

## HOW RELIABLE IS SPRINKLER PROTECTION?

By Richard Schulte

The National Institute of Standards and Technology (NIST) report on its investigation into the collapse of the World Trade Center towers is roughly 10,000 pages in length. Buried in this avalanche of paper is information on the fire history of the WTC towers and the WTC 7 Building. The following are excerpts from NIST report referred to as NCSTAR 1-4A, *Post Construction Fires Prior to September 11, 2001*:

*“The fire protection engineering department of the Port Authority of New York and New Jersey (PANYNJ) maintained records of all significant fire events in the WTC buildings. These records were lost in the collapse of the towers.”*

*“. . .On February 14, 1975, a fire started on floor 11 of WTC 1. Workers reported the fire to the WTC headquarters. When the police reached the fire floor, they reported a serious fire and ordered the heating, ventilating and air conditioning (HVAC) system be placed into the smoke purge mode. Fire spread through unprotected floor openings in utility closets. Fire damage occurred on floor 10 through 19. Approximately 9,000 ft<sup>2</sup> (800 m<sup>2</sup>) of the floor 11 contents were destroyed or damaged. At that time, sprinklers had not been installed in the office spaces. However, fire barriers divided the floor into quadrants. The fire on floor 11 was confined to the southeast quadrant. Fire damage on other floors was confined to the utility closets. The fire was extinguished by the FDNY.”*

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*“The retrofit installation of sprinklers into WTC buildings 1 and 2 was accomplished in two phases. During the first phase in 1976, sprinkler risers/mains were installed throughout WTC 1 and WTC 2. Sprinklers were installed to protect corridors, storage rooms, lobbies, and certain tenant/PANYNJ spaces. In the second phase of the retrofit from 1983 to 2001, sprinklers were installed in all remaining places in the complex (PACO 2002; shown in Appendix I). Prior to retrofit, only the sub-grade areas and selected hazards were protected by automatic sprinklers. This retrofit, proceeded through the buildings as much as practical when other renovations of the office spaces were under way, such as when change of tenants occurred.”*

*“There were 12 significant fires found for WTC 1. . . .”*

*“On September 9, 1977, at 11:04 p.m., the FDNY received an alarm for a fire in the B-6 level storage room at the address of WTC 1. The fire activated two sprinklers, and was noted to be extinguished before the FDNY’s arrival.”*

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*“Another fire occurred on September 23, 1977, at 11:48 p.m., in a dumpster on the B-4 level of WTC 1. The fire also activated two sprinklers, and the FDNY noted that the fire had been extinguished prior to their arrival.”*

*“In both cases [referring to the fires on September 9 and September 23, 1977], no injuries or casualties [fatalities] resulted from the fires, and the damage was confined to the area of origin.”*

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*“Six years later on December 23, 1983, at 2:50 a.m., the FDNY responded to an alarm of fire and heavy smoke conditions on the B-4 level of WTC 1. The FDNY found two dumpsters fully involved in separate locations on the same floor and noted that the two activated sprinklers extinguished a major portion of the fire. The FDNY extinguished the rest of the flames by stretching hose from the standpipe system. Again, no injuries or casualties resulted from the fire. The cause noted on the report was suspicious and the damage was confined to the origin of the fire.”*

*“The FDNY found two dumpsters fully involved in separate locations on the same floor and noted that the two activated sprinklers extinguished a major portion of the fire.”*

*“On January 27, 1985, at 8:53 p.m., the FDNY was called for a fire located in an unoccupied office on the mezzanine level of WTC 1. Two sprinklers contained the incendiary (involving arson) fire consuming trash paper/waste. When the FDNY arrived, they extinguished the remaining fire with one standpipe line. Building and content damage was confined to less than 15 percent of the space. Also, no injuries or casualties [fatalities] were reported.”*

*“Two sprinklers contained the incendiary (involving arson) fire consuming trash paper/waste.”*

*“Eight months later on September 10, 1985, at 4:05 p.m., the Port Authority Police informed the FDNY on arrival of a sprinkler flow and smoke condition on floor 43. A medium smoke condition was report[ed] by the FDNY on floor 43, where a fire was extinguished by two sprinklers. The fire report notes the use of one standpipe line; however, this was used during the overhaul process. This fire originated suspiciously in a garbage dumpster in a service elevator lobby. There was no build-up or content damage as well as no injuries or casualties [fatalities] reported.”*

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*“On November 1, 1985, at 4:05 a.m., the FDNY was called for another suspicious fire producing heavy smoke on the B-4 level under WTC 1 and WTC 2. This fire occurred in a storage closet of the men’s bathroom, and the FDNY noted that three sprinklers activated to keep the fire under control until their arrival. Upon arrival, the FDNY extinguished the remaining fire in the closet area with one standpipe line. Again, the damage was noted to be confined to the area of origin.”*

*“. . . This fire occurred in a storage closet of the men’s bathroom, and the FDNY noted that three sprinklers activated to keep the fire under control until their arrival.”*

*“Less than a year later, on June 7, 1986, at 9:49 a.m., the FDNY received an alarm for a heavy smoke condition on floor 110. For this call, fires were burning in two separate places: a garbage dumpster on floor 106 and a trash compactor on floor 107. Sprinklers were noted in operation in both locations and seemed to control the fires, until the FDNY could complete extinguishment with one standpipe line on floor 106. There was no report of injuries or casualties [fatalities] for the previous two fires [referring to the fire on November 1, 1985, as well as this fire].*

*“An additional fire occurred in WTC 1 where multiple standpipe lines were used along with the activation of the sprinkler system. The fire occurred on September 30, 1991, at 6:32 p.m., in an office on the B-4 level. The fire report noted that sprinklers operated; however, there is no mention of how many sprinklers or even their activation in the Operations/Command section of the report. Two 1-3/4 in. or larger hose lines were used by the FDNY to extinguish this fire. The cause of the fire was abandoned material (cigarette) igniting boxes/carton material in an office. The fire damage was confined to the area of origin and smoke damage was confined to the floor. There was one uniformed officer injured and no civilian injuries or casualties [fatalities].”*

*“The fire damage was confined to the area of origin and smoke damage was confined to the floor.”*

*“A fire occurred on November 19, 1991, at 6:27 p.m., and two 2-1/2 in. standpipe hose lines were used by the FDNY. The FDNY responded to WTC 1 for this fire due to a report of fire and smoke condition in electrical closets on possibly four floors (floors 93-96) and an alarm transmitted from floors 93 through 98. According to the fire report, the sprinklers were in service, but did not operate for this fire. The noted cause of this fire was a short circuit and the material that was ignited was electrical wire or cable insulation. The fire and smoke damage was confined to its area of origin (electrical closet). . . .Also, two occupants were injured and required first aid.”*

*“According to the fire report, the sprinklers were in service, but did not operate in this fire. The noted cause of this fire was a short circuit and the material that was ignited was electrical wire or cable insulation.”*

*“The FDNY responded to WTC 1 on July 23, 1992, at 10:02 p.m., due to a transformer fire on the 5<sup>th</sup> subbasement level. Firefighters found a fire situation in a large power distribution panel, where a firefighter was knocked unconscious by a shock blast from the panel. Similar to the fire in November 1991, two 2-1/2 in. standpipe lines were used by the FDNY on this fire. The cause of this fire was an electrical failure and the materials ignited was electrical wire or cable insulation. No appreciable damage is noted. As mentioned earlier, one firefighter was injured, as well as three civilians.”*

*“The final fire associated with WTC 1 was one that occurred on November 10, 1999, at 11:01 p.m., in a computer room on floor 104. The FDNY noted that the fire was “knocked down” by three sprinklers when they arrived and they completed extinguishment with a line extended from the standpipe. The flame damage was confined to the area of origin and computer equipment was involved in fueling the fire. There was one injury and no casualties [fatalities] reported in the FDNY record for this fire.”*

*“A fire occurred on May 19, 1975, at 9:38 p.m., on floor 32 of the WTC 2 [building]. The FDNY noted that they used three standpipe lines to extinguish the fire and that the Port Authority reported occupants trapped on floors 31 and 32. The fire report notes that no sprinklers opened, but does not note whether or not sprinklers were present at the time of the fire. Given the date of the incident, sprinklers are not expected to be located on floors 31 and 32. The fire was labeled incendiary and involved trash/waste. The FDNY stated that the fire involved the core area of the floor and was confined to that area. More than 20 people (civilians and uniformed personnel) were injured by the incident.”*

*“The FDNY noted that they used three standpipe lines to extinguish the fire and that the Port Authority reported occupants trapped on floors 31 and 32. The fire report notes that no sprinklers opened, but does not note whether or not sprinklers were present at the time of the fire. Given the date of the incident, sprinklers are not expected to be located on floors 31 and 32.”*

*“On April 4, 1977, at 1:15 p.m., the FDNY was called to WTC 2 for a fire in ductwork over the grills in a restaurant on floor 107. The FDNY record on this fire noted that the fire was extinguished prior to its arrival. The damage was confined to the area of origin, and the fire caused no injuries or casualties [fatalities].”*

*“The fire activated two sprinklers due to an overheated bearing in a fan motor on floor 108. The damage to the area did not exceed 15 percent of the space, and there were no injuries or casualties [fatalities].”*

*“The second fire occurred on March 22, 1993, at 8:39 a.m., and caused a smoke condition on floor 108. The fire activated two sprinklers due to an overheated bearing in a fan motor on floor 108. The damage to the area did not exceed 15 percent of the space, and there were no injuries or casualties [fatalities].”*

*“On April 17, 1981, at 9:18 a.m., the FDNY was informed of a fire on floor 7 and a smoke condition on floors 7 through 11 of WTC 1. The FDNY hooked up to one standpipe and extinguished the fire located in an air conditioning unit in the “MER” room on floor 7. The cause of the fire was labeled as a mechanical failure. The fire report notes that the Port Authority personnel reported an evacuation of approximately 1,500 people from floors 9 through 23. However, no injuries or casualties were reported from this fire.”*

*“In WTC 7, a fire occurred on May 20, 1988, at 12:38 a.m., in the construction shanties on floor 3. Although the fire report does not specifically note the number of sprinklers that activated, the operation notes state that Ladder Truck 10 found the sprinklers (noting more than one) in operation and shut them down. The FDNY had to complete the extinguishment by stretching a line from the standpipe to the fire source. This fire is noted by the report as being suspicious in nature and the flame damage was confined to the area of origin.”*

*“From information contained in FDNY fire reports and fire investigation records provided to NIST, 47 fires occurred in WTC 1, 2, and 7 that were of sufficient size and duration to activate multiple sprinklers or were estimated by NIST to be capable of doing so, over the period of time the buildings were occupied. This total does not include the major 1975 office fire in WTC 1 or the 1993 bombing.”*

*“The records indicate that in areas protected by automatic sprinklers, no fire activated more than three sprinklers. Three sprinklers would provide coverage for a floor area of approximately 675 ft<sup>2</sup> (63 m<sup>2</sup>). This area is much smaller than the 9,000 ft<sup>2</sup> (800 m<sup>2</sup>) damaged by the 1975 fire in an office space unprotected with automatic sprinklers.”*

*“The fire report notes that the Port Authority personnel reported an evacuation of approximately 1,500 people from floors 9 through 23. However, no injuries or casualties were reported from this fire.”*

*“In cases where sprinklers were activated, the FDNY records indicated that the sprinklers either extinguished the fire completely or aided in controlling the [fire] spread.”*

## **Discussion**

Surely you’ve heard the statistic that sprinkler systems fail to control 1 in 6 fires (large enough to activate sprinklers). Based upon this statistic and the number of fires in the WTC 1, WTC 2 and WTC 7 Buildings, there should have been at least one or two sprinkler system failures in these buildings.

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Of course, the statistic that sprinkler systems fail to control one in six fires has been discredited long ago. The same folks who came up with the discredited statistic, William Koffel and the Alliance for Fire and Smoke Containment and Control (AFSCC) now say that sprinkler systems fail in 1 in 10 or 1 in 11 fires large enough to activate sprinklers.

Based upon the information provided in the NIST report excerpted above, the sprinkler system success rate for the three WTC Buildings included in the NIST investigation was 100 percent. In other words, there were no failures of the sprinkler systems to perform their intended function to either control or extinguish fires. (The fires which occurred on September 11<sup>th</sup> were caused by missile attacks-the hi-jacked aircraft were utilized as missiles. Neither buildings, nor sprinkler systems, are designed to withstand missile attacks. The sprinkler systems protecting the WTC buildings were destroyed in the attack, hence, the systems did not fail on September 11<sup>th</sup>.)

As has been noted many times before by this author, a major fire has never occurred in a high rise building in the United States protected throughout by a sprinkler system since we began providing sprinkler protection throughout high rise buildings in the early 1970's. Quite an impressive record, isn't it?

The Alliance for Fire and Smoke Containment and Control, a trade organization which represents the manufacturers of passive fire protection products, would have us believe that sprinkler protection is inherently unreliable. The AFSCC's purpose behind this ruse is to expand the market for passive fire protection products. The discussion above undercuts the AFSCC's argument.

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Are sprinkler systems one hundred percent reliable? Of course not, but then again, neither is passive fire protection. In fact, based upon my experience, many passive fire protection features, such as fire door assemblies and fire dampers, are highly unreliable fire protection features.

The NFPA statistics on sprinkler system failures tell us that wet pipe sprinkler systems are far more reliable than dry pipe systems and that sprinkler protection provided for buildings which contain industrial and storage occupancies is more prone to failure. One of the reasons why more failures occur in industrial and storage occupancies is that more dry pipe sprinkler systems are installed in these two occupancies than in other occupancies.

Once again, we have a real world confirmation that sprinkler protection is indeed highly reliable-actually more reliable than indicated by the NFPA statistics on sprinkler system reliability.

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