



**Tuesday e-Tech Alert**  
**November 16, 2004**

## **Building Code Earthquake Protection for Sprinkler Systems**

The new model building codes have changed the role of NFPA 13, but the sprinkler standard still provides the means to protect sprinkler systems against earthquakes. Some Q&A on the subject:

Q: What is the basis of the new model building code criteria?

A: The earthquake protection criteria of both the International Building Code (IBC) and the NFPA 5000 Building Code are taken from the National Earthquake Hazard Reduction Program (NEHRP) Recommended Provisions developed through the federally funded Building Seismic Safety Council (BSSC). These provisions were directly adopted within the 2000 edition of the IBC, but the 2003 editions of both of the model building codes adopt the NEHRP criteria through reference to ASCE 7 – *Minimum Design Loads for Buildings and Other Structures*. The 2002 edition of the publication can be ordered at a price of \$98 at [www.asce.org](http://www.asce.org).

Q: What does the NEHRP / ASCE 7 criteria provide?

A: The NEHRP / ASCE 7 provisions make both the basic determination of whether the sprinkler system needs to be protected against earthquakes, and the force factor (in terms of percentage of gravity) that is to be resisted by means of the system bracing.

Q: What about the traditional requirement for bracing for a force of half the weight of the water-filled pipe?

A: Since NFPA 13 defers to the building codes, this traditional loading will become obsolete in the United States as the newer model building codes are adopted.

Q: Is the NEHRP / ASCE 7 criteria based on a map?

A: Two maps developed by the U.S. geological survey form the basis of loads, one representing the maximum accelerations (as a percentage of gravity) from short-period accelerations, and the other from longer period (1 second) accelerations. However, the maps must be used in combination with site-specific soil data and a classification of the building occupancy to obtain the expected earthquake forces. The higher occupancy classification (Seismic Use Group III) is used for essential facilities needed to be functional following an earthquake and for occupancies with a potential to release hazardous contents during an earthquake.

Q: How is this information used to determine if a sprinkler system needs to be protected against earthquakes?

A: The mapped accelerations, soil classification, and Seismic Use Group together produce a Seismic Design Category for the building of A through F. Mechanical systems within the building are given the same Seismic Design Category as the building itself. Sprinkler systems in Seismic Design Categories A and B are exempt from requirements for earthquake protection. Systems in the other categories must be protected.

Q: Where is the protection likely to be required?

A: It depends on the soil conditions and the type of occupancy. For a non-essential facility built on hard rock, earthquake protection of sprinkler systems is required only in traditional high-risk earthquake areas such as the west coast, the New Madrid fault area around St. Louis and Memphis, and the area around Charleston, SC and Savannah, GA. For a hospital built on soft soils, earthquake protection of the sprinkler system would be required in almost all parts of the United States except small areas in the north central states, southern Texas, and Southern Florida. Results vary considerably with soil types.

Q: What information should be requested as part of the project specifications?

A: Since the earthquake protection criteria is needed for the building as well as the sprinkler system, the project structural engineer or architect should be asked for the Seismic Design Category of the building. Unless it is A or B, the sprinkler system must be protected against earthquakes using NFPA 13 criteria. The structural engineer or architect should then be asked for the value of  $S_{DS}$ , which is the design acceleration to be used, expressed as a percentage of gravity. NFPA 13 recognizes this factor in Section 9.3.5.6 (2002 edition), such that the horizontal force equation becomes  $F_p = S_{DS} W_p$ , where  $W_p$  is 1.15 times the weight of the water-filled piping. As noted above,  $S_{DS}$  may be higher or lower than the traditional 0.5.

Q: The 2003 edition of the International Building Code specifically deletes Section 9.6.3.11.2 of ASCE 7, which states that “sprinkler systems designed and constructed in accordance with NFPA 13...shall be deemed to meet the requirements...except the force and displacement requirements...shall be satisfied.” Does this deletion mean that NFPA 13 protection criteria cannot be used?

A: No. As explained in the official commentary to the 2003 IBC, there were force and fastener concerns with the edition of NFPA 13 then available. Some fastener loads were based on outdated criteria. These concerns were addressed by a joint task group of the BSSC and NFPA 13, and led to the Tentative Interim Amendment to NFPA 13 issued in August of 2003. Compliance with the reduced fastener loads and other aspects of the TIA should allow full compliance using the provisions of NFPA 13.

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Upcoming NFSA Technical Tuesday Online Seminar:

**November 30, 2004**

**Subject: The Safety Program as a Profit Center**

**Instructor: Michael J. Friedman, P.E.**

**Information and registration for this seminar is available at [www.nfsa.org](http://www.nfsa.org).**