NATIONAL FIRE SPRINKLER ASSOCIATION, INC.

Tuesday e-Tech Alert
April 25, 2006

Earthquake Protection Update

We are currently in an uncomfortable transition period with regard to the earthquake protection criteria of NFPA 13 and the International Building Code (IBC). As explained in the November 13, 2005, edition of NFSA e-Tech Alert, the 2003 IBC does not contain the detailed seismic requirements of the 2000 edition. That material, which originated in the federally funded National Earthquake Hazard Reduction Program (NEHRP), now resides in standard ASCE-7, and the 2002 edition is referenced by the 2003 IBC. Although a general reference to the 1999 edition of NFPA 13 is contained in the 2003 IBC, a section of ASCE-7 that made special reference to the use of NFPA 13 for earthquake protection was omitted during the adoption process, leading some to believe that sprinkler piping must be protected the same as other mechanical piping with an importance factor of 1.5.

Seismic engineers who helped write the NEHRP provisions have been participating in the NFPA 13 process for some time, trying to eliminate the aspects of NFPA 13 that troubled them. Among the major areas of dispute were the fastener requirements for bracing, specifically anchorage allowances that were outdated and considered too liberal. These were addressed with a TIA (emergency amendment) to the 2002 edition issued in July of 2003. That TIA can be viewed at the nfpa.org website with other TIAs and errata within the "Codes & Standards / Code Development Process" section. It is officially part of the 2002 edition, but is not directly applicable to the 1999 edition referenced by the IBC.

As part of the preparation of the 2007 edition of NFPA 13, there are a number of changes being made to the earthquake protection rules, including the incorporation of the TIA language. These changes are summarized below, and incorporation of these changes is expected to bring NFPA 13 in line with the latest thinking of the earthquake experts as represented by the 2005 edition of ASCE-7. It is expected that ASCE-7 will continue to reference the use of NFPA 13, and that interim revisions to the IBC will likewise fully endorse the use of the standard in conformance with ASCE-7. In the meantime, the decision by some local authorities to treat sprinkler systems like other mechanical systems with an importance factor of 1.5 (like gas piping) creates an unnecessary economic burden for the customer and in some ways lowers the level of earthquake protection to the sprinkler system.

How should NFPA 13 to be used in conjunction with the 2003 edition of the IBC? NFSA continues to recommend that the 2002 edition of NFPA 13, including the TIA, represents the appropriate protection criteria for the 2003 IBC. The forthcoming 2007 edition of NFPA 13 will be tied to the 2005 edition of ASCE-7, not the 2002 edition of ASCE-7 referenced by the 2003 IBC. Attempts to treat NFPA 13 like other mechanical systems will produce the worst of both worlds: more cost with less actual protection against earthquakes.

Ceiling Penetration Criteria in the 2003 IBC

Aside from the issue of application of NFPA 13, there are significant aspects of earthquake protection in the reference to the 2002 edition of ASCE-7 with regard to sprinkler penetration of suspended ceilings. For buildings in seismic design category C, sprinklers and other penetrations are required to have a minimum clearance of ¼ inch (6 mm) on all sides. However, for buildings in seismic design categories D, E and F, except where rigid braces are used limit lateral deflections, sprinklers and other penetrations are required to have a 2-inch oversize ring, sleeve, or adapter through the ceiling tile to allow for free movement of at least 1 in. (25 mm) in all horizontal directions. Alternatively, a swing joint that can accommodate 1 in. (25 mm) of ceiling movement in all horizontal directions can be provided at the top of the sprinkler drop. Heavy-duty T-bar grids are required to be used in ceilings in these seismic design categories.

Larger escutcheons are obviously needed to cover the clearances in these ceiling sprinkler applications, and many contractors have resorted to the use of special extension plates or "doughnuts". One question has arisen regarding whether these plates are required to be metal or whether they can be nonmetallic. There are both listing issues and code issues to consider. From a listing perspective it must be presumed that the size of the listed escutcheon is sufficient to protect the sprinkler. In other words, if the surrounding ceiling material is not controlled as part of the escutcheon listing, then neither would the escutcheon extension. The building code issue is more complicated. In the 2003 edition of the International Building Code (IBC), for example, Section 712.4.2 addresses penetrations of the ceiling membrane of a fire-rated roof/ceiling assembly. Exception 3 to that section includes "The annular space created by the penetration of a fire sprinkler provided it is covered by a metal escutcheon plate." As such, care must be taken that the extension plate is metal if the ceiling membrane (the suspended ceiling) is part of a fire-rated assembly.

As an alternative to the large clearances, a registered design professional is permitted to tie together the sprinkler system and ceiling grid as an integral unit, considering the mass and flexibility of all elements including light fixtures and mechanical appurtenances.

Pending Changes to NFPA 13 – 2007

The following are considered significant changes to the earthquake protection criteria of NFPA 13 planned for the 2007 edition and expected to be issued following the committee report at the NFPA meeting in Orlando in June:

Figures 9.3.1(a) and (b) – These example seismic maps are finally being eliminated from the annex. The IBC and ASCE-7 contain the new specific maps generated by the U.S. Geological Survey.

Section 9.3.1.3 – A new section will be added to read as follows: "Displacement due to story drift is addressed in Sections 9.3.2 through 9.3.4." The actual sections cited apply to other forms of displacement as well as story drift, and the intent is to tie the criteria to the stated "displacement" concerns of the IBC and ASCE-7.

Section 9.3.2.3(2) – The wording is being revised to allow a flexible coupling on either the vertical or horizontal portion of piping that ties in to the riser below the upper flexible coupling on the riser.

Section 9.3.2.3(5) – The wording is being clarified to require the flexible coupling at the top of a drop to hose lines, rack sprinklers and mezzanines to be above the uppermost support attachment.

Section 9.3.3 and A.9.3.3 – Additional guidance is being provided on the use of listed seismic separation assemblies as an alternate to the configuration of six flexible elbows currently shown in the annex. New wording will require four-way bracing both upstream and downstream within 6 ft of a seismic separation assembly, and prohibit bracing from being attached to the assembly.

Section 9.3.5.3.2 – The maximum allowable distance from the last lateral brace to the end of a main is being reduced from 20 ft to 6 ft.

Section 9.3.5.3.9 – The requirement that branch lines 2-1/2-inch and larger be braced will not apply to 2-1/2-inch starter pieces that do not exceed 12 ft in length.

Section 9.3.5.3.9 – A proposed new section that would have allowed holes in solid structural members to serves as braces (just as they presently are permitted to serve as hangers) was rejected.

Sections 9.3.5.6, 9.3.5.6.1, A.9.3.5.6.1, and 9.3.5.6.2 and 9.3.5.7 – Language from the 2003 TIA was incorporated with some modifications, clarifying that the horizontal seismic load is determined by the authority having jurisdiction (AHJ), which in most cases will be the applicable building code. The accompanying annex section provides guidance for the selection of variables in the code-based force equations, including the Importance Factor I_P of 1.5, a Component Response Modification Factor R_P of 4.5, and a Dynamic Amplification Factor a_P of 2.5. (Note: In the TIA the recommended value of R_P was 3.5, and the value of a_P was 1, but these new values reflect changes to the 2005 edition of ASCE-7). The traditional force factor equal to half the weight of the water-filled pipe remains as a default value if no other value is available from the AHJ. New tables on fasteners loads for through bolts in wood, lag screws and lag bolts in wood, wedge and undercut anchors in concrete and steel bolt connections replace the former tables. In addition, new tables are added for both Schedule 10 and Schedule 40 steel pipe that limit the maximum load determined using the zone of influence method based on maximum lateral brace spacing of 10 ft, 20 ft, 30 ft, or the traditional 40 ft. A huge change adopted during the consideration of public comments involved the creation of Table 9.3.5.6.2, the Seismic Coefficient Table. This table bypasses consideration of the above factors and directly relates the short period (0.2 second) spectral response acceleration value from the USGS maps into a force coefficient $C_{P,}$ ranging from a low of 0.31 for S_S of 0.33 or less to a high of 1.43 for an S_S of 3. This will result in a corresponding force of 0.31 W_P to 3 W_P, where W_P is 1.15 times the weight of the water-filled piping. In addition, restraint of branch lines will not be required simply where sprinklers could be damaged, but on all branch lines that are not laterally braced, with the maximum spacing of restraint ranging from 27 ft to 55 ft depending on the force coefficient C_P described.

Table 9.3.5.8.9(a), (b) and (c) – The tables of allowable loads for sway braces were modified to introduce safety factors, bringing the brace buckling aspects into conformance with other allowable stress design aspects of the NFPA 13 earthquake protection criteria.

Section 9.3.6.1 – A new subsection (5) will be added to allow a method of restraint involving the use of an additional hanger installed at not less than 45 degrees from vertical within 6 inches of the vertical hanger installed to resist upward movement, provided it is utilized such that l/r does not exceed 300, and the rod extends to the pipe or a surge clip is installed.

Section 9.3.6.4 – Another significant change that took place during the public comment period replaces the former language calling for restraint of branch lines at 30-ft intervals where

sprinklers could be damaged through impact with the structure, equipment or finish materials, and replaces it with a general requirement that all branch lines be restrained at specific maximum spacings ranging from 27 ft to 55 ft depending on the size of pipe and the seismic coefficient from new Table 93.5.6.2 as mentioned above.

Section 9.3.6.5 – A new section will clarify that restraint is not required for branch lines supported by hanger rods less than 6 inches in length.

Upcoming NFSA Technical Tuesday Online Seminar

Topic: Sprinkler Aesthetics and Protective Coverings
Instructor: – Russell P. Fleming, P.E., NFSA Executive Vice President
Date: May 9, 2006

NFPA 13 defines recessed, flush and concealed sprinklers but does not separately present requirements applicable to their proper use as ceiling sprinklers, and only briefly discusses the expected differences in their performance. NFPA 13 also contains requirements relating to escutcheons and cover plates, guards and shields, and requirements for special coatings that can be either protective or ornamental coatings. Also included are aspects relating to earthquake protection requirements and to the inspection, testing and maintenance requirements of NFPA 25.

Information and registration for this seminar is available at www.nfsa.org.

2006 Basic and Advanced Technician Training, NICET Inspection Seminars

The NFSA is the only organization that offers two-week basic technician training seminars, 3-day advanced technician training seminars, and NICET-oriented inspection and testing review seminars at various locations across the United States. The 2006 schedule has been set for the following dates and locations:

2-week Basic Technician Training

August 14-25, 2006 – Seattle, WA
October 16-27, 2006 – Philadelphia, PA

3-day Advanced Technician Training

October 3-5, 2006 – Minneapolis, MN

3-day NICET Inspection and Testing Certification Review

June 27-29, 2006 – Sugarland, TX
July 11-13, 2006 – Edwards, CO
September 6-8, 2006 – Dallas, TX
November 14-16, 2006 – Anchorage, AK

For more information, contact Nicole Sprague using Sprague@nfsa.org

NFSA In-Class Training Opportunities

NFSA also offers in-class training on a variety of subjects at locations across the country. Here are some upcoming seminars:

May 1	Towson, MD	Introduction to Sprinkler Systems (1/2 day)
May 2	Cockeysville, MD	Inspection, Testing & Maintenance
May 3	Cockeysville, MD	Sprinkler Protection for Rack Storage
May 4	Cockeysville, MD	Standpipe Systems (1/2 day)
May 4	Cockeysville, MD	Underground Piping (1/2 day)
May 9	Colorado Springs, CO	Pumps for Fire Protection
May 10	Colorado Springs, CO	Sprinkler Protection for General Storage
May 11	Colorado Springs, CO	Sprinkler Protection for Rack Storage
May 9-10	Nags Head, NC	Plan Review & Inspection
May 11	Nags Head, NC	Hydraulics for Fire Protection
May 16	Winston-Salem, NC	Inspection, Testing & Maintenance
May 17	Winston-Salem, NC	Pumps for Fire Protection
May 18	Winston-Salem, NC	Underground Piping (1/2 day)
May 16-17	Richmond, CA	Plan Review & Inspection
May 18	Richmond, CA	Underground Piping (1/2 day)
May 18	Richmond, CA	Seismic Protection (1/2 day)
May 23-24	Freeland, MI	Plan Review & Inspection
May 25	Freeland, MI	Residential: Homes to High-Rise
May 23-24	Murray, UT	Plan Review & Inspection
May 25	Murray, UT	Hydraulics for Fire Protection
May 23	Spokane, WA	Sprinkler Protection for General Storage
May 24	Spokane, WA	Sprinkler Protection for Rack Storage
May 25	Spokane, WA	Hydraulics for Fire Protection
June 13	Oak Ridge, TN	Pumps for Fire Protection
June 14	Oak Ridge, TN	Hydraulics for Fire Protection
June 15	Oak Ridge, TN	Inspection, Testing & Maintenance
June 13	Quogue, NY	Residential: Homes to High-Rise
June 14	Quogue, NY	Inspection, Testing & Maintenance
June 15	Quogue, NY	Standpipe Systems (1/2 day)
June 13	Lake Jackson, TX	Inspection, Testing & Maintenance
June 14	Lake Jackson, TX	Pumps for Fire Protection
June 15	Lake Jackson, TX	Sprinklers for Dwellings
June 20-21	Bozeman, MT	NFPA 13 Overview & Plan Review
June 22	Bozeman, MT	Hydraulics for Fire Protection

For more information or to register, visit www.nfsa.org or call 845-878-4207.

relied upon, to provide professional consultation or services. Please send comments to Russell P. Fleming, P.E. fleming@nfsa.org .

In the promotion of the fire sprinkler concept, the National Fire Sprinkler Association represents all fire sprinkler industry interests including fire sprinkler contractors, manufacturers and suppliers of fire sprinklers and related equipment and fire protection professionals. Established in 1905, the National Fire Sprinkler Association provides publications, nationally accredited seminars, representation in codes and standards-making, market development, labor relations and other services to its membership. Headquartered in Patterson, New York, the National Fire Sprinkler Association has regional operations offices throughout the country.