

enough usable oxygen to generate 2×10^4 MJ, only about 2 percent of the combustibles would have burned.

- Even if a fire burned over as short a duration as 1 h (3,600 s), the fire would have averaged only about 6 MW in intensity. This would not have been sufficient to heat enough of the insulated structural steel or the concrete floor slab to a temperature that would have led to significant thermal expansion or weakening.

The fires burned for up to 7 h and, on some floors, had sustained intensities estimated to have exceeded 100 MW (Section 9.4). Thus, the rate at which fresh air became available played a major role in determining the intensity and duration of the fires. The locations from which air became available determined the direction of fire growth.

Initially, the intake air supply for the fires came from the south side of the building. As noted in Section 5.5, the debris from the collapse of WTC 1 created a gash in the west side of the south face of the building that stretched from the 17th floor down to the 5th floor. Photographs also showed that windows in this vicinity were broken by the percussion and debris impact (Section 5.5). Fires on the interior of the tenant spaces would have had to draw and vent air through these openings. Section 5.6 also documents additional window breakage by the fires as they reached the building façade. Only a very few (about three) windows were known to have been broken by building occupants.¹ These occurred well before fires reached these locations, and were too few to affect the fire ventilation or spread rate significantly.

Floor-to-floor Fire Spread

Initially, the Investigation Team hypothesized that it was unlikely that fires, once ignited on a given floor but prior to the initiation of the total building collapse, would have spread to an adjacent floor once they had moved past the gash in the south face. There were several bases for this reasoning:

- There was only one constructed opening connecting adjacent fire floors in the tenant spaces, which was a convenience stair between the 11th and 12th floors in the southwest corner. This was in the immediate vicinity of the gash created by debris impact and would have been little more than an extension of the debris-caused opening between these two floors.
- There was no visual evidence of floors collapsing prior to the beginning of the building collapse itself.
- There was no visual evidence of a fire having spread from floor to floor on the inside of the curtain wall, i.e., through gaps in the firestopping. However, such spread would have been difficult to verify.
- There were no photographs or videos indicating flames had emanated from a window and ignited a fire on the floor above through the windows located directly above.

Subsequently, thermostructural calculations (Chapter 11) indicated that approximately 15 min prior to the total building collapse, it was likely that the following floor sections had failed:

¹ NYC Housing Authority Interview 8, April 2004.