

It is important to note that floors 5 through 7 contained structural elements that were important to supporting the structure of the overall building. The 5th and 7th floors were diaphragm floors that contained transfer girders and trusses. These floors transferred loads from the upper floors to the structural members and foundation system that was built prior to the WTC 7 office tower. Fire damage in the 5th to 7th floors of the building could, therefore, have damaged essential structural elements.

With the limited information currently available, fire development in this building needs additional study. Fires were observed to be located on the lower levels for the majority of the time from the collapse of WTC 1 to the collapse of WTC 7. It appears that the sprinklers may not have been effective due to the limited water on site, and that the development of the fires was not significantly impeded by the firefighters because manual firefighting efforts were stopped fairly early in the day.

Available information indicates that fires spread horizontally and vertically throughout the building during the course of the day. The mode of spread was most likely either along the south façade that was damaged, or internally through shafts or the gap between the floor slab and the exterior wall. It is currently unclear what fuel may have been present to permit the fires to burn on these lower floors for approximately 7 hours. The change in the color and buoyancy of the smoke as the day progressed may indicate a change in the behavior of the fires. The darker color may be indicative of different fuels becoming involved, such as fuel oil, or the fire becoming ventilation limited. The increased buoyancy of the fires suggests that the heat release rate (or “fire size”) may have also increased.

The mechanisms behind these apparent changes in behavior are currently unknown and therefore various scenarios need to be investigated further. These include gathering additional information regarding storage of materials on various levels, the quantity and combustibility of materials, and the presence of dense storage, including file rooms, tape vaults, etc. In addition, further analysis is needed on the specific locations of the fuel tanks, supply lines, fuel pumps, and generators to determine whether it may have been possible for a fuel line to be severed by the falling debris, allowing the pumps to run and pump fuel out of the broken pipes.

5.5.4 Sequence of WTC 7 Collapse

Approximately 7 hours after fires initiated in WTC 7, the building collapsed. The start of a timed collapse sequence was based on 17:20:33, the time registered by seismic recordings described in Table 1.1 (in Chapter 1). The time difference between each of the figures was approximated from time given on the videotape. Figures 5-20 to 5-25 illustrate the observed sequence of events related to the collapse.

~5:20:33 p.m. WTC 7 begins to collapse. Note the two mechanical penthouses at the roof on the east and west sides in Figure 5-20.

~5:21:03 p.m. Approximately 30 seconds later, Figure 5-21 shows the east mechanical penthouse disappearing into the building. It takes a few seconds for the east penthouse to “disappear” completely.

~5:21:08 p.m. Approximately 5 seconds later, the west mechanical penthouse disappears (Figure 5-22) or sinks into WTC 7.

~5:21:09 p.m. Approximately 1 or 2 seconds after the west penthouse sinks into WTC 7, the whole building starts to collapse. A north-south “kink” or fault line develops along the eastern side as the building begins to come down at what appears to be the location of the collapse initiation (see Figures 5-23 and 5-24).

~5:21:10 p.m. WTC 7 collapses completely after burning for approximately 7 hours (Figure 5-25). The collapse appeared to initiate at the lower floors, allowing the upper portion of the structure to fall.