the system.
- §5.3.4.2.1 (new) introduces some design factors for membrane tanks. For example, “Reduction in the wall post-tensioning due to prestressing steel softening and relaxation at elevated temperature” should also apply for FC because elevated temperature may also reduce the stress in concrete wall of a FC.
- There is a possibility for the membrane to continuously monitor the annular space between the membrane and the outer concrete tank.
- Open and fair Competition is providing the right cost for project and promotes improvement.

Membrane and full containment tanks are proven and have demonstrated high reliability and safety. The clarification brought for the membrane will ease the integration of this technology in new projects from small scaled storage to very large capacity.

Alain GIACOSA
Dear Sir/Madam, BG Group supports the inclusion of membrane tanks in NFPA 59A so that it will fully clarify the status of the technology for project developers and contractors.

Yours faithfully,

Paul Kirkup
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Comments from Thomas R Howe - KBR (ACI 376 member). The inclusion of membrane tank requirements in NFPA 59A is encouraged as this technology has been considered acceptable by KBR and specified for several projects and has been based on using EN 14620 design code. ACI 376 has also been discussing adding requirements for membrane tanks as an Appendix to ACI 376. The write up below needs work and appears not to follow the 2013 issued document for this mark up. My comments are shown below.

NFPA 59A—Proposed 2016 Edition

Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG)

TIA Log No.: 1187

Reference: Various

Comment Closing Date: June 19, 2015

Submitter: Adnan Ezzarhouni, GTT

1. Add new entries to Subsection 2.3.12 to read as follows:

EN14620-1 through 5, (2006) Design and manufacture of site built, vertical, cylindrical, flat-bottomed, steel tanks for the storage of refrigerated, liquefied gases with operating temperatures between 0 °C and -165 °C PARTS 1 – 5


2. Add new Annex 3.3.4.3.3* and Annex to read as follows (renumber current 3.3.4.3.3 as 3.3.4.3.4):

3.3.4.3.3* Membrane Containment Tank System. A tank system consisting of a thin metal liquid barrier and load-bearing thermal insulation supported by a self-standing outer concrete container jointly forming an integrated composite tank structure which provides liquid and vapor containment during tank operating as well as LNG containment in the event of leakage from the liquid barrier, and where the vapor-containing roof of the outer container is either steel or concrete configured such that the excess vapor caused by a spill of LNG from the liquid barrier will discharge through the relief valves.

A.3.3.4.3.3 A membrane containment tank system comprises a thin metal liquid- and vapor-tight barrier acting against load-bearing thermal insulation and supported by a free-standing outer pre-stressed concrete container. In normal conditions primary liquid containment is afforded by a thin metallic barrier which is structurally supported via load-bearing insulation and an outer pre-stressed concrete container. Under these conditions primary vapor containment is afforded by the thin metallic barrier which is connected to the metallic roof liner or roof liner provided.

In emergency conditions secondary liquid and vapor containment is afforded by an outer pre-stressed concrete container and metallic roof liners. The outer container must be capable of both containing the liquid product and controlling the vapor resulting from evaporation. In this instance the vapor generated from the leakage is discharged through pressure relief valves located in the roof. Vapor losses due to permeability through the outer pre-stressed concrete are acceptable while containing liquid in the event of leakage from the thin metal barrier and insulation system. The roof of the outer pre-stressed concrete container may be concrete or steel. Significant design issues arise at the monolithic base-to-wall connection due to the mechanical restraint offered by the base. To mitigate these issues, a secondary liquid containment barrier inside the insulation system across the entire bottom and part of the wall in the vicinity of the base-to-wall joint is to be provided to protect and thermally isolate this area from the cold liquid and provide liquid tightness.

3.3.4.3.2* Single Containment Tank System.
A single wall container or a double wall tank system in which only the self-supporting primary or inner container is designed to contain LNG.

3. Revise 5.3.1.1(4) to read as follows:

5.3.1.1 Provisions shall be made to minimize the potential of accidental discharge of LNG at containers, pipelines containing LNG, and other equipment such that a discharge from any of these does not endanger adjoining property or important process equipment and structures or reach waterways. LNG containers shall be provided with one of the following methods to contain any release:

1. An impounding area surrounding the container(s) that is formed by a natural barrier, dike, impounding wall, or combination thereof complying with 5.3.2 and 5.3.3

2. An impounding area formed by a natural barrier, dike, excavation, impounding wall, or combination thereof complying with 5.3.2 and 5.3.3, plus a natural or man-made drainage system surrounding the container(s) that complies with 5.3.2 and 5.3.3

3. Where the container is constructed below or partially below the surrounding grade, an impounding area formed by excavation complying with 5.3.2 and 5.3.3

4. Secondary containment as required for double, or full, or membrane containment tank systems complying with 5.3.2 and 5.3.3.

4. Revise 5.3.2.5* and the Annex to read as follows:

5.3.2.5* Dikes and impounding walls shall meet the following requirements:

1. Dikes, impounding walls, drainage systems, and any penetrations thereof shall be designed to withstand the full hydrostatic head of impounded LNG or flammable refrigerant, the effect of rapid cooling to the temperature of the liquid to be confined, any anticipated fire exposure, and natural forces, such as earthquakes, wind, and rain.

2. Where the outer shell of a double wall tank complies with the requirements of 5.3.1.1, the dike shall be either the outer shell or as specified in 5.3.1.1.

A-5.3.2.5 Section 7.2.1.1 requires compliance with API 625. API 625 paragraph 5.6 requires the selection of storage concept to be based on a risk assessment. API 625 Annex C discusses implications of a release of liquid from the primary liquid container and provides specific discussion related to each containment type. API 625 Annex D provides guidance for selection of storage concepts as part of the risk assessment including external and internal events and hazards to be evaluated. Paragraph D.3.2.2 discusses the possibility of sudden failure of the inner tank and advises “if extra protection from brittle fracture” (or unattended ductile crack propagation) is desired, the general practice is to increase the primary container toughness. Available materials meeting the required specifications of API 620 Appendix Q (and this standard) for LNG service are considered to have crack-arrest properties at LNG service temperature and stress levels. Therefore, rapid failure of a steel primary container meeting this standard is not considered credible. In membrane containment tank systems, due to primary membrane specific construction, rapid failure is not considered credible as well.
5. Revise 5.3.2.8 to read as follows:

5.3.2.7 Double, full, and membrane containment tank systems shall be designed and constructed such that in the case of a fire in an adjacent tank, the secondary container shall retain sufficient structural integrity to prevent collapse, which can cause damage to and leakage from the primary container.

6. Rename 5.3.2.7 and revise to read as follows:

5.3.2.78 Double, full, and membrane containment tank systems shall have no pipe penetrations below the liquid level.

7. Revise 5.3.4.2 and add new 5.3.4.2.1 to read as follows:

5.3.4.2 Double, full, and double membrane containment tank systems of greater than 70,000 gal (265 m³) water capacity shall be separated from adjacent LNG storage containers such that a fire in an adjacent single or double containment impoundment or from a design spill will not cause loss of containment from adjacent containers. This shall be accomplished by ensuring that no part of the adjacent storage container roof, walls, or its impoundment structure reaches a temperature at which the strength of the material of the container roof, wall, or its impoundment is reduced to a level where the LNG tank, roof, or impoundment loses its structural integrity.

5.3.4.2.1 The outer concrete container shall be designed for the external fire in accordance with ACI 376 unless the fire protection measures are provided. The outer tank thermal analysis shall be performed to determine temperature distribution for the heat flux and duration of exposure as specified in the fire risk assessment.

(1) The applicable load components and the ultimate state load factors for the fire load combinations shall be in accordance with ACI 376 Table 7.3. For membrane tanks an additional liquid pressure load in accordance with ACI 376 Table 7.2 shall be included.

(2) The design of the outer concrete container shall take into account the following factors:

(a) Reduction in the wall post-tensioning due to the difference in the coefficient thermal expansion of post-tensioning steel and wall concrete at the temperature post-tensioning steel is exposed. The effects of the concrete aggregate type on the concrete coefficient thermal expansion shall be considered;

(b) Reduction in strength and modulus of elasticity of the outer tank concrete, reinforcing and post-tensioning steel due to elevated temperature;

(c) Reduction in the wall post-tensioning due to prestressing steel softening and relaxation at elevated temperature;

(3) Concrete shall be designed to avoid explosive spalling.

8. Revise 7.2.1.1 to read as follows:
7.2.1.1 Storage tank systems shall comply with the requirements of API 625, *Tank Systems for Refrigerated Liquefied Gas Storage or, for membrane containment tank systems, EN 14620*, and the additional provisions of this chapter. The API 625 risk assessment shall be approved by the AHJ.

9. Add new 7.2.1.4 and 7.2.1.5 and renumber current 7.2.1.4 to read as follows:

7.2.1.4 The metallic membrane, load bearing insulation, and the outer container moisture barrier specific to the membrane tank system shall comply with EN 14620 parts 1-5 for material selection, design, installation, examination, and testing and further requirements of 7.4. All other components of the membrane tank system shall comply with API 625, API 620, ACI 376 and additional requirements in 7.4.

7.2.1.5 Requirements for openings, internals, roof, and suspended deck shall follow API 625.

7.2.1.46 Should any conflict exist between the above requirements, the most stringent requirement shall apply.

10. Revise 7.3.1.2 (A) to read as follows:

7.3.1.2 All piping that is a part of an LNG tank system shall comply with requirements in this chapter and requirements within API 625.

(A) Tank system piping shall include all piping internal to the container, within insulation spaces and within void spaces, external piping attached or connected to the container up to the first circumferential external joint of the piping, and external piping serving only tank instrumentation (including tank pressure relief valves). All liquid piping with a source of external line pressure shall be designed for the external line relief valve setting but not less than 50 psi (345 kPa). Double, and full, and membrane containment tank systems shall have no pipe penetrations below the liquid level. . . .

11. Revise 7.3.3.2 and 7.3.3.2(A) and add new (D) to read as follows:

7.3.3.2 The space between the inner container and the outer container shall contain insulation that is compatible with LNG and natural gas and that is noncombustible as installed for normal service and abnormal conditions.

(A) A fire external to the outer tank shall not cause a reduction of the insulation thermal conductivity–
due to melting or settling to the internal containment system performance due to damage to any component of the insulation systems.

(B) The load-bearing bottom insulation shall be designed and installed so that cracking from thermal and mechanical stresses does not jeopardize the integrity of the container.

(C) Only materials used between the inner and outer tank bottoms (floors) shall not be required to meet the combustibility requirements, where the material and the design of the installation comply with all of the following:

(1) The flame spread index of the material shall not exceed 25, and the material shall not support continued progressive combustion in air.
(2) The material shall be of such composition that surfaces that would be exposed by cutting through the material on any plane shall have a flame spread index not greater than 25 and shall not support continued progressive combustion.

(3) It shall be shown by test that the combustion properties of the material do not increase significantly as a result of long-term exposure to LNG or natural gas at the anticipated service pressure and temperature.

(4) The materials in the installed condition shall be demonstrated to be capable of being purged of natural gas.

(5) The natural gas remaining after purging shall not be significant and shall not increase the combustibility of the material.

(D) For membrane containment tank systems, the insulation system block shall include a non-foam cover (underneath the primary membrane) and shall include a welding thermal protection system in order to withstand all heat from welding during installation and during maintenance, if any.

12. Add a new 7.4.2.3 to read as follows:

7.4.2.3 For membrane containment tank systems, weld procedure and production weld testing shall comply with EN14620 part 2 and the following requirements:

7.4.2.3.1 Qualification of Welders. All personnel associated with the welding fabrication of the membrane system shall be qualified by the manufacturer per an agreed upon schedule between the purchaser, the AHJ, and the fabricator. All records shall be available for review.

7.4.2.3.2 Inspection. 100% of all welding shall be visually inspected for workmanship and conformance to the fabrication requirements. Bead placement and consistency shall be, at a minimum, documented by digital means for review by supervisory personnel.

The personnel performing this visual inspection shall be qualified to an accepted standard for this inspection work.

Upon cooldown of the welds to room temperature, provisions shall be made to perform a penetrant inspection (PT) of at least 5% of each weld type each day. The selection factors include orientation, welding direction, and complexity of welding being performed.

a) All profiles and configurations of welds shall be subjected to this 5% requirement. The selection of this 5% sample shall be agreed upon by the fabricator, customer’s representative, and the AHJ.

b) The acceptance standard for this inspection technique shall be agreed upon by all parties.

c) Any indications require an additional 5% penetrant inspection of the total distance welded by each welder.

Inspection after completion of membrane shall be performed at the completion of the installation of the membrane, and represents the last step prior to the cooldown of the tank to service temperature.

After completion of the membrane, a leakage test shall be performed. Leakage shall be determined as agreed upon by the fabricator and customer.

Tracer gas for this leak test shall be in accordance with approved procedure. All areas where leakage exceeds limit shall be repaired per 7.4.2.3.2, the manufacturer’s approved procedure and re-inspected.

In parallel, mechanical stress testing of the welding joints shall be performed by applying 3 cycles from atmospheric pressure to +20 mbarg inside the insulation space, with the pressure maintained, for a minimum time of 30 minutes. Data shall be recorded.
7.4.2.3.3 Post-Repair Inspection. Additional tracer gas testing shall be performed if more than 4 leaks per 1,000 m² of membrane are identified.
All repaired areas shall be visually inspected (VT), vacuum box (VB) tested, and dye penetrant (PT) tested.
7.4.2.3.4 Final Global Test and Control During Dismantling Work.
This testing shall be in agreement with the approved test procedure and witnessed by all parties. This represents the final acceptance testing of the completed membrane structure following completion of its installation in the structural outer shell / container.
   a) The overall tightness of the membrane shall be determined by establishing a pressure difference between the tank and the insulation space.
   b) This pressurization allows gas flow through the membrane representative of potential leaks on the membrane.
   c) The potential leak(s) shall be characterized by measuring the oxygen content increase in the primary insulated space as the tank is pressurized with dry air.
   d) The primary insulated space shall be regulated slightly above the atmospheric pressure.
   e) All test data, all records, documentation, and witness records shall be submitted to all parties for their review and final acceptance.
Daily tightness check / monitoring shall be performed during dismantling work by pulling vacuum inside insulated spaces. Any pressure rise is indicative of a leak and must be reported and correction action taken.

13. Add a new 7.4.4.12 to read as follows:

   for membrane tank

7.4.4.12 The outer concrete tank analysis and design for the major leak and major leak plus ALE aftershock event shall take into account any damage that may have occurred to the outer concrete tank due to prior events including the SSE earthquake. The outer concrete tank shall be considered as undamaged during the prior SSE event if the following conditions are met:
   (1) Tensile stresses in the reinforcing steel do not exceed 90% of the reinforcing steel yield
   (2) Maximum concrete compressive stresses do not exceed 85% of the concrete design compressive strength.
Otherwise, the prior damage shall be taken into account in the spill analysis.

14. Add new 7.4.6.5 and Annex to read as follows:

7.4.6.5* Membrane containment tank systems shall be tested in accordance with EN 14620 Part 5.
Table 1. The leakage test, as defined in the Note under EN 14620 Part 5 paragraph 4.1.1, shall be performed. Leakage through the membrane to the insulation space during service must be controlled in order to maintain gas concentration level below 30% of the LEL by sweeping the insulated space with N2. If the gas concentration cannot be maintained below 30% LEL the tank must be decommissioned and retested. For purposes of evaluating this level, the flow of purge gas within the annular space shall not be increased above the normal operating rate.
A.7.4.6.5 EN 14620 Part 5 Table 1 requires the outer concrete tank to be hydrostatically tested prior to installing insulation and the membrane. The membrane is leak tested after all welding is completed. A retest is required following repairs to close leaks. An insulation space monitoring system is required by EN 14620 Part 1 paragraph 7.2.1.8 which is intended to identify any leaks of LNG gas or vapor into the space between the membrane and the wall.

15. Add new 7.4.6.6 and 7.4.6.7 to read as follows:

7.4.6.6 All the membrane system components, including insulation, primary membrane, and the secondary barrier of the thermal protection system, shall be designed in such a way that they can withstand all possible static and dynamic actions throughout the tank lifetime.

7.4.6.7 Verification of all components of the membrane containment tank system design by experimental data from model tests shall be carried out.

16. Add a new Subsection 7.4.7 to read as follows:

7.4.7 Additional Requirements for Membrane containment tank system.

7.4.7.1 A thermal corner protection system functionally identical to the thermal corner protection system for concrete tanks defined in API625 Section 6 shall be provided for the outer concrete tank of the membrane tank system. The thermal corner protection shall protect the outer tank entire bottom and at least lower 16.5 feet (5m) of the wall from thermal shock and shall be liquidtight when it is in contact with LNG and vaportight in all conditions. The thermal corner protection system shall be permitted to be either metallic or from nonmetallic materials compatible with LNG and shall maintain structural integrity and liquid/gas tightness under all applicable mechanical and thermal loads.

The membrane containment tank system supplier shall provide tests independently witnessed and verified by a third party agency clearly demonstrating the leak tightness of all the thermal corner system under spill conditions. Historical tests shall be acceptable provided that construction processes and materials of construction are the same as those proposed. Nondestructive examination (NDE) performed on the secondary barrier and NDE acceptance criteria shall ensure that provided tightness is equivalent to the tightness provided by the metallic thermal corner protection system of the full containment tank system.

7.4.7.2 The outer concrete container of the membrane containment tank system shall meet all requirements of ACI376 for the secondary concrete container including materials, design, construction, inspection, and testing and the additional requirements specified below:

7.4.7.2.1 The product liquid pressure shall be a design load for the outer concrete tank. Liquid product pressure ultimate limit state (ULS) load factors for operating and abnormal loading conditions shall be in accordance with Table 7.2 of ACI376.

7.4.7.2.2 The outer concrete container wall and slab-to-wall junction shall be checked for fatigue assuming four full load-unload cycles a week for the expected life of the tank. Performance criteria of ACI376 Appendix C shall apply.

7.4.7.2.3 The outer concrete container wall shall resist the specified impact load without perforation and scabbing.
A) The concrete wall thickness shall be at least 40% greater than the scabbing depth calculated per CEB 187 Section 4.1.2.2.

B) The concrete wall thickness shall be at least 20% greater than the perforation thickness calculated per CEB 187 Section 4.1.1.1

C) The tank shall be designed so that either one of the following is satisfied:

1. The distance between the outer face of the concrete container measured to the centroid of the pre-stressing tendons shall be greater than the penetration depth calculated as per CEB 187 Section 4.1.2.1 with the following allowances for uncertainty:
   - 20% thicker than the penetration depth when $z > 0.75$
   - 50% thicker than the penetration depth when $z \leq 0.75$

2. The tank shall be designed to be able to resist normal operating loads with any one horizontal tendon completely ineffective.

7.4.7.2.4 At a minimum, the outer concrete container for the membrane tank system shall meet the construction tolerances specified in ACI376. Where more stringent tolerances are required by the membrane and insulation systems, the more stringent tolerances shall be specified by the membrane tank engineer and be met by the tank contractor.

7.4.7.2.5 The outer concrete container shall be hydrotested prior to membrane and insulation installation following primary container hydrotest requirements of API625 Section 10.

17. Revise the title of Figure 10.7.2(e) to read as follows:

**FIGURE 10.7.2(e) Full and Membrane Containment Container tank systems.**

18. Revise Item (3) to the Atmospheric Cryogenic Tanks section of Table 15.6.1 to read as follows:

<table>
<thead>
<tr>
<th>Table 15.6.1 Example Component Failure Database</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Component</strong></td>
</tr>
<tr>
<td>Atmospheric Cryogenic Tanks</td>
</tr>
</tbody>
</table>

| (1) Instantaneous failure of primary container and outer shell, release of entire contents (single containment tank) | 5E-07 |
| (2) Instantaneous failure of primary container and outer shell, release of entire contents (double containment tank) | 1.25E-08 |
| (3) Instantaneous failure of primary and secondary container, release of entire contents (full and membrane containment tanks) | 1E-08 |
19. **Revise B.3.4 to read as follows:**

**B.3.4**  The impounding system must, as a minimum, be designed to withstand the SSE level of loading while empty (or while full if a membrane containment tank system) and the ALE level of loading while holding the volume, \( V \), as specified in 7.4.4.7. The rationale is that should the LNG container fail following an SSE, the impounding system must remain intact and be able to contain the contents of the LNG container when subjected to an aftershock.

**Substantiation:**

In terms of technical substantiation, membrane containment system tank is a full integrity system. This means the performance of the tank system shall be similar to what is required of a full containment system:

- Able to store LNG and natural gas inside the tank in all normal operating conditions.
- Able to retain LNG and natural gas inside the tank, in all abnormal design conditions (seismic, release of the LNG to the secondary container, external & internal hazards, etc.)

In order to do so, all the safety and performance requirements for a full containment shall be also applicable to membrane containment system.

LNG tank storage has to comply with other tank design codes. Currently, NFPA59A refers to API625 for LNG tank overall design, ACI376 for civil tank design and API620 for mechanical design. Membrane containment tank systems are fully addressed in EN14620 and partially in ACI376. Relevant references to these standards have to be made in the proposed standards. Currently, ACI376 does not fully include the membrane containment system, so additional requirements have been added to close the gap. For membrane components exclusive to the technology, the language refers to EN14620, but additional prescriptive requirements are added as agreed within the task group, in order to be more conservative for membrane tanks in a first release.

Finally, all components in membrane containment tank systems which are similar to other systems (roof, suspended deck, etc.) will be referred to the same American standard.

**Emergency Nature:**  During March 2014 NFPA59A meeting, public inputs were reviewed. The Public Input No. 50-NFPA 59A-2013 put alert on Membrane containment tank system, which was addressed on the Definition clause only. During the meeting, TC agreed to remove the Membrane definition. However, in order not to send the wrong signal to the LNG industry (such as the technology is not allowed), the technical committee decided to create, on an urgent basis, a subcommittee to prepare wording for inclusion of a full treatment of membrane containment tank for issuance as a TIA coincidentally with the 2016 version. This subcommittee has now completed its work and agreed wording is proposed as a TIA. Acceptance of this TIA on an emergency basis is consistent with the following bases as prescribed in the standard:
(f) The proposed TIA intends to correct a circumstance in which the revised NFPA Standard has resulted in an adverse impact on a product or method that was inadvertently overlooked in the total revision process or was without adequate technical (safety) justification for the action. In the absence of a TIA (expected to be released concurrently with 2016 edition), membrane containment systems will not be in NFPA59A 2016 edition and will be deferred until the next revision in 2018 (or 2019). From a practical standpoint, the absence of a TIA will restrict competition in an important timeframe when LNG as fuel, particularly in marine applications, is driving the development of LNG distribution and delivery systems. Proponents who are seeking options are facing a significant barrier in terms of regulatory uncertain without specific treatment of membrane tanks in NFPA 59A.

Moreover, the timeframe for project development is such that developers cannot practically consider membrane alternatives without using European Norms, Canadian or other standards for references to membrane tanks.

*Anyone may submit a comment by the closing date indicated above.* To submit a comment, please identify the number of the TIA and forward to the Secretary, Standards Council, 1 Batterymarch Park, Quincy, MA 02169-7471.
To: The Technical Committee – NFPA 59A

Dear Sir,

ConocoPhillips strongly supports inclusion of membrane tanks in the temporary interim amendment (TIA) to the 2016 edition of NFPA 59A. The membrane tank technology has the potential to offer significant savings in construction costs in terms of reduced labor costs and savings in schedule, and at the same time meet the required safety standards.

Best regards,

Satish Gandhi

Director, Product Development Center
LNG Technology & Licensing
ConocoPhillips
713-235-4174
NFPA 59A – Proposed 2016 Edition
Comments to TIA Log No.: 1187
By J. Hoptay - Member ACI 376 Committee

General Comment: The ACI 376 Code was written primarily for double and full containment traditional refrigerated storage tanks. The topic of including membrane storage tanks was discussed by the committee but the consensus was that at this time the Code would not include design rules for membrane tanks since, the membrane storage configuration does not have two independent containers, the rules currently in the Code are not directly applicable in all cases. This is stated in Section R.1.1, “This code is not applicable to the design of membrane tanks because construction and detailing requirements are not included.”

The ACI 376 code has attempted to provide design, construction, and inspection and testing criteria for storage tanks consisting of an independent concrete primary and secondary containments, that when compared with an independent steel primary container and concrete secondary container, would yield equally safe structures. Without a similar evaluation with the intent of providing a complete set of design, construction, and inspection and testing acceptance criteria for membrane tanks, to conclude that a design that complies with some of the ACI 376 requirements would yield an equally safe structure as compared to traditional refrigerated storage concepts, is open for interpretation.

ACI 376 recognizes that in the future the Code may be used for the design of membrane tanks by stating in Section R.1.1, “With appropriate additional analysis and justification, portions of this code may be applied to the design of the concrete outer tank of a membrane tank using both primary and secondary tank criteria.” Without this justification and definition the committee could not include a complete set of criteria for the membrane storage concept in the current revision of the code.

Therefore without specific design criteria established in ACI 376 it is premature for NFPA 59A to permit this storage concept under a TIA and indicate that it is to be designed per ACI 376.

Item Number 11.) – Section 7.3.3.2 (A) - The suggested strike through wording should remain in the paragraph, possibly reworded as follows: “A fire external to the outer tank shall not cause a reduction to the internal containment system performance due to damage to any component of the insulation system. For example, damage due to reduction of the insulation’s thermal conductivity due to melting or settlement of the insulation.”

Section 7.3.3.2 (C) – For traditional refrigerated storage tanks the insulation between the inner and outer tank bottom is a rigid cellular glass and therefore do not need to meet the combustibility requirements. The bottoms of membrane tanks are supported on reinforced polyurethane foam panels, so those panels as well as the sidewall panel should meet the combustibility requirements.

It is not clear if the requirements of 7.3.3.2 A, B, and C also apply to membrane tanks or if only 7.3.3.2 D applies to membrane tanks.
Item Number 13.) – One of the areas that caused the ACI 376 committee to decide that there was not enough information for the committee to include membrane tanks in the code dealt with seismic design. Since the membrane tank requires the concrete wall to be structurally sound to support the membrane during the OBE and SSE seismic events how is the concrete wall classified, as a primary or secondary containment, and what are appropriate performance criteria?

The proposed new Section 7.4.4.12 does not provide acceptance criteria consistent with ACI 376 whether classified as a primary or secondary container. ACI 376 requires minimum compression zones, minimum average compressive stress in the compression zone for both primary and secondary containers. Additionally, for secondary containers, the crack width is limited adjacent to the thermal corner protection but no crack width requirements are included in the proposed section.

Section 7.4.4.12 (1) & (2) provide limits for determining if the wall can be considered undamaged but does not establish upper limits for acceptance as described above. The acceptance of prior damage being taken into account in the design after an SSE event presumes that this damage can be sufficiently quantified. Without specific guidelines the evaluation of the ALE load case is open to interpretation which should be avoided.

Are there any specific seismic performance criteria that for which the liner is required to meet? How does damage to the wall affect the liner and how is that to be evaluated?

Item Number 14.) – New Section 7.4.6.5 requires that the concrete wall be hydrostatically tested before the installation of the membrane and supporting insulation to prove the structural design of the wall and foundation. It is not clear if the secondary bottom and thermal corner protection are being hydrostatically tested.
Foran, Rosanne

From: David Nasab <david.nasab@kbr.com>
Sent: Thursday, June 18, 2015 6:04 PM
To: TIAs
Subject: Comment on Proposed TIA 1187 on NFPA 59A
Attachments: ProposedTIA1187_NFPA59A.pdf

I would like to express my general comment on docuement TIA 187.

Thanks,
David Nasab, P.E.

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General Comment:

THE MEMBRANE TANK HAS NOT PROVEN IN INDUSTRY TO BE CONSIDERED AS A FULL CONTAINMENT TANK WHEN THE INTERNAL LINNER IS COMPOSITE OF OUTER CONCRETE TANK. MANY RISK STUDY SHALL BE PERFORMED ON MEMEBRANE TANK FOR LNG SERVICE TO PROVIDE TO USER IT IS SAFE DESIGN AND SYSTEM. NO MENTION OF ANY SETTLEMENT REQUIREMENTS FOR MEMEBRANE TANK WHEN THE INTERNAL LINER FULLY SUPPORTED BY INSULATION WHICH CAN BE SHIFTED AND CAUSE VOIDS WHICH WOULD CAUSE LINER FAILUR. BASED ON DISCRIPTION AND DESIGN SYSTEM. THE MEMBRANE TANKS IS SIMILAR TO SIGNLE CONTAINMENT THEREFORE A SECONDARY IMPOUNDING DIKE MAYBE REQUIRED TO IMPROVE THE INTERGRITY OF THE DESIGN CONDITIONS FOR FALURE DUE TO EVENT OF LEAKAGE FROM LIQUID LINER BARRIER.
June 18, 2015

To:
Secretary, Standards Council,
1 Batterymarch Park,
Quincy, MA, 02169-7471

From:

Rama Challa, Matrix PDM Engineering, 5100, East Skelly Drive, Tulsa, OK
Chair, API Refrigerated Tank Task Group, API SCAST

Subject: Comments on Proposed TIA 1187, NFPA 59A

Dear Secretary:

I am submitting my comments on the proposed changes to NFPA 59A in the attached pages. Please contact me if there are any questions.

Respectfully,

Rama K. Challa
A. General

AS PROPOSED

NFPA 59A-Proposed 2016 Edition
Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG)
TIA Log No.: 1187
Reference: Various
Comment Closing Date: June 19, 2015
Submitter: Adnan Ezzarhouni, GTT

Substantiation:

In terms of technical substantiation, membrane containment system tank is a full integrity system. This means the performance of the tank system shall be similar to what is required of a full containment system:

- Able to store LNG and natural gas inside the tank in all normal operating conditions.
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Emergency Nature: During March 2014 NFPA59A meeting, public inputs were reviewed. The Public Input No. 50-NFPA 59A-2013 put alert on Membrane containment tank system, which was addressed on the Definition clause only. During the meeting, TC agreed to remove the Membrane definition. However, in order not to send the wrong signal to the LNG industry (such as the technology is not allowed), the technical committee decided to create, on an urgent basis, a subcommittee to prepare wording for inclusion of a full treatment of membrane containment tank for issuance as a TIA coincidentally with the 2016 version. This subcommittee has now completed its work and agreed wording is proposed as a TIA. Acceptance of this TIA on an emergency basis is consistent with the following bases as prescribed in the standard:

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the absence of a TIA (expected to be released concurrently with 2016 edition), membrane containment systems will not be in NFPA59A 2016 edition and will be deferred until the next revision in 2018 (or 2019). From a practical standpoint, the absence of a TIA will restrict competition in an important timeframe when LNG as fuel, particularly in marine applications, is driving the development of LNG distribution and delivery systems. Proponents who are seeking options are facing a significant barrier in terms of regulatory uncertain without specific treatment of membrane tanks in NFPA 59A.

Moreover, the timeframe for project development is such that developers cannot practically consider membrane alternatives without using European Norms, Canadian or other standards for references to membrane tanks.

Anyone may submit a comment by the closing date indicated above. To submit a comment, please identify the number of the TIA and forward to the Secretary, Standards Council, 1 Batterymarch Park, Quincy, MA 02169-7471.

**General Comments**

1. The industry will benefit if alternate systems for LNG Storage are available in the market place.

2. The proposed changes imply that a membrane tank system and a full containment tank systems are equivalent with regard safety and performance requirements. The task group should identify the risks and hazards associated with membrane tank systems to ensure that safety and performance requirements are not compromised.

   These aspects of full containment tank systems follow the requirements of API standard 625; API Standard 620 and ACI 376. These standards in turn rely on other standards and codes such as ASCE 7, ASME Section IX etc. to provide a frame work of safety and performance. The TG should ensure that this frame work is not compromised when EN and US standards are used together.

3. The requirements imposed on the design of membrane tank systems should be clear, specific and prescriptive. Some of the requirements proposed are not prescriptive and require agreement between manufacturers and end users. Similarly, certain requirements proposed refer to tests and procedures that do not identify the test methods or acceptance criteria. These should be identified.

4. Certain proposed changes refer to the construction and examination methods with the methods and acceptance criteria left to agreement between the constructor and end user. API and ACI standards have very prescriptive requirements with regard to construction. These requirements should be utilized for membrane tank construction.
B. Comments on specific sections

1. Add new entries to Subsection 2.3.12 to read as follows:

**AS PROPOSED**

EN14620-1 through 5, (2006) Design and manufacture of site built, vertical, cylindrical, flat-bottomed, Steel tanks for the storage of refrigerated, liquefied gases with operating temperatures between 0 °C and -165 °C PARTS 1 – 5


**COMMENTS**

None. Addition to the references section.

2. Add new 3.3.4.3.3* and Annex to read as follows (renumber current 3.3.4.3.3 as 3.3.4.3.4):

**AS PROPOSED**

3.3.4.3.3* Membrane Containment Tank System. A tank system consisting of a thin metal liquid barrier and load-bearing thermal insulation supported by a self-standing outer concrete container jointly forming an integrated composite tank structure which provides liquid and vapor containment during tank operation as well as LNG containment in the event of leakage from the liquid barrier, and where the vapor-containing roof of the outer container is either steel or concrete configured such that the excess vapor caused by a spill of LNG from the liquid barrier will discharge through the relief valves.

**COMMENTS**

Editorial Change

3.3.4.3.3* Membrane Containment Tank System. A tank system consisting of a thin metal liquid barrier and load-bearing thermal insulation supported by a self-standing outer concrete container jointly forming an integrated composite tank structure designed to contain liquid and vapor during tank operation and to contain LNG in the event of leakage from the liquid barrier, and where the vapor-containing steel or concrete roof of the composite tank structure is configured such that the excess vapor caused by a spill of LNG from the liquid barrier will discharge through the relief valves.

Technical Comment:

From the wording, it appears that the outer concrete container will be permeable to LNG vapor in case of a leakage from the membrane. This has to be clarified.

**AS PROPOSED**

A.3.3.4.3.3 A membrane containment tank system comprises a thin metal liquid- and vapor-tight barrier acting against load-bearing thermal insulation and supported by a free-standing outer pre-stressed concrete container. In normal conditions primary liquid containment is afforded by a thin metallic barrier which is structurally supported via load-bearing insulation and an outer pre-stressed concrete container. Under these conditions primary vapor containment is afforded by the thin metallic barrier which is connected to the metallic roof liner. In emergency conditions secondary liquid and vapor containment is afforded by an outer pre-stressed concrete container and metallic roof liner. The outer container must be capable of both containing the liquid product and controlling the vapor resulting from evaporation. In this instance the vapor generated from the leakage is discharged through pressure relief...
valves located in the roof. Vapor losses due to permeability through the outer pre-stressed concrete are acceptable while containing liquid in the event of leakage from the thin metal barrier and insulation system. The roof of the outer pre-stressed concrete container may be concrete or steel. Significant design issues arise at the monolithic base-to-wall connection due to the mechanical restraint offered by the base. To mitigate these issues, a secondary liquid containment barrier inside the insulation system across the entire bottom and part of the wall in the vicinity of the base-to-wall joint is to be provided to protect and thermally isolate this area from the cold liquid and provide liquid tightness.

**COMMENTS**

**Editorial Change**

A.3.4.3.3 a membrane containment tank system comprises a thin metal liquid- and vapor-tight barrier acting against load-bearing thermal insulation and supported by a free-standing outer pre-stressed concrete container. In normal conditions, primary liquid and vapor containment is afforded by a thin metallic barrier which is structurally supported via load-bearing insulation and an outer pre-stressed concrete container. Under these conditions primary vapor containment is afforded by a thin metallic barrier connected to the metallic roof liner. In emergency conditions, secondary liquid and vapor containment is afforded by an outer pre-stressed concrete container and metallic roof liner. The outer container must be capable of both containing the liquid product and controlling the vapor resulting from evaporation. In this instance the vapor generated from the leakage is discharged through pressure relief valves located in the roof. Vapor losses due to permeability through the outer pre-stressed concrete are acceptable while containing liquid in the event of leakage from the thin metal barrier and insulation system. The roof of the outer pre-stressed concrete container may be concrete or steel. Significant design issues arise at the monolithic base-to-wall connection due to the mechanical restraint offered by the base. To mitigate these issues, a secondary liquid containment barrier inside the insulation system across the entire bottom and part of the wall in the vicinity of the base-to-wall joint is to be provided to protect and thermally isolate this area from the cold liquid and provide liquid tightness.

Technical Comment:
See comment for Section 3.3.4.3.3.

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**AS PROPOSED**

3.3.4.3.34* Single Containment Tank System.

A single wall container or a double wall tank system in which only the self-supporting primary or inner container is designed to contain LNG.

**COMMENTS**

None.

3. Revise 5.3.1.1(4) to read as follows:

**AS PROPOSED**

5.3.1.1 Provisions shall be made to minimize the potential of accidental discharge of LNG at containers, pipelines containing LNG, and other equipment such that a discharge from any of these does not endanger adjoining property or important process equipment and structures or reach waterways. LNG containers shall be provided with one of the following methods to contain any release:

1. An impounding area surrounding the container(s) that is formed by a natural barrier, dike,
impounding wall, or combination thereof complying with 5.3.2 and 5.3.3

(2) An impounding area formed by a natural barrier, dike, excavation, impounding wall, or combination thereof complying with 5.3.2 and 5.3.3, plus a natural or man-made drainage system surrounding the container(s) that complies with 5.3.2 and 5.3.3

(3) Where the container is constructed below or partially below the surrounding grade, an impounding area formed by excavation complying with 5.3.2 and 5.3.3

(4) Secondary containment as required for double, or full, or membrane containment tank systems complying with 5.3.2 and 5.3.3.

**COMMENTS**

Technical Comment:
This section of NFPA 59A deals with accidental discharge and the requirement for impoundment. The implication of this clause is that that Full Containment and Membrane Containment Tank Systems are equivalent from a risk consideration. Full Containment Tanks have two separate vessels with the 9% Ni tank is independent of the outer containment. Structurally, the Membrane Tank has only one major containment - the concrete vessel with the membrane liner. Both systems have inherent advantages and disadvantages. Prior to considering equivalency, I suggest review of studies or safety assessments comparing both system types.

4. **Revise 5.3.2.5** and the Annex to read as follows:

**AS PROPOSED**

5.3.2.5* Dikes and impounding walls shall meet the following requirements:

(1) Dikes, impounding walls, drainage systems, and any penetrations thereof shall be designed to withstand the full hydrostatic head of impounded LNG or flammable refrigerant, the effect of rapid cooling to the temperature of the liquid to be confined, any anticipated fire exposure, and natural forces, such as earthquakes, wind, and rain.

(2) Where the outer shell of a double wall tank complies with the requirements of 5.3.1.1, the dike shall be either the outer shell or as specified in 5.3.1.1.

**COMMENTS**

Technical Comment:
See comment on Item 3

**AS PROPOSED**

A.5.3.2.5 Section 7.2.1.1 requires compliance with API 625. API 625 paragraph 5.6 requires the selection of storage concept to be based on a risk assessment. API 625 Annex C discusses implications of a release of liquid from the primary liquid container and provides specific discussion related to each containment type. API 625 Annex D provides guidance for selection of storage concepts as part of the risk assessment including external and internal events and hazards to be evaluated. Paragraph D.3.2.2 discusses the possibility of sudden failure of the inner tank and advises “if extra protection from brittle fracture” (or unabated ductile crack propagation) “is desired, the general practice is to increase the” primary container toughness. Available materials meeting the required specifications of API 620 Appendix Q (and this standard) for LNG service are considered to have crack-arrest properties at LNG service temperature and stress levels. Therefore, rapid failure of a steel primary container meeting this
standard is not considered credible. In membrane containment tank systems, due to primary membrane specific construction, rapid failure is not considered credible as well.

**COMMENTS**

**Editorial Comment:**
The statements in A.5.3.2.5 preceding the proposed change pertain to Single, Double and Full containment systems. Adding the word “membrane” dilutes the import of this paragraph. I do not see a need to add the last sentence, I suggest the following:

Therefore, rapid failure of a steel primary container, for single, full and double containment tank systems, meeting this standard is not considered credible. In membrane containment tank systems, due to primary membrane specific construction, rapid failure is not considered credible as well.

If required and if the following statement is true, the following may be added with specific hazards, unique to the membrane tank systems, clearly identified:

Brittle fracture of membrane material is typically not a pertinent hazard for membrane tanks. However, other hazards based on a risk assessment should be considered.

**Technical Comment:**
A.5.3.2.5 expands on Section 5.3.2.5, specifically with regard to dikes and impounding wall. A credible scenario for risk evaluation is the risk of the brittle fracture of the material of the inner tank of a full containment tank system. Membrane material in membrane tanks does not seem have a potential for brittle fracture as the membrane tank liner is constructed of very thin wall material. However, that may not be failure scenario to be examined here. Are there other hazards that need to be considered such as a potential for a membrane tank connections or corrugations to unzip in a rapid failure mode? If they exist, how are they addressed?

5. Revise 5.3.2.7 to read as follow

**AS PROPOSED**

5.3.2.7 Double, and full, and membrane containment tank systems shall be designed and constructed such that in the case of a fire in an adjacent tank, the secondary container shall retain sufficient structural integrity to prevent collapse, which can cause damage to and leakage from the primary container.

**COMMENTS**

None

6. Renumber 5.3.2.7 and revise to read as follows:

**AS PROPOSED**

5.3.2.78 Double, and full, and membrane containment tank systems shall have no pipe penetrations below the liquid level.

**COMMENTS**

**Editorial Comment:**
5.3.2.78 For Double, and full, and membrane containment tank systems shall have no pipe penetrations below the liquid level shall not be permitted.

7. Revise 5.3.4.2 and add new 5.3.4.2.1 to read as follows:

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August 7, 2015
Supplemental Agenda Standards Council Meeting August 17-19, 2015
Page 500 of 536
AS PROPOSED

5.3.4.2 Double, full, and double membrane containment tank systems of greater than 70,000 gal (265 m³) water capacity shall be separated from adjacent LNG storage containers such that a fire in an adjacent single or double containment impoundment or from a design spill will not cause loss of containment from adjacent containers. This shall be accomplished by ensuring that no part of the adjacent storage container roof, walls, or its impoundment structure reaches a temperature at which the strength of the material of the container roof, wall, or its impoundment is reduced to a level where the LNG tank, roof, or impoundment loses its structural integrity. ….

5.3.4.2.1 The outer concrete container shall be designed for the external fire in accordance with ACI 376 unless the fire protection measures are provided. The outer tank thermal analysis shall be performed to determine temperature distribution for the heat flux and duration of exposure as specified in the fire risk assessment.

(1) The applicable load components and the ultimate state load factors for the fire load combinations shall be in accordance with ACI 376 Table 7.3. For membrane tanks an additional liquid pressure load in accordance with ACI 376 Table 7.2 shall be included.

(2) The design of the outer concrete container shall take into account the following factors:

(a) Reduction in the wall post-tensioning due to the difference in the coefficient thermal expansion of post-tensioning steel and wall concrete at the temperature post-tensioning steel is exposed. The effects of the concrete aggregate type on the concrete coefficient thermal expansion shall be considered;

(b) Reduction in strength and modulus of elasticity of the outer tank concrete, reinforcing and Post-tensioning steel due to elevated temperature;

(c) Reduction in the wall post-tensioning due to prestressing steel softening and relaxation at elevated temperature;

(3) Concrete shall be designed to avoid explosive spalling.

COMMENTS

8. Revise 7.2.1.1 to read as follows:

AS PROPOSED

7.2.1.1 Storage tank systems shall comply with the requirements of API 625, Refrigerated Liquefied Gas Storage or, for membrane containment tank systems, EN 14620, and the additional provisions of this chapter. The API 625 risk assessment shall be approved by the AHJ.

COMMENTS

Technical Comment:
The last line refers to risk assessment for storage built to API 625. It should be modified to reflect that any risk assessments shall be approved by AHJ.

9. Add new 7.2.1.4 and 7.2.1.5 and renumber current 7.2.1.4 to read as follows:

AS PROPOSED
7.2.1.4 The metallic membrane, load bearing insulation, and the outer container moisture barrier specific to the membrane tank system shall comply with EN 14620 parts 1-5 for material selection, design, installation, examination, and testing and further requirements of 7.4. All other components of the membrane tank system shall comply with API625, API620, ACI376 and additional requirements in 7.4.

COMMENTS

Technical Comment:
1. API 625 standard points to API 620 for metallic containers and ACI 376 for concrete. Within these standards explicit design margins are spelled out for various components that are used in the Single, Double and Full containment Tanks. The proposal implies that the design margins in EN 14620 parts 1 through 5 are established using similar philosophies and are based equivalent safety considerations. Unless the design margins have been examined and considered equivalent, it is premature to invoke a different standard with a different philosophical underpinnings under this TIA.
2. This clause, if used, will lead to a process of two standards having different requirements for the same component. It may lead to a process of mixing and matching requirements to suit one’s convenience. If used together, a hierarchy for resolution of conflicts need to be established.

AS PROPOSED

7.2.1.5 Requirements for openings, internals, roof, and suspended deck shall follow API 625.

COMMENTS

Technical Comment:
See comment on Section 7.2.1.4, item 1. API 625 on specific requirements points to API 620 & ACI 376. Within API 620, requirements for the above items such as openings are based on the design criteria, load and failure paths established within the particular standard. As an example, opening reinforcement differs between API 620 and API 650, though they are both for welded storage tanks. If the tank and the roof are designed per EN 14620, using a different standards for certain components may have issues.

AS PROPOSED

7.2.1.46 Should any conflict exist between the above requirements, the most stringent requirement shall apply.

COMMENTS

Technical Comment:
See comments on Section 7.2.1.4, item 1 & 7.2.1.5. Using a different standards for certain components may have issues. Similarly, whether a requirement is more stringent or less stringent could be a point of contention and may result in undesirable consequences.

10. Revise 7.3.1.2 (A) to read as follows:

AS PROPOSED

7.3.1.2 All piping that is a part of an LNG tank system shall comply with requirements in this chapter and requirements within API 625.
(A) Tank system piping shall include all piping internal to the container, within insulation spaces and within void spaces, external piping attached or connected to the container up to the first circumferential external joint of the piping, and external piping serving only tank instrumentation (including tank pressure relief valves). All liquid piping with a source of external line pressure shall be designed for the external line relief valve setting but not less than 50 psi (345 kPa). Double, full, and membrane containment tank systems shall have no pipe penetrations below the liquid level.

COMMENTS
None.

11. Revise 7.3.3.2 and 7.3.3.2(A) and add new (D) to read as follows:

AS PROPOSED

7.3.3.2 The space between the inner container and the outer container shall contain insulation that is compatible with LNG and natural gas and that is noncombustible as installed for normal service and abnormal conditions.
(A) A fire external to the outer tank shall not cause a reduction of the insulation thermal conductivity due to melting or settling to the internal containment system performance due to damage to any component of the insulation systems.
(B) The load-bearing bottom insulation shall be designed and installed so that cracking from thermal and mechanical stresses does not jeopardize the integrity of the container.
(C) Only materials used between the inner and outer tank bottoms (floors) shall not be required to meet the combustibility requirements, where the material and the design of the installation comply with all of the following:
   (1) The flame spread index of the material shall not exceed 25, and the material shall not support continued progressive combustion in air.
   (2) The material shall be of such composition that surfaces that would be exposed by cutting through the material on any plane shall have a flame spread index not greater than 25 and shall not support continued progressive combustion.
   (3) It shall be shown by test that the combustion properties of the material do not increase significantly as a result of long-term exposure to LNG or natural gas at the anticipated service pressure and temperature.
   (4) The materials in the installed condition shall be demonstrated to be capable of being purged of natural gas.
   (5) The natural gas remaining after purging shall not be significant and shall not increase the combustibility of the material.
(D) For membrane containment tank systems, the insulation system block shall include a non-foam cover (underneath the primary membrane) and shall include a welding thermal protection system in order to withstand all heat from welding during installation and during maintenance, if any.

COMMENTS

Editorial Comment:
Suggest the following:

7.3.3.2 The space between the inner container and the outer container shall contain insulation that is

compatible with LNG and natural gas and that is noncombustible as installed for normal service and abnormal conditions.

(D) In addition to the above requirements, for membrane containment tank systems, the insulation system block shall include a non-foam cover (underneath the primary membrane) and shall include a welding thermal protection system in order to withstand all heat from welding during installation and during maintenance, if any.

Technical Comment:
- The word “as installed” in 7.3.3.2 appears to be redundant. Will the insulation become combustible after the system is put in service?
- (A) Statement indicating reduction of the insulation thermal conductivity due to melting or settling in Section 7.3.3.2 (A) is removed. It is not clear why a reduction of insulation thermal conductivity could not be deleterious to the performance of the internal containment system
- (D) Suggest guidance on type of welding thermal protection.
- (C) This item, as originally written, is with regard to guidance on conventional double wall tanks. Are these requirements still valid for membrane tanks?

12. Add a new 7.4.2.3 to read as follow

**AS PROPOSED**

**7.4.2.3** For membrane containment tank systems, weld procedure and production weld testing shall comply with EN14620 part 2 and the following requirements:

**COMMENTS**

Technical Comment:
US Codes and standards require that welding follow the requirements set forth in ASME Section IX. For example in NFPA 59A-13, welding requirements are to follow Section IX (See Section 6.2.2). API 620 requires all welding procedures to follow API 620 Section 6.6 and Q.4. Both the sections point to ASME Section IX.

**AS PROPOSED**

**7.4.2.3.1 Qualification of Welders.** All personnel associated with the welding fabrication of the membrane system shall be qualified by the manufacturer per an agreed upon schedule between the purchaser, the AHJ, and the fabricator. All records shall be available for review.

**COMMENTS**

Editorial Comment:

Suggest dropping the requirements for a schedule

**7.4.2.3.1 Qualification of Welders.** All personnel associated with the welding fabrication of the membrane system shall be qualified by the manufacturer per an agreed upon schedule between the purchaser, the AHJ, and the fabricator. All records shall be available for review.

Technical Comment:
Typically welders are qualified by the manufacturer or fabricator prior to any production welding.
per prescribed welder qualification procedure meeting ASME Section IX. The testing is done by the manufacturer to meet the construction schedule. If a welder is qualified, there is no requirement that they be requalified from project to project. See API 620, Section 6.8. If the qualifications processes in ASME Section IX are inadequate for this application, then a prescriptive qualification procedure should be provided. Once the welders are qualified, these records shall be made available for the inspector.

**AS PROPOSED**

7.4.2.3.2 Inspection. 100% of all welding shall be visually inspected for workmanship and conformance to the fabrication requirements. Bead placement and consistency shall be, at a minimum, documented by digital means for review by supervisory personnel.

The personnel performing this visual inspection shall be qualified to an accepted standard for this inspection work.

Upon cool down of the welds to room temperature, provisions shall be made to perform a penetrant inspection (PT) of at least 5% of each weld type each day. The selection factors include orientation, welding direction, and complexity of welding being performed.

a) All profiles and configurations of welds shall be subjected to this 5% requirement. The selection of This 5% sample shall be agreed upon by the fabricator, customer’s representative, and the AHJ. b) The acceptance standard for this inspection technique shall be agreed upon by all parties.

c) Any indications require an additional 5% penetrant inspection of the total distance welded by each Welder.

Inspection after completion of membrane shall be performed at the completion of the installation of the membrane, and represents the last step prior to the cool down of the tank to service temperature.

After completion of the membrane, a leakage test shall be performed. Leakage shall be determined as agreed upon by the fabricator and customer.

Tracer gas for this leak test shall be in accordance with approved procedure. All areas where leakage exceeds limit shall be repaired per 7.4.2.3.2, the manufacturer’s approved procedure and re-inspected.

In parallel, mechanical stress testing of the welding joints shall be performed by applying 3 cycles from atmospheric pressure to +20 mbarg inside the insulation space, with the pressure maintained, for a minimum time of 30 minutes. Data shall be recorded.

**COMMENTS**

Technical Comment:
Multiple comments for the items within this section:

1. 1st paragraph refers to visual inspection and the 2nd paragraph refers to qualification of the inspectors. The documentation requirements are digital. Does this mean photography or video record of the welds are after completion? It should be clarified. API 620 Section 7.15.5 has specific requirements with regard to visual inspection including qualification of the visual examiner and methodology for acceptance or rejection of the welds. Similarly API 620 Section Q.5 has guidance on requirements for each type of weld such as butt welds, fillet welds etc. Either the requirements should point to the API 620 requirements or should
clearly define what the requirements are.

2. Similarly API 620 Section 7.15.4 identifies requirements for qualification of the Penetrant Testing (PT) examiner and methodology for acceptance or rejection of the welds. Either the requirements should point to the API 620 requirements or should clearly define what these requirements are. Any other requirements added should be additive to these requirements.

3. Should the leakage rate through the membrane be zero and not an agreed upon number between the manufacturer and the purchaser?

4. The tracer gas to be used for the leakage test should be per an approved procedure. Requirements in the procedure should be prescriptive and based on a standard publications such as a EN or API document. If approval is required for this procedure, the authority issuing approval has to be identified.

5. There is a statement that areas that have leakage have to be repaired per 7.4.2.3.2. However, this proposed section does not give guidance with regard to the repair. API 620 in various sections, provides guidance on repairs that are needed for welds for defects discovered by various examination techniques. See for example API 620 Section 7. These are prescriptive and should be utilized.

6. Requirement for mechanical testing of the membrane weld is not clear. It appears that mechanical testing refers to using an apparatus such as vacuum box. The type of testing should be clearly mentioned. Typical pressures for vacuum box testing in API 620 are 3 psi gage. Pressures mentioned here is about 030 psi.

**AS PROPOSED**

7.4.2.3.3 Post-Repair Inspection. Additional tracer gas testing shall be performed if more than 4 leaks per 1,000 m² of membrane are identified. All repaired areas shall be visually inspected (VT), vacuum box (VB) tested, and dye penetrant (PT) tested.

**COMMENTS**

Technical Comment:
The requirement for additional tracer gas testing to be done only if more than 4 leaks are discovered seems to be a deviation from EN 14620-5. EN 14620-5 requires another leak test.

**AS PROPOSED**

7.4.2.3.4 Final Global Test and Control during Dismantling Work.
This testing shall be in agreement with the approved test procedure and witnessed by all parties. This represents the final acceptance testing of the completed membrane structure following completion of its installation in the structural outer shell / container.

a) The overall tightness of the membrane shall be determined by establishing a pressure difference between the tank and the insulation space.

b) This pressurization allows gas flow through the membrane representative of potential leaks on the Membrane.

c) The potential leak(s) shall be characterized by measuring the oxygen content increase in the primary insulated space as the tank is pressurized with dry air.

d) The primary insulated space shall be regulated slightly above the atmospheric pressure.

e) All test data, all records, documentation, and witness records shall be submitted to all parties for their review and final acceptance.

Daily tightness check / monitoring shall be performed during dismantling work by pulling vacuum.
inside insulated spaces. Any pressure rise is indicative of a leak and must be reported and correction action taken.

COMMENTS

Technical Comment:
Definition shall be provided for dismantling work in membrane tanks.

13. Add a new 7.4.4.12 to read as follows:

AS PROPOSED

7.4.4.12 The outer concrete tank analysis and design for the major leak and major leak plus ALE aftershock event shall take into account any damage that may have occurred to the outer concrete tank due to prior events including the SSE earthquake. The outer concrete tank shall be considered as undamaged during the prior SSE event if the following conditions are met:
(1) Tensile stresses in the reinforcing steel do not exceed 90% of the reinforcing steel yield
(2) Maximum concrete compressive stresses do not exceed 85% of the concrete design compressive strength.
Otherwise, the prior damage shall be taken into account in the spill analysis.

COMMENTS

Technical Comment:
Specific requirements for Secondary Concrete Container are provided in ACI 376, Section 6.3. It is not clear if these requirements are additional requirements.

14. Add new 7.4.6.5 and Annex to read as follows:

AS PROPOSED

7.4.6.5* Membrane containment tank systems shall be tested in accordance with EN 14620 Part 5 Table 1. The leakage test, as defined in the Note under EN 14620 Part 5 paragraph 4.1.1, shall be performed. Leakage through the membrane to the insulation space during service must be controlled in order to maintain gas concentration level below 30% of the LEL by sweeping the insulated space with N2. If the gas concentration cannot be maintained below 30% LEL the tank must be decommissioned and retested. For purposes of evaluating this level, the flow of purge gas within the annular space shall not be increased above the normal operating rate.

COMMENTS

Editorial Comment:
Suggest the following changes:

7.4.6.5* Membrane containment tank systems shall be tested in accordance with EN 14620 Part 5 Table 1. The leakage test, as defined in the Note under EN 14620 Part 5 paragraph 4.1.1, shall be performed. If there is leakage through the membrane to the insulation space during service, it must be controlled in order to maintain gas concentration level below 30% of the LEL by sweeping the insulated space with an inert gas insulation space monitoring system. If the gas concentration cannot be maintained below 30% LEL the tank must be decommissioned and retested. For purposes of evaluating this level, the flow of purge gas within the annular space shall not be increased above the normal operating rate.
Technical Comment:
Editorial change made with the premise that there should be not be any leaks through the membrane after construction.

**AS PROPOSED**

A.7.4.6.5 EN 14620 Part 5 Table 1 requires the outer concrete tank to be hydrostatically tested prior to installing insulation and the membrane. The membrane is leak tested after all welding is completed. A retest is required following repairs to close leaks. An insulation space monitoring system is required by EN 14620 Part 1 paragraph 7.2.1.8 which is intended to identify any leaks of LNG gas or vapor into the space between the membrane and the wall.

**COMMENTS**
None

15. Add new 7.4.6.6 and 7.4.6.7 to read as follows:

**AS PROPOSED**

7.4.6.6 All the membrane system components, including insulation, primary membrane, and the secondary barrier of the thermal protection system, shall be designed in such a way that they can withstand all possible static and dynamic actions throughout the tank lifetime.

7.4.6.7 Verification of all components of the membrane containment tank system design by experimental data from model tests shall be carried out.

**COMMENTS**

Technical Comment:
Section 7.4.6.7 suggests all components be tested using model tests. For certain components, EN 14620 identifies both analytical work and model tests as being admissible for design. Using all is too onerous and may not be practical.

16. Add a new Subsection 7.4.7 to read as follows:

**AS PROPOSED**

7.4.7 Additional Requirements for Membrane containment tank system.

7.4.7.1 A thermal corner protection system functionally identical to the thermal corner protection system for concrete tanks defined in API625 Section 6 shall be provided for the outer concrete tank of the membrane tank system. The thermal corner protection shall protect the outer tank entire bottom and at least lower 16.5 feet (5m) of the wall from thermal shock and shall be liquid tight when it is in contact with LNG and vapor tight in all conditions. The thermal corner protection system shall be permitted to be either metallic or from nonmetallic materials compatible with LNG and shall maintain structural integrity and liquid/gas tightness under all applicable mechanical and thermal loads.

The membrane containment tank system supplier shall provide tests independently witnessed and verified by a third party agency clearly demonstrating the leak tightness of all the thermal corner system under spill conditions. Historical tests shall be acceptable provided that construction processes and materials of construction are the same as those proposed. Nondestructive examination (NDE) performed on the secondary barrier and NDE acceptance criteria shall ensure that provided tightness is equivalent to the tightness provided by the metallic thermal corner protection system of the full containment tank.
**COMMENTS**

Technical Comment:
The type of tests and acceptance criteria should be defined. Clarity should be provided with regard to if the tests are for individual components or assemblies.

**AS PROPOSED**

7.4.7.2 The outer concrete container of the membrane containment tank system shall meet all requirements of ACI376 for the secondary concrete container including materials, design, construction, inspection, and testing and the additional requirements specified below:

7.4.7.2.1 The product liquid pressure shall be a design load for the outer concrete tank. Liquid product pressure ultimate limit state (ULS) load factors for operating and abnormal loading conditions shall be in accordance with Table 7.2 of ACI376.

7.4.7.2.2 The outer concrete container wall and slab-to-wall junction shall be checked for fatigue assuming four full load-unload cycles a week for the expected life of the tank. Performance criteria of ACI376 Appendix C shall apply.

7.4.7.2.3 The outer concrete container wall shall resist the specified impact load without perforation and scabbing:

   A) The concrete wall thickness shall be at least 40% greater than the scabbing depth calculated per CEB 187 Section 4.1.2.2

   B) The concrete wall thickness shall be at least 20% greater than the perforation thickness calculated per CEB 187 Section 4.1.1.1

   C) The tank shall be designed so that either one of the following is satisfied:

      1. The distance between the outer face of the concrete container measured to the centroid of the pre-stressing tendons shall be greater than the penetration depth calculated as per CEB 187 Section 4.1.2.1 with the following allowances for uncertainty:
         - 20% thicker than the penetration depth when \( z > 0.75 \)
         - 50% thicker than the penetration depth when \( z \leq 0.75 \).

      2. The tank shall be designed to be able to resist normal operating loads with any one horizontal tendon completely ineffective.

7.4.7.2.4 At a minimum, the outer concrete container for the membrane tank system shall meet the construction tolerances specified in ACI376. Where more stringent tolerances are required by the membrane and insulation systems, the more stringent tolerances shall be specified by the membrane tank engineer and be met by the tank contractor.

7.4.7.2.5 The outer concrete container shall be hydro tested prior to membrane and insulation installation following primary container hydro test requirements of API625 Section 10.

**COMMENTS**

None
17. Revise the title of Figure 10.7.2(e) to read as follows:

**AS PROPOSED**
FIGURE 10.7.2(e)   Full and Membrane Containment Container tank systems.

Table 15.6.1  Example Component Failure Database

<table>
<thead>
<tr>
<th>Component</th>
<th>Annual Probability of Failure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Atmospheric Cryogenic Tanks</strong></td>
<td></td>
</tr>
<tr>
<td>(1) Instantaneous failure of primary container and outer shell,</td>
<td>5.00E-07</td>
</tr>
<tr>
<td>release of entire contents (single containment tank)</td>
<td></td>
</tr>
<tr>
<td>(2) Instantaneous failure of primary container and outer shell,</td>
<td>1.25E-08</td>
</tr>
<tr>
<td>release of entire contents (double containment tank)</td>
<td></td>
</tr>
<tr>
<td>(3) Instantaneous failure of primary and secondary container, release</td>
<td>1.00E-08</td>
</tr>
<tr>
<td>of entire contents (full and membrane containment tank tanks)</td>
<td></td>
</tr>
</tbody>
</table>

**Technical Comment:**
Proposed changes imply that both the full containment and membrane containment tanks have the same annual probability of failure. The equivalency should be based on studies. Recommend having a separate line for membrane tanks identifying the Probability of Failure (POF). Item 3 of table 15.6.1 refers to primary and secondary containments for a full containment tank system. There is no primary container for a membrane tank unless the outer tank with the liner is considered to be a primary tank.

19. Revise B.3.4 to read as follows:

**AS PROPOSED**

**B.3.4**  The impounding system must, as a minimum, be designed to withstand the SSE level of loading while empty (or while full if a membrane containment tank system) and the ALE level of loading while holding the volume, \( V \), as specified in 7.4.4.7. The rationale is that should the LNG container fail following an SSE, the impounding system must remain intact and be able to contain the contents of the LNG container when subjected to an aftershock.

**COMMENTS**

**Editorial Comment:**
Suggest the following change:

**B.3.4**  The impounding system must, as a minimum, be designed to withstand the SSE level of loading while empty (and full if a membrane containment tank system) and the ALE level of loading while holding the volume, \( V \), as specified in 7.4.4.7. The rationale is that should the LNG container fail following an SSE, the impounding system must remain intact and be able to contain the contents of the LNG container when subjected to an aftershock.
Technical Comment:
It appears that the intent is to impose additional requirements for membrane tanks for a load condition that combines SSE will liquid.
Dear Coleen Kelly,

I am writing to you as Chairperson of American Concrete Institute (ACI) Committee 376 - “Concrete Structures for Refrigerated Liquefied Gas Containment”.

I have reviewed TIA Log No.: 1187 and support implementing proposed text into NFPA 59A on technical merit as an interim document. After implementation of this text, ACI 376 committee will update the ACI 376 code “Code Requirements for Design and Construction of Concrete Structures for Containment of Refrigerated Liquefied Gases and Commentary” as required.

Best regards,
Kåre

Kåre HJORTESET M.Sc
Principal Engineer, Concrete Structures
DNV GL – Oil & Gas

E-mail  kare.hjorteset@dnvgl.com
Mobile +47 911 38 484
www.dnvgl.com  |  LinkedIn
Good morning

Please find here attached comment on TIA 1187.

Sincerely,
NFPA 59A-Proposed 2016 Edition

Standard for the Production, Storage, and handling of liquefied natural gas (LNG)

TIA Log No 1187: Comment on changes proposed by GTT

Date: June 18, 2015

Autor: Entrepose Contracting

General EC comment:

From a technical point of view the membrane tank concept cannot be linked to that of the full containment tank concept. Indeed the **full containment tank concept** is based on the principle of a **primary and a secondary independent containers (two safety barriers)** which is a fundamental difference with the **membrane tank concept** whose principle is based on a **monolithic primary and secondary container (one safety barrier)**.

Accordingly, membrane and full containment tank concepts shall be treated independently.

5.3.1.1
« (4) Secondary containment as required for double, or full, or membrane containment tank systems complying with 5.3.2 and 5.3.3 »

EC comment:

Revise wording of item (4) and add an additional item (5) as proposed here below.

« (4) An independent secondary containment as required for double or full containment tank systems complying with 5.3.2 and 5.3.3

(5) Secondary containment as required for membrane containment tank system complying with 5.3.2 and 5.3.3 »

5.3.2.5*
« (2) Where the outer shell of a double wall tank complies with the requirement of 5.3.1.1, the dike shall be either the outer shell or as specified in 5.3.1.1. »

EC comment:

Revise wording of item (2) and add additional item (3) dealing with membrane concept.

« (2) Where the outer shell of a double wall tank complies with the requirement of 5.3.1.1, the dike shall be either the outer shell or as specified in 5.3.1.1.

(3) ... »
7.3.3.2

« The space between the inner container and the outer container shall contain insulation that is compatible with LNG and natural gas and that is noncombustible as installed for normal service and abnormal conditions.

(A) A fire external to the outer tank shall not cause a reduction of the insulation thermal conductivity due to melting or settling to the internal containment system performance due to damage to any component of the insulation systems. »

EC comment:
Allowing the use of a flammable material would be a step backwards in terms of safety of goods and people. Revise as follow.

« The space between the inner container and the outer container shall contain insulation that is compatible with LNG and natural gas and that is noncombustible.

(A) A fire external to the outer tank shall not cause reduction of the insulation thermal conductivity due to melting or settling »

Table 15.6.1

«

| (3) Instantaneous failure of primary and secondary container, release of entire contents (full and membrane containment tank tanks) | 1E-08 |

»

EC comment:
Revise item (3) and add additional item (4) dealing with membrane concept.

«

| (3) Instantaneous failure of primary and secondary container, release of entire contents (full containment tank) | 1E-08 |
| (4) ... | ... |

»
Dear Sir or Madam,

Herewith attached is my comments on TIA 1187 of NFPA 59A.

Please find the attached PDF file.

My comments are inserted as annotations.

They are based on IHI’s experiences and professional opinions for Membrane tanks.

For your reference, IHI has constructed 30+ Membrane tanks in the world (mainly in Japan).

If you have any question on the comments, please let me know.

Best regards,

Masaki Takahashi / IHI

**********************************************************

Masaki Takahashi
Manager
Tankage Engineering Group, Engineering Department
Plant Project Center
Energy & Plant Operations

IHI Corporation
Tel: +81-3-6204-7619
E-mail: masaki_takahashi@ihi.co.jp

**********************************************************
1. Add new entries to Subsection 2.3.12 to read as follows:

EN14620-1 through 5, (2006) Design and manufacture of site built, vertical, cylindrical, flat-bottomed, steel tanks for the storage of refrigerated, liquefied gases with operating temperatures between 0 °C and -165 °C PARTS 1 – 5


2. Add new 3.3.4.3.3* and Annex to read as follows (renumber current 3.3.4.3.3 as 3.3.4.3.4):

3.3.4.3.3* Membrane Containment Tank System. A tank system consisting of a thin metal liquid barrier and load-bearing thermal insulation supported by a self-standing outer concrete container jointly forming an integrated composite tank structure which provides liquid and vapor containment during tank operating as well as LNG containment in the event of leakage from the liquid barrier, and where the vapor-containing roof of the outer container is either steel or concrete configured such that the excess vapor caused by a spill of LNG from the liquid barrier will discharge through the relief valves.

A.3.3.4.3.3 A membrane containment tank system comprises a thin metal liquid- and vapor-tight barrier acting against load-bearing thermal insulation and supported by a free-standing outer pre-stressed concrete container.
In normal conditions primary liquid containment is afforded by a thin metallic barrier which is structurally supported via load-bearing insulation and an outer pre-stressed concrete container. Under these conditions primary vapor containment is afforded by the thin metallic barrier which is connected to the metallic roof liner.
In emergency conditions secondary liquid and vapor containment is afforded by an outer pre-stressed concrete container and metallic roof liner. The outer container must be capable of both containing the liquid product and controlling the vapor resulting from evaporation. In this instance the vapor generated from the leakage is discharged through pressure relief valves located in the roof. Vapor losses due to permeability through the outer pre-stressed concrete are acceptable while containing liquid in the event of leakage from the thin metal barrier and insulation system.
The roof of the outer pre-stressed concrete container may be concrete or steel. Significant design issues arise at the monolithic base-to-wall connection due to the mechanical restraint offered by the base. To mitigate these issues, a secondary liquid containment barrier inside the insulation system across the entire bottom and part of the wall in the vicinity of the base-to-wall joint is to be provided to protect and thermally isolate this area from the cold liquid and provide liquid tightness.

3.3.4.3.4* Single Containment Tank System.
A single wall container or a double wall tank system in which only the self-supporting primary or inner container is designed to contain LNG.

3. Revise 5.3.1.1(4) to read as follows:

5.3.1.1 Provisions shall be made to minimize the potential of accidental discharge of LNG at containers, pipelines containing LNG, and other equipment such that a discharge from any of these does not endanger adjoining property or important process equipment and structures or reach waterways. LNG containers shall be provided with one of the following methods to contain any release:

(1) An impounding area surrounding the container(s) that is formed by a natural barrier, dike, impounding wall, or combination thereof complying with 5.3.2 and 5.3.3

(2) An impounding area formed by a natural barrier, dike, excavation, impounding wall, or combination thereof complying with 5.3.2 and 5.3.3, plus a natural or man-made drainage system surrounding the container(s) that complies with 5.3.2 and 5.3.3

(3) Where the container is constructed below or partially below the surrounding grade, an impounding area formed by excavation complying with 5.3.2 and 5.3.3

(4) Secondary containment as required for double, or full, or membrane containment tank systems complying with 5.3.2 and 5.3.3.

4. Revise 5.3.2.5* and the Annex to read as follows:

5.3.2.5* Dikes and impounding walls shall meet the following requirements:

(1) Dikes, impounding walls, drainage systems, and any penetrations thereof shall be designed to withstand the full hydrostatic head of impounded LNG or flammable refrigerant, the effect of rapid cooling to the temperature of the liquid to be confined, any anticipated fire exposure, and natural forces, such as earthquakes, wind, and rain.

(2) Where the outer shell of a double wall tank complies with the requirements of 5.3.1.1, the dike shall be either the outer shell or as specified in 5.3.1.1.

A.5.3.2.5 Section 7.2.1.1 requires compliance with API 625. API 625 paragraph 5.6 requires the selection of storage concept to be based on a risk assessment. API 625 Annex C discusses implications of a release of liquid from the primary liquid container and provides specific discussion related to each containment type. API 625 Annex D provides guidance for selection of storage concepts as part of the risk assessment including external and internal events and hazards to be evaluated. Paragraph D.3.2.2 discusses the possibility of sudden failure of the inner tank and advises “if extra protection from brittle fracture” (or unabated ductile crack propagation) “is desired, the general practice is to increase the” primary container toughness. Available materials meeting the required specifications of API 620 Appendix Q (and this standard) for LNG service are considered to have crack-arrest properties at LNG service temperature and stress levels. Therefore, rapid failure of a steel primary container meeting this standard is not considered credible. In membrane containment tank systems, due to primary membrane specific construction, rapid failure is not considered credible as well.
5. Revise 5.3.2.7 to read as follows:

5.3.2.7  Double, and full, and membrane containment tank systems shall be designed and constructed such that in the case of a fire in an adjacent tank, the secondary container shall retain sufficient structural integrity to prevent collapse, which can cause damage to and leakage from the primary container.

6. Renumber 5.3.2.7 and revise to read as follows:

5.3.2.78  Double, and full, and membrane containment tank systems shall have no pipe penetrations below the liquid level.

7. Revise 5.3.4.2 and add new 5.3.4.2.1 to read as follows:

5.3.4.2  Double, full, and double membrane containment tank systems of greater than 70,000 gal (265 m³) water capacity shall be separated from adjacent LNG storage containers such that a fire in an adjacent single or double containment impoundment or from a design spill will not cause loss of containment from adjacent containers. This shall be accomplished by ensuring that no part of the adjacent storage container roof, walls, or its impoundment structure reaches a temperature at which the strength of the material of the container roof, wall, or its impoundment is reduced to a level where the LNG tank, roof, or impoundment loses its structural integrity….

5.3.4.2.1  The outer concrete container shall be designed for the external fire in accordance with ACI 376 unless the fire protection measures are provided. The outer tank thermal analysis shall be performed to determine temperature distribution for the heat flux and duration of exposure as specified in the fire risk assessment.

   (1) The applicable load components and the ultimate state load factors for the fire load combinations shall be in accordance with ACI 376 Table 7.3. For membrane tanks an additional liquid pressure load in accordance with ACI 376 Table 7.2 shall be included.

   (2) The design of the outer concrete container shall take into account the following factors:

      (a) Reduction in the wall post-tensioning due to the difference in the coefficient thermal expansion of post-tensioning steel and wall concrete at the temperature post-tensioning steel is exposed. The effects of the concrete aggregate type on the concrete coefficient thermal expansion shall be considered;

      (b) Reduction in strength and modulus of elasticity of the outer tank concrete, reinforcing and post-tensioning steel due to elevated temperature;

      (c) Reduction in the wall post-tensioning due to prestressing steel softening and relaxation at elevated temperature;

   (3) Concrete shall be designed to avoid explosive spalling.

8. Revise 7.2.1.1 to read as follows:
7.2.1.1 Storage tank systems shall comply with the requirements of API 625, *Tank Systems for Refrigerated Liquefied Gas Storage* or, for membrane containment tank systems, EN 14620, and the additional provisions of this chapter. The API 625 risk assessment shall be approved by the AHJ.

9. Add new 7.2.1.4 and 7.2.1.5 and renumber current 7.2.1.4 to read as follows:

7.2.1.4 The metallic membrane, load bearing insulation, and the outer container moisture barrier specific to the membrane tank system shall comply with EN 14620 parts 1-5 for material selection, design, installation, examination, and testing and further requirements of 7.4. All other components of the membrane tank system shall comply with API625, API620, ACI376 and additional requirements in 7.4.

7.2.1.5 Requirements for openings, internals, roof, and suspended deck shall follow API 625.

7.2.1.46 Should any conflict exist between the above requirements, the most stringent requirement shall apply.

10. Revise 7.3.1.2 (A) to read as follows:

7.3.1.2 All piping that is a part of an LNG tank system shall comply with requirements in this chapter and requirements within API 625.

(A) Tank system piping shall include all piping internal to the container, within insulation spaces and within void spaces, external piping attached or connected to the container up to the first circumferential external joint of the piping, and external piping serving only tank instrumentation (including tank pressure relief valves). All liquid piping with a source of external line pressure shall be designed for the external line relief valve setting but not less than 50 psi (345 kPa). Double, and full, and membrane containment tank systems shall have no pipe penetrations below the liquid level….

11. Revise 7.3.3.2 and 7.3.3.2(A) and add new (D) to read as follows:

7.3.3.2 The space between the inner container and the outer container shall contain insulation that is compatible with LNG and natural gas and that is noncombustible as installed for normal service and abnormal conditions.

(A) A fire external to the outer tank shall not cause a reduction of the insulation thermal conductivity due to melting or settling to the internal containment system performance due to damage to any component of the insulation systems.

(B) The load-bearing bottom insulation shall be designed and installed so that cracking from thermal and mechanical stresses does not jeopardize the integrity of the container.

(C) Only materials used between the inner and outer tank bottoms (floors) shall not be required to meet the combustibility requirements, where the material and the design of the installation comply with all of the following:

(1) The flame spread index of the material shall not exceed 25, and the material shall not support continued progressive combustion in air.
The material shall be of such composition that surfaces that would be exposed by cutting through the material on any plane shall have a flame spread index not greater than 25 and shall not support continued progressive combustion.

It shall be shown by test that the combustion properties of the material do not increase significantly as a result of long-term exposure to LNG or natural gas at the anticipated service pressure and temperature.

The materials in the installed condition shall be demonstrated to be capable of being purged of natural gas.

The natural gas remaining after purging shall not be significant and shall not increase the combustibility of the material.

For membrane containment tank systems, the insulation system block shall include a non-foam cover (underneath the primary membrane) and shall include a welding thermal protection system in order to withstand all heat from welding during installation and during maintenance, if any.

12. Add a new 7.4.2.3 to read as follows:

7.4.2.3 For membrane containment tank systems, weld procedure and production weld testing shall comply with EN14620 part 2 and the following requirements:

7.4.2.3.1 Qualification of Welders. All personnel associated with the welding fabrication of the membrane system shall be qualified by the manufacturer per an agreed upon schedule between the purchaser, the AHJ, and the fabricator. All records shall be available for review.

7.4.2.3.2 Inspection. 100% of all welding shall be visually inspected for workmanship and conformance to the fabrication requirements. Bead placement and consistency shall be documented by digital means for review by supervisory personnel.

The personnel performing this visual inspection shall be qualified to an accepted standard for this inspection work.

Upon cooldown of the welds to room temperature, provisions shall be made to perform a penetrant inspection (PT) of at least 5% of each weld type each day. The selection factors include orientation, welding direction, and complexity of welding being performed:

a) All profiles and configurations of welds shall be subjected to this 5% requirement. The selection of this 5% sample shall be agreed upon by the fabricator, customer’s representative, and the AHJ.

b) The acceptance standard for this inspection technique shall be agreed upon by all parties.

c) Any indications require an additional 5% penetrant inspection of the total distance welded by each welder.

Inspection after completion of membrane shall be performed at the completion of the installation of the membrane, and represents the last step prior to the cooldown of the tank to service temperature. After completion of the membrane, a leakage test shall be performed. Leakage shall be determined as agreed upon by the fabricator and customer.

Tracer gas for this leak test shall be in accordance with approved procedure. All areas where leakage exceeds limit shall be repaired per 7.4.2.3.2, the manufacturer’s approved procedure and re-inspected.

In parallel, mechanical stress testing of the welding joints shall be performed by applying 3 cycles from atmospheric pressure to +20 mbarg inside the insulation space, with the pressure maintained, for a minimum time of 30 minutes. Data shall be recorded.
7.4.2.3.3 Post-Repair Inspection. Additional tracer gas testing shall be performed if more than 4 leaks per 1,000 m² of membrane are identified. All repaired areas shall be visually inspected (VT), vacuum box (VB) tested, and dye penetrant (PT) tested.

7.4.2.3.4 Final Global Test and Control During Dismantling Work. This testing shall be in agreement with the approved test procedure and witnessed by all parties. This represents the final acceptance testing of the completed membrane structure following completion of its installation in the structural outer shell / container.

a) The overall tightness of the membrane shall be determined by establishing a pressure difference between the tank and the insulation space.

b) This pressurization allows gas flow through the membrane representative of potential leaks on the membrane.

c) The potential leak(s) shall be characterized by measuring the oxygen content increase in the primary insulated space as the tank is pressurized with dry air.

d) The primary insulated space shall be regulated slightly above the atmospheric pressure.

e) All test data, all records, documentation, and witness records shall be submitted to all parties for their review and final acceptance.

Daily tightness check / monitoring shall be performed during dismantling work by pulling vacuum inside insulated spaces. Any pressure rise is indicative of a leak and must be reported and correction action taken.

13. Add a new 7.4.4.12 to read as follows:

7.4.4.12 The outer concrete tank analysis and design for the major leak and major leak plus ALE aftershock event shall take into account any damage that may have occurred to the outer concrete tank due to prior events including the SSE earthquake. The outer concrete tank shall be considered as undamaged during the prior SSE event if the following conditions are met:

   (1) Tensile stresses in the reinforcing steel do not exceed 90% of the reinforcing steel yield

   (2) Maximum concrete compressive stresses do not exceed 85% of the concrete design compressive strength.

Otherwise, the prior damage shall be taken into account in the spill analysis.

14. Add new 7.4.6.5 and Annex to read as follows:

7.4.6.5* Membrane containment tank systems shall be tested in accordance with EN 14620 Part 5, Table 1. The leakage test, as defined in the Note under EN 14620 Part 5 paragraph 4.1.1, shall be performed. Leakage through the membrane to the insulation space during service must be controlled in order to maintain gas concentration level below 30% of the LEL by sweeping the insulated space with N2. If the gas concentration cannot be maintained below 30% LEL the tank must be decommissioned and retested. For purposes of evaluating this level, the flow of purge gas within the annular space shall not be increased above the normal operating rate.
A.7.4.6.5 EN 14620 Part 5 Table 1 requires the outer concrete tank to be hydrostatically tested prior to installing insulation and the membrane. The membrane is leak tested after all welding is completed. A retest is required following repairs to close leaks. An insulation space monitoring system is required by EN 14620 Part 1 paragraph 7.2.1.8 which is intended to identify any leaks of LNG gas or vapor into the space between the membrane and the wall.

15. Add new 7.4.6.6 and 7.4.6.7 to read as follows:

7.4.6.6 All the membrane system components, including insulation, primary membrane, and the secondary barrier of the thermal protection system, shall be designed in such a way that they can withstand all possible static and dynamic actions throughout the tank lifetime.

7.4.6.7 Verification of all components of the membrane containment tank system design by experimental data from model tests shall be carried out.

16. Add a new Subsection 7.4.7 to read as follows:

7.4.7 Additional Requirements for Membrane containment tank system.

7.4.7.1 A thermal corner protection system functionally identical to the thermal corner protection system for concrete tanks defined in API625 Section 6 shall be provided for the outer concrete tank of the membrane tank system. The thermal corner protection shall protect the outer tank entire bottom and at least lower 16.5 feet (5m) of the wall from thermal shock and shall be liquidtight when it is in contact with LNG and vapor tight in all conditions. The thermal corner protection system shall be permitted to be either metallic or from nonmetallic materials compatible with LNG and shall maintain structural integrity and liquid/gas tightness under all applicable mechanical and thermal loads.

The membrane containment tank system supplier shall provide tests independently witnessed and verified by a third party agency clearly demonstrating the leak tightness of all the thermal corner system under spill conditions. Historical tests shall be acceptable provided that construction processes and materials of construction are the same as those proposed. Nondestructive examination (NDE) performed on the secondary barrier and NDE acceptance criteria shall ensure that provided tightness is equivalent to the tightness provided by the metallic thermal corner protection system of the full containment tank system.

7.4.7.2 The outer concrete container of the membrane containment tank system shall meet all requirements of ACI376 for the secondary concrete container including materials, design, construction, inspection, and testing and the additional requirements specified below:

7.4.7.2.1 The product liquid pressure shall be a design load for the outer concrete tank. Liquid product pressure ultimate limit state (ULS) load factors for operating and abnormal loading conditions shall be in accordance with Table 7.2 of ACI376.

7.4.7.2.2 The outer concrete container wall and slab -to- wall junction shall be checked for fatigue assuming four full load-unload cycles a week for the expected life of the tank. Performance criteria of ACI376 Appendix C shall apply.

7.4.7.2.3 The outer concrete container wall shall resist the specified impact load without perforation and scabbing.
A) The concrete wall thickness shall be at least 40% greater than the scabbing depth calculated per CEB 187 Section 4.1.2.2.

B) The concrete wall thickness shall be at least 20% greater than the perforation thickness calculated per CEB 187 Section 4.1.1.1.

C) The tank shall be designed so that either one of the following is satisfied;

1. The distance between the outer face of the concrete container measured to the centroid of the pre-stressing tendons shall be greater than the penetration depth calculated as per CEB 187 Section 4.1.2.1 with the following allowances for uncertainty:
   - 20% thicker than the penetration depth when \( z > 0.75 \)
   - 50% thicker than the penetration depth when \( \leq 0.75 \).

2. The tank shall be designed to be able to resist normal operating loads with any one horizontal tendon completely ineffective.

7.4.7.2.4 At a minimum, the outer concrete container for the membrane tank system shall meet the construction tolerances specified in ACI376. Where more stringent tolerances are required by the membrane and insulation systems, the more stringent tolerances shall be specified by the membrane tank engineer and be met by the tank contractor.

7.4.7.2.5 The outer concrete container shall be hydrotested prior to membrane and insulation installation following primary container hydrotest requirements of API625 Section 10.

17. Revise the title of Figure 10.7.2(e) to read as follows:

FIGURE 10.7.2(e) Full and Membrane Containment Container tank systems.

18. Revise Item (3) to the Atmospheric Cryogenic Tanks section of Table 15.6.1 to read as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Annual Probability of Failure</th>
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19. Revise B.3.4 to read as follows:

**B.3.4**  The impounding system must, as a minimum, be designed to withstand the SSE level of loading while empty (or while full if a membrane containment tank system) and the ALE level of loading while holding the volume, \( V \), as specified in 7.4.4.7. The rationale is that should the LNG container fail following an SSE, the impounding system must remain intact and be able to contain the contents of the LNG container when subjected to an aftershock.

**Substantiation:**

In terms of technical substantiation, membrane containment system tank is a full integrity system. This means the performance of the tank system shall be similar to what is required of a full containment system:
- Able to store LNG and natural gas inside the tank in all normal operating conditions.
- Able to retain LNG and natural gas inside the tank, in all abnormal design conditions (seismic, release of the LNG to the secondary container, external & internal hazards, etc.)

In order to do so, all the safety and performance requirements for a full containment shall be also applicable to membrane containment system.

LNG tank storage has to comply with other tank design codes. Currently, NFPA59A refers to API625 for LNG tank overall design, ACI376 for civil tank design and API620 for mechanical design. Membrane containment tank systems are fully addressed in EN14520 and partially in ACI376. Relevant references to these standards have to be made in the proposed standards. Currently, ACI376 does not fully include the membrane containment system, so additional requirements have been added to close the gap. For membrane components exclusive to the technology, the language refers to EN14620, but additional prescriptive requirements are added as agreed within the task group, in order to be more conservative for membrane tanks in a first release.

Finally, all components in membrane containment tank systems which are similar to other systems (roof, suspended deck, etc.) will be referred to the same American standard.

**Emergency Nature:** During March 2014 NFPA59A meeting, public inputs were reviewed. The Public Input No. 50-NFPA 59A-2013 put alert on Membrane containment tank system, which was addressed on the Definition clause only. During the meeting, TC agreed to remove the Membrane definition. However, in order not to send the wrong signal to the LNG industry (such as the technology is not allowed), the technical committee decided to create, on an urgent basis, a subcommittee to prepare wording for inclusion of a full treatment of membrane containment tank for issuance as a TIA coincidentally with the 2016 version. This subcommittee has now completed its work and agreed wording is proposed as a TIA. Acceptance of this TIA on an emergency basis is consistent with the following bases as prescribed in the standard:
(f) The proposed TIA intends to correct a circumstance in which the revised NFPA Standard has resulted in an adverse impact on a product or method that was inadvertently overlooked in the total revision process or was without adequate technical (safety) justification for the action. In the absence of a TIA (expected to be released concurrently with 2016 edition), membrane containment systems will not be in NFPA 59A 2016 edition and will be deferred until the next revision in 2018 (or 2019). From a practical standpoint, the absence of a TIA will restrict competition in an important timeframe when LNG as fuel, particularly in marine applications, is driving the development of LNG distribution and delivery systems. Proponents who are seeking options are facing a significant barrier in terms of regulatory uncertain without specific treatment of membrane tanks in NFPA 59A.

Moreover, the timeframe for project development is such that developers cannot practically consider membrane alternatives without using European Norms, Canadian or other standards for references to membrane tanks.

Anyone may submit a comment by the closing date indicated above. To submit a comment, please identify the number of the TIA and forward to the Secretary, Standards Council, 1 Batterymarch Park, Quincy, MA 02169-7471.
CB&I has the following public comments on NFPA 59A TIA No.: 1187.

Best Regards,
Mark D. Butts
CB&I
Director of Plate Structures Engineering,
Plainfield, IL

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The CB&I refrigerated gas storage Engineering department has reviewed the proposed TIA No.: 1187 and recommends against passage based on three main points. 1) There is no credible emergency basis for making such a significant complex change to the standard. 2) The value proposed for “annual probability of failure” in table 15.6.1 is incorrect for the membrane tank system. 3) There are extensive errors, potential conflicts, and wording changes, which need to be resolved prior to passage of this change to the standard. The following paragraphs provide specific discussion on these points:

1. **Emergency Nature**

The basis provided in the TIA to justify the emergency nature of this TIA is not convincing and the proposed changes are substantially out of proportion in scope and complexity with the reason stated. If the basis is as urgent as stated, a better solution would be to put the definition removed by the committee back in. This could be handled by a NITMAM. The changes proposed are extensive and have an impact to the public safety. In addition, the timing of this TIA would make it applicable for 3 years, which stretches the “interim” basis of a TIA. Changes of this magnitude should receive the full revision process established for NFPA standards. Use of the full revision process would allow input from the API and ACI standards committees, which are referenced in the changes.

2. **“Annual Probability of Failure” and resulting instantaneous release of the entire tank contents for “Atmospheric Cryogenic Tanks” in Table 15.6.1**

The proposed change assigns the same annual probability of instantaneous failure to a membrane tank as is currently assigned to full containment tank. This is not correct and must be corrected prior to TIA publication; otherwise risk profiles will not be appropriately addressed in facility design.

The full containment and membrane tanks are two distinct types, each with unique configurations and related performance behavior. As such, each carries a different risk profile under various loading conditions.

By providing two independent structural containers each independently capable of carrying the tank contents, a full containment tank concept has redundancy, which is not provided by a membrane tank concept. A failure of either primary or secondary container in the full containment concept will not result in the release of the entire contents. However, the failure of the outer tank for the membrane concept will result in the catastrophic release of the tank content.

To demonstrate the above point, the membrane concept is a thin flexible stainless steel membrane that transfers the liquid load through load bearing insulation to a single structural outer concrete tank component. The membrane tank concept does not provide two independent structural storage containers as are present in a conventional full containment tank. This is a fundamental difference that has a critical impact on various risk assessment scenarios.

LNG tanks are typically designed for external loads including blast loads, projectile loads, and adjacent tank fires. All of these loading conditions have the potential to either weaken the concrete tank or cause localized damage. The outer tank of a conventional full containment tank can be subjected to significant damage with no impact on the liquid containing capability of the inner tank. The concrete tank of a membrane tank is the only structural component capable of resisting the hydrostatic forces of the product. Therefore, damage to the outer concrete tank of a membrane tank potentially reduces the capacity of the membrane tank to contain the liquid product. Thus, the plant design and risk assessment for the two concepts must be substantially different.
Therefore, the Annular Probability of Failure resulting in instantaneous release of content cannot be the same for the membrane tank system as it is for the full containment tank system. The probability of release value is higher for a membrane tank. Also a membrane tank should be described separately in Table 15.6.1 as “Instantaneous failure of membrane and the outer concrete container”. A further study is required to determine the appropriate value for the membrane tank system in table 15.6.1.

3. **In addition to the fundamental issues discussed above Specific Comments by Paragraphs are provided below:**

a) 3.3.4.3.3: The word "operating" should be "operation".

b) 5.3.2.5(2): The deletion of "of a double wall tank" leaves a hole. Instead of a simple deletion, suggest the words in question should be replaced by "of a tank system". That completes the sentence while still being general enough to include membrane tanks.

c) A.5.3.2.5: This section points to API 625 section 5.6 and Annexes C and D on selection of a storage concept based on risk assessment. However, the referenced sections have no information on the membrane tank concept. It seems that this is a serious gap. In the comment below on 5.3.2.7 a difference is noted in the way a full containment tank system and a membrane tank system may react to damage to their secondary containers from external events. Such differences need to be added to the API document.

d) 5.3.2.7: The simple addition of "and membrane" to the existing sentence creates an inaccurate picture of the situation resulting from a secondary container collapse. In a membrane tank system, if the concrete wall collapses, damage to and leakage from the primary container is not simply a possibility, it is a catastrophic certainty. This sentence should be revised to reflect a more accurate assessment.

e) 7.2.1.1: The added phrase "or, for membrane containment tank systems, EN 14620," creates ambiguity since the overall sentence then ends up with both an "or" and an "and". It is not really clear whether "the additional provisions of this chapter" are intended to apply API 625 to all tank systems equally or only to membrane tanks.

f) The reference to EN14620 shall be removed from 7.2.1.1. All tank concepts including membrane shall comply with API 625. The components specific to membrane system to be covered by EN 14620 are listed in 7.2.1.4.

g) 7.2.1.4: There is a potential conflict between this section which calls for EN14620 in its entirety (for membrane tanks) and 7.2.1.4 which invokes only certain parts of EN14620.

h) 7.2.1.4: This proposed new section states that the metallic membrane is to comply with EN14620. But the existing 7.2.1.2 says that metal containers shall comply with API 620. That is a potential conflict. 7.2.1.2 could be worded "EXCEPT FOR METALLIC MEMBRANES IN MEMBRANE TANK SYSTEMS, metal containers that are part of ....".

i) 7.2.1.5 Four things from API 625 are noted. 7.2.1.1 already specifies API 625 without any limit on the applicable sections. The added 7.2.1.5 is superfluous and confusing. It should not be added.

j) 7.3.3.2: What is meant by adding "as installed for normal service and abnormal conditions" to the rule about insulation being non-combustible?. Membrane tanks typically have plywood and foam in their insulation systems. Are there any combustibility requirements for plywood and insulation?
k) 7.3.3.2(A): Taking out words prohibiting melting insulation during an external fire and replacing with a requirement to maintain containment seems like a major reduction in a NFPA59A performance standard. What is the justification for this?

l) 7.4.2.3.2: "visually inspected" is improper terminology. It should say "visually examined".

m) 7.4.2.3.2: The requirement for digital means of documentation of bead placement and consistency is vague. Is this documentation required on 100% of the welds?

n) 7.4.2.3.2: Qualification of visual examination personnel to "an accepted standard" is too vague. What are the acceptance criteria and what are the qualifications of the inspector?

o) 7.4.2.3.2: The proposed tracer gas testing requirements are very vague. For example, saying that "leakage shall be determined as agreed..." and "in accordance with approved procedure". EN14620 references NF A09-106. Does that apply here since EN14620 compliance is required?

p) 7.4.2.3.3: "Additional" tracer gas testing is required if more than 4 leaks per 1000m2. "Additional" is extremely vague. How much more testing is required?

q) 7.4.2.3.4: What is the "dismantling work" named in this section? Dismantling doesn't make sense for the new construction work being addressed.

r) 7.4.2.3.4(c): Where is the acceptance criteria for this final global test? How can NFPA59A accept such a critical test without any acceptance criteria?

s) 7.4.6.5: Table 1 of EN14620-5 is referenced for hydrotesting. But that table is very confusing for membrane tanks for LNG. It says PH for partial height test, but then lists NOTE 2 which says hydrotest is not required. Is that a typo?

t) 7.4.6.5: The second sentence seems to be a reference to the same tracer gas testing already discussed in 7.4.2.3.2. Having it in two places and saying different things is confusing. The information should be brought together and harmonized.

u) 7.4.6.5: The first two sentences pertain to tests done during new tank construction. In contrast, the last sentence refers to ongoing monitoring during tank operation. Therefore, this tank operation requirement should be separated from the new construction test requirements. Perhaps it should be moved to chapter 10 with other types of tank monitoring.

v) 7.4.6.6: This proposed clause is in the wrong section. Section 7.4.6 is on testing. But this proposed clause only addresses design. It says nothing about testing.
1. At a time when Natural Gas is rapidly becoming the fuel of choice, we read with some concern in the referenced TIA: “Emergency Nature: During March 2014 NFPA59A meeting, public inputs were reviewed. The Public Input No. 50-NFPA 59A-2013 put alert on Membrane containment tank system, which was addressed on the Definition clause only. During the meeting, TC agreed to remove the Membrane definition.”

Public expectation is for any Code TC to make decisions that affect the industry by writing a code that is technical and safety focused. In the current global environment, logic demands that the TC will also enlarge the options for safe storage tank designs. The Code should inform Project Developers & Engineers of all possible design configurations and related safety pros & cons. In this context, the TC should be giving more clarity to the aforesaid Membrane definition, rather than electing to go backward by removing the reference to the Membrane Tank design in the Definition clause in the 2013 version. We hope the TC is not being swayed by commercial consideration of the organizations represented by committee members.

2. In my more than 40 years of involvement in LNG Storage design & construction, I have had the privilege to be involved in every type of LNG tanks, SC, DC, FC, MT, onshore and offshore GBS. It is my personal opinion that the Membrane Tank design has been studied and reviewed by many international regulatory bodies, and accepted as equal from a safety perspective to the conventional API 620 type (psc outer / 9% Ni inner) “Full Containment” Tank. In fact, EN 14620 has added certain additional requirements for the outer concrete design to make it more robust and more resistant to external events, which has generally been the main concern with the Membrane Tank. This is reflected in Table 15.6.1 in the above referenced TIA which rates Annual Probability of Failure of the Full and Membrane containment tanks as the same, IE-08.
We also refer to Table 2.3 in the Risk Assessment Data Directory / Report No. 434 produced by the International Association of Oil & Gas Producers in March 2010 which gives Estimates of frequencies of catastrophic rupture for different designs of refrigerated storage tanks. This table also gives the same value for Catastrophic Rupture & Leak Frequency Rates for both Full Containment tanks and Membrane Containment tanks = $1.0 \times 10^{-7}$ / $1.0 \times 10^{-8}$ / 0

4.
NFPA 59-A is among the most specified codes worldwide simply because it is generated in the USA and we remain technologically one of the most advanced countries. It is therefore important that NFPA 59A Technical Committee stay abreast of developments in other parts of the world. The Membrane Tank has been accepted by most other codes as equivalent to the psc outer / 9% Ni inner “Full Containment” Tank for safety in containment of LNG under all conditions. With this perspective, we fully endorse the changes and additions to the next edition of NFPA 59A-2016 Edition proposed in this TIA Log No: 1187.

Signed / Sam Kumar / 19th June 2015

Sent from Windows Mail
Foran, Rosanne

Rosanne,

CB&I has the following public comments on NFPA 59A TIA No.: 1187.

Thanks, Marty

(See attached file: Additional CB&I Comment on NFPA59A Membrane TIA No 1187 - (6-19-15).pdf)

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Mr. Butts, This will acknowledge receipt of your comment on proposed TIA No. 1187 on NFPA 59A. It will be forwarded to the Standards Council for consideration.

Regards,

Rosanne Foran
NFPA
Codes & Standards Administration
617-984-7243
rforan@nfpa.org
Public Comment to NFPA 59A - Proposed 2016 Edition

The proposed changes associated with the Membrane Containment Tank System contain confusing terminology and incorrectly state that the Membrane Containment Tank System is equivalent to a Full Containment Tank System.

The proposed 2016 edition of NFPA 59A contains a revised membrane tank system definition and a new annex paragraph to provide additional information on membrane tank systems. The proposed 2016 definition for membrane tank systems follows.

3.3.4.3.3 Membrane Containment Tank System. A tank system consisting of a thin metal liquid barrier and load-bearing thermal insulation supported by a self-standing outer concrete container jointly forming an integrated composite tank structure which provides liquid and vapor containment during tank operating as well as LNG containment in the event of leakage from the liquid barrier, and where the vapor-containing roof of the outer container is either steel or concrete configured such that the excess vapor caused by a spill of LNG from liquid barrier will discharge through relief valves.

The proposed definition has removed “primary container” from the membrane definition. However, the proposed Annex paragraph A.3.3.4.3.3 includes the following statement.

"... In normal conditions primary liquid containment is afforded by a thin metallic barrier which is structurally supported via load-bearing insulation and an outer pre-stressed concrete container. Under these conditions primary vapor containment is afforded by the thin metallic barrier which is connected to the metallic roof liner. In emergency conditions secondary liquid and vapor containment is afforded by an outer pre-stressed concrete container and metallic roof liner. ..."

This information is incorrect by stating that the membrane tank system has a “primary liquid containment” and “secondary liquid and vapor containment”. The membrane tank has only one containment structure. The information contained in the annex should be consistent with the definition in paragraph 3.3.4.3.3.

Table 15.6.1 is an "Example Component Failure Database" and gives the "Annual Probability of Failure" for single, double, and full containment tanks. The proposed change to Table 15.6.1 would assign membrane tanks the same probability of failure as a full containment tank and again incorrectly states that a membrane tank has a primary and secondary container. The proposed wording for item 3 follows.

<table>
<thead>
<tr>
<th>Component</th>
<th>Annual Probability of Failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>(3) Instantaneous failure of primary and secondary container, release of entire tank contents (full and membrane containment tanks)</td>
<td>1 E-08</td>
</tr>
</tbody>
</table>

The membrane tank should be described separately and stated as the “Instantaneous failure of the membrane and concrete container”.

August 7, 2015

Supplemental Agenda Standards Council Meeting August 17-19, 2015
Foran, Rosanne

From: Keith.Mash@shell.com
Sent: Friday, June 19, 2015 11:56 PM
To: TIAs
Subject: Membrane inclusion in NFPA59A

59A,

As a key contributor to the Membrane Task responsible for developing the clauses for inclusion in NFPA59A I am in full support of the clauses developed by the Team and believe that a solid document has been delivered that addresses key issues. In particular the clauses developed pertaining to missile impact and also fire damage are not only relevant for Membrane Tanks but also for Full Containment Counterparts. Towards the end of this year it is Shells intention to work with ACI 376 in order to bring these clauses into both technologies.

Whilst the experience was a positive one I am disappointed to read that there has been a negative comment from Jack pertaining to Risk levels associated with the failure rate of the concrete tank. This came as quite a surprise since I believe that all Team members had an obligation to bring all concerns to the table so that they could be addressed in an open an honest manner. Moreover I am not in agreement with Jack’s angle regarding reduced safety levels and relatively quick search of public domain information will reveal comparable levels of safety for both Full and Membrane Technology. Note I use the word comparable as clearly there is a difference in safety levels between the technologies.

In addition Shell have conducted numerous independent studies through DNV and AEA to compare the risk levels associated containment types and as one expect the data is similar from most studies. Importantly none of the studies or learned experts consider failure of the outer concrete wall as credible as there been no data set or evidence to support this. IN my position as Subject Matter Expert for Shell I have reviewed numerous independent reviews by Woodside, Kogas and others which support this position.

I would strongly suggest that in order for the concrete wall to fail there would need to be an significant initiating event as determined from a Hazid, or risk assessment as per API 625; such as a large scale incendiary to ‘knock’ a hole in the wall. This might be credible however the consequences of such an event would be identical for both Full and Membrane Tanks i.e. the incendiary would puncture both the outer an inner tank and lead to loss of containment. Same event, same result.

These type of discussions we explored extensively whilst developing Membrane clauses for Canadian Standard and the learned audience agreed (Including CBI representation) that this was reasonable. It should be noted that CBI were key participants and infact led a number of the task forces to enable Membrane tanks to be included in CSA 276. You will therefore understand my bemusement to have been involved in such a leading committee to then have one of the members raise an issue in such a visual manner which can only serve one purpose i.e. to derail the process and win over an ill-informed audience.

I have the upmost respect for Jack and consider him one of the most knowledgeable wisest men in the industry. I do however challenge the modus operandi and whether there is a potential conflict of interest regarding the comments.

A review of the documentation provided by the Membrane Task Force will indicate that the risk levels of the technologies are similar. Moreover from an operational perspective Membrane Tanks can be decommissioned and inspected more readily than their counterparts and are not subjected to the outgassing phenomenon (methane vapour leaking to atmosphere) which is now prevalent on an industry wide basis and impacts numerous Full Containment Tanks. With this mind they offer a greatly needed alternative to full containment tanks and maintain competition in the marketplace.
I hope that the amendments to 59A for the inclusion of membrane tanks will receive full support because I believe that the efforts carried out by the expert committee warrant such a result.

Happy to assist and discuss further as necessary.

Kind regards,

Keith A Mash
General Manager Civil Structural Offshore (CSO)
Subject Matter Expert LNG Tankage (SME)

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