5.8 External Water Application (indirect attack) WDF 8 (smooth bore)

The eigth experiment in the series was conducted to examine the impact of wind on the structure fire, quantify the impact of a smooth bore water stream into the bedroom, and to compair results to experiment 7 (section 5.7) with the living room to corridor door open. The experimental preparations were made as described in Section 4. The fan speed used in this experiment was 1500 RPM, which provided a 3.0 m/s to 4.0 m/s (7 mph to 9 mph) wind speed at the window opening. A trash container fuel package was ignited remotely with and electric match to start the experiment at Time = 0 s. A time line of the experiment is presented in Table 5.8-1. The results for the experiment are presented in the following sections: observations, heat release rate, temperature, heat flux, pressure, velocity, and gas concentrations. An uncertainty range marker is included in each graph.

Table 5.8-1. Experiment 8 Timeline

Time (s)	Event
0	Ignition
40	Visible smoke layer
141	Window vented
145	Hot gas flow to floor in corridor IR
298	Hose on, at ceiling
350	Sweeping stream
435	Fire knocked down
470	Hose off
475	Hose on, at contents
489	Fire out

5.8.1 Observations

The observations are presented as a series of images captured from eight camera locations, six were video cameras and two were thermal imaging cameras. The camera positions are shown in Figure 4.1.3-1.

Figure 5.8.1-1 through Figure 5.8.1-14, present two sets of four camera views, on above the other. Each represents a given time, from the time of ignition to 480 s after ignition. Each image view is labeled.

The first view, outside, shows the west wall and window of the structure, and is presented with 3 other views. The view to the left of outside is the bedroom view; from the bottom of the south wall in the bedroom, where ignition occurs. The bottom two views of the top quad, living room and doorway, both show the living room; the left shows a view from the southwest wall of the living room, while the right shows a view from the corridor center position, through the corridor door into the living room, with a path directly down the hallway and out the bedroom window visible.

The bottom four views include two infrared cameras as well as two normal camera views. The top IR view, corridor IR, shows a view up the corridor from an IR camera mounted in the south corridor exit door. The bottom IR view, outside IR, is positioned similar to the outside view, but through an IR camera. The top normal view, corridor, shows a view down both the central corridor to the south corridor exit and down the north corridor to the northwest corridor vent. The last view, stack, shows the exhaust exit path from the vent stack into the exhaust hood above the structure.

Figure 5.8.1-1 shows the conditions at the time of ignition. At this point, the eight video views were clear and unobstructed. However, the thermal images provided limited thermal contrast because the surfaces in the view were at nearly equal temperature.

The images in Figure 5.8.1-2 were captured 60 s after ignition. The fire has spread to the bed at this point; a heavy smoke layer has formed down to approximately the center of the window opening, approximately 1.22 m below the ceiling, and is beginning to spread down the hall and into the living room.

The images in Figure 5.8.1-3 were recorded at 120 s after ignition. The flame had spread to the upholstered chair nearest the bed and the smoke layer had formed down to within the meter of the floor, approximately 1.52 m below the ceiling. The smoke layer had fully spread throughout the structure and hot gasses had begun to flow through the top of the corridor door toward the vent.

Figure 5.8.1-4 shows the images recorded at 150 s after ignition. At this point the window had been cleared of the window opening, and flames could be seen pushing out of that opening. There was little or no visibility at any place inside the structure at this point. Hot gas was flowing, floor to ceiling, through the corridor door toward the vent, as is visible in the IR view of the corridor area.

Figure 5.8.1-5 shows the conditions at 180 s after ignition. Flames had encompassed the full height of the bedroom and extend into the living room. Some visibility has returned to the bedroom and living room.

Figure 5.8.1-6 was captured at 185 s after ignition. At this point flames have spread into the corridor. Shortly after this flames were visible in the vent stack.

Figure 5.8.1-7 shows the conditions at 240 s after ignition. At this point there was zero visibility in any of the internal views, including the corridor IR camera. Smoke had begun to fill the laboratory structure and has thus obscured the external stack view aswell.

The images in Figure 5.8.1-8 were recorded at 300 s after ignition. At this point the corridor IR camera had been removed and a large amount of combustion was occurring outside the structure, above the stack. Even though there were no furnishings or other fuels located in the corridor. Another example that smoke is fuel.

The images in Figure 5.8.1-9 were recorded at 310 s after ignition. A solid stream has been flowed into the window from a low angle, simulating an indirect suppression.

The images in Figure 5.8.1-10 were recorded at 315 s after ignition. At this point flames were withdrawing from the stack, and combustion has completely discontinued outside the structure.

The images in Figure 5.8.1-11 were recorded at 360 s after ignition. Indirect suppression was still ongoing, visibility was returning to the bedroom.

The images in Figure 5.8.1-12 were recorded at 420 s after ignition. Visibility had returned to the bedroom and had begun to return to the living room. Indirect suppression was still ongoing.

The images in Figure 5.8.1-13 were recorded at 468 s after ignition. Within several seconds indirect suppression stopped and direct suppression began.

Figure 5.8.1-1. Experiment 8, ignition.

Figure 5.8.1-2. Experiment 8, 60 s after ignition.

Figure 5.8.1-3. Experiment 8, 120 s after ignition.

Figure 5.8.1-4. Experiment 8, window fully vented, 150 s after ignition.

Figure 5.8.1-5. Experiment 8, 180 s after ignition.

Figure 5.8.1-6. Experiment 8, corridor flames, 185 s after ignition.

Figure 5.8.1-7. Experiment 8, 240 s after ignition.

Figure 5.8.1-8. Experiment 8, 300 s after ignition.

Figure 5.8.1-9. Experiment 8, indirect suppression started, 310 s after ignition.

Figure 5.8.1-10. Experiment 8, flames withdraw from vent, 315 s after ignition.

Figure 5.8.1-11. Experiment 8, 360 s after ignition.

Figure 5.8.1-12. Experiment 8, 420 s after ignition.

Figure 5.8.1-13. Experiment 8, indirect suppression stopped, 468 s after ignition.

Figure 5.8.1-14. Experiment 8, 480 s after ignition.

5.8.2 Heat Release Rate

Figure 5.8.2-1 shows the heat release rate time history for Experiment 8. The increase in measured heat release rate is delayed because for the first 141 s after ignition no heat or combustion products generated by the fire flowed out of the structure. After the window failed, at 141 s after ignition, the increase in heat release rate was clear. The heat release rate reached a peak of approximately 32 MW, 140 s after window failure. A strait stream of water was directed at the bedroom ceiling of the structure and began flowing at 298 s after ignition. Within 5 s the heat release rate dropped rapidly to 12 MW at 326 s after ignition. At this point the heat release rate is no longer drastically affected by the hose stream until 475 s after ignition, when direct suppression begins.

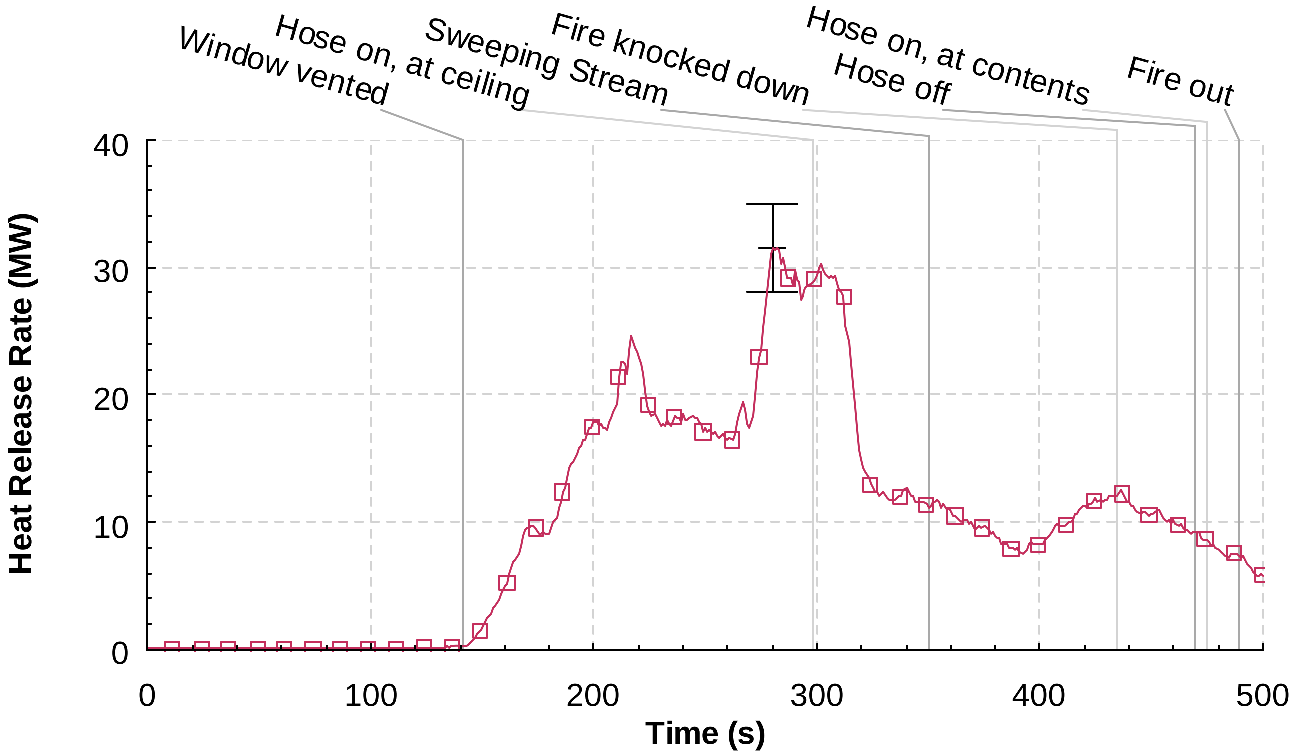

Figure 5.8.2-1. Heat release rate versus time, Experiment 8.

5.8.3 Temperatures

Figure 5.8.3-1 shows the temperature time history of the thermocouples on the bedroom window. These were positioned at 0.38 m (1.25 ft), 0.76 m (2.50 ft) and 1.14 m (3.75 ft) below the top of the window opening; the window was positioned .46 m (1.5 ft) below the ceiling of the structure. As these thermocouples were positioned outside the window, there response is negligible until the window is vented at 141 s. After this point a clear temperature gradient appears vertically across the window opening. At 298 s after ignition indirect suppression of the bedroom begins and temperature data from these three thermocouples becomes suspect due to exposure to the hose stream.

Figure 5.8.3-2 shows the temperature time history for the thermocouple string in the center of the bedroom. It shows the thermal layering which occurs from the point of ignition up until the window is vented at 141 s. The width of the smoke layer is also evident, as the respose of each thermocouple corresponds to its exposure to hot gases. Consiquently, Figure 5.8.3-2 shows that the smoke layer had not yet reached the thermocouples located 1.83 m below the ceiling. When the window is vented the thermal layering in the bedroom is disrupted, causing rapid temperature changes at each level due to erratic gas flow. This continues up until approximately 180 s after ignition, when ignition of all combustible surfaces in the bedroom becomes apparent and thermal layering disappears. At 203 s after ignition the maximum temperature in the bedroom is reached at 937 °C. The thermal conditions in the bedroom remain the same until the indirect suppression begins to sweep the hose stream across the bedroom ceiling, 350 s after ignition. At approximately 360 s after ignition the thermocouple tree in the bedroom is damage by a hose stream and no longer provides accurate data.

Thermal conditions in the hallway, demonstrated in Figure 5.8.3-3, mimic the bedroom in that the thermal layer is disrupted when the window is vented at 141 s after ignition and in that thermal layering begins to disappear at approximately 180 s after ignition. However, the smoke layer descends more slowly in the hallway than in the bedroom, because the response the hallway thermocouple tree is delayed at much as 40 s from those in the bedroom. This is consistent with the video footage of the hallway area. At approximately 300 s after ignition, the thermocouple tree in the hallway is damaged by a hose stream and no longer provides accurate data.

The thermocouples trees in the living room corner and in the center of the living room, Figure 5.8.3-4 and Figure 5.8.3-5 respectively, reflect similar results to the bedroom and hallway trees, with two significant differences. The maximum temperature is nearly 200 °C lower than either the hallway or the bedroom. Additionally, the stratification of gas termperatures in the living room is not significantly disrupted when the window is vented. The living room center thermocouple tree shows some thermal layering after 180 s, unlike the other thermocouple trees in fuel loaded areas. This effect disappears by approximately 280 s after ignition. By this point a large amount of exhaust product is exiting the stack at or above ignition temperature and ignition outside the structure is clearly visible in the stack view of Figure 5.8.1-8, just 20 s later.

Temperatures inside the corridor just beyond the corridor door are nearly consistent with the living room at approximately 750 °C by 180 s after ignition as shown in Figure 5.8.3-6. The temperature at all heights is well mixed in this area after 180 s.

Temperatures in the corridor outside the exhaust path, in the corridor south and southwest areas, are shown in figures Figure 5.7.3-7 and Figure 5.8.3-8. In the corridor shouth area temperatures are vertically mixed but range from approximately 400 °C to 700 °C. Temperatures in the southwest corridor area remained layered and never reached above 500 °C. Temperatures in these areas begin to drop substantially within 20 s of the onset of indirect suppression at 298 s after ignition.

Temperatures along the exhaust flow path in the corridor, in the corridor north and vent areas, are shown in Figure 5.8.3-9 and Figure 5.8.3-10. Neither demonstrates significant thermal layering at any point during the test and both show similar trends in temperature. Temperatures from 180 s after ignition until the onset of indirect suppression range between 600 °C and 900 °C and drop significantly within 20 s of the onset of indirect suppression at 298 s after ignition.

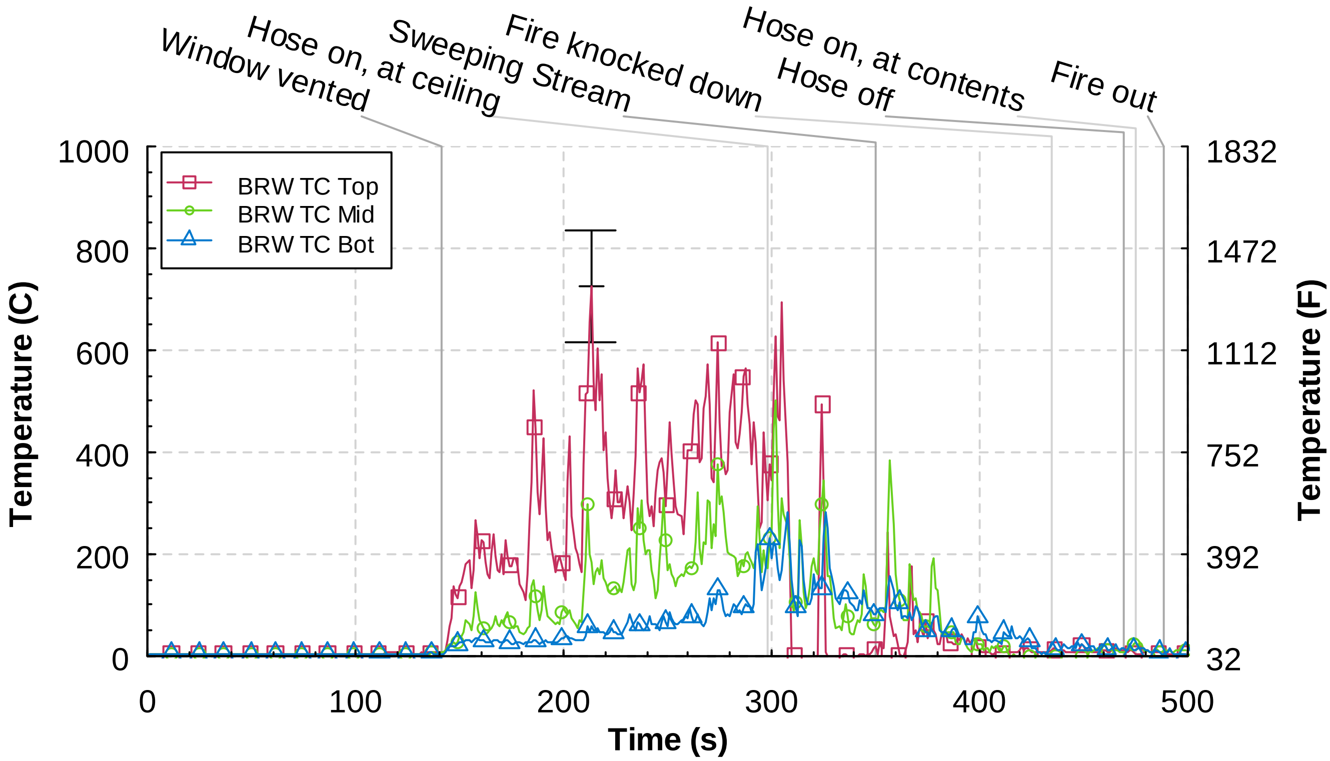

Figure 5.8.3-1. Temperature versus time from the bedroom window (BRW) thermocouple array, Experiment 8.

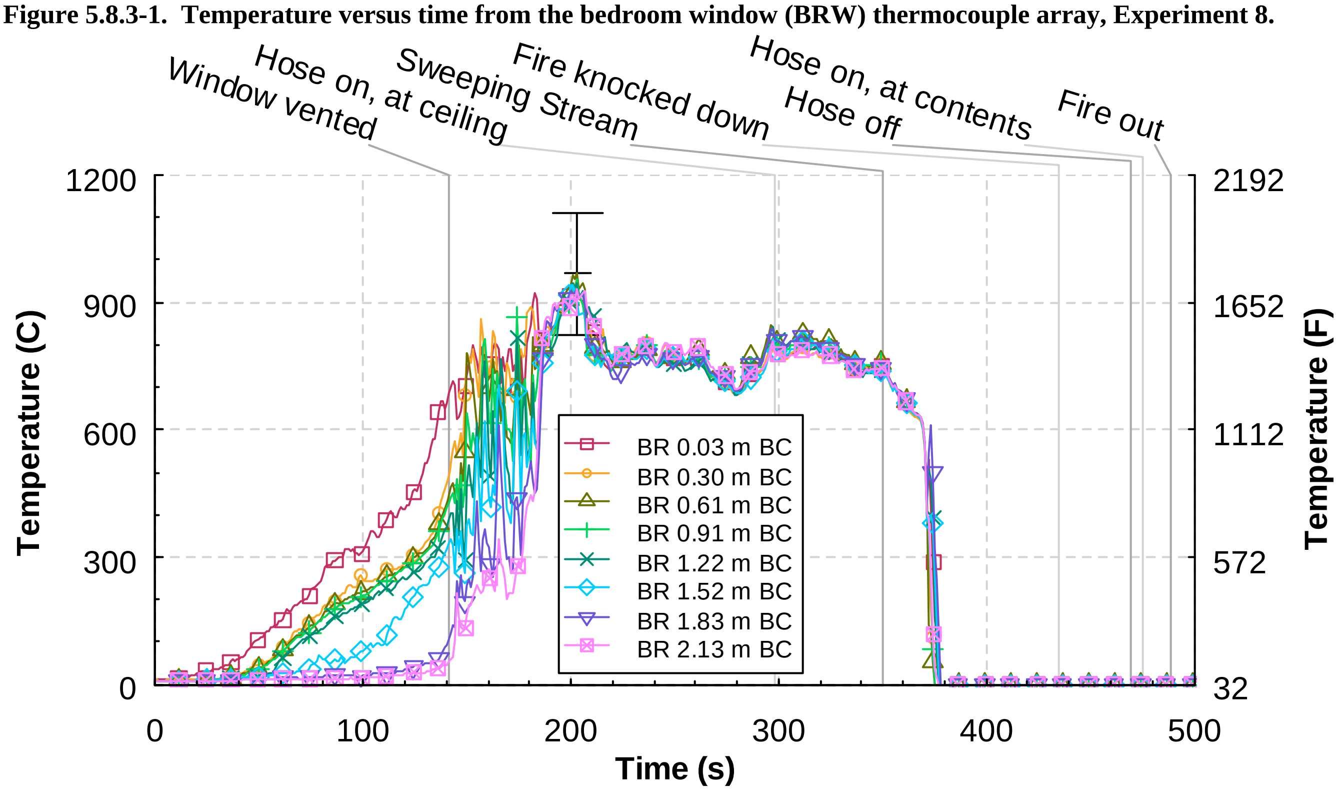

Figure 5.8.3-2. Temperature versus time from the bedroom (BR) thermocouple array, Experiment 8.

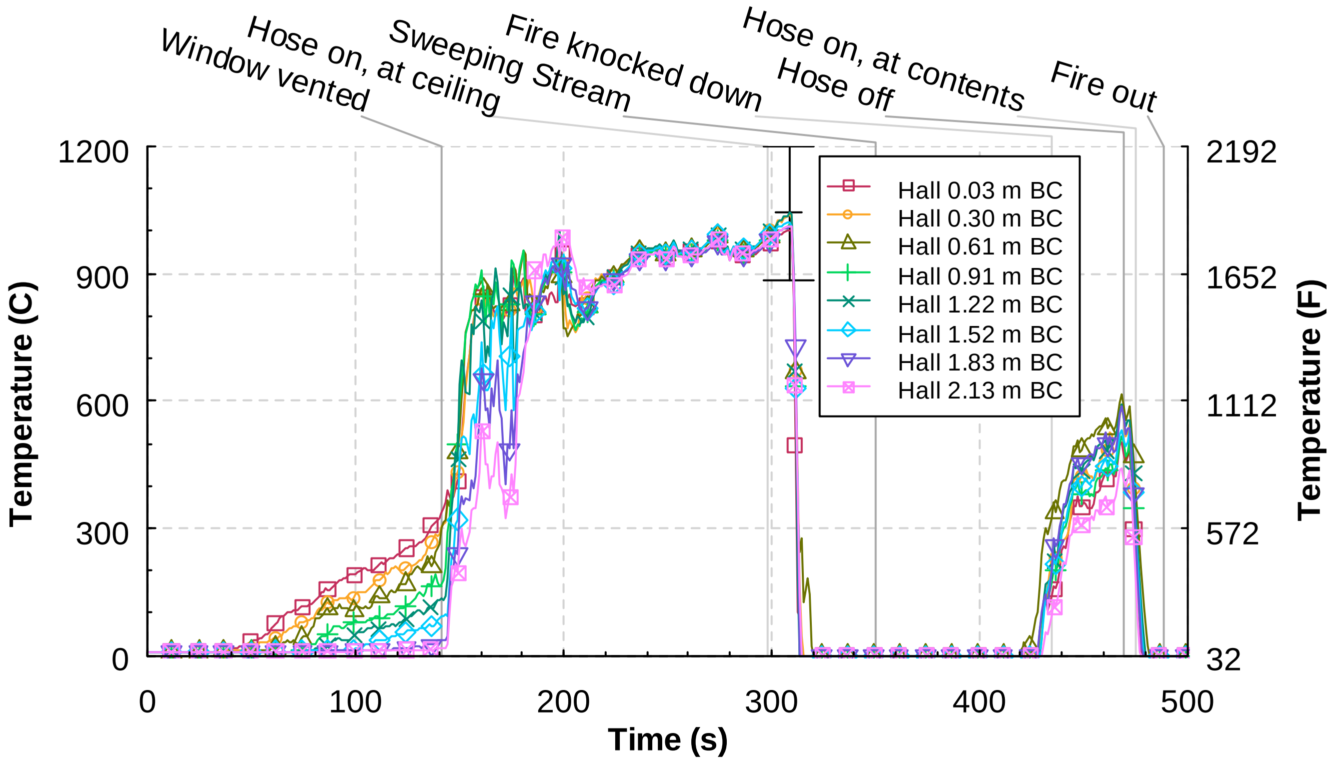

Figure 5.8.3-3. Temperature versus time from the hall thermocouple array, Experiment 8.

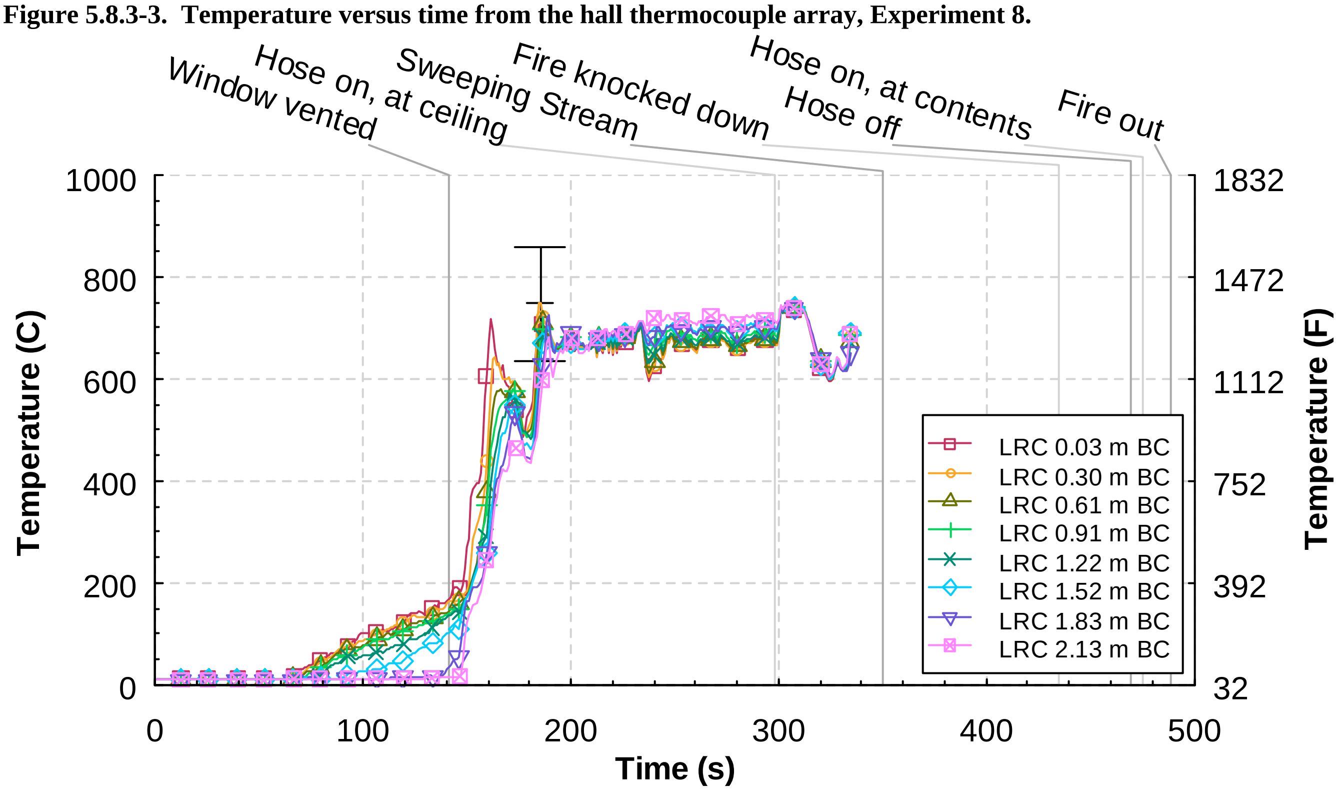

Figure 5.8.3-4. Temperature versus time from the living room corner (LRC) thermocouple array, Experiment 8.

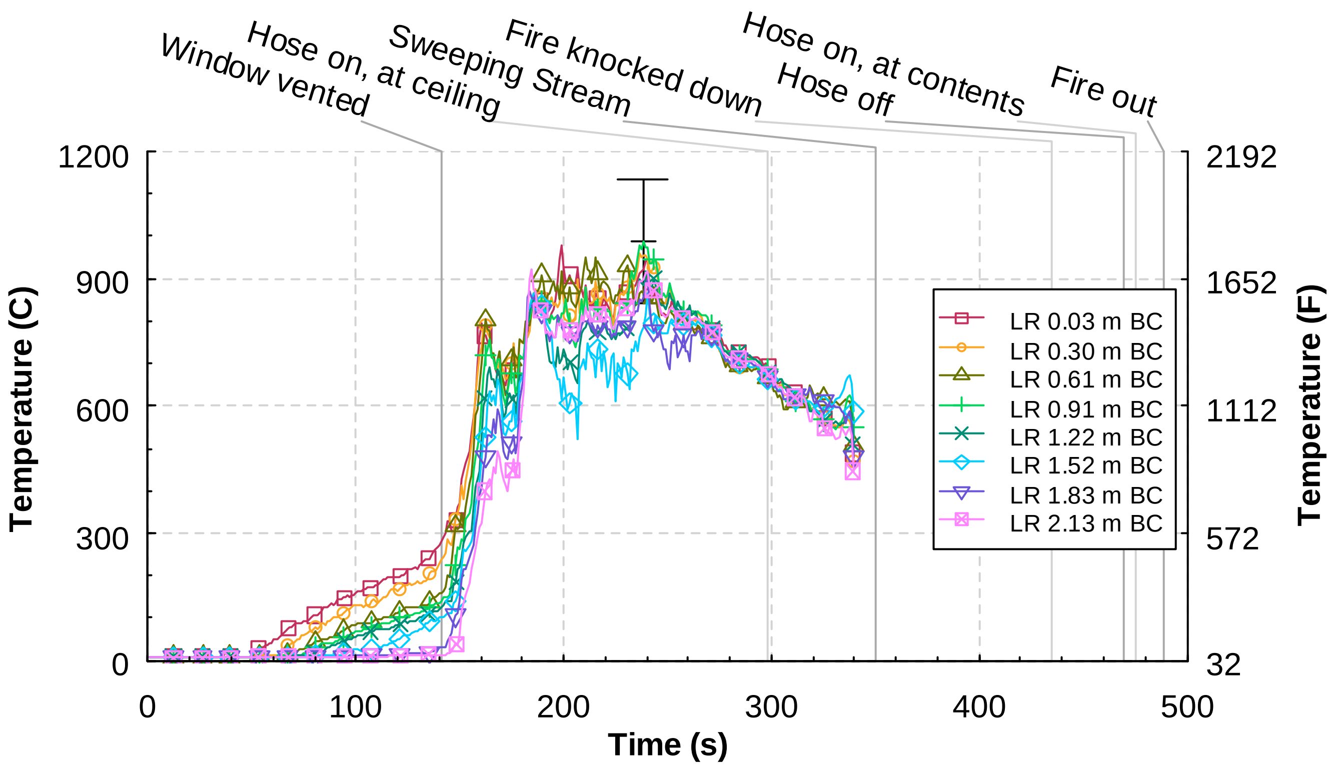

Figure 5.8.3-5. Temperature versus time from the living room (LR) thermocouple array, Experiment 8.

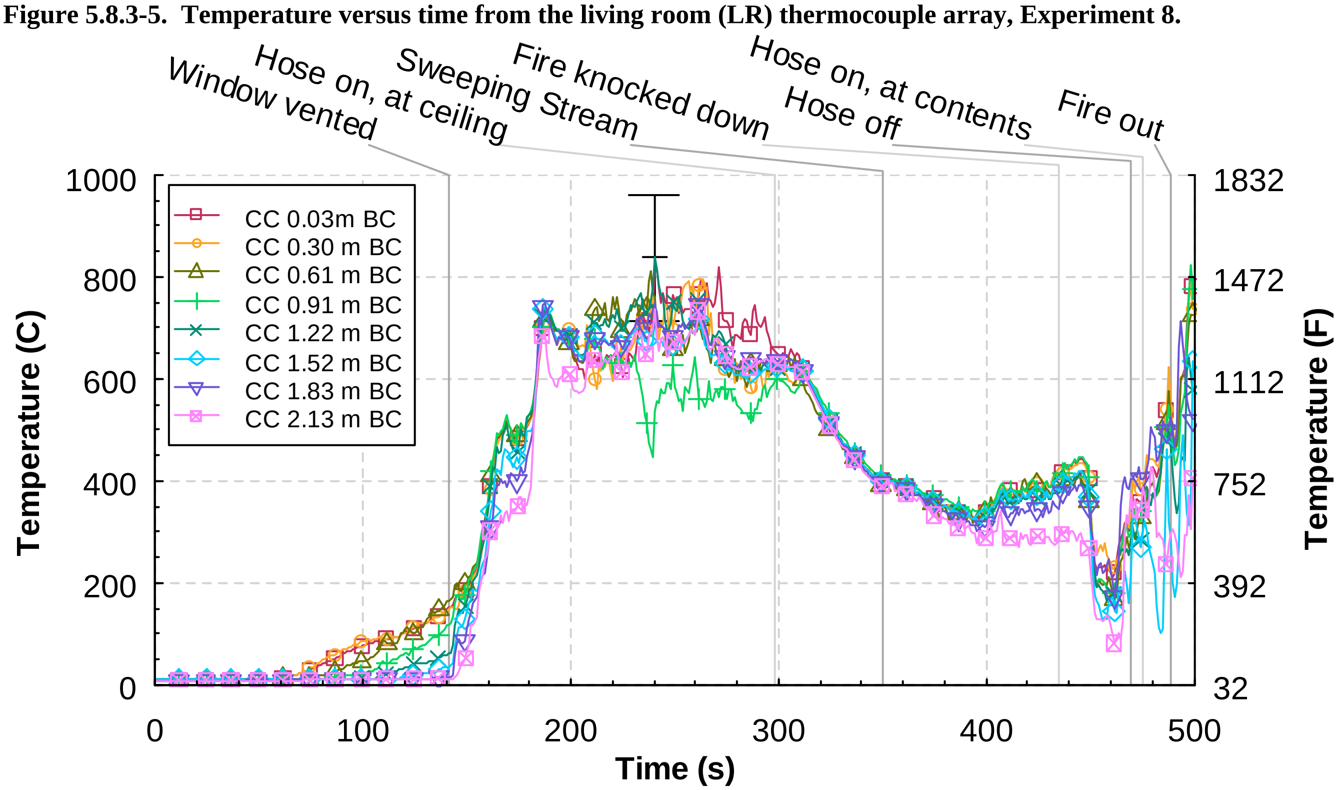

Figure 5.8.3-6. Temperature versus time from the corridor center (CC) thermocouple array, Experiment 8.

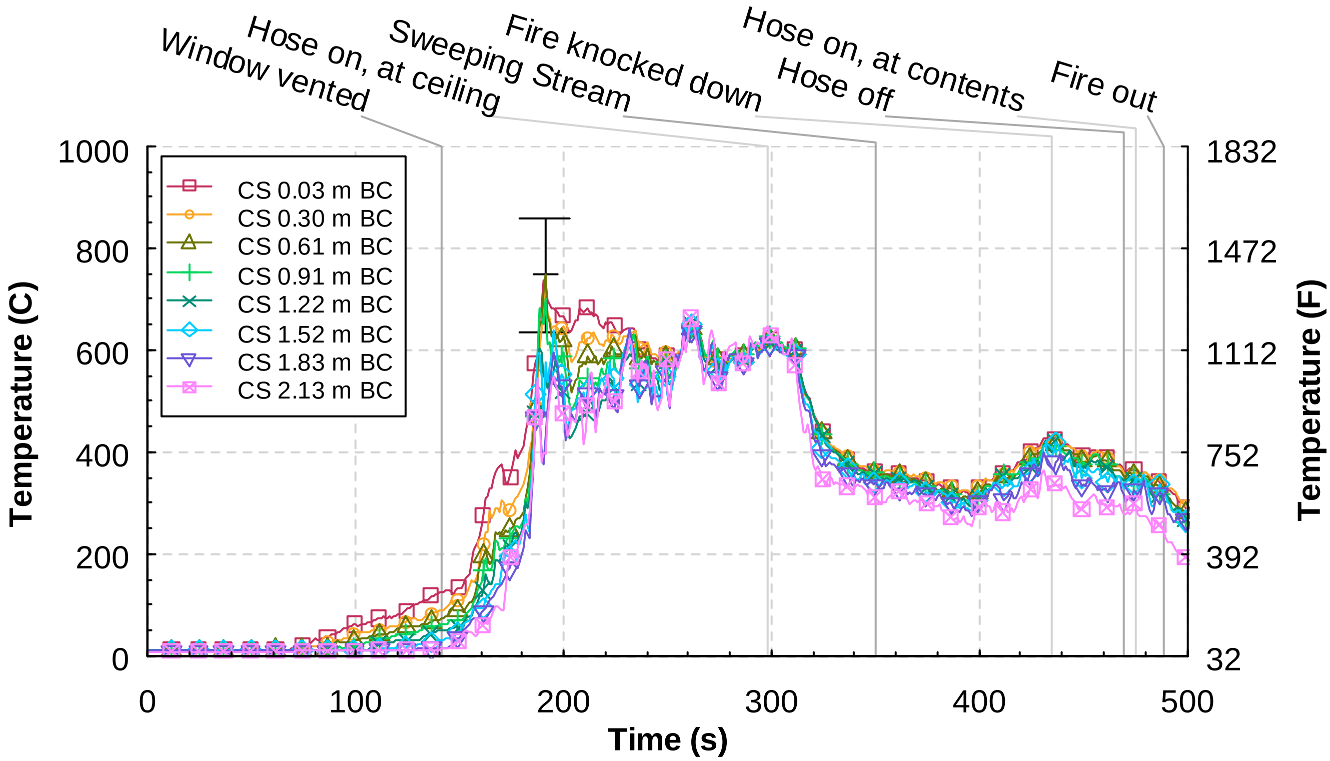

Figure 5.8.3-7. Temperature versus time from the corridor south (CS) thermocouple array, Experiment 8.

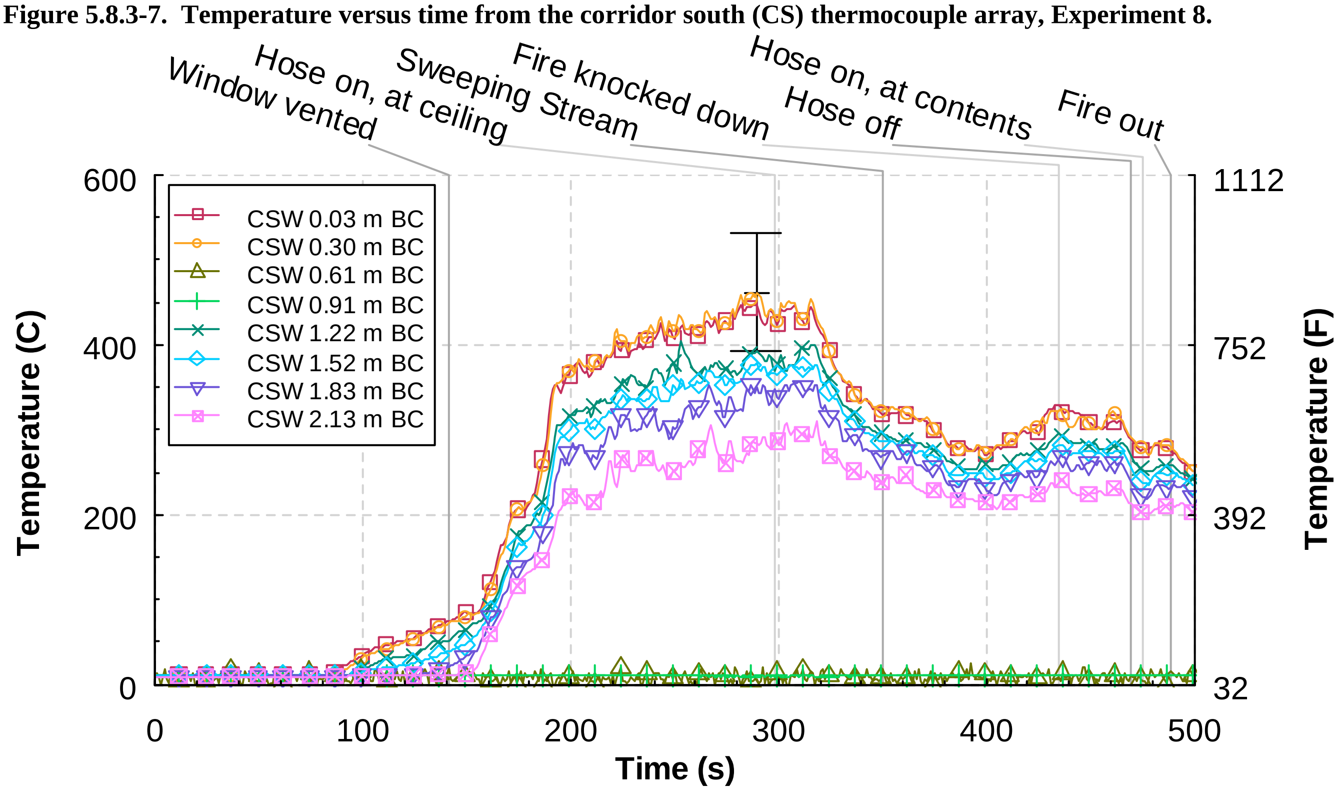

Figure 5.8.3-8. Temperature versus time from the corridor southwest (CSW) thermocouple array, Experiment 8.

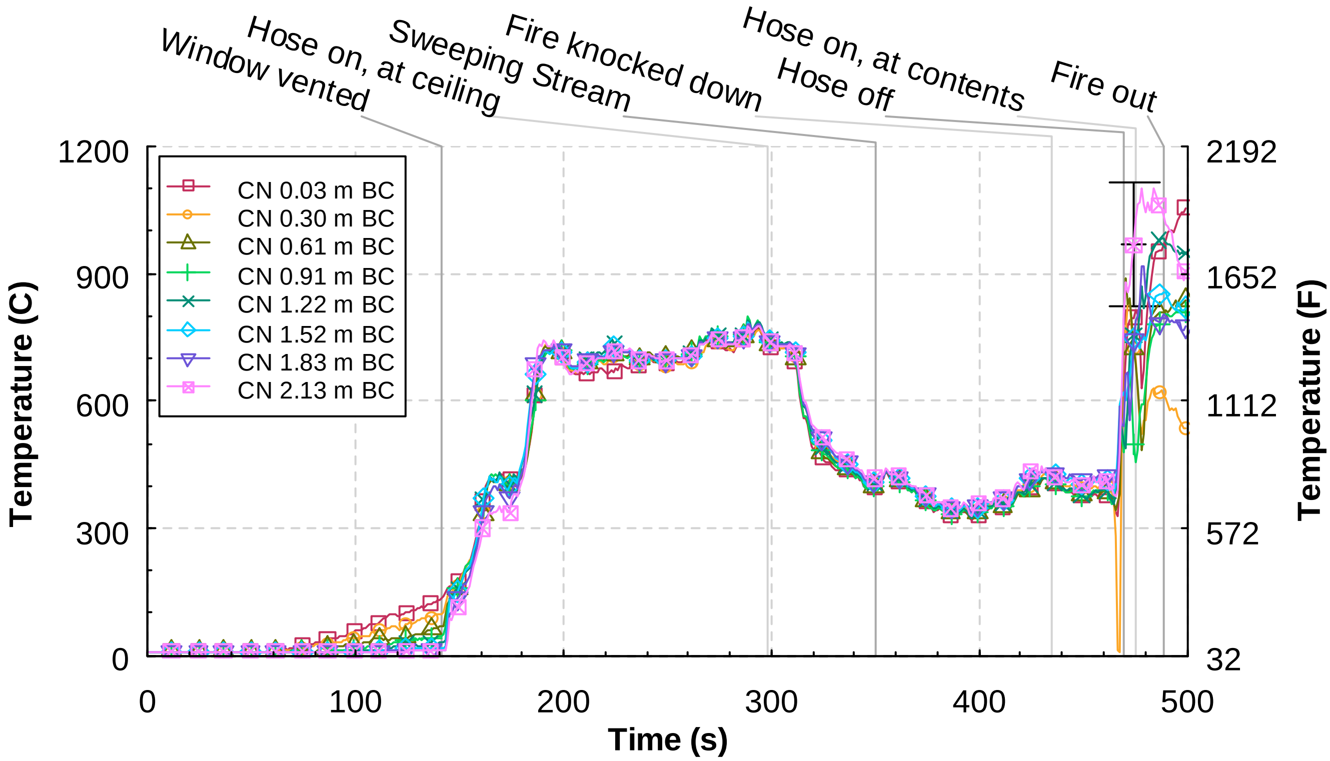

Figure 5.8.3-9. Temperature versus time from the corridor north (CN) thermocouple array, Experiment 8.

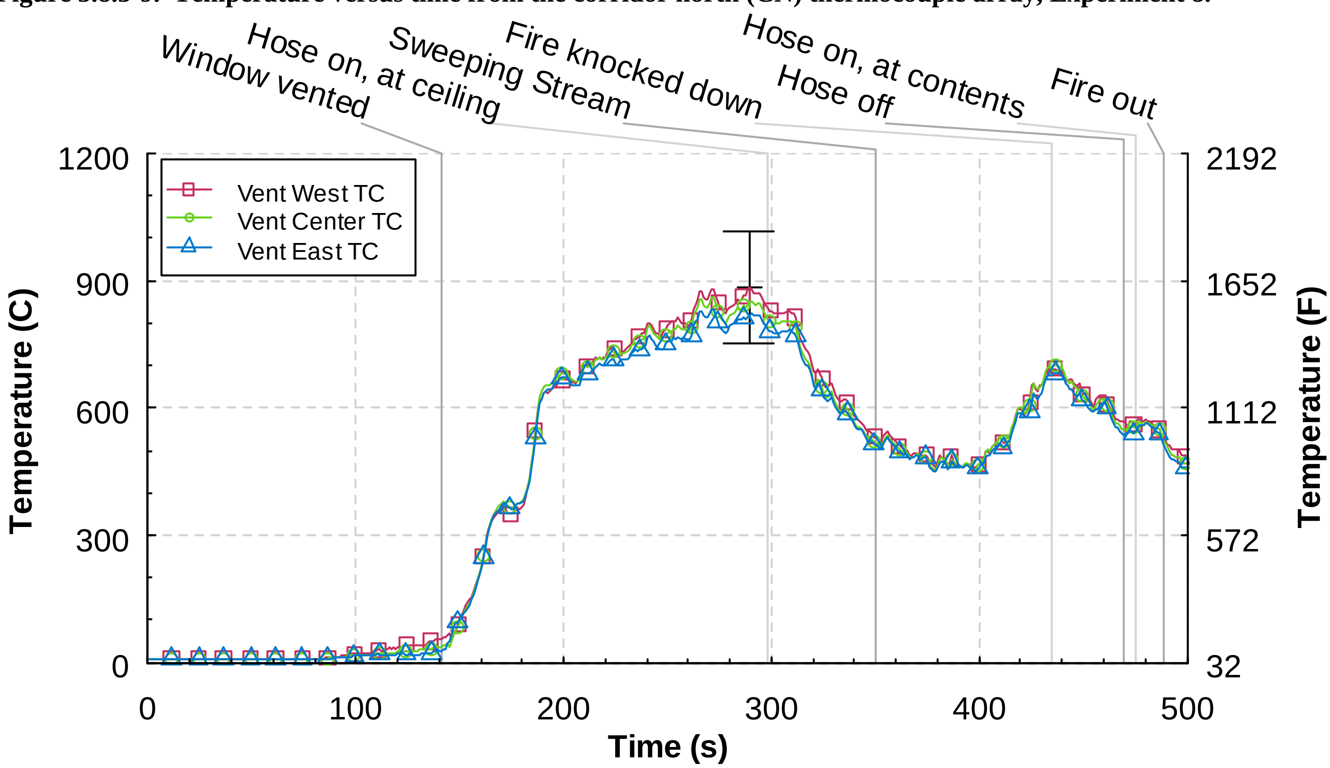

Figure 5.8.3-10. Temperature versus time from the ceiling vent thermocouple array, Experiment 8.

5.8.4 Heat Flux

The time history from all five heat flux gauges is given in Figure 5.8.4-1. The heat flux in the bedroom increased to approximately 20 kW/m^2 prior to the window failure. After the window vented, the heat flux measurement in the bedroom increased to approximately 160 kW/m^2 within 60 s. Every other heat flux measurement exceeded 70 kW/m^2 in the same period of time after window failure.

After the indirect suppression started, the heat fluxes throughout the structure, excluding the bedroom heat flux, decreased to below 75 kW/m^2 in less than 20 s. The heat flux in the bedroom remained relatively unaffected by the hose stream until it was swept across the ceiling at 350 s after ignition, at which point the bedroom heat flux begins decreasing exponentially until the fire is extinguished. However, at approximately 370 s the heat flux of all other areas begin to rise again, most significantly in the living room, where the heat flux increases from 54 kW/m^2 at 370 s to 122 kW/m^2 at 418 s. All heat fluxes beyond the living room in the exhaust path show a similar trend, but none as pronounced as the living room.

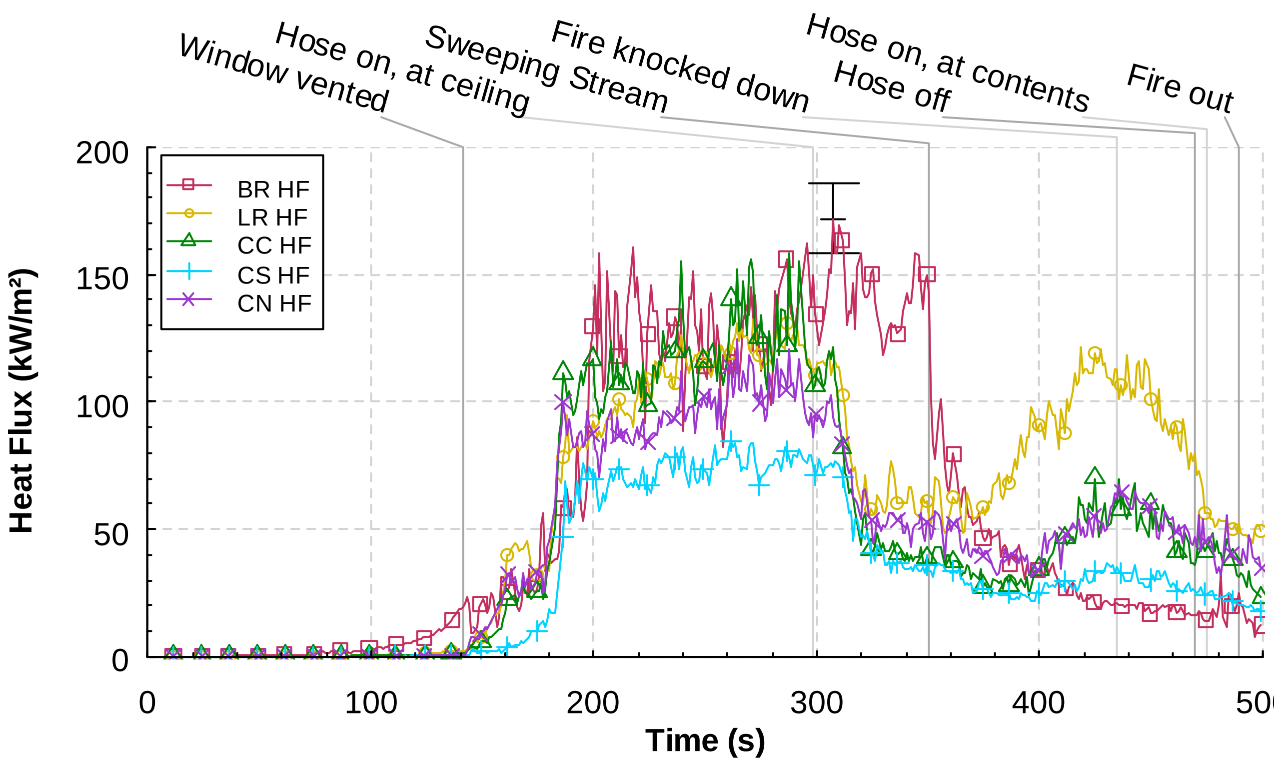

Figure 5.8.4-1. Heat flux versus time at five locations, Experiment 8.

5.8.5 Pressure

Figure 5.8.5-1 shows the pressures at the 5 measurement locations. As the differential pressure pulses rapidly, Figure 5.8.5-1 presents each pressure as a 10 s average, to reduce random variation. The pressure in all areas begins to decrease relative to pressures outside the structure, prior to window failure. Each slowly decreases starting at approximately 60 s to at average of approximately -5 Pa just prior to window failure. This is not significant within error, however is does correspond closely with hot gas flow through the corridor, and consequently out of the structure. The pressures increase rapidly after window failure and immediately form a pressure gradiant through the exhaust path, with the largest pressure being in the bedroom and the lowest pressure being the the Northwest corridor, just below the vent. The average bedroom pressure peaks at approximately 75 Pa just before 340 s. All other pressures peak at approximately the same time.

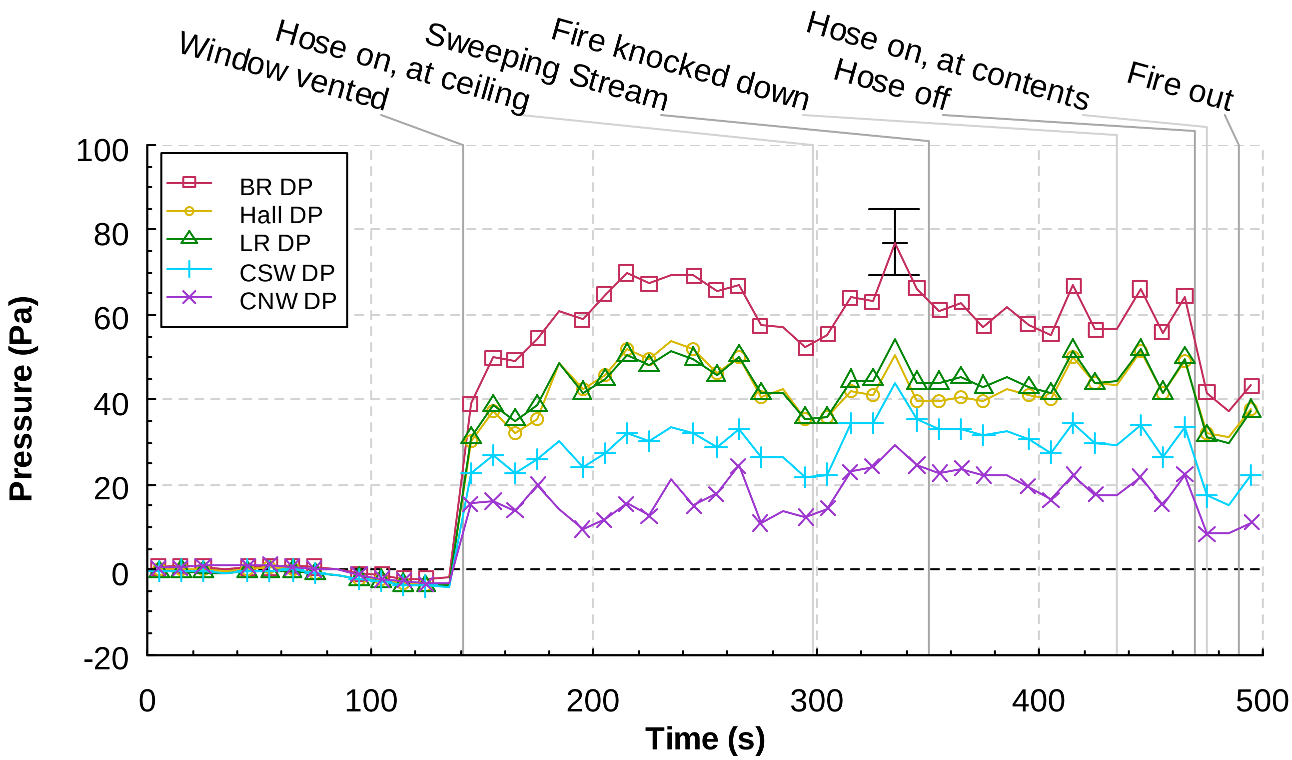

Figure 5.8.5-1. Pressure versus time at five locations, Experiment 8.

5.8.6 Velocities

Figure 5.8.6-1 through Figure 5.8.6-5 represent the data output from 5 sets of bi-directional probe arrays at different locations in the structure. In the order of exhaust flow path, those locations were just outside of the bedroom window, in the center of the hallway, in the southern corridor (out of the flow path), in the northern corridor, and in the ceiling vent. Each graph represents the average velocity at three heights in 10 s intervals. The data that each graph represents was logged by a computer in 1 s intervals and oscillated significantly during the entire experiment.

The gas velocity in the entire structure prior to window venting was not significant within error in all areas except the hallway and the living room. In the hallway, as seen in Figure 5.8.6-2, the gas movement 0.30 m below the ceiling can be seen starting at about 40 s after ignition. This corresponds to the temperature response of the thermocouple tree at the same location as shown in Figure 5.8.3-3. Consequently, this movement is likely due to the smoke and hot gas flow from the bedroom to the hallway. Once the window vented, the peak velocities in the hall reached approximately 9 m/s(20 mph). The hall bi-directional probes were damaged by water from the solid stream.

The measurements from the south corridor bi-directional probes, shown in figure Figure 5.8.6-3, show movement at the .30 m below ceiling level more than 20 s delayed from the similar hallway movement. This corresponds closely with the temperature response shown in Figure 5.8.3-7.

The corridor north bi-directional probe 0.30 m below the ceiling had malfunctioned during this test. The remaining two probes, shown in Figure 5.8.6-4, showed gas movement consistent with the other locations. Gas movement increased rapidly as the window was vented at 141 s after ignition.

When the window is vented all areas show movement consistent with a gas flow path through the window and out of the ceiling vent. The gas flow through the vent, shown in figure Figure 5.8.6-5, corresponds closely with hot gas flow indicated in temperature data from section 5.8.3, with a rapid rise in temperature throughout the structure between when the window vents at 141 s after ignition and approximately 180 s after ignition. Gas flow is positive in that direction with the exception of the gas velocity at the window, shown in Figure 5.8.6-1, in which case jets of burning gasses were being pushed out of the window against the wind and the gas velocity in the southern corridor, shown in Figure 5.8.6-3, in which case the gas was trapped in the dead end of the southwest corridor and forced to recirculate in a complicated way. Gas flow out of the ceiling vent, shown in Figure 5.8.6-5, decreased significantly as a result of the indirect suppression at 298 s after ignition.

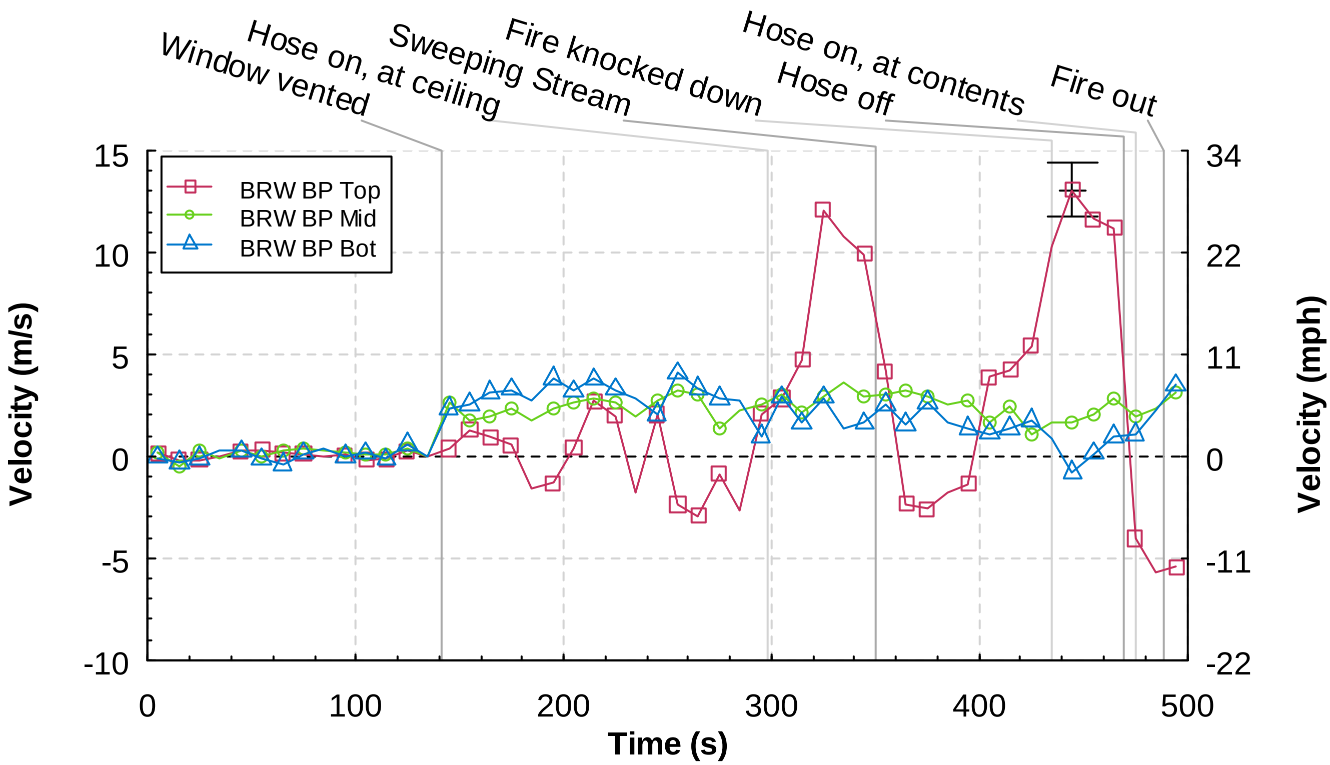

Figure 5.8.6-1. Velocity versus time from the bedroom window (BRW) bi-directional probe array, Experiment 8.

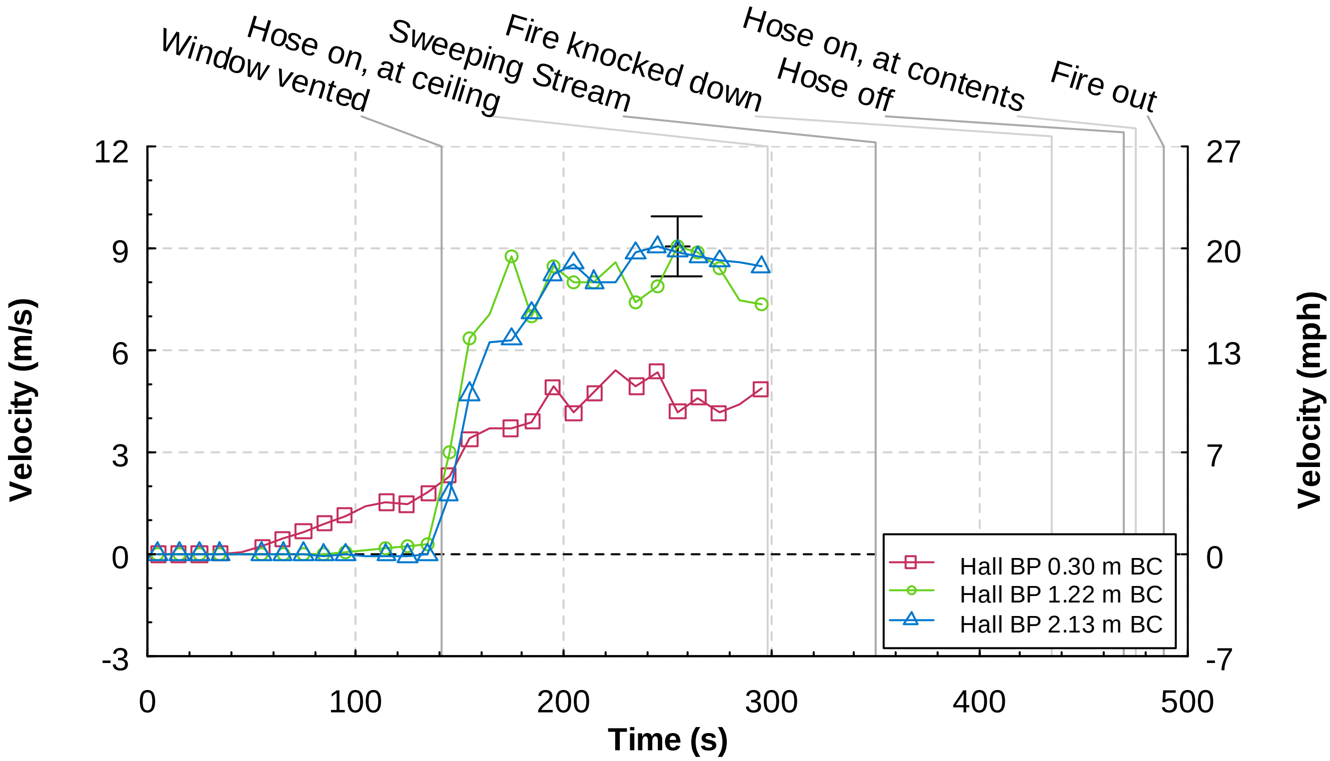

Figure 5.8.6-2. Velocity versus time from the hall bi-directional probe array, Experiment 8.

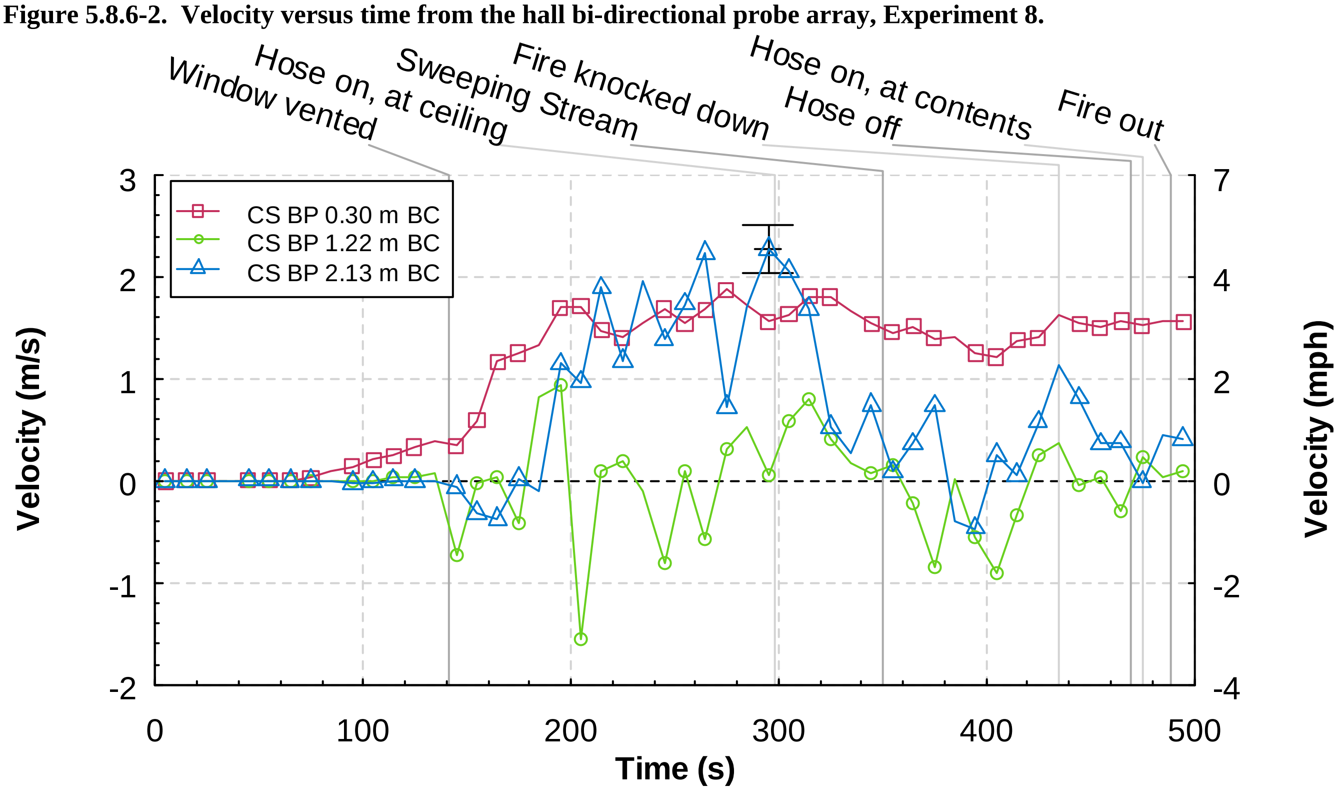

Figure 5.8.6-3. Velocity versus time from the corridor south (CS) bi-directional probe array, Experiment 8.

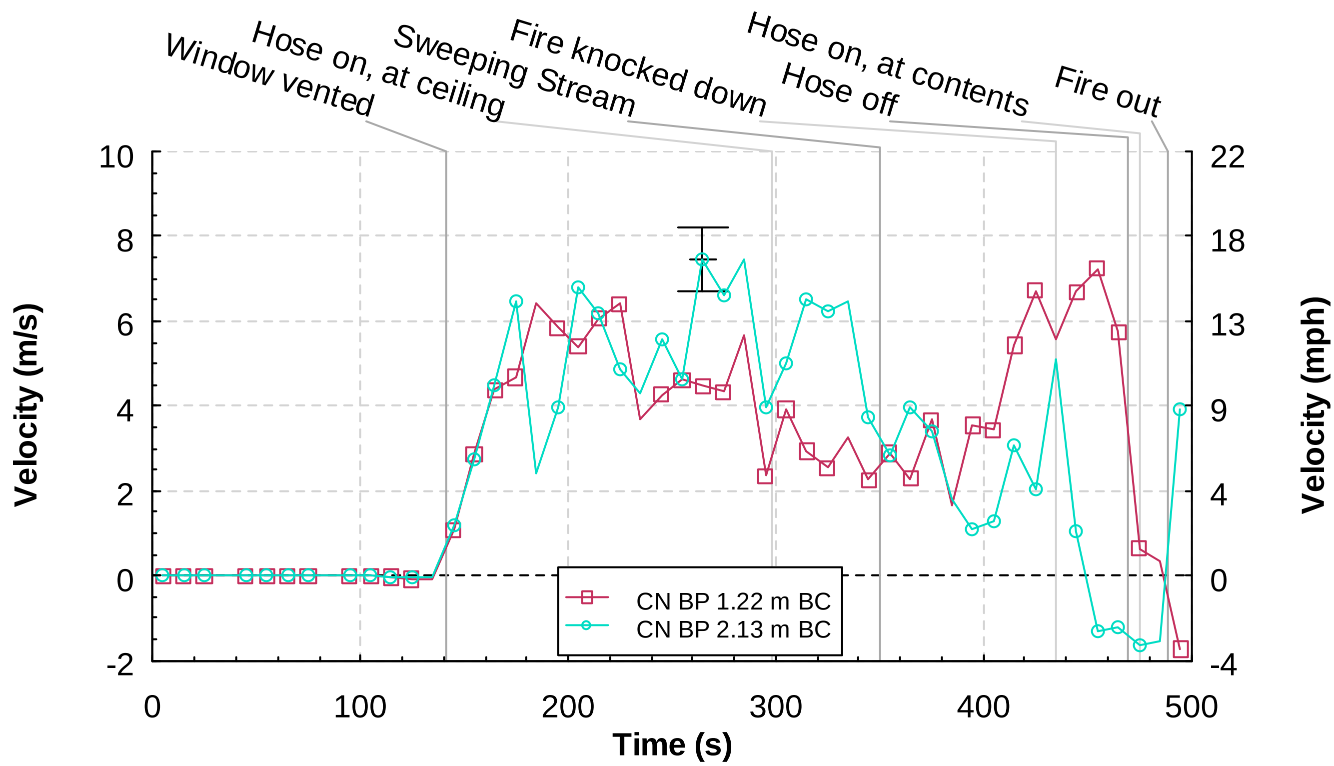

Figure 5.8.6-4. Velocity versus time from the corridor north (CN) bi-directional probe array, Experiment 8.

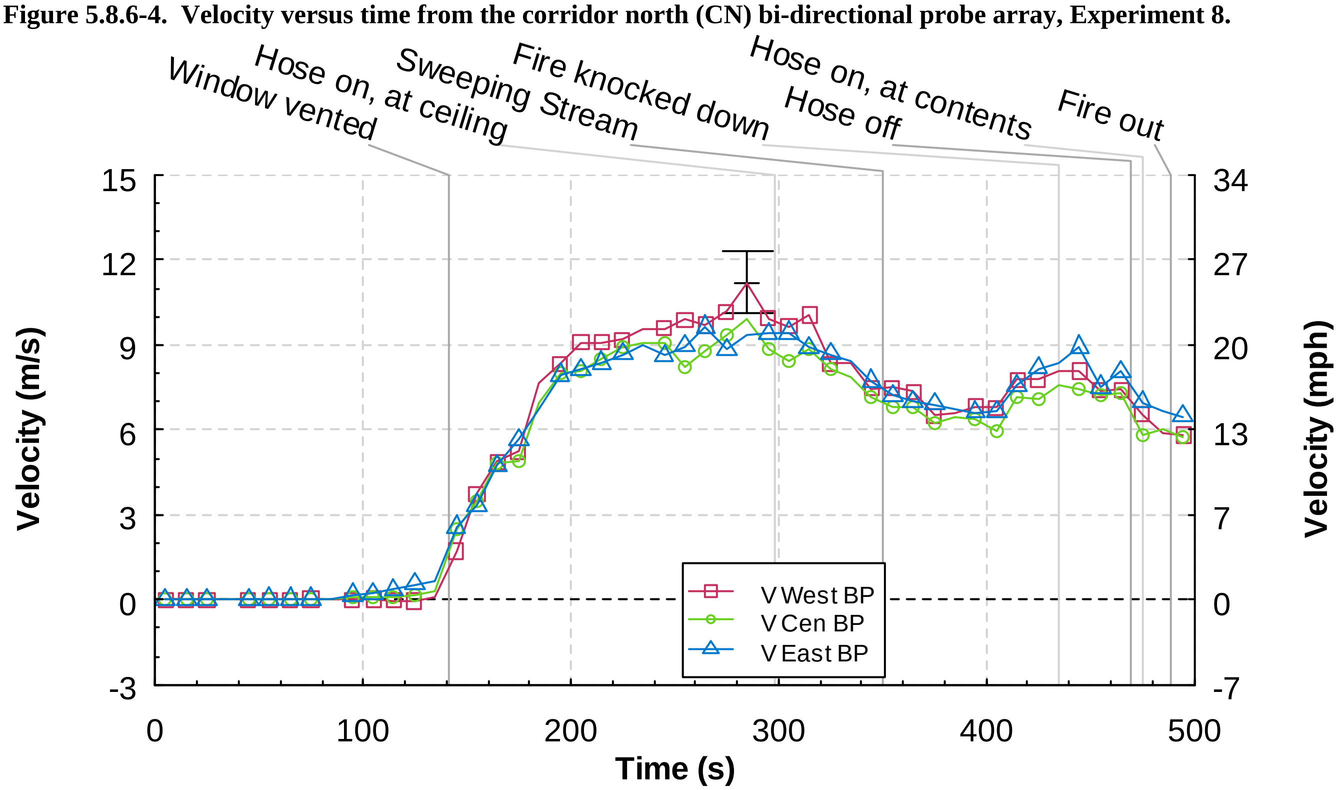

Figure 5.8.6-5. Velocity versus time from the ceiling vent (V) bi-directional probe array, Experiment 8.

5.8.7 Gas Concentrations

Figure 5.8.7-1 through Figure 5.8.7-4 represent the data produced from the gas sampling instruments used in the structure. The data represents the percent volume of the atmosphere at each of the locations encompassed by each gas measured. The four locations in order are the upper bedroom, 0.61 m (2.00 ft) below the ceiling, the lower bedroom, 1.83 m (6.00 ft) below the ceiling, the upper living room, 0.61 m (2.00 ft) below the ceiling, and the lower bedroom, 1.83 m (6.00 ft) below the ceiling. The sampling instrumentation measured the percent volume of carbon monoxide, molecular oxygen, and carbon dioxide at every location and the total hydrocarbon content at the upper sampling locations of the bedroom and living room.

Figure 5.8.7-1, the upper bedroom sampling location, showed the earliest response. Oxygen levels began to decrease at approximately 40 s after ignition and carbon dioxide levels began to increase. After the window vented the rates of change increased, until the oxygen approached 0 at approximately 300 s after ignition and the carbon dioxide plateaued at approximately 220 s after ignition. The carbon monoxide and total hydrocarbons reached their peaks' at approximately 320 s, this was about 20 s after the solid stream was introduced into the window opening and bounced off the ceiling. At 350 s after ignition, the solid stream was moved back and forth across the ceiling. Within 30 s of the start of the stream movement across the ceiling, the ceiling area was began clearing of fire gases and the oxygen concentration began to increase.

Figure 5.8.7-2 shows the gas concentrations from lower probe in the bedroom. The gas concentrations exhibited an oscillatory nature due to the motion of the gas layer in the area of the probe. Prior to window failure, the gas concentrations are unchanged. After the window was vented, oxygen dipped and carbon dioxide increased. The values continued to go up and down, until the solid stream began to move across the ceiling. From that point on the oxygen increased and the carbon dioxide and carbon monoxide decreased. At 470 s after ignition, the stream was shut down. The gas concentration had almost returned to initial conditions at this time.

The measurements from the upper living room probe, shown in Figure 5.8.7-3, exhibit similar behavior but they were delayed 40 s from the bedroom readings. Neither of the upper gas concentrations is significantly affected by the window being vented. At 260 s ignition the oxygen concentration approached 0 %. At 300 s after ignition, just after the solid stream began to flow into the window opening, the carbon dioxide concentration peaked at 19 %. Carbon monoxide concentration and total hydrocarbon concentration reached peaks of approximately 6 %. Even after the fire was out in the bedroom, at approximately 490 s after ignition, the gas concentrations in the living room had not returned to initial conditions.

Figure 5.8.7-4 has the measurements from the lower bedroom probe, shows no significant response prior to the window being vented at 141 s after ignition. Within 60 s of the window failure, the oxygen concentration was reduced to approximately 1 % and the carbon dioxide had increased to 18 %. The carbon monoxide also increased by this time. The values did not change significantly until 10 s after the solid stream was introduced in to the window opening. After the stream was being swept across the ceiling, at 350 s after ignition, the concentrations began to oscillate. Again the gas concentrations had not returned to initial conditions at 490 s after ignition.

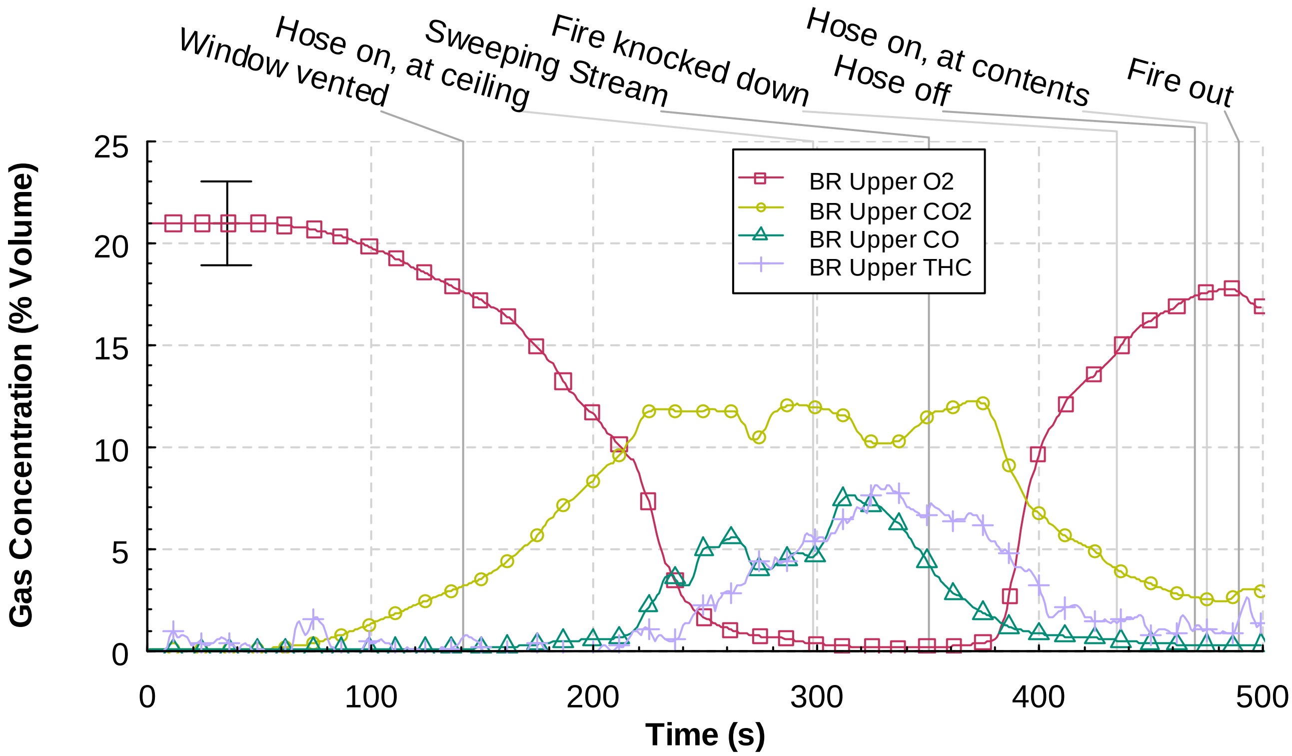

Figure 5.8.7-1. Oxygen, carbon dioxide, carbon monoxide, and total hydrocarbon percent volume versus time from the upper bedroom (BR) sampling location, Experiment 8.

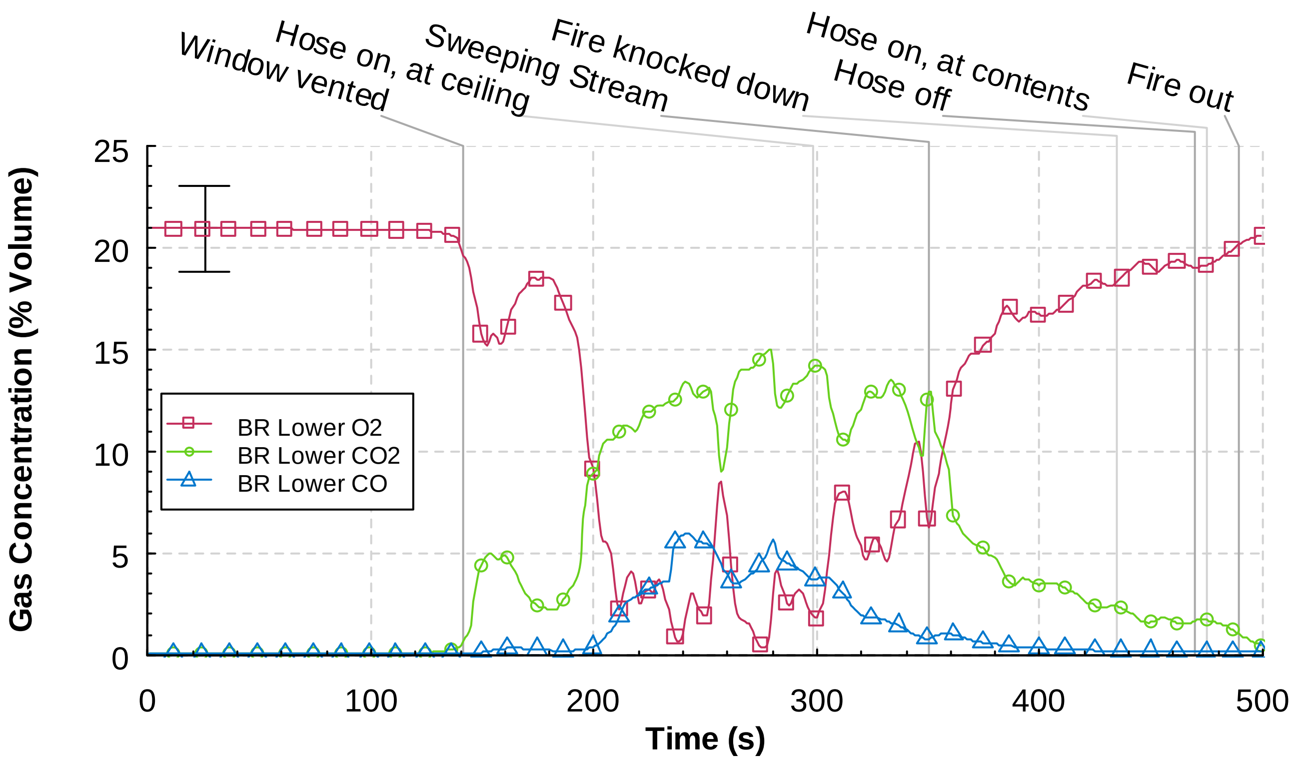

Figure 5.8.7-2. Oxygen, carbon dioxide, and carbon monoxide percent volume versus time from the lower bedroom (BR) sampling location, Experiment 8.

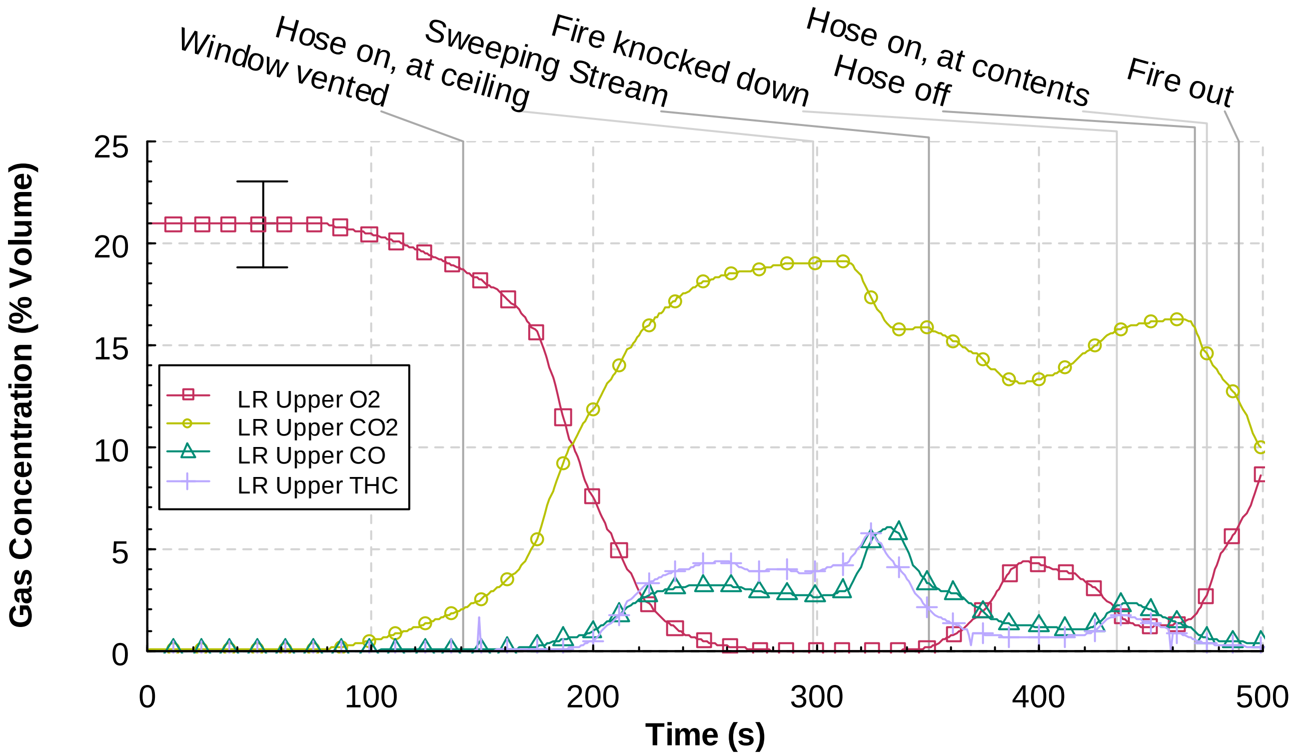

Figure 5.8.7-3. Oxygen, carbon dioxide, carbon monoxide, and total hydrocarbon percent volume versus time from the upper living (LR) room sampling location, Experiment 8.

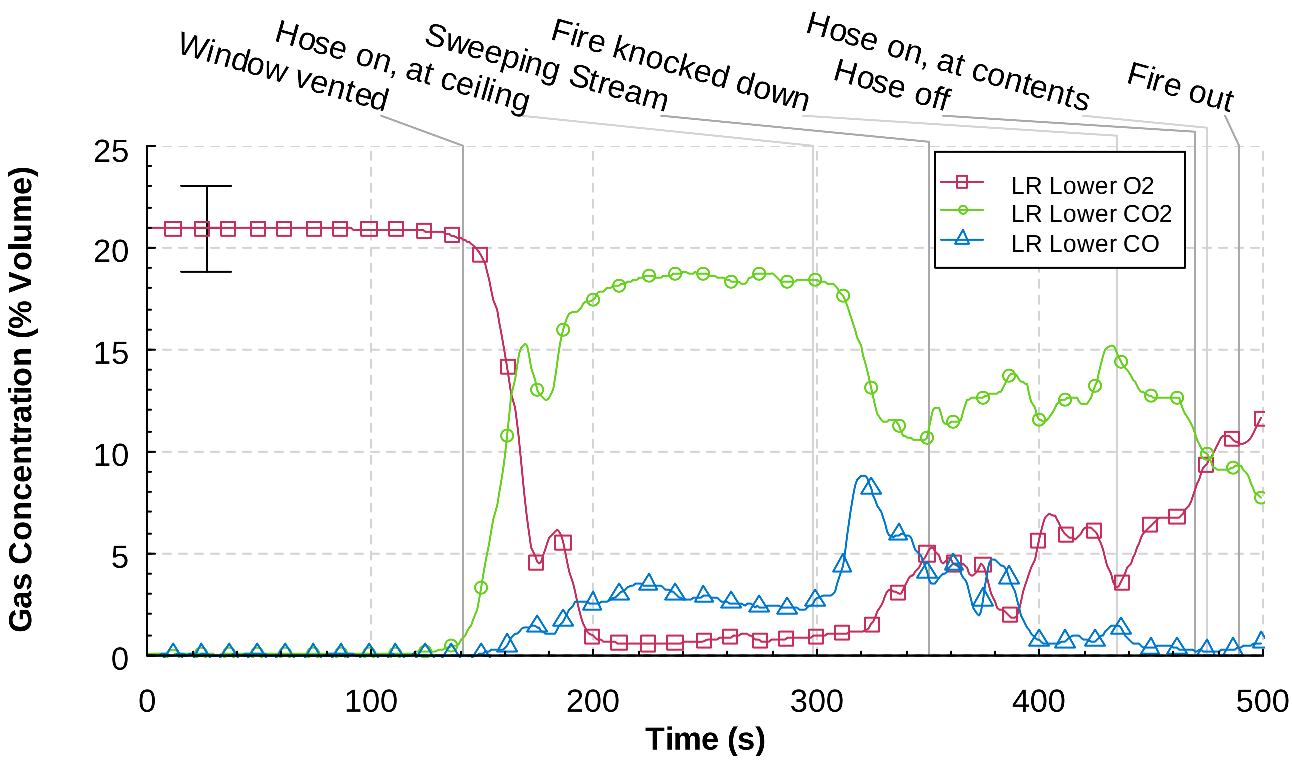

Figure 5.8.7-4. Oxygen, carbon dioxide, carbon monoxide, and total hydrocarbon percent volume versus time from the lower living (LR) room sampling location, Experiment 8.

6 Discussion

The eight experiments have provided measurements to examine the impact of wind on a fire in a structure. Further, these experiments serve as a means to evaluate the ability a WCD and/or externally applied water to provide survivable conditions in the corridor for firefighters in full PPE. In order to determine the effectiveness of the tactics a brief discussion of firefighter teneability is required.

The fire environment provides many challenges; reduced visibility, toxic combustion products, thermal energy and potential for structural collapse. If our scenario, assuming fire resistive construction, the challenges are limited to the first three item listed above. Firefighters may be equipped to deal with these challenges with thermal imagers to improve visibility, self contained breathing apparatus (SCBA) to protect against the combustion products for a limited time, and PPE to absorb thermal energy for a limited time. How long the PPE can protect the firefighter from a thermal injury is based on many factors; thermal storage capacity of the gear, condition of the PPE, moisture content of the PPE, fit of the PPE, insulation under the PPE (station uniform), and the rate of energy (heat) transfer to the PPE.

The rate of heat transfer is of predominate interest in examining the results of these experiments. Unfortunately there is no single measure, as the heat is transferred in different ways. The two principle means of heat transfer that we examine here are convection which is a function of temperature and gas velocity and radiation which is a function of temperature and the composition of the fire gases. In the wind driven tests post-window failure, the majority of the heat transfer, even in positions near the floor is a combination of convection and radiation. In other words, hot fire gases flowing over a firefighter and hot gases and/or hot surfaces in the compartment radiating energy to the firefighter. One of the more extreme examples of this combination of convective and radiative heat transfer is direct flame impingement.

In the ideal situation PPE was designed to protect a firefighter from temperatures up to 260 ºC (500 ºF) for 5 minutes [**55**]. However, that does not account for the heat flux that the PPE is exposed to along with the elevated temperature. Just prior to flashover, the heat flux from the upper hot gas layer to the floor, approaches 20 kW/m^2. Post-flashover heat flux conditions range from 60 kW/m^2 to more than 160 kW/m^2. Based on previous research at NIST, a firefighter in full PPE, exposed to temperatures in excess of 260 ºC (500 ºF) combined with heat fluxes in excess of 20 kW/m^2 suggest that survival time would be limited to less than 30 s [**56, 57, 58**]. In all of the experiments in this series, conditons in excess of 260 ºC (500 ºF) and 20 kW/m^2 occurred in the corridor, prior to using one of the mitigating tactics, indicating that conditions in the corridor may not be not survivable for a firefighter in full PPE.

6.1 Fire Conditions with no external wind

In experiment 1, no wind was imposed on the structure. However, even with no external wind the change in ventilation caused by the removal of the window glass caused a significant increase in heat release rate. Figure 6.1-1is a graph of the heat release rate from experiment 1. Since the time when the window was vented was the significant event in this experiment, the data in this section is presented to show the changes relative to the time when the window was vented, “time zero”. In less than a minute after the window was vented, the heat release rate increased by almost a factor of 10, from approximately 1.5 MW to more than 14 MW.

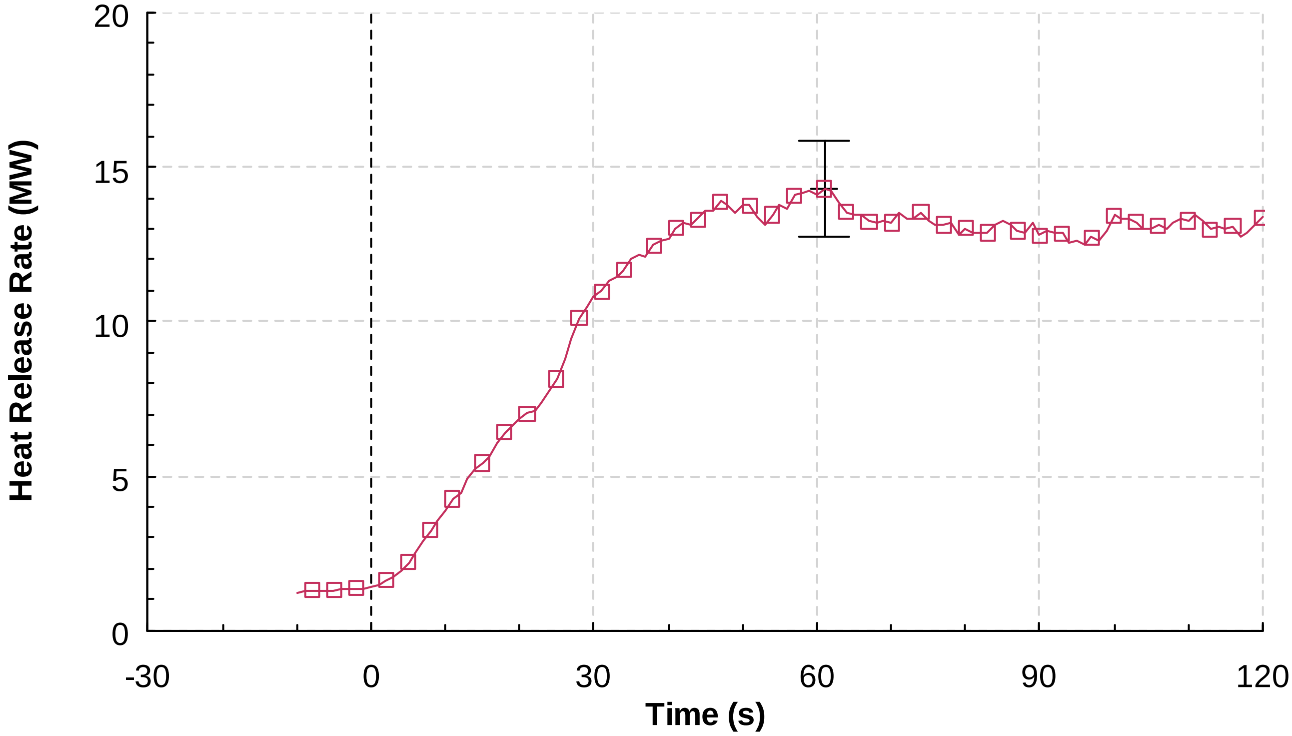

Figure 6.1-1. Heat release rate versus time, Experiment 1, no imposed wind. T = 0 is the time of window failure.

It was not a surprise to find that this rapid increase in heat release rate resulted in increased temperatures and heat fluxes throughout the test structure. Figure 6.1-2 and Figure 6.1-3 show the temperatures and heat fluxes at 1.52 m (5.00 ft) below the ceiling, at five different positions throughout the structure. These measurements are being examined because they are located at 0.91 m (3.00 ft) above the floor, a position chosen to be representative of the height of a crawling firefighter's head.

Areas of the structure that include the flow path between the two open vents, the window opening on the west side of the bedroom and the ceiling vent in the northwest portion of the corridor have the higest temperatures and heat fluxes. Temperatures in the bedroom, living room and the north corridor all exceeded 600 °C (1112 °F) within 120 s after the window was vented. However the areas that were not in the flow path had temperatures significantly lower. The temperatures in the south and southwest portion of the corridor never exceeded 300 °C (572 °F) during this same time interval.

The heat fluxes are shown in Figure 6.1-3. The heat flux measurements were grouped in different levels. The highest heat flux level, approximately 70 kW/m², was in the bedroom, which was also the room with the best ventilation. The middle grouping of heat flux values were from the living room, center corridor and north corridor positions. These three areas reached heat flux levels of approximately 50 kW/m² within 120 s, after the window was vented. The heat flux at the corridor south position was typically 20 kW/m² or less, with the exception of one reading at approximately 30 kW/m², during this period.

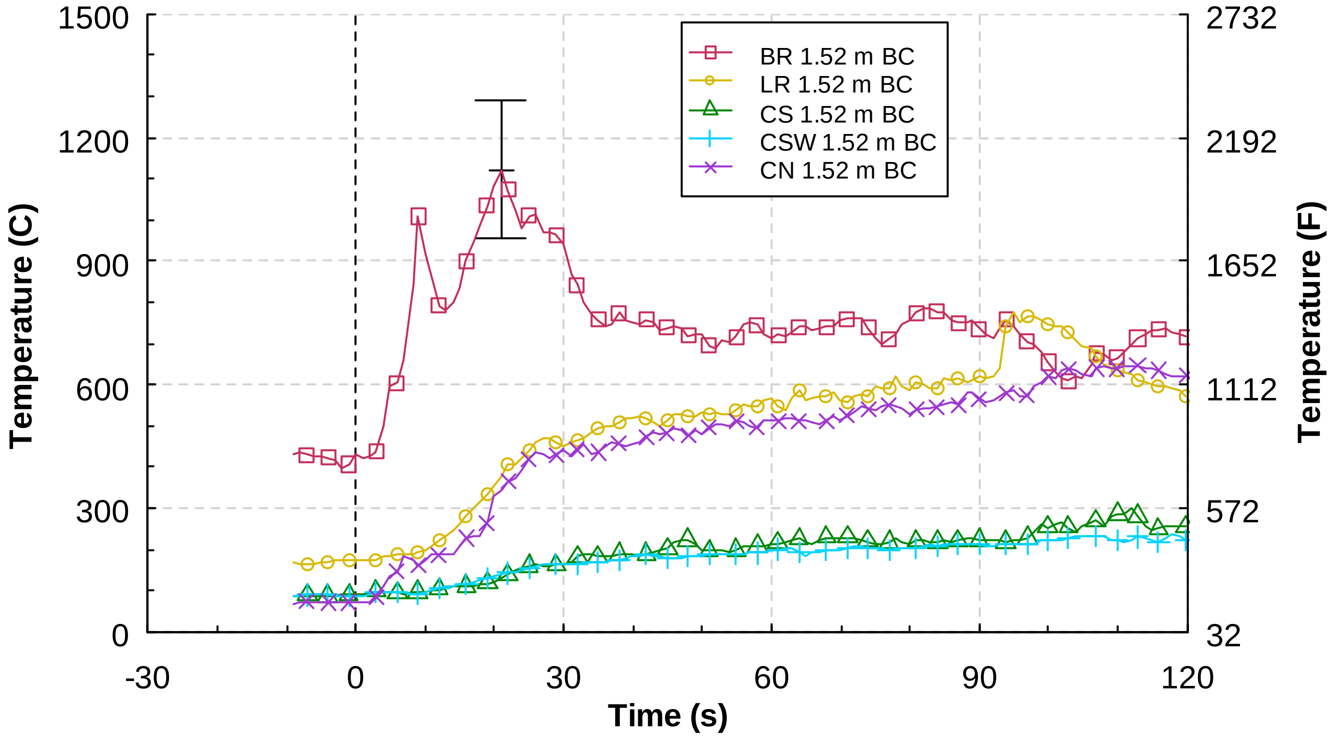

Figure 6.1-2. Temperature versus time, Experiment 1, no imposed wind. T = 0 is the time of window failure.

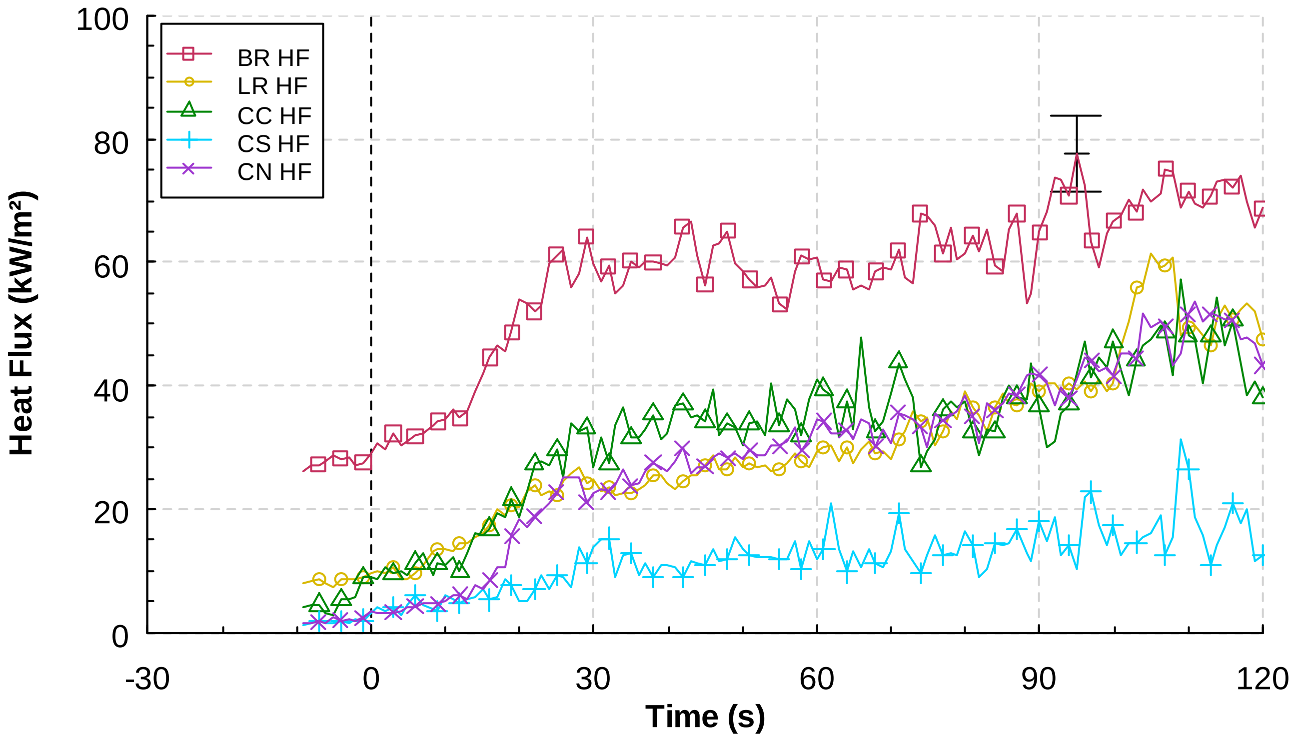

Figure 6.1-3. Heat flux versus time, Experiment 1, no imposed wind. T = 0 is the time of window failure.

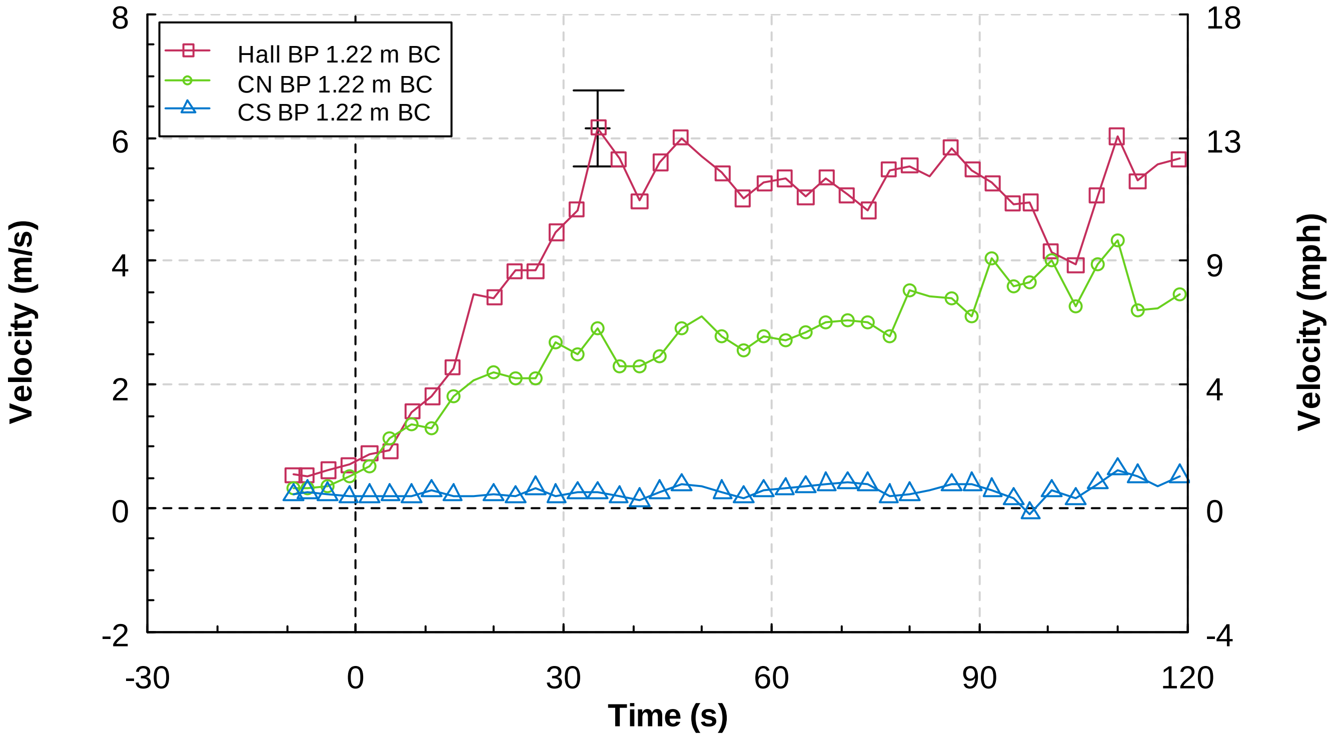

Figure 6.1-4. Velocity versus time, Experiment 1, no imposed wind. T = 0 is the time of window failure.

Clearly the temperatures and the heat fluxes in the ventilation flow path were significantly higher than the measurements from the south and southwest areas of the corridor. Figure 6.1-4 has the velocity data from the hall (inside the apartment) and the north and south corridor areas. The velocities at the hall and the corridor north positions demonstrate the flows that can be achieved based on the fire development and the ventilation path through the structure. With no externally supplied wind, velocities in the hall exceeded 5 m/s (11 mph) flowing from west to east. In the north end of the corridor the speed of the fire gases peaked at approximately 4 m/s (9 mph). In contrast, the speed of the fire gases in the south portion of the corridor was less than 1 m/s (2 mph).

Experiment 1 provided some valuable baseline data and demonstrated several important points. **Smoke is Fuel.** A ventilation-limited (fuel-rich) condition had developed prior to the failure of the window. Oxygen depleted combustion products, containing carbon dioxide, carbon monoxide, unburned hydrocarbons, and smoke filled the rooms of the structure. Once the window failed, the fresh air provided the oxygen needed to sustain the transition through flashover, which caused a significant increase in heat release rate.

This leads to the next observation. **Venting does not always equal cooling.** In this experiment, post ventilation temperatures and heat fluxes all increased, due to the **ventilation induced flashover**.

Fire induced flows. Velocities within the structure exceeded 5 m/s (11 mph), just due to the fire growth and the flow path that was set-up between the window opening and the corridor vent. The directional nature of the fire gas flow was demonstrated with thermal conditions, both temperature and heat flux, which were twice as high in the “flow” portion of the corridor as opposed to the “static” portion of the corridor. **Thermal conditions in the flow path were not consistant with firefighter survival**.

6.2 Tactics

In this section, the remaining seven experiments were examined to determine the impact that the WCD or the externally applied water had on the fire conditions. As discussed earlier in this section, the fire environment generated in each experiment, prior to the use of any fire fighting tactic, resulted in conditions in the corridor that were not survivable for a firefighter in full PPE. Therefore, the principle areas of interest in this section are the impact on heat release rate and the conditions in the corridor.

The next section of this chapter focuses on the impact of WCDs and is followed by a section that is focused on the impact of external hose streams. In both sections, just as in the previous section, the temperatures and heat fluxes that are used in the comparsions are positioned at 1.52 m (5.00 ft) below the ceiling.

6.2.1 Wind Control Devices

In experiments 2 through 5, WCDs were deployed across the window opening to mitigate the impact of the externally imposed wind. Two different WCDs were used in these experiments. In Section 4.3.2, it was shown that both of the WCDs were equally effective in stopping the impact of the wind under non-fire conditions.

Figure 6.2.1-1 shows the heat release rates from Experiments 2-5 from the point of WCD application. In each case, the WCD resulted in a heat release rate reduction of at least 80 % within 20 s of deployment.

Figure 6.2.1-2 shows the decrease in temperatures at the corridor north position, which was in the flow path. Post WCD deployment the temperatures decreased by at least 50 % within 60 s. Due to the hot gas flow through the north portion of the corridor, the thermal hazard was higher than in the southern portions of the corridor.

Figure 6.2.1-3 and Figure 6.2.1-4 are the graphs of the temperatures at the corridor south and southwest positions respectively. The temperature decrease at the corridor south position, due to WCD application, ranged from 35 % to 70 %. The corridor southwest position is the most remote from the doorway between the living room and the corridor, which served as the source of the hot gas flow into the corridor. Therefore the temperatures at the time of WCD deployment, while still extreme at 300 °C to 350 °C (572 °F to 662 °F), are on average approximately half the initial temperatures at the corridor south position. The decreases in temperature, within 60 s of WCD deployment ranged from 12 % to 50 %.

The post WCD deployment corridor north and corridor south heat flux measurements are provided in Figure 6.2.1-5 and Figure 6.2.1-6. Use of the WCDs resulted in heat flux decreases which ranged from 33 % to 75 %

The figures in this section showed that the WCDs reduced the thermal hazards generated by a wind driven fire. In fact, the temperatures and heat fluxes measured at the corridor north position in the WCD experiments, post WCD deployment, were significantly lower than the temperatures and heat fluxes measured in non-wind driven case. The thermal measurements at the south and southwest positions of the corridor, post WCD, were brought into the same range or below, as those in the non-wind driven case.

The velocities in the corridor were typically reduced by 30 % to 60 % as shown in Figure 6.2.1-7 and Figure 6.2.1-8. The corridor south velocity measurements at 1.22 m (4.00 ft) below the ceiling were the exception. In this case, there appeared to be significant mixing of the flow in and out of the southern portion of the corridor, until after the WCD was deployed. The flow at the south corridor position was oscillating from a flow to the north to a flow to the south at the time of WCD deployment. Therefore the the value at the time of deployment is less than the value after the bulk flow of fire gases had been reduced.

The results from Experiments 2 through 5 demonstrate that WCDs can have a significant effect on reducing the thermal hazard from a wind driven fire. However, these results also indicate that the post deployment thermal conditions were still of a level which could pose a hazard to firefighters in full PPE.

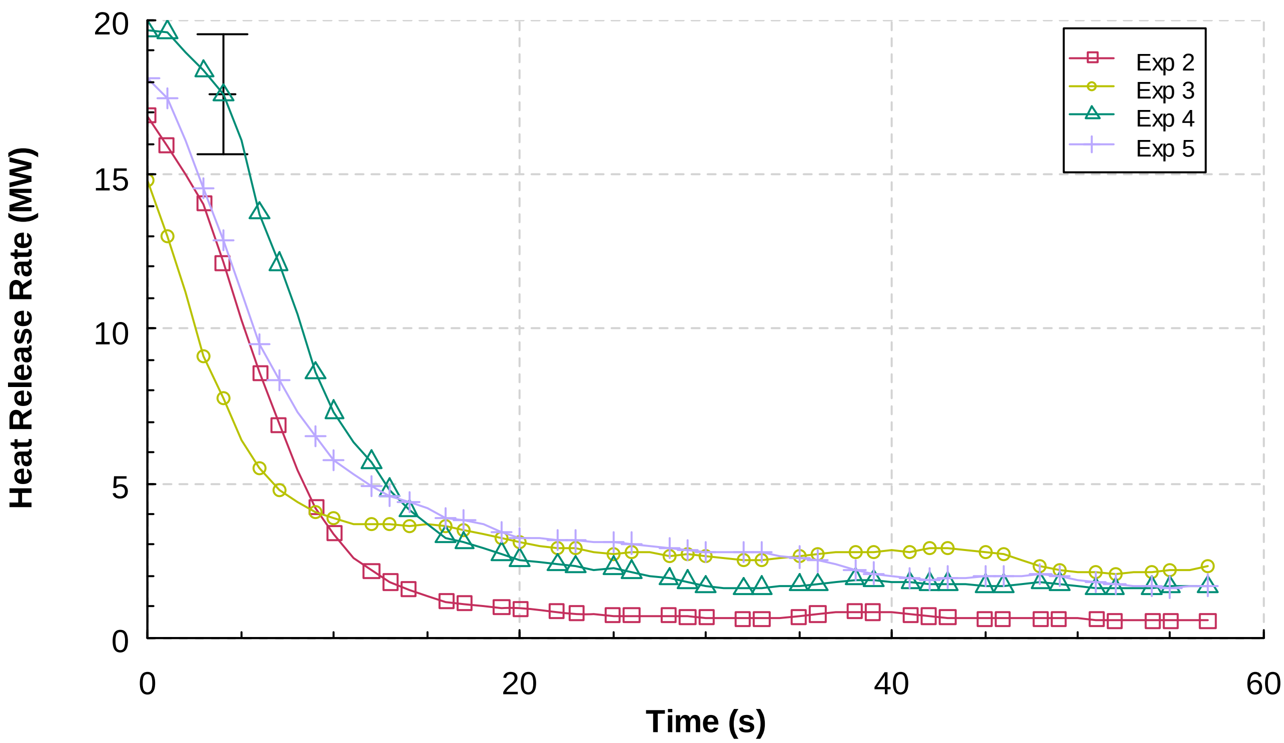

Figure 6.2.1-1. Heat release rate versus time, Experiments 2 through 5. T = 0 is the time of WCD deployment.

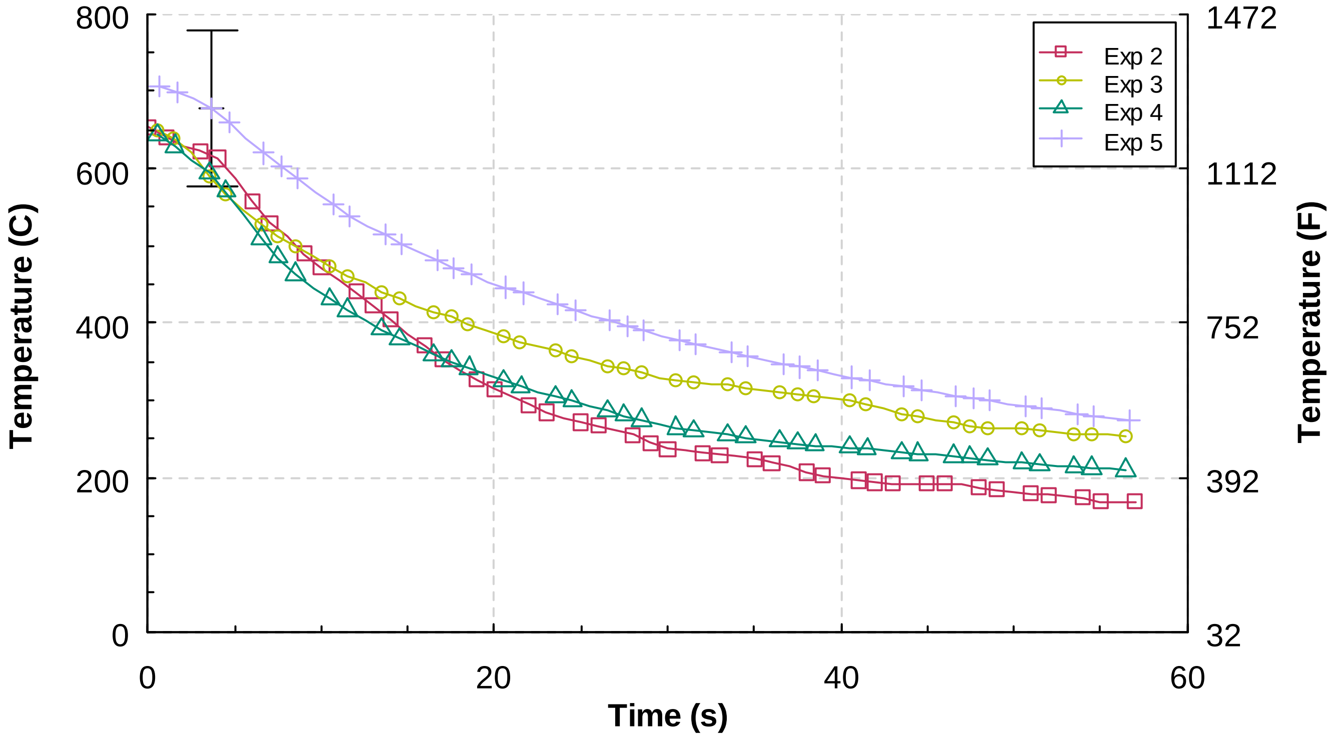

Figure 6.2.1-2. Temperature versus time from the Corridor North array, 1.52 m (5.00 ft) below the ceiling, Experiments 2 through 5. T = 0 is the time of WCD deployment.

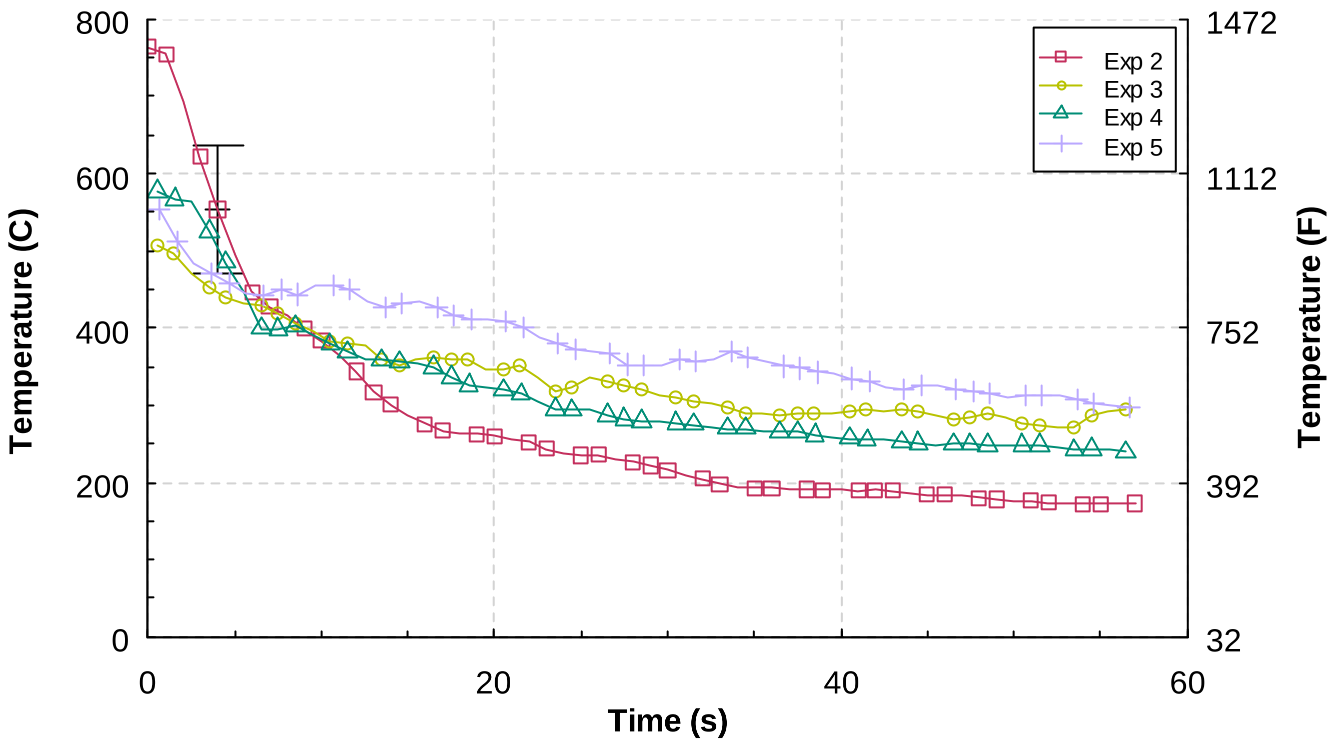

Figure 6.2.1-3. Temperature versus time from the Corridor South array, 1.52 m (5.00 ft) below the ceiling, Experiments 2 through 5. T = 0 is the time of WCD deployment.

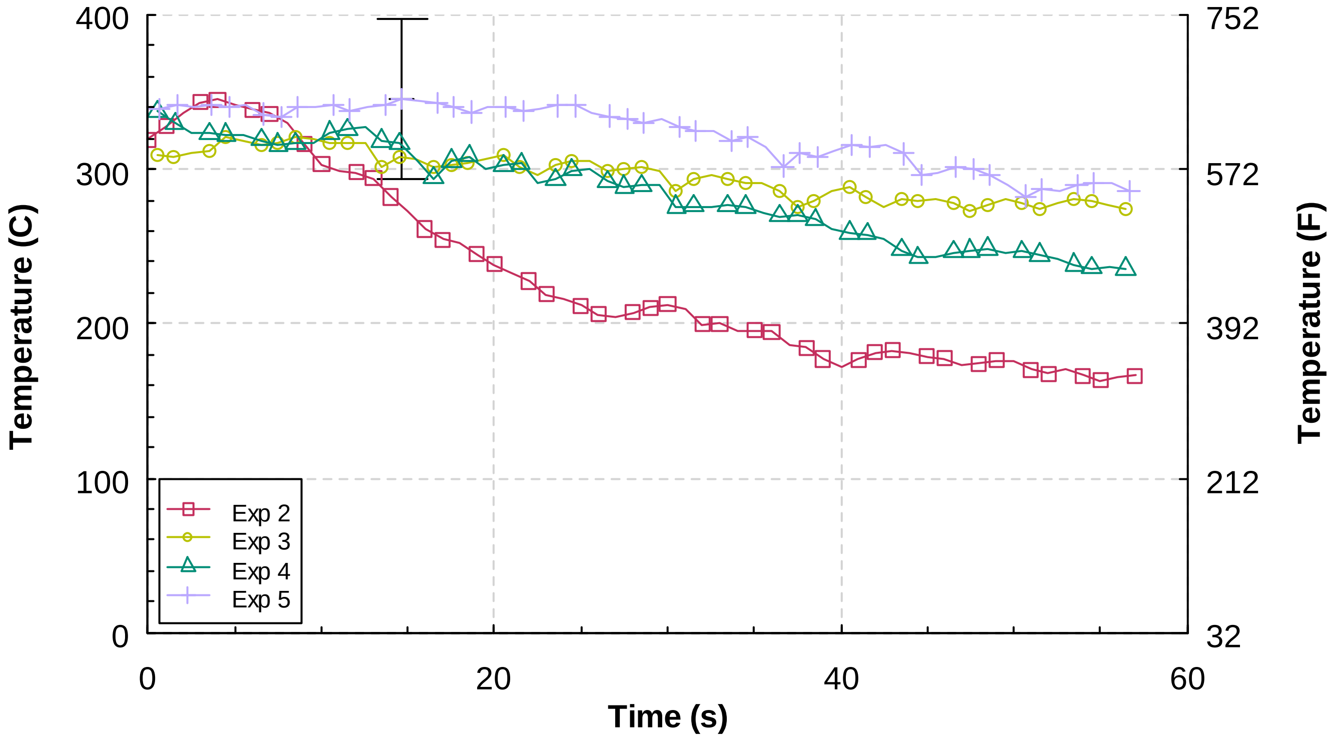

Figure 6.2.1-4. Temperature versus time from the Corridor Southwest array, 1.52 m (5.00 ft) below the ceiling, Experiments 2 through 5. T = 0 is the time of WCD deployment.

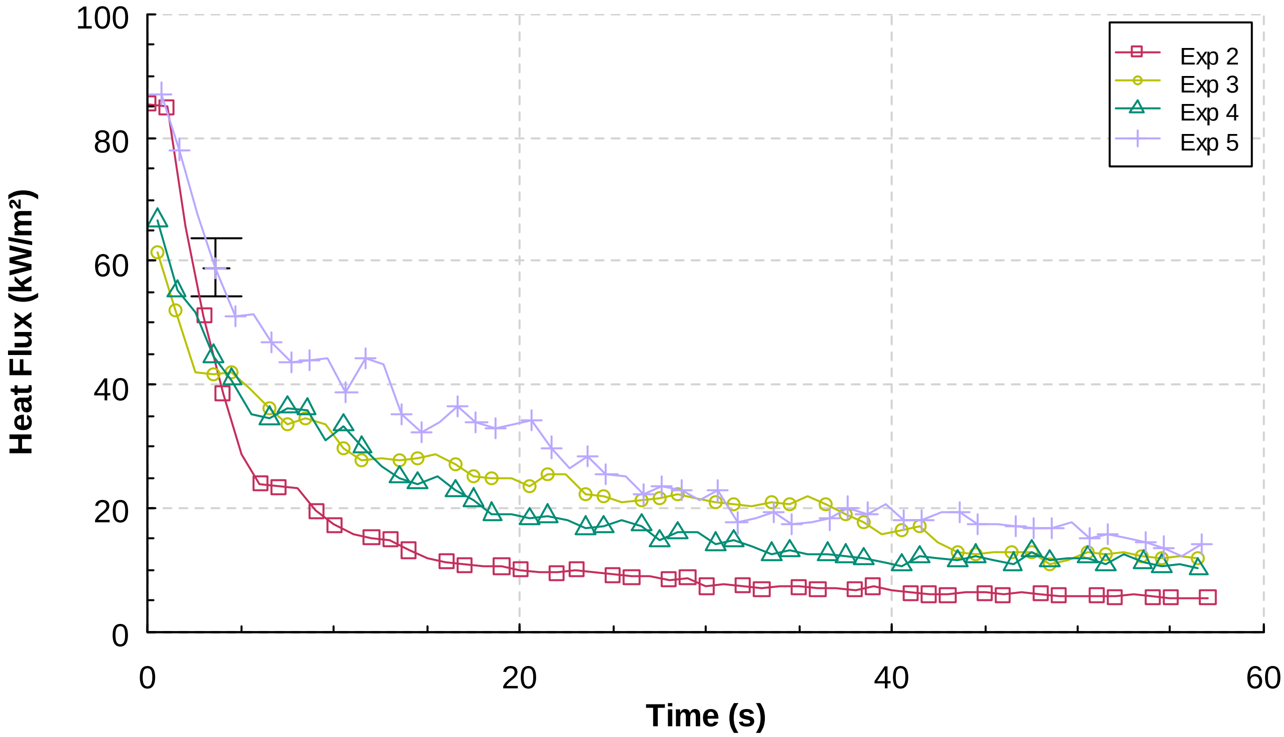

Figure 6.2.1-5. Heat flux versus time from the Corridor North position, 1.52 m (5.00 ft) below the ceiling, Experiments 2 through 5. T = 0 is the time of WCD deployment.

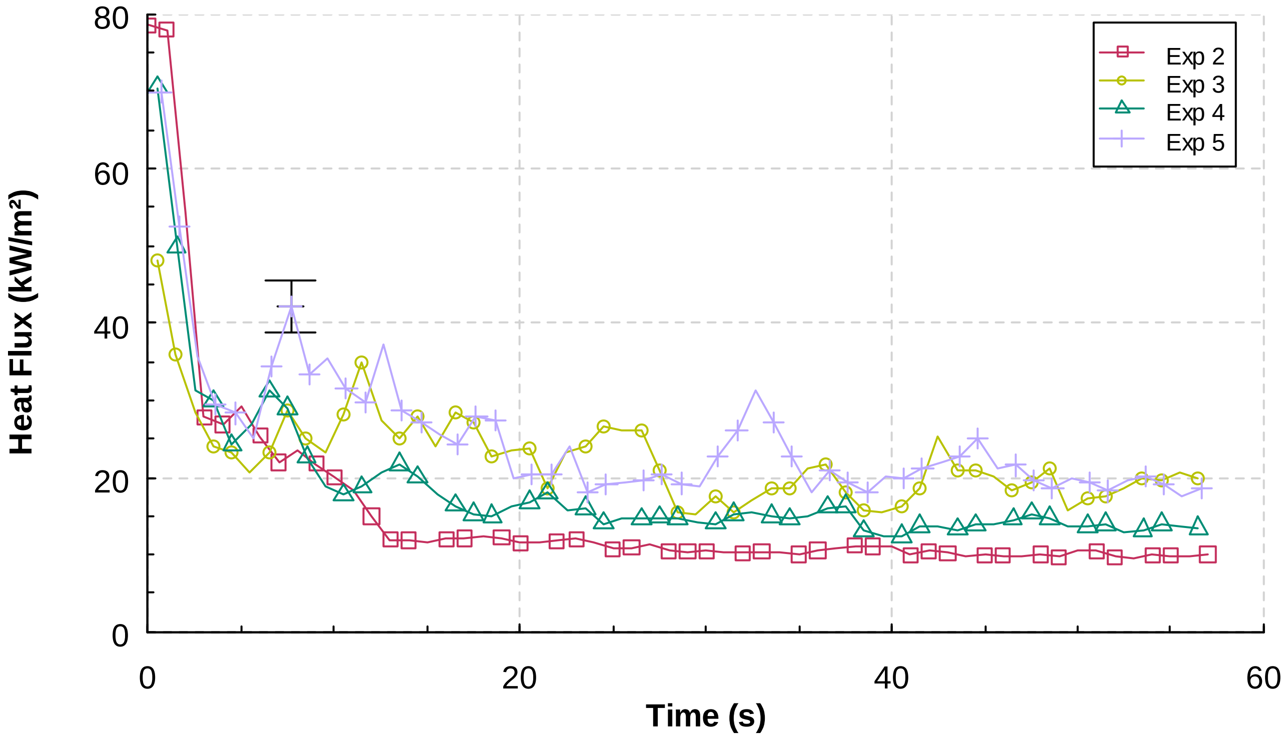

Figure 6.2.1-6. Temperature versus time from the Corridor South position, 1.52 m (5.00 ft) below the ceiling, Experiments 2 through 5. T = 0 is the time of WCD deployment.

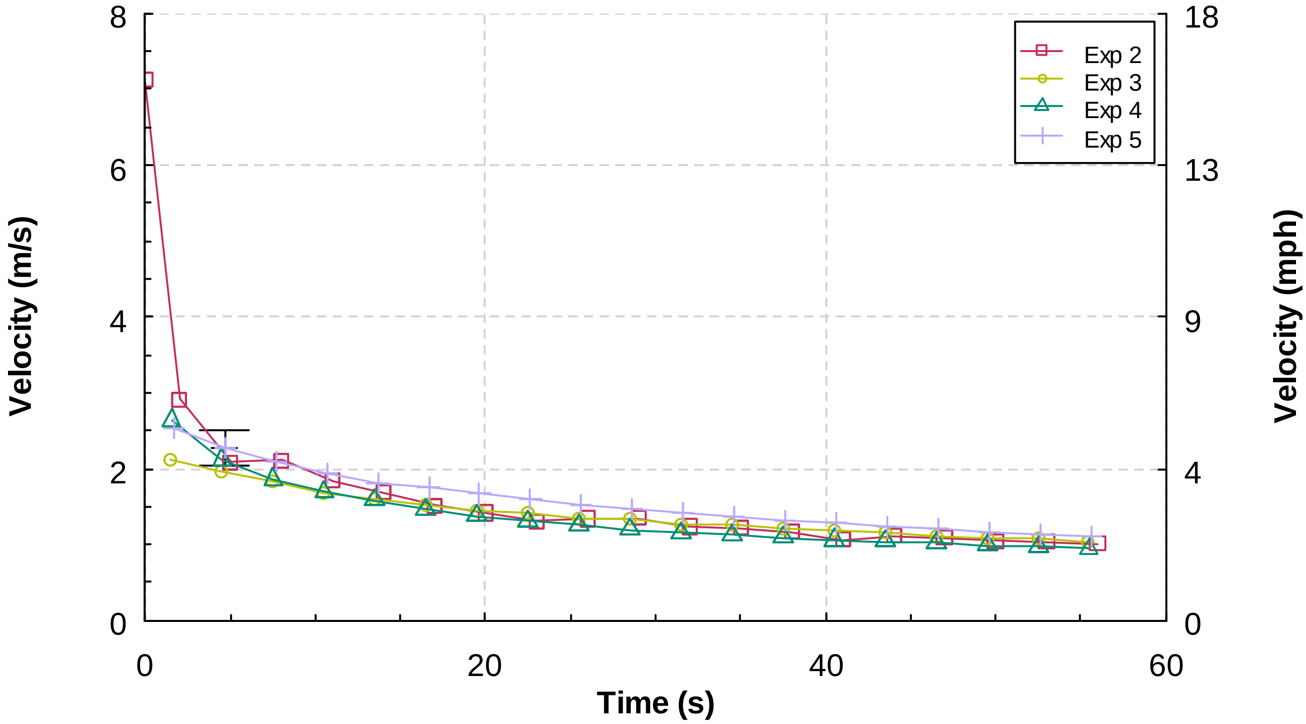

Figure 6.2.1-7. Velocity versus time, from the Corridor North position, 1.22 m (4.00 ft) below the ceiling, Experiments 2 through 5. T = 0 is the time of WCD deployment.

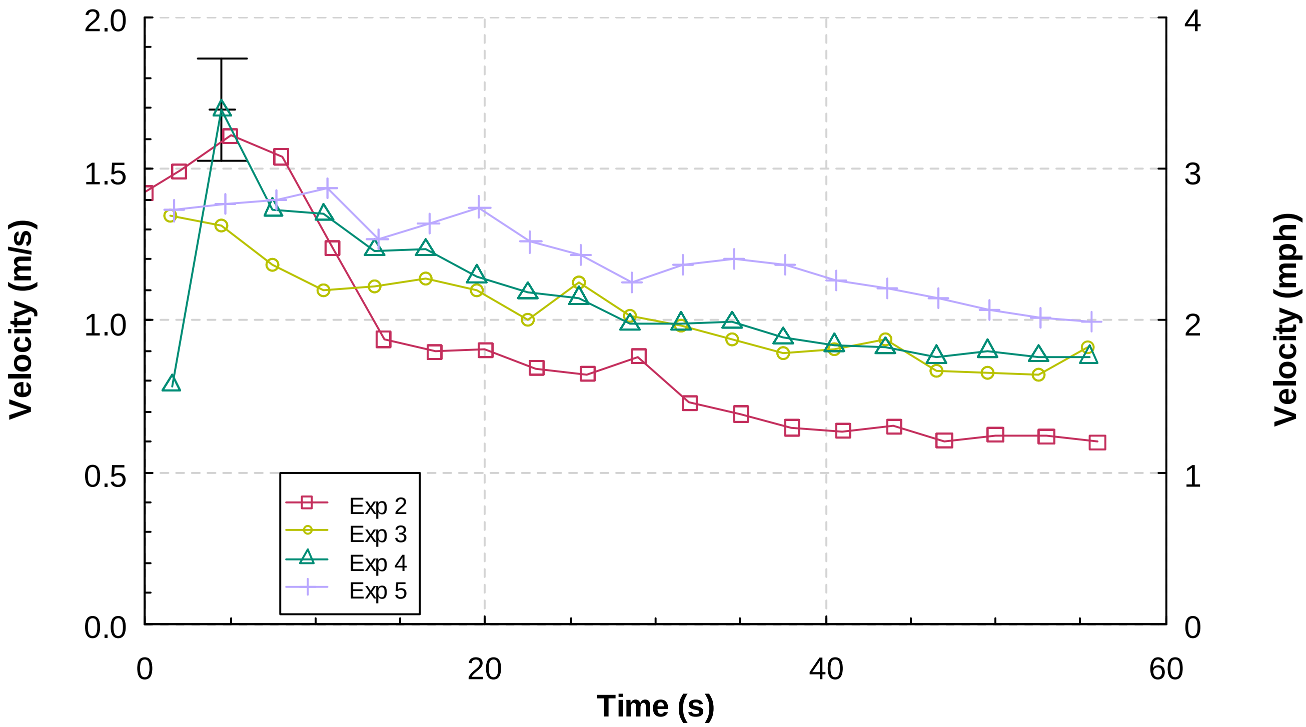

Figure 6.2.1-8. Velocity versus time, from the Corridor South position, 1.22 m (4.00 ft) below the ceiling, Experiments 2 through 5. T = 0 is the time of WCD deployment.

6.2.2 External Water Application

The comparisons presented in this section were derived from Experiments 6 through 8, which focused on the impact that external water application would have on the thermal environment throughout the structure. Just as in the previous section, the temperatures and heat fluxes that are used in the comparsions are positioned at 1.52 m (5.00 ft) below the ceiling.

In Experiment 6, three different water flow conditions were examined. After the window vented and the fire was observed to be fully developed, a sprinkler positioned near the bottom of the window opening and angled up at 45°, flowed 1.9 l/s (30 gpm) after it was manually activated. Based on the observations and the heat release rate this appeared to have little impact on the fire and water fog spray from a hoseline was added. The fog spray was generated from an adjustable fog nozzle set to approximately 30º, flowing approximately 5.0 l/s (80 gpm). Initially the fog spray was discharged parallel to the west wall of the structure in front of the window opening. Again it appeared that the impact on the fire was limited so the fog spray was stopped. The nozzle, with the same settings, was repositioned and was discharged directly into the window opening, such that the spray pattern nearly filled the window opening. Since the sprinkler had little if any effect, it was only operated by itself for a short time approximately 25 s. Therefore it will not be considered separately in the following comparsions. It is considered inconjunction with both of the fog nozzle flows.

Experiments 7 and 8 were replicate experiments from the perspective that each of them employed a solid stream of water deflected off of the bedroom ceiling. Experiment 8 was allowed to burn until the gases in the hood above the structure ignited, then suppression was started.

The heat release rates from the four different hose stream applications, two from Experiment 6 and one each from Experiments 7 and 8 are shown in Figure 6.2.2-1. The application of the fog stream across the window opening did not result in a significant decrease in heat release rate. When the fog stream was directed into the window opening, the heat release rate increased slightly. The solid streams of water had a more significant impact, reducing the heat release rate by more than 40 % within the first 30 s.

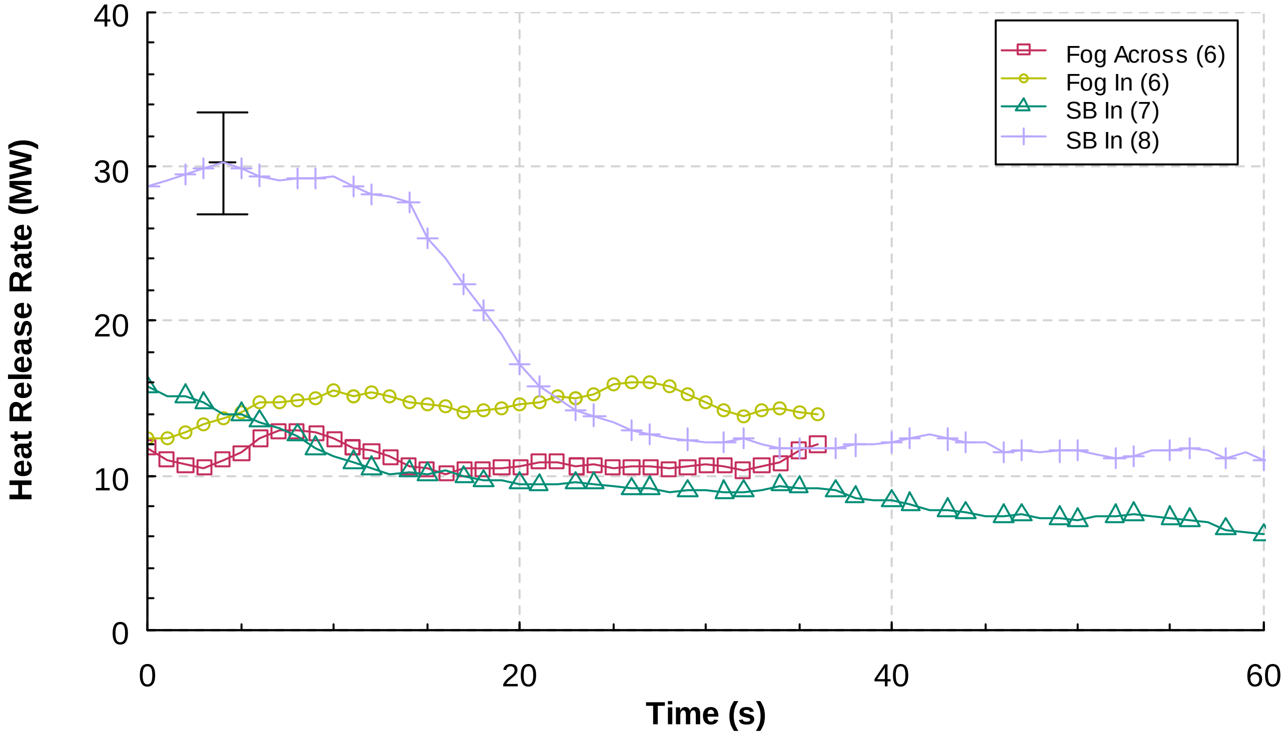

Figure 6.2.2-1. Heat release rate versus time, Experiments 6 through 8. T = 0 is the time of water application.

Figure 6.2.2-2 gives the temperatures from the corridor north position at 1.52 m (5.00 ft) below the ceiling. The water fog application across the window generated a temperature increase. The fog application into the window opening resulted in a slight decrease in temperature relative to the solid stream applications. The solid stream applications from the smooth bore (SB) nozzle resulted in temperature reductions of approximately 40 % to 50 %.

The temperatures from the south corridor position are shown in Figure 6.2.2-3. At this position the fog stream across the window generated an increase in temperature of approximately 20 %. The fog in the window resulted in a 35 % decrease in temeperature. The solid stream in Experiments 7 and 8, resulted in temperature decreases of 50 % and 40 % respectively.

Figure 6.2.2-4 has the temperatures from the southwest corridor position at 1.52 m (5.00 ft) below the ceiling. In the case of the fog stream across the window opening the temperature reduction was less than 5 %. In the other three external hose stream applications the temperature reductions ranged from 10 % to 30 %.

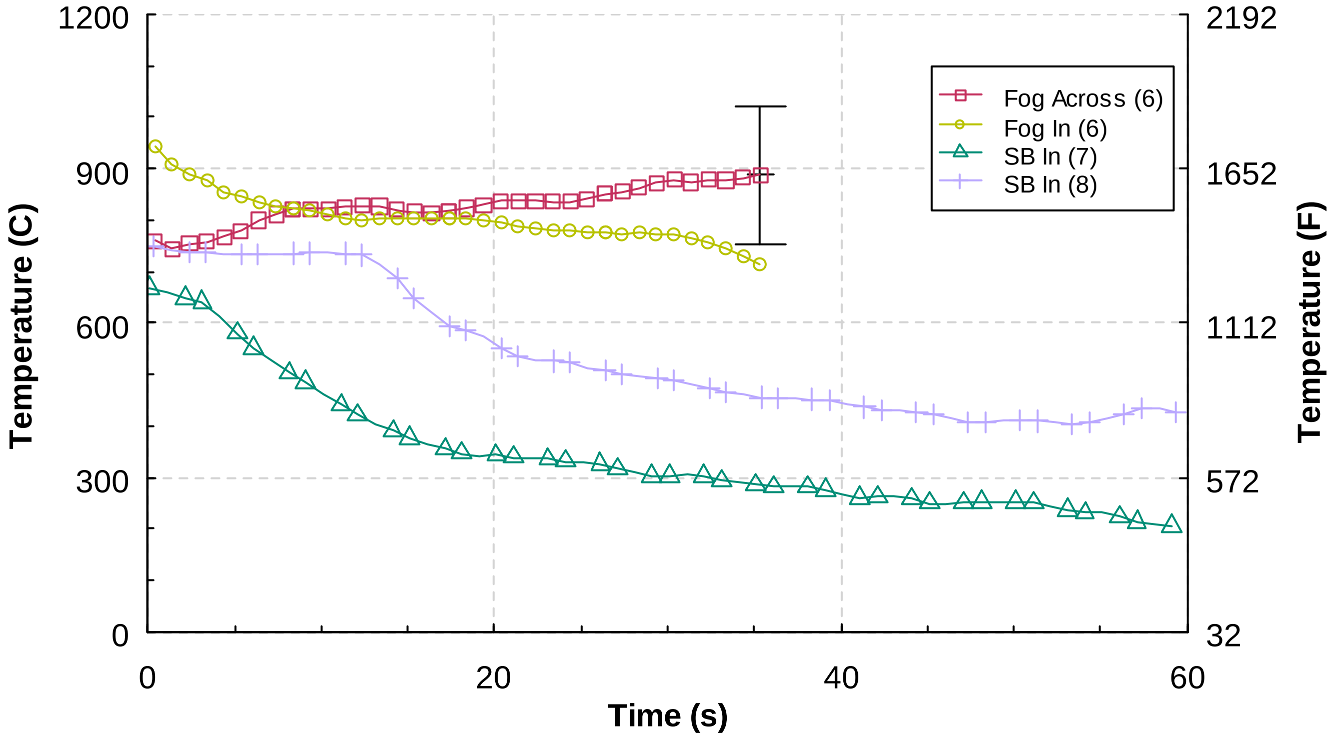

Figure 6.2.2-2. Temperature versus time from the Corridor North position, 1.52 m (5.00 ft) below the ceiling, Experiments 6 through 8. T = 0 is the time of water application.

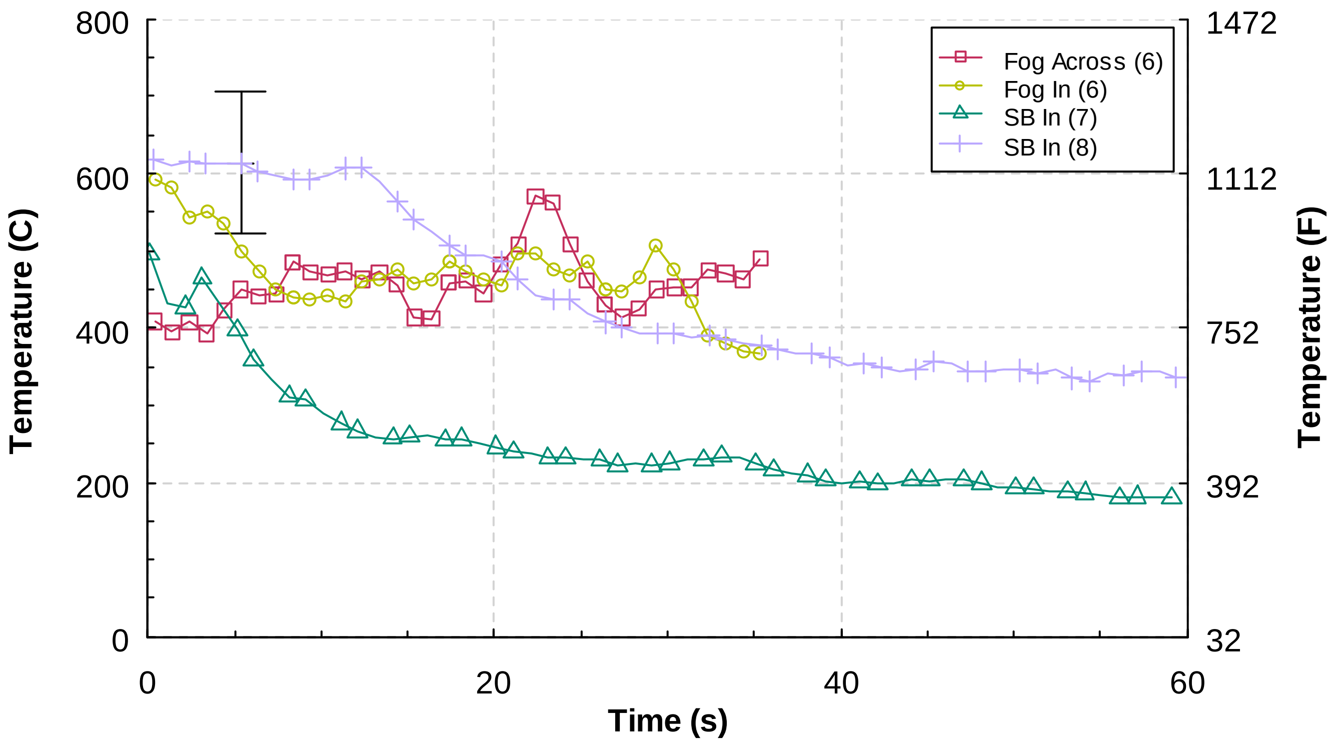

Figure 6.2.2-3. Temperature versus time from the Corridor South position, 1.52 m (5.00 ft) below the ceiling, Experiments 6 through 8. T = 0 is the time of water application.

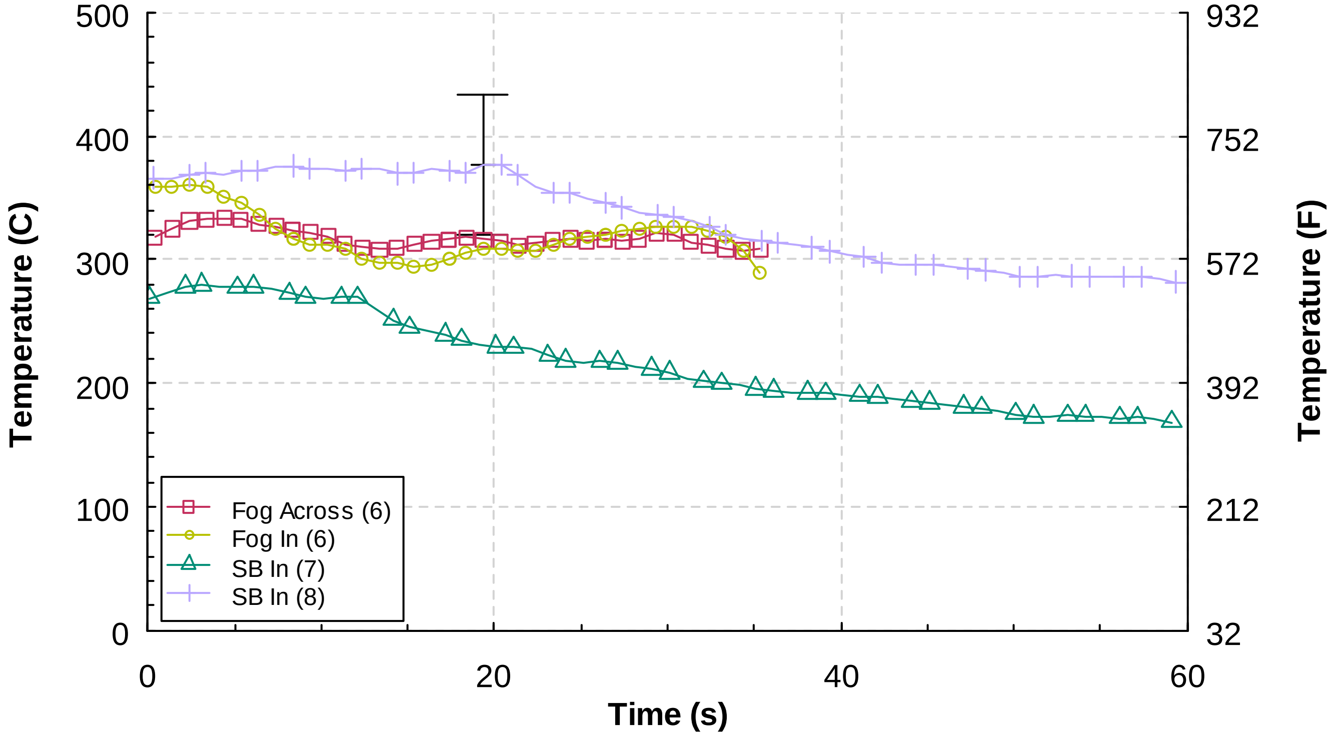

Figure 6.2.2-4. Temperature versus time from the Corridor Southwest position, 1.52 m (5.00 ft) below the ceiling, Experiments 6 through 8. T = 0 is the time of water application.

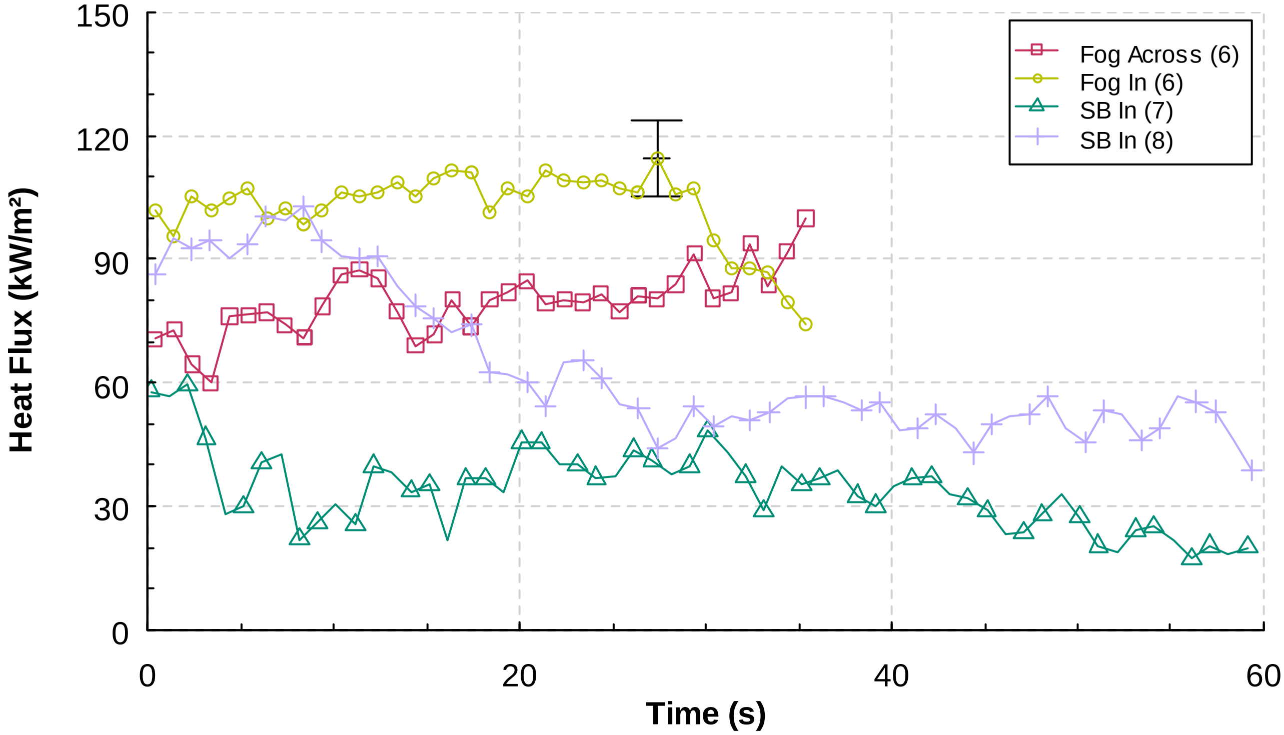

Figure 6.2.2-5. Heat flux versus time from the Corridor North position, 1.52 m (5.00 ft) below the ceiling, Experiments 6 through 8. T = 0 is the time of water application.

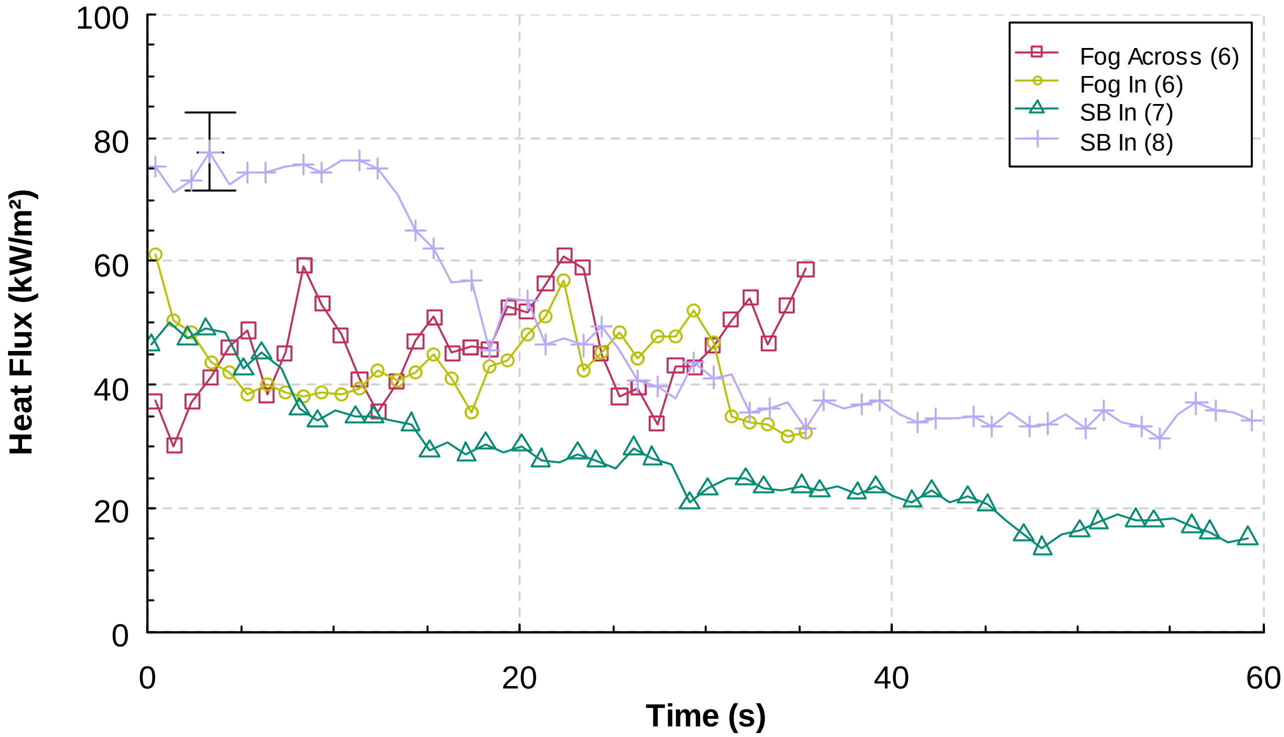

Figure 6.2.2-6. Heat flux versus time from the Corridor South position, 1.52 m (5.00 ft) below the ceiling, Experiments 6 through 8. T = 0 is the time of water application.

Figure 6.2.2-5 and Figure 6.2.2-6 provide the heat flux values at the corridor north and the corridor south positions for the 4 external water applications. The fog stream across the window resulted in an increase in heat flux at both measurement locations. The streams that were directed into the window all resulted in heat flux decreases in the range of 30 % to 50 %. At these locations, the fog stream in the window was nearly as effective at reducing the heat flux as the solid stream.

Figure 6.2.2-7 and Figure 6.2.2-8 show the velocities at the corridor north and the corridor south positions. The corridor north position is in the flow path an in general has higher velocities than the corridor south position. Post water application the velocities tend to oscillate and there is no consistant trend of increased or decreased velocity as a result of the water application. In these experiments, in addition to the wind, the water sprays may be introducing some momentum to the fire gases, as well as mixing and movement due to steam generation.

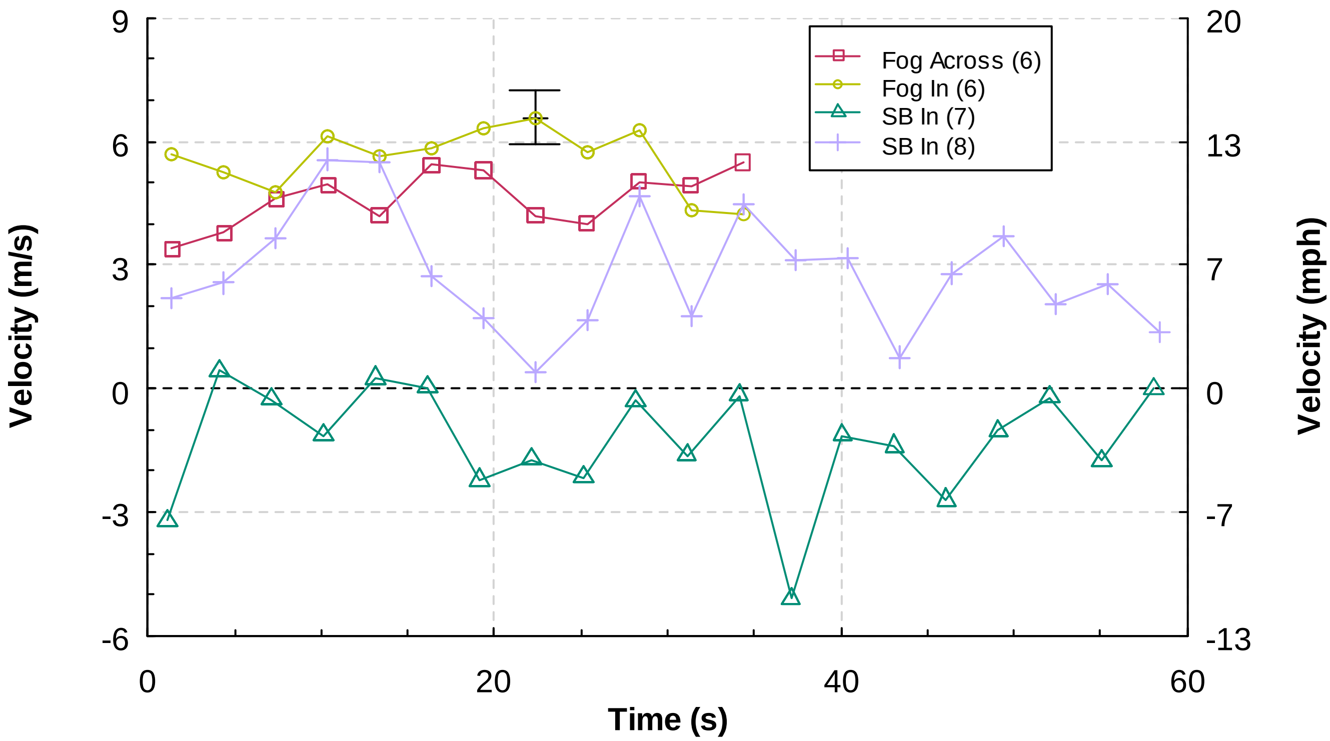

Figure 6.2.2-7. Velocity versus time, from the Corridor North position, 1.22 m (4.00 ft) below the ceiling, Experiments 6 through 8. T = 0 is the time of water application.

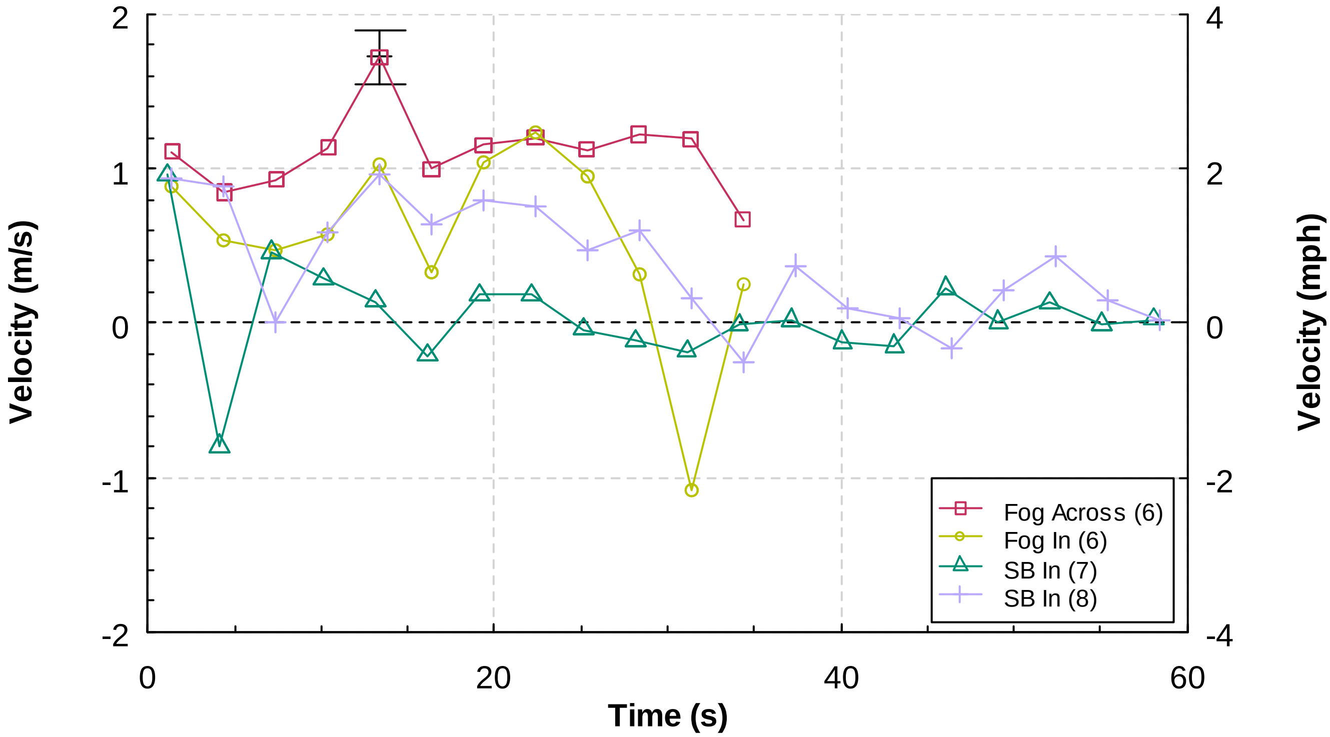

Figure 6.2.2-8. Velocity versus time, from the Corridor South position, 1.22 m (4.00 ft) below the ceiling, Experiments 6 through 8. T = 0 is the time of water application.

6.2.3 Door Control

In Experiment 7, the fire was started with the door from the living room to the corridor in the closed position. The window failed at approximately 300 s. The door was opened at 377 s after ignition, this point is designated as time "zero" in Figure 6.2.3-1. Figure 6.2.3-1 clearly shows how the door was used as a WCD and a thermal barrier to protect the corridor from extreme thermal conditions. Temperatures along the flow path (corridor north position) exceeded 600 °C (1112 °F) within 20 s of the door being opened. The temperatures in the south portions of the corridor, which were not in the flow path, increased at a much slower rate. **This data demonstrates the importance of door control and the importance of keeping firefighters out of the flow path of fire gases**.

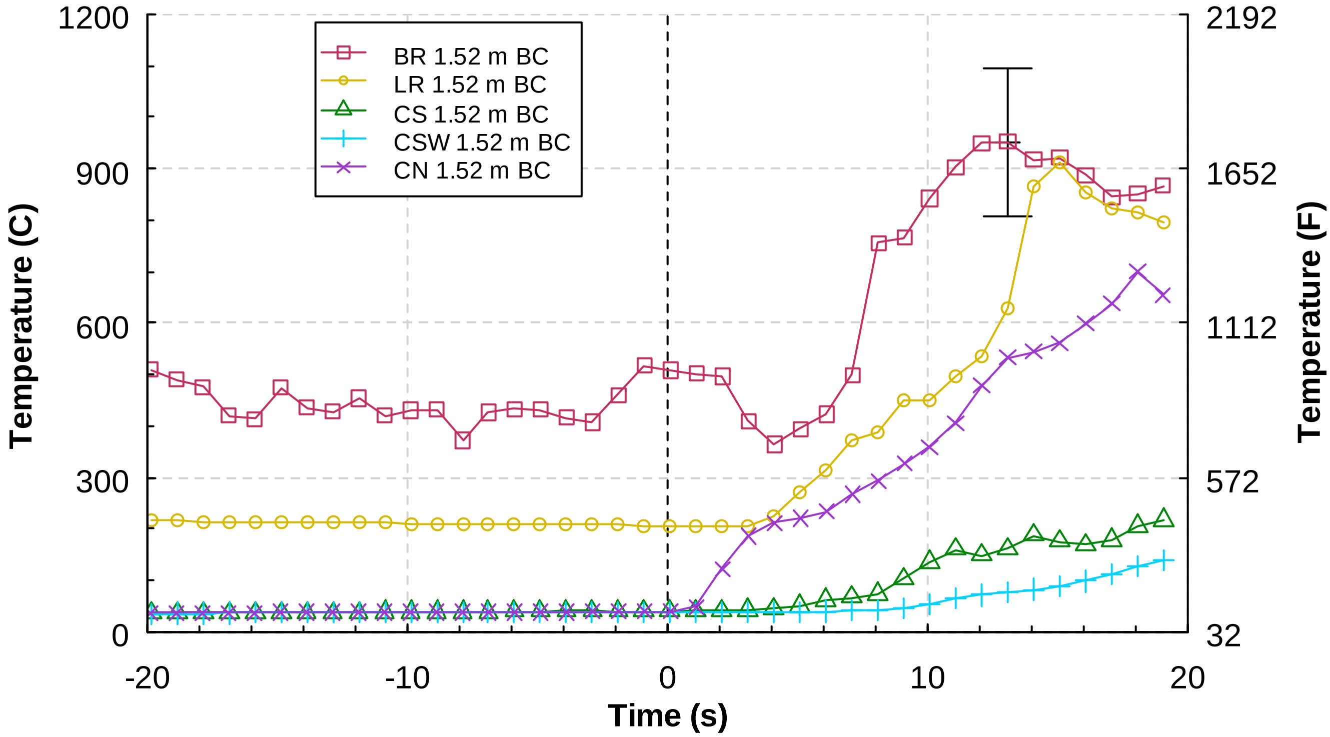

Figure 6.2.3-1. Temperature versus time, Experiment 7. T = 0 is the time that the door between the living room and the corridor was opened.

7 Future Research

The results from this series of experiments demonstrated that both wind control devices (WCDs) and externally applied water streams have the potential to mitigate the hazard from a wind driven apartment fire. The resulting conditions in the corridor offered a fire environment with an improved level of safety for firefighters, although not an environment free from hazard. Therefore, it is necessary to conduct further research on these two tactics as well as the use of these tactics in combination with positive pressure ventilation (PPV). The constraints of the laboratory structure and geometry may make some conditons worse than would be expected in a large multistory fire resistive multiple dwelling or in the case of a wood framed home it may not have not fully addressed all of the hazards that could be exaserbated by a wind driven fire such as a shorter time until structural collapse. Therefore it is important to take the lessons from these laboratory based experiments and conduct real-scale experiments in buildings of opportunity in the field. Experiments in real buildings with realistic fuel loads are required to further the understanding of the capabilities and limitations of implementing fire fighting tactics with PPV, WCDs and external hose streams. In the future, computer based fire models may be validated from the this data and data collected in acquired structures. Modeling may then be used to develop tactical training for cases that have not been tested directly.

7.1.1 Full-scale experiments

A series of wind driven fire experiments were conducted in 2008 in a 7 story, fire resistant, apartment building located on Governors Island in New York City. This series of experiments examined the use of positive pressure ventilation (PPV), WCDs and external hose streams for controlling wind driven fires in fire resistant structures. Analysis of these experiments will enable the fire service to see exactly what fire conditions could be generated in the public corridor of a large building and determine how effective and practical it would be for firefighters to put PPV, WCD and external hose streams into practice. The research effort is being led by Polytechnic University, FDNY and NIST with funding support from a DHS/ FEMA Assistance to Firefighters Research and Development Grant Program and the USFA. The results from these experiments will be provided in a separate NIST Technical Note.

7.1.2 Pilot Programs

FDNY has developed a training program on wind driven fires to provide their members with the importance of considering wind conditions when sizing up a fire, and to develop an understanding of flows within the building and how to control those flows with doors and PPV fans. Depending on the outcome of the Governors Island experiments, FDNY plans to implement a pilot program that includes training on tactics to mitigate wind driven fire hazards and deployment of PPV fans, WCDs and external hose stream nozzles which could be used in high rises.

7.1.3 Standard Test Methods for equipment

As the research and field trials continue, there are many commercially available products that are being examined and there are many prototype firefighting tools that are being offered for use in the experiments. If the technologies demonstrated continue to prove effective in the field trials and pilot programs, the next step may be to examine the need for standards and standardized test methods to define a miniumum level of acceptable performance of these devices.

8 Summary

The National Institute of Standards and Technology, with the support of the Fire Protection Research Foundation, the U.S. Department of Homeland Security, and the U.S. Fire Administration conducted a series of fire experiments to examine the impact of wind on fire spread through a multi-room structure and examine the capabilities of wind-control devices (WCD) and externally applied water to mitigate the hazard. The measurements used to examine the impact of the WCDs and the external water application tactics were heat release rate, temperature, heat flux, and gas velocity inside the structure. Oxygen, carbon dioxide, carbon monoxide, total hydrocarbons and differential pressures were also measured. Each of the experiments was recorded with video and thermal imaging cameras. Some of these measurements are not practical or affordable to make in an acquired structure, hence the need to build a structure and conduct the experiments within the confines of the NIST Large Fire Facility. These experiments also provided visual documentation of fire phenomena that are not typically observable on the fire ground.

A limited series of heat release rate experiments were conducted to characterize the fuel load packages used in wind driven structure experiments. Both the bedroom and the living room contained a fuel load composed of furnishings with an average peak heat release rate of 7.8 MW with a total heat release of at least 1700 MJ, not accounting for any of the wooden furniture or interior finish materials.

The experiments were designed to expose a public corridor area to a wind driven, post-flashover apartment fire. The door from the apartment to the corridor was open for each of the experiments. The conditions in the corridor were of critical importance because that is the portion of the building that firefighters would use to approach the fire apartment or that occupants from an adjoining apartment would use to exit the building.

The fires were ignited in the bedroom of the apartment. Prior to the failure or venting of the bedroom window, which was on the upwind side of the experimental apartment, the heat realease rate from the fire was on the order of 1 MW. Prior to implementing either of the mitigating tactics, the heat release rates from the post-flashover structure fire were typically between 15 MW and 20 MW. When the door from the apartment to the corridor was open, temperatures in the corridor area near the open doorway, 1.52 m (5.00 ft) below the ceiling, were in excess of 600 °C (1112 °F) for each of the experiments. The heat fluxes measured in the same location, during the same experiments, were in excess of 70 kW/m². These extreme thermal conditions are not teneable, even for a firefighter in full protective gear. These conditions were attained within 30 s of the window failure.

Experiment 1 was conducted without any external wind. This experiment provided valuable baseline data and demonstrated several important points relevant to fire fighting:

Smoke is Fuel. A ventilation limited (fuel rich) condition had developed prior to the failure of the window. Oxygen depleted combustion products, containing carbon dioxide, carbon monoxide and unburned hydrocarbons, filled the rooms of the structure. Once the window failed, the fresh air provided the oxygen needed to sustain the transistion through flashover, which caused a significant increase in heat release rate.

Venting does not always equal cooling. In this experiment, post ventilation temperatures and heat fluxes all increased, due to the **ventilation induced flashover**.

Fire induced flows. Velocities within the structure exceeded 5 m/s (11 mph), just due to the fire growth and the flow path that was set-up between the window opening and the corridor vent.

Avoid the flow path. The directional nature of the fire gas flow was demonstrated with thermal conditions, both temperature and heat flux, which were twice as high in the “flow” portion of the corridor as opposed to the “static” portion of the corridor in Experiment 1**. Thermal conditions in the flow path were not consistant with firefighter survival.**

Experiments 2 through 8 all used a mechanically generated wind, ranging from 3 m/s to 9 m/s (7 mph to 20 mph).
The fuel load in the structure was the same for all of the experiments. Each of these experiments demonstrated a rapid transistion to untenable conditions in the corridor, even for a firefighter in full PPE, after the window failed.

Experiments 2 through 5 focused on the **impact of WCDS**. In these experiments, the WCDs reduced the temperatures in the corridor outside the doorway by more than 50 % within 60 s of deployment. The heat fluxes were reduced by at least 70 % during this same time period. The WCDs also completely mitigated any gas velocity due to the external wind.

Experiments 6 through 8 focused on the **impact of externally applied water**. In these experiments, the externally applied water streams were implemented in three different ways; a fog stream across the face of the window opening, a fog stream into the window opening, and a solid water stream into the window opening. The fog stream across the window was not effective at reducing the thermal conditions in the corridor. The fog stream in the window decreased the corridor temperature by at least 20 % and the corresponding heat flux measured by at least 30 %. The solid stream experiments resulted in corridor temperature and heat flux reductions of at least 40 % within 60 s of application. None of the water applications reduced the gas velocities in the structure. In some cases, the gas velocity increased during water application, due to momentum imparted from the water.

These experiments demonstrated the “extreme” thermal conditions that can be generated by a “simple room and contents” fire and how these conditions can be extended along a flow path within a structure when wind and an open vent are present. Two potential tactics which could be implemented from either the floor above the fire in the case of a WCD, or from the floor below the fire in the case of the external water application were demonstrated to be effective in reducing the thermal hazard in the corridor. However, these experimental results also indicate that the post deployment thermal conditions for any single tactic were still of a level which could pose a hazard to firefighters in full PPE.

The experiments also provided potential guidance for firefighters as a part of a fire size up and approach to the room of fire origin: note wind conditions in the area of the fire, look for “pulsing flames”, examine smoke conditions around closed doors in the potential flow path, and maintain control of doors in the flow path.

Further research in actual buildings is required to fully understand the ability of firefighters to implement these tactics, to examine the thermal conditions throughout the structure such as in stairways, and to examine the interaction of these tactics with building ventilation strategies both natural and with positive pressure ventilation.

If the demonstrated technologies continue to prove effective in the field trials and pilot programs, the next step may be to examine the need for standards and standardized test methods to define a miniumum level of acceptable performance of these devices.

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Appendix A: Summary of Fire Events Where Wind Did or Could Have Impact Fire Fighting Tactics

Information compiled by Casey Grant, Fire Protection Research Foundation, and Tracy Golinveaux, National Fire Protection Association

Appendix A Methodology

This is a summary of historical data on structure fires that were influenced by wind or may have been impacted by wind, but might not have been indicated as such at the time their fire data was recorded. The purpose for compiling this information is to complement on-going research on structural fires where wind may have been a factor.

Historically, recognition of wind driven fire conditions has been taken into account with wildland fires for centuries. In addition, large area urban conflagrations that swept through entire cities were not unusual in the late 1800s and early 1900s prior to more rigorous modern building codes and construction techniques, and strong wind conditions was normally a strong influence on these fires. However, while weather and wind conditions and are a more obvious consideration for wildland fires and large-scale multiple-building urban conflagrations, attention to the direct influence of wind during structural fire fighting has traditionally been minimal.

In recent decades, more focused attention has been slowly evolving within the fire service that wind during a typical structure fire may have more of an impact on fire ground operations than previously acknowledged. This has led to several research studies that are confirming potentially dangerous fire ground conditions that can rapidly occur if external winds are present. Taller buildings will generally have a more appreciable influence from wind conditions than a one story structure and thus they have had more initial focus of this phenomenon; however, this is a condition that can affect a structure fire of any size.

The approach used to generate this summary is based on first collecting and tabulating readily available fire loss information of previous fires, and second to match and compare this with available historical wind speed data. The limitations of back-fitting the data in this manner is acknowledged, and while this comparison may not be fully representative of conditions local to the building involved or representative of the exact wind at the time of the fire, nevertheless it is possible that a trend may emerge based on the hundreds of available incidents.

The applicable weather data for each of the specific incidents included in this summary was gathered through two primary sources depending if the jurisdiction is part of or outside of the North America. Mean wind speed, maximum sustained wind speed, and the maximum gust speed for U.S. and Canadian cities were provided through the on-line Farmer's Almanac.[1] Wind speed data for cities outside of North America was collected on-line from the National Climate Data Center.[2] Wind speeds were classified as calm, light air, light breeze, gentle breeze, moderate wind, fresh wind, or strong wind using the Beaufort scale.[3] This wind classification information is summarized in Table A-1, *Wind classification based on the Beaufort Scale*.

To provide a basis for organizing the collecting data, each incident has been analyzed to determine its relevance based on confirmed fire reports. An "event status" rating has been assigned to each incident, from "5" to "1" with "5" being the incidents of most interest and "1" being of least interest. The event status summary is shown in Table A-2, *Event status summary for wind driven structural fires*. Since the exact wind speed ranges for a potential wind driven fire is not known and can vary based on multiple factors, an assumption was made that fires which occurred on days with wind speeds of 13 mph and above (i.e. moderate wind or greater) had a higher probability of being a wind driven event. These were generally given an event status rating of "4" or "5", although in some cases this was further modified if a confirmed fire loss report indicated more precise wind or other data.

The fire events in this summary have been collected from several sources, and the primary compilation of 565 events is included in Table A-3, *Historical summary of structure fires that may have been impacted by wind*. The starting point for this information came from incidents included in an NFPA report on "High-Rise Building Fires (8/05)", which included and appendix with an international listing of fatal high-rise structure fires from 1911 through 2004.[4] This was supplemented with information from the Fire Incident Data Organization (FIDO) data base handled by NFPA's Fire Analysis and Research Division, with a specific focus on high-rise structure fires from 2002 through 2007.[5] Additional structure fire incidents were added to the summary based on data and/or reports collected from multiple fire service organizations who have been participated in the various on-going research projects on this topic.

To provide additional focus on the historical fire events where wind did or could have had an impact on fire fighting tactics, two sub-sets of the Table A-3 incidents are also provided. First, Table A-4, *Historical summary of structural fires with probable but unconfirmed wind impact*, summarizes 55 historical incidents where external wind appears to have had possible impact but is still unconfirmed through fire reports. Next, Table A-5, *Historical summary of structural fires with reports confirming wind impact*, summarizes the 30 fire events where wind was a factor impacting fire fighting tactics and which has been confirmed through a secondary fire report. The number of fatalities associated with the top three event ratings ("5", "4" and "3") tabulate to more than one thousand cumulative deaths, and are as follows:

- Event rating "5" involved 30 incidents with 42 recorded fatalities
- Event rating "4" involved 55 incidents with 113 recorded fatalities
- Event rating "3" involved 257 incidents with 955 recorded fatalities

Appendix A References

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Table A-1: Wind classification based on the Beaufort Scale

No.	mph	Description	Effects on land
0	0mph	Calm	Smoke rises vertically.
1	1-3mph	Light air.	Smoke drifts in the wind.
2	4-7mph	Light breeze.	Leaves rustle. Wind felt on face.
3	8-12mph	Gentle breeze.	Small twigs in constant motion. Light flags extended.
4	13-18mph	Moderate wind.	Dust, leaves and loose paper raised. Small branches move
5	19-24mph	Fresh wind.	Small trees sway.
6	25-31mph	Strong wind.	Large branches move. Whistling in phone wires. Difficult to use umbrellas.
7	32-38mph	Very strong wind.	Whole trees in motion.
8	39-46mph	Gale.	Twigs break off trees. Difficult to walk.
9	47-54mph	Severe gale.	Chimney pots and slates removed.
10	55-63mph	Storm.	Trees uprooted. Structural damage.
11	64-72mph	Severe storm.	Widespread damage.
12	73mph+	Hurricane force.	Widespread damage. Very rarely experienced on land.

Source: BBC Weather. Beaufort Scale by Bill Giles O.B.E.. retrieved 12 May, 2008.
http://www.bbc.co.uk/weather/features/understanding/beaufort_scale.shtml

Table A-2: Event status summary for wind driven structural fires

5	Confirmed and Relevant (fire report identified that wind altered the firefighting tactics)
4	Probable but unconfirmed with documentation (event shows some evidence, e.g. wind speed, open windows, etc, of being a wind driven event but is not stated in a fire report)
3	Under consideration; still needs to be pursued (fire report has not yet been examined)
2	Confirmed but irrelevant to project (fire cause, fire spread, and resulting fatalities were unrelated to wind conditions)
1	Possible but unlikely; further documentation not available (fire event was unlikely driven by wind and that there is no fire report available)

Table A-3: Historical summary of structure fires that may have been impacted by wind

Location	Date	Mean Wind Speed MPH [1,2]	Max Sust. [1,2]	Max Gust [1,2]	Mean Wind Class. [1,3]	Building	Floor of Origin	Total Flrs	Firefighter / Civilian : Total Deaths	Dollar Loss (USD)	NFPA Report #	Rating [7]
NY	Jul-45	n/a	n/a	n/a	n/a	Office Building	79	102	0 / 11 : 11	$500K		1
IL	Jun-46	11.85	17.1	n/a	Gentle Breeze	Hotel (Transient)	1	22	0 / 61 : 61	$650K		3
GA	Dec-46	7.71	10.1	n/a	Gentle Breeze	Hotel (Transient)	3	15	0 / 119 : 119	$400K		3
CT	Dec-61	15.31	25.1	n/a	Moderate Wind	Hospital	9	13	0 / 16 : 16	Ukwn.	n/a	1
FL	Dec-63	6.21	10.1	n/a	Light Breeze	Hotel	1	14	0 / 22 : 22	$250K		1
MA	Jan-66	27.39	33	n/a	Strong Wind	Hotel (Transient)	B	11	0 / 11 : 11	$474K	n/a	1
AL	Feb-67	9.9	12	n/a	Gentle Breeze	Restaurant /Apt. Bld.	11	11	0 / 25 : 25	$60K		3
IL	Jan-69	23.71	25.1	n/a	Fresh Wind	Apt. Bld.	36	39	0 / 4 : 4	$50K	n/a	1
IL	Jan-70	12.66	18.1	n/a	Moderate Wind	Hotel	9	25	0 / 2 : 2	$150K	n/a	1
NY	Aug-70	8.06	8	n/a	Gentle Breeze	Office Building	33	50	0 / 2 : 2	$10M		3
NY	Dec-70	7.36	9.9	20.71	Gentle Breeze	Office Building	5	47	0 / 3 : 3	$3M		3
AZ	Dec-70	8.06	13	n/a	Gentle Breeze	Hotel	4	11	0 / 28 : 28	$2M		3
IL	Mar-71	6.44	10.1	n/a	Light Breeze	Hotel	4	14	0 / 1 : 1	Ukwn.		1
IL	Apr-71	13.58	24.1	n/a	Moderate Wind	Apt. Bld.	61	100	0 / 1 : 1	Ukwn.	01684	4
OH	Apr-71	11.39	18.1	n/a	Gentle Breeze	Hotel	sub-l.	10	0 / 7 : 7	$200K		3
IL	Apr-71	11.74	15	n/a	Gentle Breeze	Apt. Hotel	9	10	0 / 1 : 1	$10K		3
MO	May-71	3.91	9.9	n/a	Light Breeze	Hotel	2	7	0 / 4 : 4	Ukwn.		1
LA	Jul-71	4.37	14	n/a	Light Breeze	Hotel	12	17	0 / 6 : 6	$175K		1
PA	Aug-71	8.17	13	n/a	Gentle Breeze	Apt. Bld.	sub-l.	22	1 / 0 : 1	Ukwn.		3
IL	Oct-71	5.18	10.1	n/a	Light Breeze	Grain Elevator	8	8	0 / 4 : 4	$100K		1
IL	Oct-71	8.29	10.1	n/a	Gentle Breeze	Departmen t Store	39	42	0 / 3 : 3	$4K		3
South Korea	Dec-71	1.8	4.7	n/a	Light Air	Hotel	2	21	0 / 163 : 163	Ukwn.		1
QC Canada	Jan-72	6.9	14	n/a	Light Breeze	Office Building	2	10	0 / 5 : 5	$371K	06062	5
Brazil	Feb-72	n/a	n/a	n/a	n/a	Departmen t Store	5	31	0 / 16 : 16	$2M		1
NY	Mar-72	16.69	30.1	n/a	Moderate Wind	Hotel	7	14	0 / 4 : 4	$200K	03334	4

Location	Date	Mean Wind Speed MPH [1,2]	Max Sust. [1,2]	Max Gust [1,2]	Mean Wind Class. [1,3]	Building	Floor of Origin	Total Flrs	Firefighter / Civilian : Total Deaths	Dollar Loss (USD)	NFPA Report #	Rating [7]
IL	May-72	8.4	15	n/a	Gentle Breeze	Hotel	8	12	0 / 1 : 1	$8K		3
OH	Jun-72	7.25	11.1	n/a	Gentle Breeze	Apt. Bld.	22	22	0 / 1 : 1	$40K		3
MO	Sep-72	10.47	15	n/a	Gentle Breeze	Apt. Bld.	8	8	0 / 1 : 1	$160K		3
DC	Oct-72	12.2	20	n/a	Moderate Wind	Hospital	6	8	0 / 1 : 1	Ukwn.	00958	2
QC Canada	Oct-72	0.69	3.9	n/a	Light Air	Apt. Bld.	3	14	0 / 1 : 1	$3K	07272	2
LA	Nov-72	10.24	12	n/a	Gentle Breeze	Clothing Store	15	16	0 / 6 : 6	$887K		3
NJ	Dec-72	7.71	12	24.17	Gentle Breeze	Apt. Bld.	4	19	1 / 0 : 1	$325K		3
IL	Jan-73	11.51	11.8	n/a	Gentle Breeze	Building Under	1	24	1 / 0 : 1	$70K		3
WI	Jan-73	8.86	11.1	n/a	Gentle Breeze	Elderly Housing	4	10	0 / 3 : 3	$25K		3
MO	Jan-73	9.21	10.1	n/a	Gentle Breeze	Apt. Bld.	5	10	0 / 1 : 1	Ukwn.		3
IL	Jan-73	9.78	13	n/a	Gentle Breeze	Restaurant	1	20	3 / 0 : 3	$60K		3
MA	Feb-73	10.59	15	n/a	Gentle Breeze	Store with Apts.	1	30	1 / 2 : 3	$135K		3
IL	Feb-73	9.09	14	20.71	Gentle Breeze	Departmen t Store	sub-l.	15	3 / 0 : 3	$200K		3
NJ	Mar-73	11.16	11.8	n/a	Gentle Breeze	Apt. Bld.	1	37	1 / 0 : 1	$21K		3
MI	Mar-73	7.94	11.8	n/a	Gentle Breeze	Apt. Bld.	sub-l.	20	1 / 0 : 1	$18K		3
IL	Apr-73	11.05	14	n/a	Gentle Breeze	Bldg Under Constr.	33	110	0 / 4 : 4	$1K		3
CA	Apr-73	15.65	19.8	29.92	Moderate Wind	Residential Hotel	10	10	0 / 2 : 2	Ukwn.	00409	2
ON Canada	Apr-73	15.77	20	27.62	Moderate Wind	Apt. Bld.	12	24	0 / 1 : 1	$2K	06565	4
NY	May-73	8.52	15	n/a	Gentle Breeze	Apt. Bld.	sub-l.	60	1 / 0 : 1	$95K		3
GA	Jul-73	7.6	10.1	n/a	Gentle Breeze	Florist Shop	1	17	0 / 1 : 1	$90K		3
TX	Jul-73	5.4	14	n/a	Light Breeze	Hotel (Idle)	2	30	1 / 0 : 1	$45K		1
NY	Sep-73	10.7	14	n/a	Gentle Breeze	Hotel	2	8	0 / 2 : 2	$250K		3
MA	Oct-73	20.94	27	47.18	Fresh Wind	Apt. Bld.	3	35	1 / 0 : 1	$8K	05393	5
MA	Dec-73	8.06	11.8	18.41	Gentle Breeze	Apt. Bld.	7	8	0 / 1 : 1	Ukwn.		3
IL	1973	n/a	n/a	n/a	n/a	Bldg Under Const	1	24	1 / 0 : 1	$70K		1
NJ	Jan-74	9.9	15	21.86	Gentle Breeze	Apt. Bld.	11	20	0 / 1 : 1	Ukwn.		3

Location	Date	Mean Wind Speed MPH [1,2]	Max Sust. [1,2]	Max Gust [1,2]	Mean Wind Class. [1,3]	Building	Floor of Origin	Total Flrs	Firefighter / Civilian : Total Deaths	Dollar Loss (USD)	NFPA Report #	Rating [7]
Brazil	Feb-74	6.9	11.4	n/a	Light Breeze	Bank Building	12	25	0 / 179 : 179	$3M		1
OH	Feb-74	8.06	14	n/a	Gentle Breeze	Apt. Bld.	5	11	0 / 1 : 1	$1K		3
OH	Mar-74	9.09	15	n/a	Gentle Breeze	Apt. Bld.	9	12	0 / 2 : 2	$3K		3
IA	Apr-74	9.78	21	27.62	Gentle Breeze	Grain Elevator	16	16	0 / 4 : 4	Ukwn.		3
NY	Jun-74	13	15	n/a	Moderate Wind	Hotel	4	12	0 / 1 : 1	Ukwn.	05151	2
NJ	Jun-74	7.94	14	n/a	Gentle Breeze	Hotel	8	8	0 / 1 : 1	$2K		3
AK	Jun-74	9.44	19	n/a	Gentle Breeze	Hotel	7	9	0 / 1 : 1	Ukwn.		3
NY	Aug-74	15.19	18.1	27.62	Moderate Wind	Hotel	6	45	0 / 1 : 1	Ukwn.	05793	2
VA	Sep-74	8.4	10.1	n/a	Gentle Breeze	Hotel	9	11	0 / 1 : 1	$145K		3
NY	Sep-74	13.92	17.1	25.32	Moderate Wind	Apt. Bld.	2	15	0 / 3 : 3	Ukwn.	09139	2
DC	Sep-74	6.67	9.9	n/a	Light Breeze	Apt. Bld.	9	10	0 / 1 : 1	$1K		1
FL	Nov-74	11.28	13	n/a	Gentle Breeze	Apt. Bld.	10	15	0 / 1 : 1	$30K		3
NY	Jan-75	14.73	18.1	n/a	Moderate Wind	Apt. Bld.	10	15	0 / 3 : 3	Ukwn.	03116	4
NY	Jan-75	3.68	8	n/a	Light Breeze	Apt. Bld.	13	18	0 / 1 : 1	$3K		1
NY	Feb-75	2.99	10.9	n/a	Light Air	Elderly Housing	7	11	0 / 1 : 1	$4K		1
NY	Feb-75	2.99	10.9	n/a	Light Air	Office Building	13	?	0 / 1 : 1	Ukwn.		1
NJ	Feb-75	10.36	15	n/a	Gentle Breeze				0 / 0 : 0	Ukwn.	03778	5
DC	Feb-75	11.16	15.9	n/a	Gentle Breeze	Hotel	11	12	0 / 2 : 2	$80K		3
IL	Feb-75	9.78	15.9	n/a	Gentle Breeze	Apt. Bld.	17	29	0 / 1 : 1	Ukwn.		3
PA	Feb-75	8.75	13	n/a	Gentle Breeze	Idle Building	4	8	1 / 0 : 1	Ukwn.		3
NY	Mar-75	8.52	17.9	27.62	Gentle Breeze	Elderly Housing	11	14	0 / 2 : 2	Ukwn.		3
NC	Mar-75	8.63	12	n/a	Gentle Breeze	Apt. Bld.	3	11	0 / 1 : 1	Ukwn.		3
AR	Apr-75	5.75	11.1	n/a	Light Breeze	Hotel	7	15	0 / 1 : 1	$18K		1
IA	May-75	9.21	18.1	27.62	Gentle Breeze	Grain Elevator	sub-Flr	9	0 / 4 : 4	$3M		3
CA	May-75	6.44	10.1	n/a	Light Breeze	Hotel	1	12	0 / 1 : 1	$50K		1
MA	Jul-75	7.6	10.1	n/a	Gentle Breeze	Dormitory	19	24	0 / 1 : 1	Ukwn.		3

Location	Date	Mean Wind Speed MPH [1,2]	Max Sust. [1,2]	Max Gust [1,2]	Mean Wind Class. [1,3]	Building	Floor of Origin	Total Flrs	Firefighter / Civilian : Total Deaths	Dollar Loss (USD)	NFPA Report #	Rating [7]
SC	Sep-75	5.52	8.9	n/a	Light Breeze	Apt. Bld.	6	14	0 / 1 : 1	$1K		1
TX	Dec-75	8.52	12	n/a	Gentle Breeze	Apt. Bld.	14	21	2 / 0 : 2	$579K		3
MA	Dec-75	10.93	12	18.41	Gentle Breeze	Elderly Housing	17	19	0 / 1 : 1	$4K		3
NC	Dec-75	5.52	8	n/a	Light Breeze	Elderly Housing	10	14	0 / 1 : 1	Ukwn.		1
NC	Jan-76	6.21	8	n/a	Light Breeze	Hotel	5	7	0 / 1 : 1	Ukwn.		1
MA	Jan-76	3.91	7	n/a	Light Breeze	Apt. Complex	1	23	0 / 3 : 3	$40K		1
IL	Feb-76	13.35	15	25.32	Moderate Wind	Elderly Housing	4	9	0 / 8 : 8	Ukwn.	00143	4
NJ	Mar-76	7.36	14	21.86	Gentle Breeze	Apt. Bld.	3	12	0 / 3 : 3	Ukwn.		3
IN	Jul-76	9.67	15	n/a	Gentle Breeze	Elderly Housing	6	7	0 / 1 : 1	$30K		3
VA	Jul-76	11.74	14	n/a	Gentle Breeze	Hotel	7	11	0 / 1 : 1	$2K		3
FL	Oct-76	11.16	18.1	25.32	Gentle Breeze	Hotel	9	14	0 / 1 : 1	$1K		3
NY	Oct-76	15.77	27	41.43	Moderate Wind	Hotel	8	16	0 / 1 : 1	Ukwn.	03950	4
OH	Nov-76	8.75	13	n/a	Gentle Breeze	Hotel	5	22	0 / 1 : 1	$50K		3
NY	Dec-76	14.04	18.1	28.77	Moderate Wind	Apt. Bld.	3	9	0 / 1 : 1	Ukwn.	05451	4
MD	Jan-77	12.54	22	40.28	Moderate Wind	Apt. Bld.	7	22	0 / 1 : 1	$625K	00160	5
NY	Jan-77	8.63	12	n/a	Gentle Breeze	Apt. Bld.	B	7	0 / 1 : 1	$325K		3
IL	Jan-77	12.54	14	n/a	Moderate Wind	Apt. Bld.	16	16	0 / 1 : 1	Ukwn.	00049	4
QC Canada	Jan-77	6.44	8.9	n/a	Light Breeze	Elderly Housing	1	8	0 / 6 : 6	$27K	03096	2
DC	Jan-77	5.87	9.9	n/a	Light Breeze	Elderly Housing	4	8	0 / 1 : 1	Ukwn.		1
NY	Feb-77	22.21	25.1	42.58	Fresh Wind	Apt. Bld.	10	12	0 / 1 : 1	Ukwn.	01015	1
MN	Feb-77	n/a	n/a	n/a	n/a	Apt. Bld.	32	32	0 / 2 : 2	$49K		1
DC	Feb-77	13.69	16.9	n/a	Moderate Wind	Apt. Bld.	1	9	0 / 1 : 1	Ukwn.	50047	1
CO	Mar-77	8.63	20	32.22	Gentle Breeze	Apt. Bld.	4	12	0 / 1 : 1	Ukwn.		3
TX	Mar-77	13.12	16.9	19.56	Moderate Wind	Elderly Housing	8	11	0 / 4 : 4	$125K	01237	5
FL	May-77	6.21	14	21.86	Light Breeze	Hospital	7	7	0 / 1 : 1	Ukwn.		1
MD	77	14.15	17.1	27.62	Moderate Wind	Office Building	11	40	1 / 0 : 1	Ukwn.	01452	4

Location	Date	Mean Wind Speed MPH [1,2]	Max Sust. [1,2]	Max Gust [1,2]	Mean Wind Class. [1,3]	Building	Floor of Origin	Total Flrs	Firefighter / Civilian : Total Deaths	Dollar Loss (USD)	NFPA Report #	Rating [7]
NE	May-77	14.61	22.9	34.52	Moderate Wind	Hotel (Vacant)	1	8	1 / 0 : 1	Ukwn.	01467	4
NB Canada	Jun-77	10.47	15	n/a	Gentle Breeze	Detention Center	SubFlr	16	0 / 21 : 21	$100K		3
NE	Jun-77	17.72	25.8	44.88	Moderate Wind				0 / 0 : 0	Ukwn.	05785	1
NV	Jul-77	10.93	15.9	25.32	Gentle Breeze	Apt. Bld.	8	15	0 / 3 : 3	$550K		3
IL	Sep-77	6.56	15.9	n/a	Light Breeze	Apt. Bld.	34	34	0 / 1 : 1	Ukwn.		1
IL	Sep-77	9.44	12	n/a	Gentle Breeze	Apt. Bld.	4	8	0 / 1 : 1	Ukwn.		3
NY	Oct-77	9.67	11.8	n/a	Gentle Breeze	Barn	1	10	1 / 0 : 1	Ukwn.		3
FL	Oct-77	12.43	18.1	25.32	Moderate Wind	Hotel	4	11	0 / 1 : 1	$2K	05734	2
NY	Dec-77	11.62	15	n/a	Gentle Breeze	Apt. Bld.	5	20	0 / 1 : 1	Ukwn.		3
IL	Dec-77	10.47	15	n/a	Gentle Breeze	Hotel	5	8	0 / 1 : 1	Ukwn.		3
IL	Dec-77	15.88	18.1	28.77	Moderate Wind	Apt. Bld.	26	26	0 / 1 : 1	Ukwn.	05702	2
NJ	Jan-78	13.58	15	n/a	Moderate Wind	Apt. Bld.	6	15	0 / 1 : 1	$5K	00409	2
FL	Jan-78	10.7	15	n/a	Gentle Breeze	Apt. Bld.	9	10	0 / 1 : 1	$2K		3
NY	Jan-78	9.21	13	n/a	Gentle Breeze	Residential Hotel	3	12	0 / 1 : 1	$30K		3
MO	Jan-78	10.93	14	21.86	Gentle Breeze	Grain Mill	sub-l.	9	0 / 3 : 3	$1M		3
MD	Jan-78	7.71	12	n/a	Gentle Breeze	Apt. Bld.	1	15	0 / 1 : 1	Ukwn.		3
VA	Jan-78	3.68	8	n/a	Light Breeze	Apt. Bld. (Infirmary)	2	9	0 / 1 : 1	Ukwn.		1
GA	Jan-78	7.71	8.9	n/a	Gentle Breeze	Apt. Bld.	10	18	0 / 1 : 1	$64K		3
DC	Feb-78	8.98	10.9	n/a	Gentle Breeze	Apt. Bld.	9	11	0 / 1 : 1	Ukwn.		3
AR	Feb-78	13.58	14	20.71	Moderate Wind	Apt. Bld.	16	16	0 / 1 : 1	$34K	00212	2
IL	Feb-78	9.32	n/a	n/a	Gentle Breeze	Apt. Bld.	1	18	0 / 2 : 2	$50K		3
IL	Feb-78	9.44	10.9	n/a	Gentle Breeze	Elderly Housing	4	8	0 / 1 : 1	$5K		3
TX	Mar-78	9.32	14	n/a	Gentle Breeze	Hotel (for Elderly)	5	11	0 / 1 : 1	$K		3
PA	Mar-78	12.66	15	n/a	Moderate Wind	Apt. Bld.	8	11	0 / 1 : 1	$11K	01066	2
CA	Mar-78	4.14	7	n/a	Light Breeze	Care of the Aged	2	9	0 / 1 : 1	$3K		1
MI	Mar-78	10.93	19.8	n/a	Gentle Breeze	Apt. Bld.	4	9	0 / 1 : 1	$10K		3

Location	Date	Mean Wind Speed MPH [1,2]	Max Sust. [1,2]	Max Gust [1,2]	Mean Wind Class. [1,3]	Building	Floor of Origin	Total Flrs	Firefighter / Civilian : Total Deaths	Dollar Loss (USD)	NFPA Report #	Rating [7]
NJ	Apr-78	14.61	19	25.32	Moderate Wind	Apt. Bld.	6	12	0 / 1 : 1	$7K	00526	2
MO	Apr-78	11.51	18.1	n/a	Gentle Breeze	Grain Mill	1	8	0 / 2 : 2	$472K		3
IL	May-78	6.79	15	n/a	Light Breeze	Apt. Bld.	4	7	0 / 1 : 1	Ukwn.		1
NY	May-78	10.7	14	n/a	Gentle Breeze	Apt. Bld.	5	7	0 / 1 : 1	Ukwn.		3
NJ	May-78	9.21	12.8	n/a	Gentle Breeze	Hospital	6	8	0 / 1 : 1	Ukwn.		3
VA	Jun-78	5.64	8	n/a	Light Breeze	Apt. Bld.	8	9	0 / 3 : 3	$100K		1
IL	Jul-78	8.4	11.1	n/a	Gentle Breeze	Apt. Bld.	10	16	0 / 1 : 1	Ukwn.		3
WI	Aug-78	6.1	11.8	n/a	Light Breeze	Jail	3	8	0 / 1 : 1	Ukwn.		1
IL	Aug-78	7.6	11.8	n/a	Gentle Breeze	Apt. Bld.	8	19	0 / 1 : 1	Ukwn.		3
PA	Oct-78	6.9	11.8	n/a	Light Breeze	Hotel	7	10	0 / 1 : 1	Ukwn.		1
GA	Oct-78	9.55	15	20.71	Gentle Breeze	Apt. Bld.	9	22	0 / 3 : 3	Ukwn.		3
IL	Oct-78	13.81	18.1	28.77	Moderate Wind	Apt. Bld.	44	44	0 / 1 : 1	Ukwn.	03146	2
NY	Nov-78	6.21	8.9	n/a	Light Breeze	Apt. Bld.	Ukwn.	21	1 / 0 : 1	Ukwn.		1
ON Canada	Dec-78	16.69	22	n/a	Moderate Wind	Apt. Bld.	2	14	0 / 1 : 1	Ukwn.	05020	1
NJ	Dec-78	8.52	15	n/a	Gentle Breeze	Hotel	2	8	0 / 1 : 1	$7K		3
IL	Jan-79	11.5	12	n/a	Gentle Breeze	Apt. Bld.	1	13	0 / 1 : 1	Ukwn.		3
MO	Feb-79	13.46	18.1	26.47	Moderate Wind	Apt. Bld.	6	8	0 / 1 : 1	$6K	02031	4
NY	Mar-79	13.46	15	n/a	Moderate Wind	Motel	2	14	0 / 1 : 1	Ukwn.	01423	4
KY	Mar-79	8.63	19.8	35.67	Gentle Breeze	Nursing Home	3	7	0 / 1 : 1	Ukwn.		3
PA	Mar-79	8.29	21	32.22	Gentle Breeze	Care of the Aged	4	8	0 / 1 : 1	$23K		3
IL	Mar-79	13.46	16.9	32.22	Moderate Wind	Apt. Bld.	9	24	0 / 3 : 3	Ukwn.	00763	2
MA	Mar-79	15.65	18.1	28.77	Moderate Wind	Hotel	3	7	0 / 1 : 1	$800K	00007	2
DC	Apr-79	4.6	5.8	n/a	Light Breeze	Elderly Housing	8	8	0 / 1 : 1	$3K		1
DC	May-79	5.87	8	n/a	Light Breeze	Elderly Housing	8	9	0 / 1 : 1	$20K		1
MD	Jun-79	5.18	8	n/a	Light Breeze	Apt. Bld.	4	7	0 / 1 : 1	Ukwn.		1
NY	Jun-79	3.8	5.8	n/a	Light Breeze	Department Store	5	20	1 / 0 : 1	$10M		1

Location	Date	Mean Wind Speed MPH [1,2]	Max Sust. [1,2]	Max Gust [1,2]	Mean Wind Class. [1,3]	Building	Floor of Origin	Total Flrs	Firefighter / Civilian : Total Deaths	Dollar Loss (USD)	NFPA Report #	Rating [7]
NY	Jun-79	10.13	9.9	n/a	Gentle Breeze	Apt. Bld.	6	31	0 / 1 : 1	Ukwn.		3
FL	Aug-79	7.6	11.8	n/a	Gentle Breeze	Apt. Bld.	2	12	0 / 1 : 1	$90K		3
PA	Sep-79	7.13	10.1	n/a	Gentle Breeze	Hospital	7	8	0 / 1 : 1	$1K		3
IL	Oct-79	7.6	12.8	n/a	Gentle Breeze	Apt. Bld.	16	17	0 / 2 : 2	Ukwn.		3
CA	Oct-79	19.79	25.1	42.58	Fresh Wind	Apt. Bld.	11	19	0 / 3 : 3	$350K	02570	5
NY	Jan-80	12.6	19.8	32.2	Moderate Wind	Apt. Bldg.	11	16	0 / 1 : 1	Ukwn.		5
IL	Jan-80	9.32	15.9	n/a	Gentle Breeze	Apt. Bld.	1	15	0 / 1 : 1	Ukwn.		3
IL	Feb-80	7.36	12.8	n/a	Gentle Breeze	Apt. Bld.	5	40	0 / 2 : 2	Ukwn.		3
CO	Mar-80	7.83	12	n/a	Gentle Breeze	Residential Hotel	5	16	0 / 1 : 1	$36K		3
VA	Mar-80	5.18	4.9	n/a	Light Breeze	Paper Mill	Ukwn.	10	0 / 7 : 7	$500K		1
OH	Mar-80	3.68	9.9	n/a	Light Breeze	Hotel	16	20	0 / 1 : 1	$20K		1
MN	Mar-80	8.06	12	n/a	Gentle Breeze	Elderly Housing	3	17	0 / 1 : 1	$4K		3
OH	May-80	7.25	12	n/a	Gentle Breeze	Apt. Bld.	6	16	0 / 1 : 1	$2K		3
NY	May-80	5.98	10.1	n/a	Light Breeze	Apt. Bld.	2	7	0 / 1 : 1	$7K		1
OH	May-80	8.52	14	n/a	Gentle Breeze	Apt. Bld.	6	16	0 / 1 : 1	$1K		3
SD	May-80	12.08	17.9	28.77	Moderate Wind	Grain Elevator	B	7	0 / 2 : 2	$207K	02502	2
NY	Jun-80	9.44	16.9	n/a	Gentle Breeze	Apt. Bld.	6	7	2 / 0 : 2	Ukwn.		3
IA	Jul-80	7.48	14	n/a	Gentle Breeze	Dormitory	7	13	0 / 1 : 1	$25K		3
FL	Jul-80	n/a	n/a	n/a	n/a	Apt. Bld.	4	7	0 / 1 : 1	$115K		1
NY	Jul-80	9.78	15	n/a	Gentle Breeze	Hotel	5	12	0 / 1 : 1	Ukwn.		3
NY	Jul-80	7.83	9.9	n/a	Gentle Breeze	Apt. Bld.	3	22	0 / 2 : 2	Ukwn.		3
IL	Jul-80	10.59	14	n/a	Gentle Breeze	Railroad Station	sub-l.	10	0 / 1 : 1	$100K		3
PA	Aug-80	8.29	11.1	n/a	Gentle Breeze	Apt. Bld.	3	7	0 / 1 : 1	$1K		3
MN	Sep-80	5.64	12.8	n/a	Light Breeze	Grain Elevator	sub-l.	13	0 / 3 : 3	$670K		1
NY	Oct-80	8.29	15	n/a	Gentle Breeze	Apt. Bld.	7	17	0 / 1 : 1	$5K		3
NV	Nov-80	6.33	10.1	n/a	Light Breeze	Hotel	1	23	0 / 85 : 85	$50M		1

Location	Date	Mean Wind Speed MPH [1,2]	Max Sust. [1,2]	Max Gust [1,2]	Mean Wind Class. [1,3]	Building	Floor of Origin	Total Flrs	Firefighter / Civilian : Total Deaths	Dollar Loss (USD)	NFPA Report #	Rating [7]
IL	Nov-80	13.69	15	27.62	Moderate Wind	Hotel	6	8	0 / 1 : 1	Ukwn.	05407	4
IL	Dec-80	7.6	10.9	n/a	Gentle Breeze	Apt. Bld.	2	14	0 / 2 : 2	Ukwn.		3
NY	Dec-80	14.61	15	n/a	Moderate Wind	Hotel	6	7	0 / 2 : 2	Ukwn.	03740	2
WV	1980	n/a	n/a	n/a	n/a	Elderly Housing	10	10	0 / 1 : 1	$3K		1
ON Canada	Jan-81	8.98	14	18.41	Gentle Breeze	Hotel	2	23	0 / 6 : 6	Ukwn.		3
PA	Jan-81	7.94	10.1	n/a	Gentle Breeze	Apt. Bld.	8	15	0 / 4 : 4	Ukwn.		3
NY	Jan-81	4.95	11.8	n/a	Light Breeze	Apt. Bld.	Ukwn.	7	0 / 3 : 3	Ukwn.		1
NV	Feb-81	7.94	8.9	n/a	Gentle Breeze	Hotel	8	30	0 / 9 : 9	$13M		3
OH	Feb-81	0.69	5.8	n/a	Light Air	Elderly Apt. Bld.	12	13	0 / 1 : 1	$105K		1
CA	Feb-81	5.98	13	n/a	Light Breeze	Apt. Bld.	5	7	0 / 1 : 1	$50K		1
CA	Feb-81	5.98	13	n/a	Light Breeze	Apt. Bld.	11	24	0 / 1 : 1	$240K		1
TX	Mar-81	7.6	15	n/a	Gentle Breeze	Hotel	3	10	0 / 1 : 1	Ukwn.		3
FL	Mar-81	10.59	15	n/a	Gentle Breeze	Hotel	3	7	0 / 1 : 1	Ukwn.		3
Mexico	Mar-81	3.5	5.8	n/a	Light Breeze	Hotel	18	19	2 / 1 : 3	$430K		1
NY	Mar-81	11.62	18.1	26.47	Gentle Breeze	Apt. Bld.	7	35	0 / 1 : 1	Ukwn.		3
Chile	Mar-81	n/a	n/a	n/a	n/a	Office Building	12	15	1 / 10 : 11	Ukwn.		1
MO	Apr-81	13	15.9	n/a	Moderate Wind	Apt. Bld.	1	10	0 / 8 : 8	$210K	02199	4
IL	Apr-81	11.39	15	n/a	Gentle Breeze	Apt. Bld.	14	16	0 / 1 : 1	Ukwn.		3
QC Canada	May-81	7.48	14	n/a	Gentle Breeze	Office Building	Ukwn.	7	3 / 0 : 3	Ukwn.	00297	4
IL	Oct-81	11.62	19.8	n/a	Gentle Breeze	Hotel	9	13	0 / 1 : 1	Ukwn.		3
IL	Oct-81	11.62	19.8	n/a	Gentle Breeze	Office Building	25	38	2 / 0 : 2	Ukwn.		3
MN	Jan-82	9.44	18.1	n/a	Gentle Breeze	Restaurant /Apt. Bld.	1	11	0 / 1 : 1	$400K		3
NY	Jan-82	25.32	27	40.28	Strong Wind	Apt. Bld.	2	7	0 / 1 : 1	Ukwn.	00959	2
MA	Jan-82	23.59	29.9	50.63	Fresh Wind	Apt. Bld.	8	8	0 / 1 : 1	$15K	00985	4
NY	Jan-82	28.19	28.9	42.58	Strong Wind	Hotel	1	8	0 / 1 : 1	Ukwn.	00974	4
Japan	Feb-82	4.6	10.2	n/a	Light Breeze	Hotel	9	10	0 / 32 : 32	Ukwn.		1

Location	Date	Mean Wind Speed MPH [1,2]	Max Sust. [1,2]	Max Gust [1,2]	Mean Wind Class. [1,3]	Building	Floor of Origin	Total Flrs	Firefighter / Civilian : Total Deaths	Dollar Loss (USD)	NFPA Report #	Rating [7]
NY	Feb-82	7.48	17.1	n/a	Gentle Breeze	Apt. Bld.	10	17	0 / 2 : 2	$7K		3
TX	Mar-82	19.79	22.9	34.52	Fresh Wind	Hotel	4	13	0 / 12 : 12	$1M	00004	4
NJ	Apr-82	14.5	20	26.47	Moderate Wind	Jail	8	8	0 / 7 : 7	Ukwn.	00008	2
IA	Apr-82	15.19	18.1	26.47	Moderate Wind	Grain Elevator	Ukwn.	7	0 / 5 : 5	$8M	01209	2
TX	May-82	7.94	12.8	n/a	Gentle Breeze	Condominium	11	16	0 / 1 : 1	$400K		3
IL	May-82	9.78	11.8	n/a	Gentle Breeze	Hotel	22	25	0 / 4 : 4	Ukwn.		3
MD	Jul-82	6.33	15.9	n/a	Light Breeze	Apt. Bld.	4	11	0 / 1 : 1	$12K		1
PA	Jul-82	7.71	12	n/a	Gentle Breeze	Apt. Bld.	5	7	0 / 1 : 1	$3K		3
NY	Jul-82	5.18	8.9	n/a	Light Breeze	Apt. Bld.	1	7	0 / 1 : 1	Ukwn.		1
ON Canada	Aug-82	9.32	15.9	n/a	Gentle Breeze	Hotel-Apt. Complex	18	38	0 / 1 : 1	$95K	02287	2
NY	Sep-82	11.05	17.1	n/a	Gentle Breeze	Hotel	14	18	0 / 1 : 1	Ukwn.		3
CA	Oct-82	4.83	10.1	n/a	Light Breeze	Apt. Bld.	4	11	0 / 1 : 1	$1M		1
NE	Nov-82	6.67	11.1	n/a	Light Breeze	Grain Elevator	sub-l.	10	0 / 6 : 6	$964K		1
TN	Nov-82	9.09	11.1	n/a	Gentle Breeze	Laboratory	Ukwn.	25	0 / 4 : 4	$2M		3
GA	Nov-82	6.44	15.9	n/a	Light Breeze	Elderly Apt. s	7	11	0 / 10 : 10	$255K		1
NY	Dec-82	12.2	17.1	25.32	Moderate Wind	Apt. Bld.	3	8	0 / 1 : 1	Ukwn.	02653	4
GA	Jan-83	6.67	12	n/a	Light Breeze	Elderly Housing	11	11	0 / 1 : 1	$18K		1
NC	Feb-83	11.28	18.1	26.47	Gentle Breeze	Elderly Housing	11	11	0 / 3 : 3	$100K		3
TX	Feb-83	5.18	9.9	n/a	Light Breeze	Apt. Bld.	6	16	0 / 2 : 2	$10K		1
CT	Feb-83	8.75	10.9	n/a	Gentle Breeze	Apt. Bld.	8	12	0 / 1 : 1	$2K		3
OH	Apr-83	20.7	28	42.58	Fresh Wind	Apt. Bld.	6	22	0 / 1 : 1	$20K	01394	4
NY	Apr-83	17.95	25.1	n/a	Moderate Wind	Apt. Bld.	6	7	1 / 0 : 1	$2M	00072	5
ON Canada	Apr-83	10.1	15	25.32	Gentle Breeze	Apt.	7	11	0 / 1 : 1	Ukwn.		3
HI	Apr-83	12.43	16.9	21.86	Moderate Wind	Hotel-Apt. Complex	9	30	0 / 1 : 1	$188K	00414	5
CA	May-83	13.12	15.9	27.62	Moderate Wind	Apt. Bld.	23	25	0 / 1 : 1	$120K	01202	2
ON Canada	May-83	8.1	8.9	n/a	Gentle Breeze		7	20	0 / 3 : 3	Ukwn.		3

Location	Date	Mean Wind Speed MPH [1,2]	Max Sust. [1,2]	Max Gust [1,2]	Mean Wind Class. [1,3]	Building	Floor of Origin	Total Flrs	Firefighter / Civilian : Total Deaths	Dollar Loss (USD)	NFPA Report #	Rating [7]
GA	Jun-83	4.03	8.9	n/a	Light Breeze	Apt. Bld.	13	15	0 / 2 : 2	$64K		1
MI	Jul-83	6.33	n/a	n/a	Light Breeze	Hotel	2	9	0 / 1 : 1	$350K		1
VA	Oct-83	5.41	17.9	n/a	Light Breeze	Hospital	4	18	1 / 0 : 1	$25K		1
CA	Oct-83	4.03	7	n/a	Light Breeze	Apt. Bld.	15	15	0 / 3 : 3	$250K		1
GA	Oct-83	2.76	8	n/a	Light Air	Apt. Bld.	3	20	0 / 1 : 1	$25K		1
IL	Dec-83	12.89	16.9	n/a	Moderate Wind	Hotel	2	8	0 / 4 : 4	$1M	00858	4
CA	Dec-83	3.11	6	n/a	Light Breeze	Hotel	2	8	0 / 3 : 3	$3M		1
WA	Dec-83	4.6	9.9	n/a	Light Breeze	Hotel	2	7	0 / 2 : 2	$80K		1
ON Canada	Dec-83	14.73	23.9	39.13	Moderate Wind	Elderly Housing	2	16	0 / 1 : 1	$4K	02663	2
South Korea	Jan-84	6.9	12.8	n/a	Light Breeze	Hotel	4	10	0 / 38 : 38	Ukwn.		1
NJ	Jan-84	5.18	8.9	n/a	Light Breeze	Apt. Bld.	3	12	0 / 1 : 1	$5K		1
ON Canada	Jan-84	10.01	12	n/a	Gentle Breeze	Apt. Bld.	23	23	0 / 2 : 2	$2K	01314	2
NJ	Apr-84	10.82	15	n/a	Gentle Breeze	Apt. Bld.	10	21	0 / 1 : 1	$40K		3
HI	May-84	9.55	11.1	n/a	Gentle Breeze	Hotel	8	29	0 / 1 : 1	$190K		3
NE	May-84	10.47	15.9	25.32	Gentle Breeze	Grain Elevator	Ukwn.	12	0 / 2 : 2	$850K		3
IL	Jun-84	19.79	21	32.22	Fresh Wind	Grain Elevator	1	11	0 / 1 : 1	Ukwn.	03681	2
NJ	Aug-84	7.83	8.9	n/a	Gentle Breeze	Office Building	7	14	1 / 0 : 1	Ukwn.		3
WI	Aug-84	7.36	9.9	n/a	Gentle Breeze	Hotel	4	7	0 / 1 : 1	$400K		3
FL	Aug-84	6.33	11.1	n/a	Light Breeze	Apt. Bld.	5	20	0 / 1 : 1	$100K		1
CA	Sep-84	6.56	11.1	n/a	Light Breeze	Office Building	SubFlr	24	0 / 2 : 2	Ukwn.		1
WA	Sep-84	3.22	6	n/a	Light Breeze	Hydro Plant	Ukwn.	17	0 / 1 : 1	$30K		1
NY	Sep-84	5.52	9.9	n/a	Light Breeze	Hotel	sub-l.	10	0 / 1 : 1	$100K		1
TX	Oct-84	11.28	15.9	25.32	Gentle Breeze	Hotel	9	18	0 / 1 : 1	$30K		3
NJ	Oct-84	5.06	8	n/a	Light Breeze	Hotel	3	9	0 / 15 : 15	$300K		1
DC	Oct-84	5.75	8.9	n/a	Light Breeze	Hotel	8	10	0 / 1 : 1	Ukwn.		1
NJ	Oct-84	5.06	8	n/a	Light Breeze	Hotel	3	9	0 / 15 : 15	$300K	00014	4

Location	Date	Mean Wind Speed MPH [1,2]	Max Sust. [1,2]	Max Gust [1,2]	Mean Wind Class. [1,3]	Building	Floor of Origin	Total Flrs	Firefighter / Civilian : Total Deaths	Dollar Loss (USD)	NFPA Report #	Rating [7]
Philippin	Nov-84	n/a	n/a	n/a	n/a	Hotel	17	16	0 / 10 : 10	Ukwn.		1
QC Canada	Nov-84	2.88	8.9	n/a	Light Air	Apt. Bld.	9	22	0 / 4 : 4	Ukwn.	03571	2
NY	Dec-84	16.8	20	31.07	Moderate Wind	School Building	4	13	1 / 0 : 1	Ukwn.	00138	2
IL	Dec-84	7.25	10.1	n/a	Gentle Breeze	Hotel (Res. Elderly)	1	9	0 / 8 : 8	Ukwn.		3
IL	Jan-85	18.99	20	33.37	Fresh Wind	Apt. Bld.	1	7	0 / 2 : 2	Ukwn.	00789	2
MD	Mar-85	9.67	15.9	n/a	Gentle Breeze	Apt. Bld.	7	9	0 / 1 : 1	$25K		3
NY	Apr-85	10.59	19	31.07	Gentle Breeze	Hospital	1	24	0 / 2 : 2	Ukwn.		3
GA	Apr-85	10.24	15	n/a	Gentle Breeze	Apt. Bld.	1	20	0 / 1 : 1	$80K		3
KS	May-85	3.22	6	n/a	Light Breeze	Nursing Home	2	7	0 / 1 : 1	$12K		1
FL	Jun-85	9.78	13	n/a	Gentle Breeze	Apt. Bld.	9	22	0 / 1 : 1	$500K		3
OH	Aug-85	1.96	8.9	n/a	Light Air	Silo	3	8	3 / 0 : 3	$58K		1
TN	Sep-85	2.42	7	n/a	Light Air	Bank Building	18	18	0 / 1 : 1	$150K		1
NY	Oct-85	11.85	18.1	25.32	Gentle Breeze	Hotel	10	12	0 / 1 : 1	Ukwn.		3
TX	Oct-85	9.44	18.1	25.32	Gentle Breeze	Retirement Hotel	5	11	0 / 1 : 1	$150K		3
SD	Nov-85	3.91	8	n/a	Light Breeze	Grain Elevator	1	16	0 / 3 : 3	$575K		1
MA	Dec-85	14.5	15.9	28.77	Moderate Wind	Apt. Bld.	3	7	0 / 1 : 1	Ukwn.	00321	5
OR	Jan-86	5.29	15	n/a	Light Breeze	Apt. Bld.	2	14	0 / 4 : 4	$100K		1
TX	Jan-86	4.6	8	n/a	Light Breeze	Apt. Bld.	9	25	0 / 1 : 1	$50K		1
Brazil	Feb-86	n/a	n/a	n/a	n/a	Office Building	Ukwn.	13	0 / 23 : 23	Ukwn.		1
NE	Feb-86	7.6	14	n/a	Gentle Breeze	Grain Elevator	Ukwn.	14	0 / 1 : 1	$350K		3
NY	Apr-86	12.31	15.9	25.32	Moderate Wind	Apt. Bld.	29	33	0 / 2 : 2	Ukwn.	00808	4
VA	May-86	9.78	11.1	n/a	Gentle Breeze	Apt. Bld.	8	16	0 / 1 : 1	$100K		3
NY	Jul-86	5.75	8.9	n/a	Light Breeze	Hotel	2	17	0 / 4 : 4	Ukwn.		1
IL	Jul-86	13.35	15	n/a	Moderate Wind	Apt. Bld.	19	22	0 / 1 : 1	Ukwn.	02361	4
OH	Aug-86	4.26	9.9	n/a	Light Breeze	Office Building	8	15	0 / 1 : 1	$100K		1
Norway	Sep-86	16.9	23.9	n/a	Moderate Wind	Hotel	1	13	0 / 14 : 14	Ukwn.	00603	4

Location	Date	Mean Wind Speed MPH [1,2]	Max Sust. [1,2]	Max Gust [1,2]	Mean Wind Class. [1,3]	Building	Floor of Origin	Total Flrs	Firefighter / Civilian : Total Deaths	Dollar Loss (USD)	NFPA Report #	Rating [7]
PA	Nov-86	9.55	12	n/a	Gentle Breeze	Apt. Bld.	6	7	0 / 4 : 4	Ukwn.		3
NY	Dec-86	14.85	32.1	41.43	Moderate Wind	Elec Distr System	6	7	0 / 2 : 2	Ukwn.	03757	2
MO	Dec-86	6.1	13	25.32	Light Breeze	Hospital	3	7	0 / 2 : 2	Ukwn.		1
PR	Dec-86	6.7	13.8	n/a	Light Breeze	Hotel	1	20	0 / 96 : 96	Ukwn.		1
IL	Jan-87	18.41	22	n/a	Fresh Wind	Apt. Bld.	15	15	0 / 2 : 2	Ukwn.	01100	5
MI	Jan-87	10.7	18.1	n/a	Gentle Breeze	Apt. Bld.	5	9	0 / 1 : 1	$4K		3
NY	Jan-87	23.48	26	40.28	Fresh Wind	Apt. Bld.	9	23	0 / 2 : 2	Ukwn.	01234	5
OH	May-87	3.57	6	n/a	Light Breeze	Apt. Bld.	5	10	0 / 1 : 1	$95K		1
IL	May-87	7.71	9.9	n/a	Gentle Breeze	Office Building	20	30	0 / 1 : 1	Ukwn.		3
TN	Jun-87	2.76	11.1	n/a	Light Air	Hotel	11	11	0 / 1 : 1	$90K		1
BC Canada	Jul-87	5.75	9.9	n/a	Light Breeze	Hotel	B	13	0 / 1 : 1	$85K	01757	4
NJ	Aug-87	8.06	12	n/a	Gentle Breeze	Hotel	B	7	0 / 1 : 1	Ukwn.		3
ME	Aug-87	6.67	9.9	17.26	Light Breeze	Apt. Bld.	5	8	0 / 1 : 1	$30K		1
CA	Sep-87	3.34	9.9	n/a	Light Breeze	Fireworks Manufctr	Ukwn.	13	0 / 1 : 1	Ukwn.		1
IN	Oct-87	8.75	18.1	n/a	Gentle Breeze	Hotel	1	7	0 / 9 : 9	Ukwn.		3
NY	Jan-88	24.51	28	44.88	Strong Wind	Apt. Bld.	1	9	0 / 2 : 2	Ukwn.	01158	2
NY	Jan-88	16.8	20	36.82	Moderate Wind	Apt. Bld.	1	10	0 / 4 : 4	Ukwn.	00001	4
NY	Feb-88	13.46	20	31.07	Moderate Wind	Hospital	3	8	0 / 1 : 1	Ukwn.	01387	2
IN	Apr-88	8.98	12	n/a	Gentle Breeze				0 / 0 : 0	Ukwn.	01553	5
CA	May-88	5.75	9.9	n/a	Light Breeze	Office Building	12	62	0 / 1 : 1	$50M		1
LA	May-88	9.55	13	n/a	Gentle Breeze	Oil Refinery	Ukwn.	16	0 / 7 : 7	$330 M		3
NJ	Aug-88	6.67	8	n/a	Light Breeze	Apt. Bld.	2	13	0 / 8 : 8	Ukwn.		1
CA	Sep-88	3.34	8.9	16.11	Light Breeze	Hospital	4	8	0 / 1 : 1	Ukwn.		1
PA	Dec-88	11.05	22	35.67	Gentle Breeze	Apt. Bld.	6	10	0 / 1 : 1	$19K		3
QC Canada	Dec-88	n/a	n/a	n/a	n/a	Hospital	1	9	0 / 5 : 5	$2M	n/a	1
NY	Feb-89	23.02	25.1	41.43	Fresh Wind	Apt. Bld.	14	18	0 / 3 : 3	Ukwn.	00513	5

Location	Date	Mean Wind Speed MPH [1,2]	Max Sust. [1,2]	Max Gust [1,2]	Mean Wind Class. [1,3]	Building	Floor of Origin	Total Flrs	Firefighter / Civilian : Total Deaths	Dollar Loss (USD)	NFPA Report #	Rating [7]
NY	Feb-89	8.75	11.1	n/a	Gentle Breeze	Apt. Bld.	4	8	0 / 1 : 1	$1K		3
HI	Mar-89	7.6	15.9	n/a	Gentle Breeze	Apt. Bld.	16	42	0 / 1 : 1	$910K		3
SC	Jun-89	7.6	13	20.71	Gentle Breeze	Apt. Bld.	Ukwn.	12	0 / 1 : 1	$5K		3
GA	Jun-89	9.78	15	n/a	Gentle Breeze	Office Building	6	10	0 / 5 : 5	$3M		3
CT	Aug-89	5.87	11.1	n/a	Light Breeze	Hotel	2	8	0 / 1 : 1	Ukwn.		1
TX	Oct-89	6.1	11.1	n/a	Light Breeze	Plastic Manufctr	Ukwn.	20	0 / 23 : 23	$700 M		1
CT	Oct-89	7.94	9.9	n/a	Gentle Breeze	Glass Manufctr	Ukwn.	8	0 / 1 : 1	$1M		3
UT	Feb-90	3.68	8	n/a	Light Breeze	Apt. Bld.	10	11	0 / 2 : 2	$600K		1
MO	Feb-90	9.55	12	n/a	Gentle Breeze	Apt. Bld.	4	12	0 / 1 : 1	$12K		3
GA	Feb-90	12.89	20	31.07	Moderate Wind	Apt. Bld.	11	13	0 / 2 : 2	$150K	00802	4
MO	Mar-90	15.08	18.1	23.02	Moderate Wind	Apt. Bld.	7	8	0 / 1 : 1	Ukwn.	01013	4
NJ	May-90	13	18.1	27.62	Moderate Wind	Apt. Bld.	23	24	0 / 1 : 1	Ukwn.	01669	4
MO	Aug-90	5.29	8	n/a	Light Breeze	Hospital	Ukwn.	7	0 / 1 : 1	Ukwn.		1
MO	Aug-90	2.19	6	n/a	Light Air	Hospital	7	12	0 / 1 : 1	Ukwn.		1
MI	Oct-90	4.49	8.9	n/a	Light Breeze	Apt. Bld.	11	12	0 / 1 : 1	$50K		1
MD	Nov-90	3.91	8.9	n/a	Light Breeze	Elderly Housing	10	18	0 / 1 : 1	$90K		1
NY	Nov-90	10.13	17.1	28.77	Gentle Breeze	Metal Manufctr	1	7	1 / 0 : 1	Ukwn.		3
NY	Dec-90	11.28	14	23.02	Gentle Breeze	Apt. Bld.	1	7	0 / 3 : 3	Ukwn.		3
MN	Dec-90	9.78	12	n/a	Gentle Breeze	Apt. Bld.	8	21	0 / 1 : 1	$10K		3
NY	Feb-91	17.49	25.1	40.28	Moderate Wind	Hotel	3	7	0 / 2 : 2	Ukwn.	00873	4
PA	Feb-91	14.38	20	29.92	Moderate Wind	Office Building	22	38	3 / 0 : 3	Ukwn.	n/a	1
LA	Mar-91	12.43	19	31.07	Moderate Wind	Petroleum Refinery	Ukwn.	10	0 / 6 : 6	$23M	00508	2
NY	Mar-91	15.42	24.1	39.13	Moderate Wind	Hospital	17	23	0 / 1 : 1	Ukwn.	00854	2
CA	Mar-91	12.2	17.1	25.32	Moderate Wind	Office Building	2	18	0 / 1 : 1	$12M	00938	4
China	May-91	6.1			Gentle Breeze	Hotel	3	7	0 / 6 : 6			1
WA	Jul-91	4.49	13	n/a	Light Breeze	Grain Elevator	7	7	0 / 1 : 1	$15K		1

Location	Date	Mean Wind Speed MPH [1,2]	Max Sust. [1,2]	Max Gust [1,2]	Mean Wind Class. [1,3]	Building	Floor of Origin	Total Flrs	Firefighter / Civilian : Total Deaths	Dollar Loss (USD)	NFPA Report #	Rating [7]
CA	Sep-91	7.25	14	n/a	Gentle Breeze	Condominiums	19	20	0 / 2 : 2	$150K		3
FL	Jan-92	6.44	11.1	n/a	Light Breeze	Apt. Bld.	2	22	0 / 1 : 1	$7K		1
IN	Feb-92	12.31	17.1	n/a	Moderate Wind	Hotel	3	9	2 / 1 : 3	$1M	00001	4
OH	Apr-92	4.95	7	n/a	Light Breeze	Apt. Bld.	7	7	0 / 1 : 1	$35K		1
IN	Oct-92	9.21	11.8	n/a	Gentle Breeze	Power Plant	7	9	0 / 3 : 3	$3M		3
NY	Nov-92	14.04	15	25.32	Moderate Wind	Apt. Bld.	11	12	0 / 2 : 2	Ukwn.	01827	1
CA	Feb-93	4.49	14	n/a	Light Breeze	Apt. Bld.	11	16	0 / 1 : 1	$7K		1
NY	Feb-93	11.85	15	26.47	Gentle Breeze	Apt. Bld.	5	12	1 / 0 : 1	$2M		3
FL	Feb-93	13.81	15.9	n/a	Moderate Wind	Apt. Bld.	7	10	0 / 1 : 1	$75K	00753	2
NY	Feb-93	5.87	7	n/a	Light Breeze	Office Building	Sub-B	110	0 / 6 : 6	$230 M		1
OH	Mar-93	18.3	25.1	43.73	Fresh Wind	Apt. Bld.	4	10	0 / 1 : 1	$1K	00703	2
MO	Mar-93	11.28	14	n/a	Gentle Breeze	Apt. Bld.	2	7	0 / 1 : 1	$13K		3
China	May-93	12.3			Moderate Wind	Emporium	2	7	0 / 0 : 0			3
MI	Apr-93	11.85	14	n/a	Gentle Breeze	Apt. Bld.	16	22	0 / 1 : 1	$12K		3
CA	Aug-93	12.08	18.1	25.32	Moderate Wind	Apt. Bld.	3	20	1 / 0 : 1	$120K	00088	5
NY	Sep-93	9.32	11.8	n/a	Gentle Breeze	Hospital	7	8	0 / 3 : 3	Ukwn.		3
NY	Jan-94	18.64	26	n/a	Fresh Wind	Apt. Bld.	3	11	0 / 1 : 1	Ukwn.	00686	2
CT	Jan-94	3.11	4.9	n/a	Light Breeze	Apt. Bld.	5	7	0 / 1 : 1	$600K		1
NY	Feb-94	12.08	15.9	n/a	Moderate Wind	Apt. Bld.	6	16	0 / 1 : 1	Ukwn.	00905	4
NY	Feb-94	19.22	26.8	n/a	Fresh Wind	Apt. Bld.	4	8	0 / 1 : 1	Ukwn.	00982	2
OR	Mar-94	4.72	11.1	n/a	Light Breeze	Apt. Bld.	4	12	0 / 1 : 1	$113K		1
TN	Apr-94	10.36	14	n/a	Gentle Breeze	Apt. Bld.	9	11	2 / 2 : 4	$500K		3
PA	Jun-94	7.6	12	n/a	Gentle Breeze	Apt. Bld.	1	8	0 / 1 : 1	$1M		3
PA	Aug-94	5.75	10.1	n/a	Light Breeze	Apt. Bld.	7	22	0 / 1 : 1	$675K		1
NY	Nov-94	16.23	24.9	n/a	Moderate Wind	Apt. Bld.	18	20	0 / 2 : 2	Ukwn.	00463	5
ON Canada	Jan-95	7.25	15	28.77	Gentle Breeze	Apt. Bld.	Ukwn.	30	0 / 6 : 6	Ukwn.	00002	5

Location	Date	Mean Wind Speed MPH [1,2]	Max Sust. [1,2]	Max Gust [1,2]	Mean Wind Class. [1,3]	Building	Floor of Origin	Total Flrs	Firefighter / Civilian : Total Deaths	Dollar Loss (USD)	NFPA Report #	Rating [7]
DE	Jan-95	7.71	15.9	n/a	Gentle Breeze	Apt. Bld.	2	15	0 / 1 : 1	$100K		3
China	Jan-95	7.6			Gentle Breeze	Emporium	3	9	0 / 10 : 10			1
China	Jan-95	3.3			Gentle Breeze	Emporium	2	4	0 / 0 : 0			1
QC Canada	Mar-95	5.75	10.9	n/a	Light Breeze	Apt. Bld.	1	8	0 / 5 : 5	$500K	01552	2
OK	Apr-95	12.08	15.9	21.86	Moderate Wind	Office Building	Outside	9	0 / 168 : 168	$136 M	00008	2
China	Apr-95	6.1			Gentle Breeze	Office	2	9	0 / 0 : 0			1
NY	Jun-95	11.97	17.1	n/a	Gentle Breeze	Apt. Bld.	10	14	0 / 1 : 1	Ukwn.		3
OH	Oct-95	8.17	11.8	n/a	Gentle Breeze	Industrial Plant	2	10	0 / 1 : 1	Ukwn.		3
NY	Jan-96	15.1	21.0	32.2	Moderate Wind	Apt.	3	13	1 / 0 : 1	$225K	00050	5
HI	Jan-96	7.25	12	n/a	Gentle Breeze	Observatory	5	14	0 / 3 : 3	$7M		3
China	Apr-96	8.4			Gentle Breeze	Emporium	1	6	0 / 0 : 0			1
FL	May-96	7.02	12	n/a	Gentle Breeze	Apt. Bld.	10	15	0 / 2 : 2	$400K		3
NE	Jul-96	9.55	13	n/a	Gentle Breeze	Sugar Manufctr	B	18	0 / 1 : 1	$44M		3
CO	Aug-96	8.06	16.9	n/a	Gentle Breeze	Apt. Bld.	Ukwn.	14	0 / 1 : 1	$2K		3
IN	Oct-96	4.6	11.1	n/a	Light Breeze	Grain Elevator	1	9	0 / 4 : 4	$45K		1
Hong Kong	Nov-96	7.7	9	n/a	Gentle Breeze	Office Building	B	16	1 / 39 : 40	Ukwn.		3
NY	Nov-96	7.94	10.1	n/a	Gentle Breeze	Hotel	4	7	0 / 3 : 3	Ukwn.		3
NY	Dec-96	11.97	18.1	26.47	Gentle Breeze	Apt. Bld.	5	7	0 / 2 : 2	Ukwn.		3
MO	Dec-96	10.24	14	n/a	Gentle Breeze	Apt. Bld.	Ukwn.	11	0 / 1 : 1	Ukwn.		3
China	Jan-97	3.3			Gentle Breeze	Hotel	2	8	0 / 10 : 10			1
NY	Jan-97	17.8	22.0	33.4	Moderate Wind	Apt. Bldg.	28	42	0 / 0 : 0	Ukwn.		5
OH	Jan-97	15.54	18.1	26.47	Moderate Wind	Apt. Bld.	1	11	0 / 1 : 1	$80K	00838	2
IL	Feb-97	12.54	13	n/a	Moderate Wind	Apt. Bld.	12	14	0 / 1 : 1	$1K	00950	2
PA	Feb-97	5.06	6	n/a	Light Breeze	Apt. Bld.	4	7	0 / 1 : 1	$75K		1
NJ	Mar-97	11.85	15	n/a	Gentle Breeze	Apt. Bld.	2	10	0 / 3 : 3	Ukwn.		3
MD	Apr-97	13.12	18.1	32.22	Moderate Wind	Apt. Bld.	4	15	0 / 1 : 1	$18K	01522	2

Location	Date	Mean Wind Speed MPH [1,2]	Max Sust. [1,2]	Max Gust [1,2]	Mean Wind Class. [1,3]	Building	Floor of Origin	Total Flrs	Firefighter / Civilian : Total Deaths	Dollar Loss (USD)	NFPA Report #	Rating [7]
NY	May-97	4.72	10.1	n/a	Light Breeze	Apt. Bld.	11	21	0 / 2 : 2	Ukwn.		1
NY	May-97	9.55	14	n/a	Gentle Breeze	Apt. Bld.	7	7	0 / 1 : 1	Ukwn.		3
Thailand	Jul-97	3.0	6.9	n/a	Light Air	Hotel	1	17	0 / 90 : 90	Ukwn.		1
NJ	Sep-97	9.44	15	21.86	Gentle Breeze	Apt. Bld.	17	20	0 / 1 : 1	$3K		3
HI	Sep-97	7.94	12	n/a	Gentle Breeze	Apt. Bld.	8	24	0 / 1 : 1	$190K		3
China	Oct-97	2.8			Light Air	Hotel	2	7	0 / 22 : 22			1
MO	Oct-97	12.54	18.1	29.92	Moderate Wind	Apt. Bld.	7	12	0 / 1 : 1	Ukwn.	02690	2
CA	Nov-97	6.1	9.9	n/a	Light Breeze	Hotel	1	12	0 / 1 : 1	Ukwn.		1
HI	Nov-97	5.87	8.9	n/a	Light Breeze	Apt. Bld.	8	10	0 / 1 : 1	$240K		1
China	Nov-97	7			Gentle Breeze	Emporium	2	6	0 / 15 : 15			1
MI	Dec-97	10.36	13	20.71	Gentle Breeze	Apt. Bld.	Ukwn.	10	0 / 1 : 1	$24K		3
China	Dec-97	4.1			Gentle Breeze	Emporium	3	7	0 / 11 : 11			1
KS	Jan-98	1.84	5.1	n/a	Light Air	Apt. Bld.	Ukwn.	9	0 / 1 : 1	$8K		1
MA	Jan-98	13.81	15.9	n/a	Moderate Wind	Apt. Bld.	4	7	0 / 1 : 1	$15K	00739	2
NY	Jan-98	8.29	10.1	n/a	Gentle Breeze	Apt. Bld.	12	18	0 / 1 : 1	Ukwn.		3
WA	Feb-98	8.29	13	n/a	Gentle Breeze	Apt. Bld.	6	7	0 / 1 : 1	$50K		3
VA	Feb-98	4.6	8.9	n/a	Light Breeze	Apt. Bld.	Ukwn.	8	0 / 1 : 1	$30K		1
FL	Mar-98	7.13	10.1	17.26	Gentle Breeze	Apt. Bld.	10	13	0 / 1 : 1	$120K		3
NY	Apr-98	6.9	11.1	n/a	Light Breeze	Apt. Bld.	10	12	1 / 0 : 1	Ukwn.		1
KS	Jun-98	18.76	19	31.07	Fresh Wind	Grain Elevator	Ukwn.	12	0 / 7 : 7	$75M	00004	2
NJ	Aug-98	5.29	10.1	n/a	Light Breeze	Apt. Bld.	4	22	0 / 4 : 4	Ukwn.		1
MO	Oct-98	1.73	5.1	n/a	Light Air	Apt. Bld.	10	13	0 / 1 : 1	$13K		1
NY	Dec-98	6.33	13	n/a	Light Breeze	Apt. Bld.	10	10	3 / 0 : 3	$350K	10	5
VA	Dec-98	18.53	22.9	40.28	Fresh Wind	Apt. Bld.	3	12	0 / 1 : 1	$100K	04351	2
NY	Dec-98	8.63	18.1	28.77	Gentle Breeze	Apt. Bld.	Ukwn.	29+	0 / 4 : 4	Ukwn.		3
China	Dec-98	2			Light Air	Emporium	3	8	0 / 8 : 8			1

Location	Date	Mean Wind Speed MPH [1,2]	Max Sust. [1,2]	Max Gust [1,2]	Mean Wind Class. [1,3]	Building	Floor of Origin	Total Flrs	Firefighter / Civilian : Total Deaths	Dollar Loss (USD)	NFPA Report #	Rating [7]
FL	Dec-98	6.33	15.9	23.02	Light Breeze	Apt. Bld.	10	13	0 / 1 : 1	$120K		1
MD	Feb-99	13	20	34.52	Moderate Wind	Apt. Bld.	15	30	0 / 1 : 1	$4M	00774	2
TN	Mar-99	14.5	26	37.98	Moderate Wind	Apt. Bld.	5	50	0 / 2 : 2	$150K	01024	2
NJ	Jul-99	6.9	10.1	n/a	Light Breeze	Apt. Bld.	17	19	0 / 1 : 1	Ukwn.		1
GA	Aug-99	9.21	13	18.41	Gentle Breeze	Energy Plant	B	10	0 / 3 : 3	$1M		3
NY	Oct-99	9.44	11.1	16.11	Gentle Breeze	Apt. Bld.	6	7	0 / 2 : 2	$12K		3
China	Nov-99	1.6			Light Air	Emporium	10	10	0 / 0 : 0			1
MA	Dec-99	9.55	14	n/a	Gentle Breeze	Vacant Property	B	9	6 / 0 : 6	Ukwn.		3
NE	Dec-99	5.98	15	n/a	Light Breeze	Power Plant	9	9	0 / 2 : 2	Ukwn.		1
China	Dec-99	2.2			Light Air	Hotel	-1	18	0 / 20 : 20			1
China	Jan-00	6.7			Gentle Breeze	Office	1	8	0 / 1 : 1			1
MI	Feb-00	7.71	14	24.17	Gentle Breeze	Apt. Bld.	1	8	0 / 1 : 1	$220K		3
China	Apr-00	5.6			Gentle Breeze	Hotel	10	10	0 / 13 : 13			1
CA	Jun-00	7.02	14	n/a	Gentle Breeze	Hotel	7	7	0 / 1 : 1	$2K		3
Russia	Aug-00	2.1	6.67	n/a	Light Air	TV/Radio Tower	99	99	1 / 1 : 2	Ukwn.		1
Mexico	Jan-01	3.5	15.9	n/a	Light Breeze	Hotel	B	26	2 / 1 : 3	Ukwn.		1
MD	Feb-01	6.9	10.1	n/a	Light Breeze	Apt. Bld.	8	15	0 / 1 : 1	$11K		1
South Korea	Mar-01	13.7	19.4	n/a	Moderate Wind	Office Building	Ukwn.	10	1 / 1 : 2	Ukwn.	00297	2
Brazil	Mar-01	n/a	n/a	n/a	n/a	Oil Rig	Ukwn.	40	0 / 10 : 10	Ukwn.		1
NY	Apr-01	9.5	13.0	n/a	Gentle Breeze	Apt. Bldg.	24	37	0 / 0 : 0	Ukwn.		5
ON Canada	Apr-01	4.26	7	n/a	Light Breeze	Apt. Bld.	10	10	1 / 1 : 2	$50K		1
MD	May-01	10.13	17.1	n/a	Gentle Breeze	Apt. Bld.	2	9	0 / 1 : 1	$60K		3
Kazakhstan	May-01	2.2	4.5	n/a	Light Air	Hotel	2	26	0 / 4 : 4	Ukwn.		1
IL	Aug-01	10.13	12	n/a	Gentle Breeze	Apt. Bld.	5	7	0 / 2 : 2	Ukwn.		3
NY	Sep-01	4.72	8	n/a	Light Breeze	Office Buildings	94/78	110/ 110	340 / 2451 : 2791	$33B		1
TX	Oct-01	11.5	25.1	44.88	Gentle Breeze	Apt. Bld.	5	41	1 / 1 : 2	Ukwn.		3

Location	Date	Mean Wind Speed MPH [1,2]	Max Sust. [1,2]	Max Gust [1,2]	Mean Wind Class. [1,3]	Building	Floor of Origin	Total Flrs	Firefighter / Civilian : Total Deaths	Dollar Loss (USD)	NFPA Report #	Rating [7]
IL	Jan-02	16.92	20	n/a	Moderate Wind	Apt. Bld.	14	44	0 / 1 : 1	Ukwn.	00675	5
LA	Jan-02	10.7	13	21.86	Gentle Breeze	Apt. Bld.		7	0 / 0 : 0	n/a	FIDO	3
MO	Feb-02	5.29	10.1	n/a	Light Breeze	Apt. Bld.		13	0 / 0 : 0	$27K	FIDO	3
MA	Feb-02	5.87	8	18.41	Light Breeze	Apt. Bld.		12	0 / 0 : 0	$20K	FIDO	3
NY	Feb-02	12.2	15.9	32.22	Moderate Wind	Apt. Bld.		35	0 / 0 : 0	n/a	FIDO	4
IL	Mar-02	12.77	16.9	n/a	Moderate Wind	Mercantile		10	0 / 0 : 0	$20K	FIDO	4
PA	Mar-02	5.87	12	n/a	Light Breeze	Office		11	0 / 0 : 0	$500K	FIDO	3
China	Mar-02	5.1			Gentle Breeze	Office	2	9	0 / 19 : 19			1
PA	Apr-02	4.72	8.9	n/a	Light Breeze	Office		18	0 / 0 : 0	$500K	FIDO	3
TX	Apr-02	12.66	14	n/a	Moderate Wind	Hospital		9	0 / 0 : 0	$20K	FIDO	4
FL	Jun-02	4.95	18.1	28.77	Light Breeze	Condominium	5	11	0 / 2 : 2	$250K		1
NY	Jun-02	9.9	14	20.71	Gentle Breeze	Hospital		7	0 / 0 : 0	n/a	FIDO	3
CT	Jun-02	6.21	11.1	17.26	Light Breeze	Power Plant		7	0 / 0 : 0	n/a	FIDO	3
WV	Jul-02	2.53	8.9	n/a	Light Air	Apt. Bld.		8	0 / 0 : 0	n/a	FIDO	3
FL	Jul-02	5.87	12	n/a	Light Breeze	Hotel		22	0 / 0 : 0	n/a	FIDO	3
WI	Jul-02	3.22	8	n/a	Light Breeze	Printing Manufctr		11	0 / 0 : 0	$17M	FIDO	3
CA	Aug-02	9.21	15	n/a	Gentle Breeze	Bldg. under Constr		7	0 / 0 : 0	$90M	FIDO	3
FL	Aug-02	8.63	12	n/a	Gentle Breeze	Apt. Bld.		11	0 / 0 : 0	$60K	FIDO	3
MN	Aug-02	7.83	11.1	14.96	Gentle Breeze	Elec Distr Center		15	0 / 0 : 0	$2.5M	FIDO	3
NV	Aug-02	4.95	14	17.26	Light Breeze	Hotel	6	16	0 / 1 : 1	$11K		1
AB Canada	Sep-02	n/a	n/a	n/a	n/a	Apt. Bld.	4	12	0 / 1 : 1	$250K	01524	4
KS	Sep-02	7.48	11.1	n/a	Gentle Breeze	Distillery		7	0 / 0 : 0	$15M	FIDO	3
TN	Sep-02	11.28	15	26.47	Gentle Breeze	Power Plant		12	0 / 0 : 0	$25M	FIDO	3
MN	Sep-02	7.71	12	n/a	Gentle Breeze	Apt. Bld.		25	0 / 0 : 0	$100K	FIDO	3
NJ	Sep-02	6.21	11.1	n/a	Light Breeze	Apt. Bld.		15	0 / 0 : 0	n/a	FIDO	3
IA	Sep-02	6.21	11.1	16.11	Light Breeze	Grain Elevator		16	0 / 0 : 0	n/a	FIDO	3

Location	Date	Mean Wind Speed MPH [1,2]	Max Sust. [1,2]	Max Gust [1,2]	Mean Wind Class. [1,3]	Building	Floor of Origin	Total Flrs	Firefighter / Civilian : Total Deaths	Dollar Loss (USD)	NFPA Report #	Rating [7]
MA	Oct-02	13.92	19	26.47	Moderate Wind	Power Plant		25	0 / 0 : 0	$10M	FIDO	4
PA	Nov-02	10.47	14	17.26	Gentle Breeze	Hospital		9	0 / 0 : 0	n/a	FIDO	3
NY	Dec-02	20.25	22	33.37	Fresh Wind	Residential Fraternity		10	0 / 0 : 0	n/a	FIDO	4
IA	Dec-02	12.54	14	23.02	Moderate Wind	Hospital		8	0 / 0 : 0	n/a	FIDO	4
CT	Jan-03	9.44	13	18.41	Gentle Breeze	Apt. Bld.		10	0 / 0 : 0	n/a	FIDO	3
PA	Jan-03	10.7	15	20.71	Gentle Breeze	Apt. Bld.		32	0 / 0 : 0	$175K	FIDO	3
MD	Jan-03	7.36	11.1	21.86	Gentle Breeze	Apt. Bld.		18	0 / 0 : 0	$1.5M	FIDO	3
WV	Jan-03	11.74	14	24.17	Gentle Breeze	Dormitory		10	0 / 0 : 0	n/a	FIDO	3
MD	Jan-03	10.01	21	32.22	Gentle Breeze	Apt. Bld.	3	14	0 / 2 : 2	$77K		3
China	Feb-03	4.5			Gentle Breeze	Hotel	1	8	0 / 33 : 33			1
NJ	Feb-03	11.51	14	21.86	Gentle Breeze	Apt. Bld.		12	0 / 0 : 0	n/a	FIDO	3
PA	Feb-03	5.87	11.1	n/a	Light Breeze	Apt. Bld.		13	0 / 0 : 0	$350K	FIDO	3
PA	Mar-03	8.52	11.1	18.41	Gentle Breeze	Elderly Housing	Ukwn.	10	0 / 1 : 1	Ukwn.		3
IL	Apr-03	12.43	15	39.13	Moderate Wind	Mercantile		14	0 / 0 : 0	n/a	FIDO	4
KY	May-03	5.52	11.1	n/a	Light Breeze	Dormitory	Ukwn.	9	0 / 1 : 1	$4K		1
IL	Jun-03	6.9	8.9	n/a	Light Breeze	Office		7	0 / 0 : 0	$2M	FIDO	3
FL	Jun-03	5.98	12	n/a	Light Breeze	Office		42	0 / 0 : 0	n/a	FIDO	3
GA	Jul-03	6.56	8.9	n/a	Light Breeze	Library		7	0 / 0 : 0	$6M	FIDO	3
Taiwan	Aug-03	15.0	18	n/a	Moderate Wind	Apt. Bld.	Ukwn.	8	0 / 13 : 13	Ukwn.	n/a	3
OH	Aug-03	4.95	8.9	n/a	Light Breeze	Grain Manufctr	B	7	0 / 1 : 1	$8M		1
IA	Sep-03	14.27	18.1	25.32	Moderate Wind	Food Manufctr		12	0 / 0 : 0	$1M	FIDO	4
FL	Oct-03	7.48	15	n/a	Gentle Breeze	Apt. Bld.		16	0 / 0 : 0	n/a	FIDO	3
NJ	Oct-03	5.52	10.1	n/a	Light Breeze	Apt. Bld.		25	0 / 0 : 0	n/a	FIDO	3
OH	Oct-03	6.67	9.9	n/a	Light Breeze	Mill		7	2 / 0 : 2	$100K		1
IL	Oct-03	3.8	8	n/a	Light Breeze	Office Building	12	27	0 / 6 : 6	Ukwn.		1
WI	Dec-03	9.32	15.9	18.41	Gentle Breeze	Bank		23	0 / 0 : 0	n/a	FIDO	3

Location	Date	Mean Wind Speed MPH [1,2]	Max Sust. [1,2]	Max Gust [1,2]	Mean Wind Class. [1,3]	Building	Floor of Origin	Total Flrs	Firefighter / Civilian : Total Deaths	Dollar Loss (USD)	NFPA Report #	Rating [7]
NE	Jan-04	9.67	14	n/a	Gentle Breeze	Bldg. under Constr		9	0 / 0 : 0	$40M	FIDO	3
Egypt	Jan-04	14.4	23	n/a	Moderate Wind	Apt. Bld.	Ukwn.	12	8 / 6 : 14	Ukwn.	00299	2
NJ	Feb-04	13.46	23.9	32.22	Moderate Wind	Apt. Bld.		20	0 / 0 : 0	n/a	FIDO	4
IL	Mar-04	9.21	12	20.71	Gentle Breeze	Apt. Bld.		43	0 / 0 : 0	n/a	FIDO	3
MO	Apr-04	11.51	15.9	21.86	Gentle Breeze	Apt. Bld.		8	0 / 0 : 0	$30K	FIDO	3
NY	May-04	11.74	15	25.32	Gentle Breeze	Apt. Bld.	10	21	0 / 1 : 1	Ukwn.		3
NY	Jun-04	14.27	21	32.22	Moderate Wind	Apt. Bld.		25	0 / 0 : 0	n/a	FIDO	4
CA	Jul-04	5.06	8.9	n/a	Light Breeze	Food Manufctr		10	0 / 0 : 0	$10M	FIDO	3
IL	Aug-04	4.37	8	n/a	Light Breeze	Hospital		18	0 / 1 : 1	$30K		1
ON Canada	Sep-04	6.1	7	n/a	Light Breeze	Apt. Bld.		19	0 / 0 : 0	n/a	FIDO	3
NY	Sep-04	17.5	25.1	39.1	Moderate Wind	Apt. Bldg.	37	44	0 / 0 : 0	Ukwn.		5
OH	Sep-04	4.6	9.9	n/a	Light Breeze	Iron/Steel Manufctr		10	0 / 0 : 0	$500K	FIDO	3
NY	Oct-04	15.19	22.9	39.13	Moderate Wind	Office		31	0 / 0 : 0	n/a	FIDO	4
IL	Dec-04	8.86	13	20.71	Gentle Breeze	Office		54	0 / 0 : 0	$1M	FIDO	3
OH	Dec-04	10.7	16.9	n/a	Gentle Breeze	Food Manufctr		17	0 / 0 : 0	$2.2M	FIDO	3
CO	Dec-04	3.45	7	n/a	Light Breeze	Apt. Bld.		13	0 / 0 : 0	$35K	FIDO	3
CT	Jan-05	12.08	15	24.17	Moderate Wind	Hospital		8	0 / 0 : 0	n/a	FIDO	4
DC	Jan-05	4.03	10.1	n/a	Light Breeze	Apt.		11	0 / 2 : 2	n/a		1
OK	Jan-05	7.48	8.9	n/a	Gentle Breeze	Grain Manufctr		8	0 / 1 : 1	$3M		3
NY	Jan-05	12.43	18.1	25.32	Moderate Wind	Apt.		7	0 / 1 : 1	n/a	00691	4
MA	Feb-05	6.44	18.1	25.32	Light Breeze	Apt. Bld.		22	0 / 0 : 0	$34K	FIDO	3
England	Feb-05	8.1	12	n/a	Gentle Breeze	Apt.		18	2 / 1 : 3	n/a		3
DE	Feb-05	4.03	8.9	n/a	Light Breeze	Apt.		12	0 / 1 : 1	$30K		1
MD	Apr-05	6.56	13	n/a	Light Breeze	Apt.		11	0 / 1 : 1	$40K		1
MD	Apr-05	10.01	15	17.26	Gentle Breeze	Apt.		15	0 / 2 : 2	$350K		3
NJ	Apr-05	3.68	8	n/a	Light Breeze	Apt. Bld.		21	0 / 0 : 0	n/a	FIDO	3

Location	Date	Mean Wind Speed MPH [1,2]	Max Sust. [1,2]	Max Gust [1,2]	Mean Wind Class. [1,3]	Building	Floor of Origin	Total Flrs	Firefighter / Civilian : Total Deaths	Dollar Loss (USD)	NFPA Report #	Rating [7]
ND	Apr-05	17.61	27	39.13	Moderate Wind	Grain elevator		12	0 / 0 : 0	$86K	FIDO	4
AR	May-05	1.61	6	n/a	Light Air	Apt.		11	0 / 2 : 2	$352K		1
OH	May-05	12.89	17.1	24.17	Moderate Wind	Apt. Bld.		7	0 / 0 : 0	n/a	FIDO	4
MA	Jun-05	8.75	15.9	25.32	Gentle Breeze	Church		10	0 / 0 : 0	$10M	FIDO	3
WV	Jun-05	5.41	8.9	16.11	Light Breeze	Mill Manufctr		7	0 / 0 : 0	n/a	FIDO	3
NY	Jul-05	8.86	15	18.41	Gentle Breeze	Apt. Bld.		10	0 / 0 : 0	n/a	FIDO	3
France	Sep-05	4.7	8	17.1	Light Breeze	Apt.		18	0 / 18 : 18	n/a		1
MT	Nov-05	2.3	7	n/a	Light Air	Grain Elevator		10	1 / 0 : 1	n/a		1
MN	Nov-05	7.6	15.9	n/a	Gentle Breeze	Power Plant		24	0 / 1 : 1	$1M		3
GA	Nov-05	12.2	18.1	28.77	Moderate Wind	Apt.		9	0 / 1 : 1	n/a	01454	2
IL	Dec-05	11.16	14	20.71	Gentle Breeze	Apt. Bld.		22	0 / 0 : 0	n/a	FIDO	3
MA	Dec-05	5.41	18.1	34.52	Light Breeze	Hotel		12	0 / 0 : 0	$500K	FIDO	3
KS	Dec-05	4.14	10.1	n/a	Light Breeze	Apt. Bld.		8	0 / 0 : 0	$55K	FIDO	3
NY	Jan-06	21.6	26.0	38.0	Fresh Wind	Apt. Bldg.	6	13	0 / 0 : 0	Ukwn.		5
MD	Jan-06	16.46	27	47.18	Moderate Wind	Apt. Bld.		8	0 / 0 : 0	$40K	FIDO	4
NY	Jan-06	9.44	19	29.92	Gentle Breeze	Apt.		7	1 / 0 : 1	n/a		3
GA	Jan-06	11.16	20	33.37	Gentle Breeze	Hotel		7	0 / 1 : 1	$4M		3
NY	Jan-06	6.9	15.9	26.47	Light Breeze	Apt.		20	0 / 3 : 3	n/a		1
Russia	Jan-06	11	20	27.2	Gentle Breeze	Office		9	0 / 9 : 9	n/a		3
NY	Feb-06	23.4	26.0	42.6	Fresh Wind	Apt. Bldg.	24	41	0 / 0 : 0	Ukwn.		5
Russia	Mar-06	8.6	17.8	n/a	Gentle Breeze	Dormitory		9	0 / 4 : 4	n/a		3
NJ	Mar-06	4.6	11.1	18.41	Light Breeze	Dormitory		16	0 / 0 : 0	n/a	FIDO	3
DE	Apr-06	11.28	16.9	25.32	Gentle Breeze	Apt.		15	0 / 1 : 1	$3M		3
Russia	Apr-06	2.7	4.5	n/a	Light Air	Dormitory		26	0 / 2 : 2	n/a		1
OH	May-06	2.65	8.9	16.11	Light Air	Apt. Bld.		13	0 / 0 : 0	$150K	FIDO	3
VA	May-06	5.29	8.9	n/a	Light Breeze	Apt.		9	0 / 2 : 2	n/a		1

Location	Date	Mean Wind Speed MPH [1,2]	Max Sust. [1,2]	Max Gust [1,2]	Mean Wind Class. [1,3]	Building	Floor of Origin	Total Flrs	Firefighter / Civilian : Total Deaths	Dollar Loss (USD)	NFPA Report #	Rating [7]
NH	Jul-06	5.18	8.9	n/a	Light Breeze	Power Plant		14	0 / 0 : 0	$60K	FIDO	3
NE	Aug-06	10.7	15	n/a	Gentle Breeze	Bldg. renovating		11	0 / 1 : 1	$25K		3
OH	Oct-06	8.63	13	n/a	Gentle Breeze	Office		30	0 / 0 : 0	n/a	FIDO	3
MA	Dec-06	20.83	26	40.28	Fresh Wind	Office		17	0 / 1 : 1	n/a	01805	2
IL	Jan-07	12.43	15.9	24.17	Moderate Wind	Apt.		44	0 / 2 : 2	n/a	00624	4
CA	Jan-07	7.25	8.9	n/a	Gentle Breeze	Health Clinic		17	0 / 0 : 0	$200K	FIDO	3
MN	Feb-07	15.08	20	32.22	Moderate Wind	Apt. Bld.		21	0 / 0 : 0	$18K	FIDO	4
NJ	Feb-07	15	n/a	22	Moderate Wind	House		2	0 / 0 : 0	$2M.	01224	5
NY	Feb-07	11.74	16.9	26.47	Gentle Breeze	Apt.		8	1 / 0 : 1	n/a		3
CA	Mar-07	13	20	32.22	Moderate Wind	Apt.		20	0 / 1 : 1	$1M	00789	4
OK	Apr-07	7.25	12	18.41	Gentle Breeze	Apt. Bld.		11	0 / 0 : 0	n/a	FIDO	3
NY	Apr-07	15.42	20	29.92	Moderate Wind	Apt.		17	0 / 2 : 2	n/a	01747	4
VA	Apr-07	25		n/a	Strong Wind	House		2	1 / 0 : 1	Ukwn.	00072	5
KY	May-07	3.91	11.1	17.26	Light Breeze	Apt. Bld.		12	0 / 0 : 0	n/a	FIDO	3
MD	May-07	3.68	12	18.41	Light Breeze	Dormitory		12	0 / 0 : 0	n/a	FIDO	3
NJ	Oct-07	11.05	15.9	23.02	Gentle Breeze	Bldg under Constr		18	0 / 0 : 0	n/a	FIDO	3
WI	Nov-07	4.37	11.1	n/a	Light Breeze	Apt. Bld.		7	0 / 0 : 0	$206K	FIDO	3
NY	Jan-08	18.9	22.0	31.1	Moderate Wind	Apt. Bldg.	14	25	1 / 0 : 1	Ukwn.		5
NY	Mar-08	9.4	13.0	n/a	Gentle Breeze	Apt. Bldg.	4	26	0 / 1 : 1	Ukwn.		5
NY	Apr-08	20.2	25.1	33.4	Fresh Wind	Apt. Bldg.	5	22	0 / 0 : 0	Ukwn.		5

Table A-3 Footnotes:

1. Weather data for North American cities taken from: The Old Farmer's Almanac: Weather History. Retrieved 12 May, 2008, http://www.almanac.com/weatherhistory/, Yankee Publishing Inc., P.O. Box 520, Dublin, NH 03444, USA, (603) 563-8111. Weather data for cities outside of North America taken from: National Climate Data Center-NOAA Satellite and Information Service. Received May, 2008. http://www.ncdc.noaa.gov/oa/ncdc.html
2. The definition for "Mean Wind Speed" is the mean wind speed for the day (mph). The definition for "Max Sustained" is the maximum sustained wind speed reported. The definition "Max Gust" is maximum wind gust reported for the day.
3. Weather classification according to Table A-1.
4. Rating according to Table A-2.

Table A-4 Historical summary of structural fires with probable but unconfirmed wind impact

Location	Date	Mean Wind Speed MPH [1,2]	Max Sust. [1,2]	Max Gust [1,2]	Mean Wind Class. [1,3]	Building	Floor of Origin	Total Flrs	Firefighter / Civilian : Total Deaths	Dollar Loss (USD)	NFPA Report #	Rating [4]
IL	Apr-71	13.58	24.1	n/a	Moderate Wind	Apt. Bld.	61	100	0 / 1 : 1	Ukwn.	01684	4
NY	Mar-72	16.69	30.1	n/a	Moderate Wind	Hotel	7	14	0 / 4 : 4	$200K	03334	4
ON Canada	Apr-73	15.77	20	27.62	Moderate Wind	Apt. Bld.	12	24	0 / 1 : 1	$2K	06565	4
NY	Jan-75	14.73	18.1	n/a	Moderate Wind	Apt. Bld.	10	15	0 / 3 : 3	Ukwn.	03116	4
IL	Feb-76	13.35	15	25.32	Moderate Wind	Elderly Housing	4	9	0 / 8 : 8	Ukwn.	00143	4
NY	Oct-76	15.77	27	41.43	Moderate Wind	Hotel	8	16	0 / 1 : 1	Ukwn.	03950	4
NY	Dec-76	14.04	18.1	28.77	Moderate Wind	Apt. Bld.	3	9	0 / 1 : 1	Ukwn.	05451	4
IL	Jan-77	12.54	14	n/a	Moderate Wind	Apt. Bld.	16	16	0 / 1 : 1	Ukwn.	00049	4
MD	77	14.15	17.1	27.62	Moderate Wind	Office Building	11	40	1 / 0 : 1	Ukwn.	01452	4
NE	May-77	14.61	22.9	34.52	Moderate Wind	Hotel (Vacant)	1	8	1 / 0 : 1	Ukwn.	01467	4
MO	Feb-79	13.46	18.1	26.47	Moderate Wind	Apt. Bld.	6	8	0 / 1 : 1	$6K	02031	4
NY	Mar-79	13.46	15	n/a	Moderate Wind	Motel	2	14	0 / 1 : 1	Ukwn.	01423	4
IL	Nov-80	13.69	15	27.62	Moderate Wind	Hotel	6	8	0 / 1 : 1	Ukwn.	05407	4
MO	Apr-81	13	15.9	n/a	Moderate Wind	Apt. Bld.	1	10	0 / 8 : 8	$210K	02199	4
QC Canada	May-81	7.48	14	n/a	Gentle Breeze	Office Building	Ukwn.	7	3 / 0 : 3	Ukwn.	00297	4
MA	Jan-82	23.59	29.9	50.63	Fresh Wind	Apt. Bld.	8	8	0 / 1 : 1	$15K	00985	4
NY	Jan-82	28.19	28.9	42.58	Strong Wind	Hotel	1	8	0 / 1 : 1	Ukwn.	00974	4
TX	Mar-82	19.79	22.9	34.52	Fresh Wind	Hotel	4	13	0 / 12 : 12	$1M	00004	4
NY	Dec-82	12.2	17.1	25.32	Moderate Wind	Apt. Bld.	3	8	0 / 1 : 1	Ukwn.	02653	4
OH	Apr-83	20.7	28	42.58	Fresh Wind	Apt. Bld.	6	22	0 / 1 : 1	$20K	01394	4
IL	Dec-83	12.89	16.9	n/a	Moderate Wind	Hotel	2	8	0 / 4 : 4	$1M	00858	4
NJ	Oct-84	5.06	8	n/a	Light Breeze	Hotel	3	9	0 / 15 : 15	$300K	00014	4
NY	Apr-86	12.31	15.9	25.32	Moderate Wind	Apt. Bld.	29	33	0 / 2 : 2	Ukwn.	00808	4
IL	Jul-86	13.35	15	n/a	Moderate Wind	Apt. Bld.	19	22	0 / 1 : 1	Ukwn.	02361	4
Norway	Sep-86	16.9	23.9	n/a	Moderate Wind	Hotel	1	13	0 / 14 : 14	Ukwn.	00603	4

Location	Date	Mean Wind Speed MPH [1,2]	Max Sust. [1,2]	Max Gust [1,2]	Mean Wind Class. [1,3]	Building	Floor of Origin	Total Flrs	Firefighter / Civilian : Total Deaths	Dollar Loss (USD)	NFPA Report #	Rating [4]
BC Canada	Jul-87	5.75	9.9	n/a	Light Breeze	Hotel	B	13	0 / 1 : 1	$85K	01757	4
NY	Jan-88	16.8	20	36.82	Moderate Wind	Apt. Bld.	1	10	0 / 4 : 4	Ukwn.	00001	4
GA	Feb-90	12.89	20	31.07	Moderate Wind	Apt. Bld.	11	13	0 / 2 : 2	$150K	00802	4
MO	Mar-90	15.08	18.1	23.02	Moderate Wind	Apt. Bld.	7	8	0 / 1 : 1	Ukwn.	01013	4
NJ	May-90	13	18.1	27.62	Moderate Wind	Apt. Bld.	23	24	0 / 1 : 1	Ukwn.	01669	4
NY	Feb-91	17.49	25.1	40.28	Moderate Wind	Hotel	3	7	0 / 2 : 2	Ukwn.	00873	4
CA	Mar-91	12.2	17.1	25.32	Moderate Wind	Office Building	2	18	0 / 1 : 1	$12M	00938	4
IN	Feb-92	12.31	17.1	n/a	Moderate Wind	Hotel	3	9	2 / 1 : 3	$1M	00001	4
NY	Feb-94	12.08	15.9	n/a	Moderate Wind	Apt. Bld.	6	16	0 / 1 : 1	Ukwn.	00905	4
NY	Feb-02	12.2	15.9	32.22	Moderate Wind	Apt. Bld.		35	0 / 0 : 0	n/a	FIDO	4
IL	Mar-02	12.77	16.9	n/a	Moderate Wind	Mercantile		10	0 / 0 : 0	$20K	FIDO	4
TX	Apr-02	12.66	14	n/a	Moderate Wind	Hospital		9	0 / 0 : 0	$20K	FIDO	4
AB Canada	Sep-02	n/a	n/a	n/a	n/a	Apt. Bld.	4	12	0 / 1 : 1	$250K	01524	4
MA	Oct-02	13.92	19	26.47	Moderate Wind	Power Plant		25	0 / 0 : 0	$10M	FIDO	4
NY	Dec-02	20.25	22	33.37	Fresh Wind	Residential Fraternity		10	0 / 0 : 0	n/a	FIDO	4
IA	Dec-02	12.54	14	23.02	Moderate Wind	Hospital		8	0 / 0 : 0	n/a	FIDO	4
IL	Apr-03	12.43	15	39.13	Moderate Wind	Mercantile		14	0 / 0 : 0	n/a	FIDO	4
IA	Sep-03	14.27	18.1	25.32	Moderate Wind	Food Manufctr		12	0 / 0 : 0	$1M	FIDO	4
NJ	Feb-04	13.46	23.9	32.22	Moderate Wind	Apt. Bld.		20	0 / 0 : 0	n/a	FIDO	4
NY	Jun-04	14.27	21	32.22	Moderate Wind	Apt. Bld.		25	0 / 0 : 0	n/a	FIDO	4
NY	Oct-04	15.19	22.9	39.13	Moderate Wind	Office		31	0 / 0 : 0	n/a	FIDO	4
CT	Jan-05	12.08	15	24.17	Moderate Wind	Hospital		8	0 / 0 : 0	n/a	FIDO	4
NY	Jan-05	12.43	18.1	25.32	Moderate Wind	Apt.		7	0 / 1 : 1	n/a	00691	4
ND	Apr-05	17.61	27	39.13	Moderate Wind	Grain elevator		12	0 / 0 : 0	$86K	FIDO	4
OH	May-05	12.89	17.1	24.17	Moderate Wind	Apt. Bld.		7	0 / 0 : 0	n/a	FIDO	4
MD	Jan-06	16.46	27	47.18	Moderate Wind	Apt. Bld.		8	0 / 0 : 0	$40K	FIDO	4

Location	Date	Mean Wind Speed MPH [1,2]	Max Sust. [1,2]	Max Gust [1,2]	Mean Wind Class. [1,3]	Building	Floor of Origin	Total Flrs	Firefighter / Civilian : Total Deaths	Dollar Loss (USD)	NFPA Report #	Rating [4]
IL	Jan-07	12.43	15.9	24.17	Moderate Wind	Apt.		44	0 / 2 : 2	n/a	00624	4
MN	Feb-07	15.08	20	32.22	Moderate Wind	Apt. Bld.		21	0 / 0 : 0	$18K	FIDO	4
CA	Mar-07	13	20	32.22	Moderate Wind	Apt.		20	0 / 1 : 1	$1M	00789	4
NY	Apr-07	15.42	20	29.92	Moderate Wind	Apt.		17	0 / 2 : 2	n/a	01747	4

Table A-4 Footnotes:

1. Weather data for North American cities taken from: The Old Farmer's Almanac: Weather History. Retrieved 12 May, 2008, http://www.almanac.com/weatherhistory/, Yankee Publishing Inc., P.O. Box 520, Dublin, NH 03444, USA, (603) 563-8111. Weather data for cities outside of North America taken from: National Climate Data Center-NOAA Satellite and Information Service. Received May, 2008. http://www.ncdc.noaa.gov/oa/ncdc.html
2. The definition for "Mean Wind Speed" is the mean wind speed for the day (mph). The definition for "Max Sustained" is the maximum sustained wind speed reported. The definition "Max Gust" is maximum wind gust reported for the day.
3. Weather classification according to Table A-1.
4. Rating according to Table A-2.

Table A-5 Historical summary of structural fires with reports confirming wind impact

Location	Date	Mean Wind Speed MPH [1,2]	Max Sust. [1,2]	Max Gust [1,2]	Mean Wind Class. [1,3]	Building	Floor of Origin	Total Flrs	Firefighter / Civilian : Total Deaths	Dollar Loss (USD)	NFPA Report #	Rating [4]
QC Canada	Jan-72	6.9	14	n/a	Light Breeze	Office Building	2	10	0 / 5 : 5	$371K	06062	5
MA	Oct-73	20.94	27	47.18	Fresh Wind	Apt. Bld.	3	35	1 / 0 : 1	$8K	05393	5
NJ	Feb-75	10.36	15	n/a	Gentle Breeze				0 / 0 : 0	Ukwn.	03778	5
MD	Jan-77	12.54	22	40.28	Moderate Wind	Apt. Bld.	7	22	0 / 1 : 1	$625K	00160	5
TX	Mar-77	13.12	16.9	19.56	Moderate Wind	Elderly Housing	8	11	0 / 4 : 4	$125K	01237	5
CA	Oct-79	19.79	25.1	42.58	Fresh Wind	Apt. Bld.	11	19	0 / 3 : 3	$350K	02570	5
NY	Jan-80	12.6	19.8	32.2	Moderate Wind	Apt. Bldg.	11	16	0 / 1 : 1	Ukwn.		5
NY	Apr-83	17.95	25.1	n/a	Moderate Wind	Apt. Bld.	6	7	1 / 0 : 1	$2M	00072	5
HI	Apr-83	12.43	16.9	21.86	Moderate Wind	Hotel-Apt. Complex	9	30	0 / 1 : 1	$188K	00414	5
MA	Dec-85	14.5	15.9	28.77	Moderate Wind	Apt. Bld.	3	7	0 / 1 : 1	Ukwn.	00321	5
IL	Jan-87	18.41	22	n/a	Fresh Wind	Apt. Bld.	15	15	0 / 2 : 2	Ukwn.	01100	5
NY	Jan-87	23.48	26	40.28	Fresh Wind	Apt. Bld.	9	23	0 / 2 : 2	Ukwn.	01234	5
IN	Apr-88	8.98	12	n/a	Gentle Breeze				0 / 0 : 0	Ukwn.	01553	5
NY	Feb-89	23.02	25.1	41.43	Fresh Wind	Apt. Bld.	14	18	0 / 3 : 3	Ukwn.	00513	5
CA	Aug-93	12.08	18.1	25.32	Moderate Wind	Apt. Bld.	3	20	1 / 0 : 1	$120K	00088	5
NY	Nov-94	16.23	24.9	n/a	Moderate Wind	Apt. Bld.	18	20	0 / 2 : 2	Ukwn.	00463	5
ON Canada	Jan-95	7.25	15	28.77	Gentle Breeze	Apt. Bld.	Ukwn.	30	0 / 6 : 6	Ukwn.	00002	5
NY	Jan-96	15.1	21.0	32.2	Moderate Wind	Apt.	3	13	1 / 0 : 1	$225K	00050	5
NY	Jan-97	17.8	22.0	33.4	Moderate Wind	Apt. Bldg.	28	42	0 / 0 : 0	Ukwn.		5
NY	Dec-98	6.33	13	n/a	Light Breeze	Apt. Bld.	10	10	3 / 0 : 3	$350K	10	5
NY	Apr-01	9.5	13.0	n/a	Gentle Breeze	Apt. Bldg.	24	37	0 / 0 : 0	Ukwn.		5
IL	Jan-02	16.92	20	n/a	Moderate Wind	Apt. Bld.	14	44	0 / 1 : 1	Ukwn.	00675	5
NY	Sep-04	17.5	25.1	39.1	Moderate Wind	Apt. Bldg.	37	44	0 / 0 : 0	Ukwn.		5
NY	Jan-06	21.6	26.0	38.0	Fresh Wind	Apt. Bldg.	6	13	0 / 0 : 0	Ukwn.		5
NY	Feb-06	23.4	26.0	42.6	Fresh Wind	Apt. Bldg.	24	41	0 / 0 : 0	Ukwn.		5

Location	Date	Mean Wind Speed MPH [1,2]	Max Sust. [1,2]	Max Gust [1,2]	Mean Wind Class. [1,3]	Building	Floor of Origin	Total Flrs	Firefighter / Civilian : Total Deaths	Dollar Loss (USD)	NFPA Report #	Rating [4]
NJ	Feb-07	15	n/a	22	Moderate Wind	House		2	0 / 0 : 0	$2M.	01224	5
VA	Apr-07	25		n/a	Strong Wind	House		2	1 / 0 : 1	Ukwn.	00072	5
NY	Jan-08	18.9	22.0	31.1	Moderate Wind	Apt. Bldg.	14	25	1 / 0 : 1	Ukwn.		5
NY	Mar-08	9.4	13.0	n/a	Gentle Breeze	Apt. Bldg.	4	26	0 / 1 : 1	Ukwn.		5
NY	Apr-08	20.2	25.1	33.4	Fresh Wind	Apt. Bldg.	5	22	0 / 0 : 0	Ukwn.		5

Table A-5 Footnotes:

1. Weather data for North American cities taken from: The Old Farmer's Almanac: Weather History. Retrieved 12 May, 2008, http://www.almanac.com/weatherhistory/, Yankee Publishing Inc., P.O. Box 520, Dublin, NH 03444, USA, (603) 563-8111. Weather data for cities outside of North America taken from: National Climate Data Center-NOAA Satellite and Information Service. Received May, 2008. http://www.ncdc.noaa.gov/oa/ncdc.html
2. The definition for “Mean Wind Speed” is the mean wind speed for the day (mph). The definition for “Max Sustained” is the maximum sustained wind speed reported. The definition “Max Gust” is maximum wind gust reported for the day.
3. Weather classification according to Table A-1.
4. Rating according to Table A-2.

Appendix B: FPRF Project Technical Panel Roster

- Brett Bowman, IAFC SHS Section Rep
  Prince William County Fire & Rescue, Fairfax VA
- John (Skip) Coleman
  Toledo FD, Toledo OH
- Kevin Courtney, NVFC Rep
  Star FD, Star ID
- Rich Duffy, IAFF Rep
  International Association of Fire Fighters
- Richard Edgeworth
  Chicago FD, Chicago IL
- Wei Gao, China Fire Protection Association
  Ministry of Public Security of P.R. China
- George Healey
  FDNY, New York NY
- Mark Huff
  Phoenix FD, Phoenix AZ
- Carl Matejka
  Houston FD, Houston TX
- Peter McBride
  Ottawa FD, Ottawa ON Canada
- Jim Milke, NFPA TC on Smoke Management
  University of Maryland
- John Miller, High Rise Building Safety Advisory Committee Rep
  LA City FD, Los Angeles CA
- Jack Mooney
  FDNY, New York NY
- Carl Peterson, NFPA 1500 TC Staff Liaison
  NFPA
- Gerald Tracy
  FDNY, New York NY
- Peter Vandorpe
  Chicago FD, Chicago IL
- Rick Verlinda
  Seattle FD, Seattle WA
- Phil Welch, NFPA Training TC rep
  Gaston College, Dallas NC
- Michael Wieder, IFSTA Rep
  OSU Fire Protection Publications, Stillwater OK