

initial fires in WTC 1 and WTC 2 in 2001 were considerably greater than three times the specified design areas.

- There were redundant and sufficient supplies of water for the standpipe and sprinkler systems for control of normally expected fires on the floors where the September 11 fires occurred. Activating the secondary water supplies required manual operation of electric fire pumps by a sizable number of people at various locations.
- No information was available at the Fire Command Desk about the water supply in areas that were burning, leading to a Port Authority employee being sent up to assess the status.
- There was no information available regarding the performance of the non-aqueous fire suppression systems on September 11, 2001. The manually operated smoke purge systems were designed to be activated by the fire department after a fire was suppressed, and, therefore, were not initiated on September 11. It is unlikely the systems would have functioned as designed, due to loss of electrical power and damage to the HVAC shafts and other structural elements in the impact zone that were integral parts of the systems.
- Analysis indicated that the aircraft impact rupture of large return air shafts and related ductwork created a major path for vertical smoke spread in the towers.

8.4.2 Evacuation

- Approximately 87 percent of WTC occupants, and over 99 percent of those below the floors of impact, were able to evacuate successfully.
- At the time of the aircraft impacts, the towers were only about one-third to one-half occupied. Had they been at the full capacity of 20,000 workers and visitors per tower, computer egress modeling indicated that a full evacuation would have required just over 3 hours. Under those circumstances, about 14,000 occupants might have perished in the building collapses.
- There were $8,900 \pm 750$ people in WTC 1 at 8:46 a.m. on September 11, 2001. Of those, 7,470 (or 84 percent) survived, while 1,462 to 1,533 occupants died.¹⁵ At least 107 occupants were killed below the aircraft impact zone. No one who was above the 91st floor in WTC 1 after the aircraft impact survived. This was due to the fact that the stairwells and elevators were destroyed and helicopter rescue was impossible.
- There were $8,540 \pm 920$ people in WTC 2 at 8:46 a.m. on September 11, 2001. Of those, 7,940 (or 93 percent) survived, while 630 to 701 occupants were killed.¹⁵ Eleven of those killed were employed on floors located below the aircraft impact zone. Approximately 75 percent of the occupants above the 78th floor at 8:46 a.m. had successfully descended below the 78th floor prior to the aircraft impact at 9:03 a.m. The use of elevators and self-initiated evacuation during this period saved roughly 3,000 lives.

¹⁵ As shown in Table 4–1, there were a total of 71 decedents whose initial locations in the towers were not certain: 30 below the impact zone in either WTC 1 or WTC 2, 24 at an unknown location in WTC 1 or WTC 2, and 17 people for whom no location information was available.