Hardware Store Basement Fire: Queens, NY

# Fire Behavior Case Study

**Introduction**

Developing mastery of the craft of firefighting requires experience. However, it is unlikely that we will develop the base of knowledge required simply by responding to incidents. Case studies provide an effective means to build our knowledge base using incidents experienced by others.

**Aim**

Firefighters and fire officers recognize and respond appropriately to the interrelated hazards presented by building construction and rapid fire progress in commercial structures.

**References**

National Institute for Occupational Safety and Health (NIOSH). (2001). *Death in the line of duty, Report F2001-23.* Retrieved December 12, 2008 from http://www.cdc.gov/niosh/fire/pdfs/face200123.pdf

Bryner, N. & Kerber, S. (2004) S*imulation of the dynamics of a fire in the basement of a hardware store – New York, June 17, 2001*, *NISTR 7137*. Retrieved December 12, 2008 from http://fire.nist.gov/bfrlpubs/fire06/PDF/f06006.pdf

**Learning Activity**

Review the incident information and discuss the questions provided. Focus your efforts on understanding the interrelated factors that influenced the outcome of the incident including building construction, fire behavior, and tactical operations. Even more important than understanding what happened in this incident is the ability to apply this knowledge in your own tactical decision-making.

**The Case**

This case study was developed using information contained in reports from the National Institute for Occupational Safety and Health (NIOSH, 2001) and National Institute of Standards and Technology (Bryner & Kerber, 2004). This incident involved a fire in the basement of a hardware store. Three firefighters suffered traumatic fatality and 80 emergency response personnel (fire, police, and EMS) were injured during the course of this incident. One of the firefighters who died was performing offensive fire attack on the interior of the structure

Figure 1. Side Alpha-Post Fire

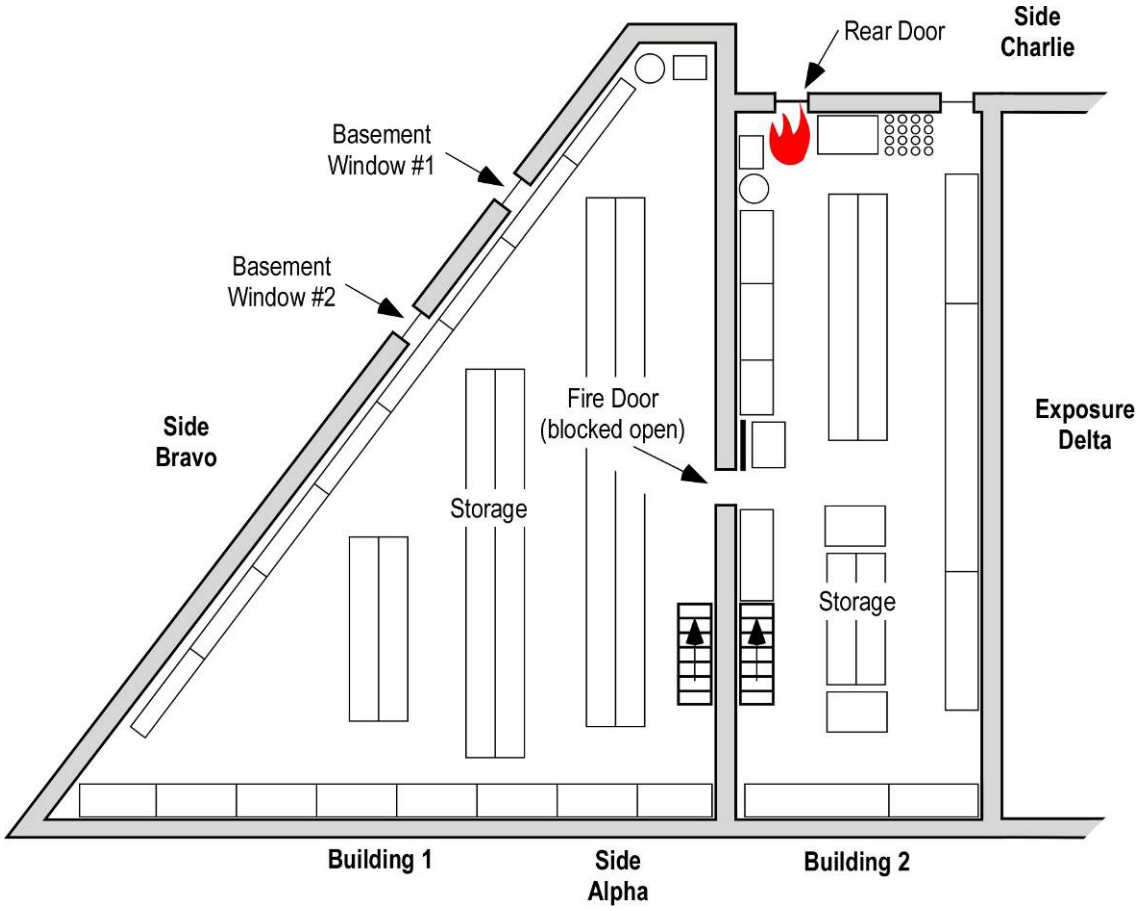
and the others were conducting exterior ventilation operations when an explosion in the basement resulted in structural collapse.

**Building Information**

The fire involved two, two-story buildings with a basement. Both structures (and Exposure Delta) were of ordinary construction. These structures shared a party wall and were interconnected on both floor 1 and in the basement (see Figure 2). The first floor and basement contained a hardware store (retail on floor one and storage and repair/assembly in the basement). Building one had apartments on floor two while building two contained office and storage space on floor two.

Roll up security doors covered the doors to the hardware store on Side Alpha. The door on Side Charlie was covered with reinforced steel security doors and basement windows on Side Bravo were covered with steel security grates.

Figure 2.Basement Floor Plan



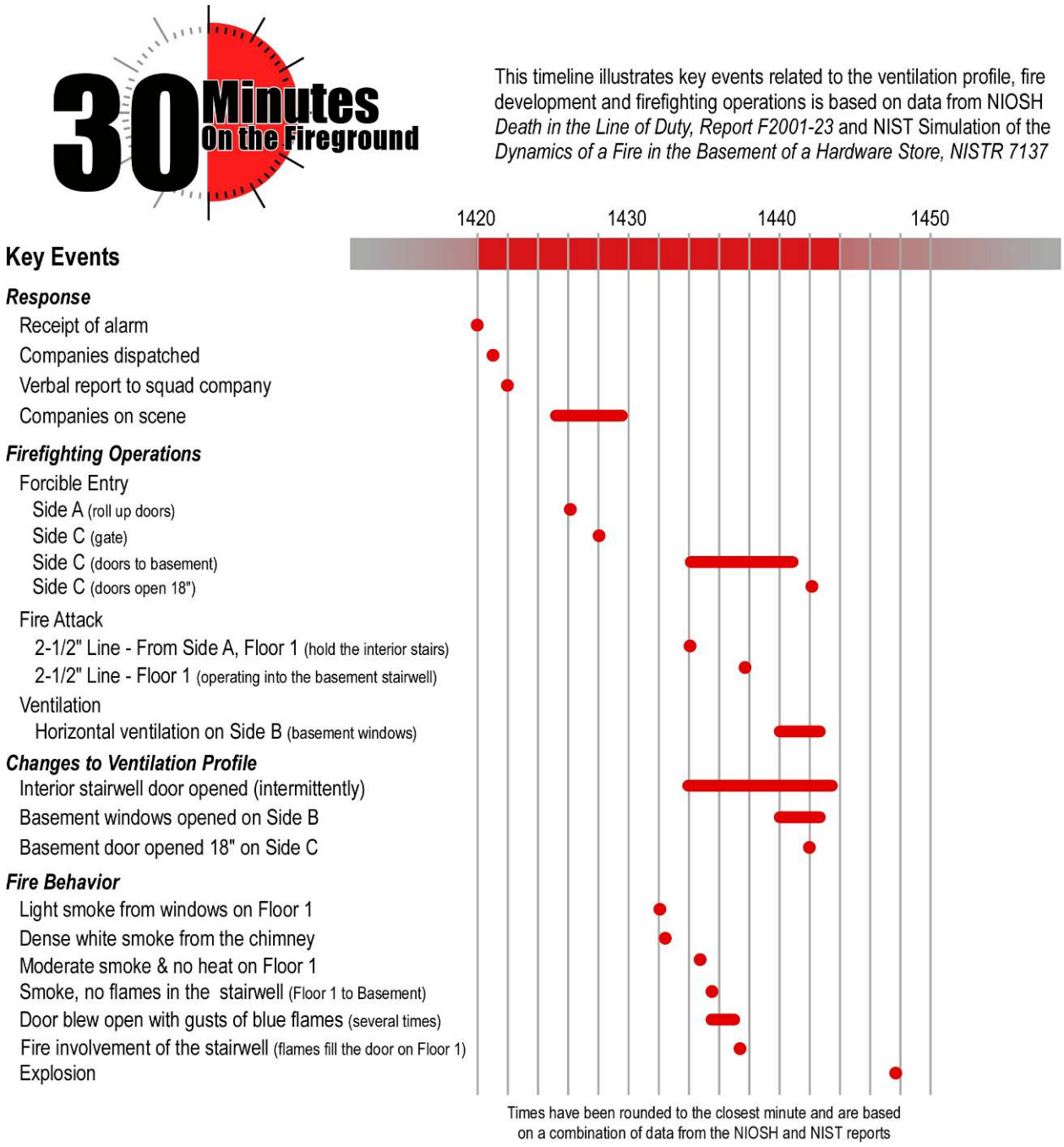

**Dispatch Information**

A first alarm assignment was dispatched to a report of a commercial fire in a hardware store at 1420 hrs on Sunday afternoon, June 17, 2001. Additional companies clearing from a previous call approximately seven blocks away added themselves to the call. This provided an initial assignment of three engines, three trucks, heavy rescue, squad, and three battalion chiefs for this incident.

**Conditions on Arrival**

On arrival, light smoke was showing from the windows on the first floor of buildings one and two. Windows of several second floor apartments (building one) were open, but no smoke was visible. A truck company accessed the roof and observed dense white smoke from the chimney on building one.

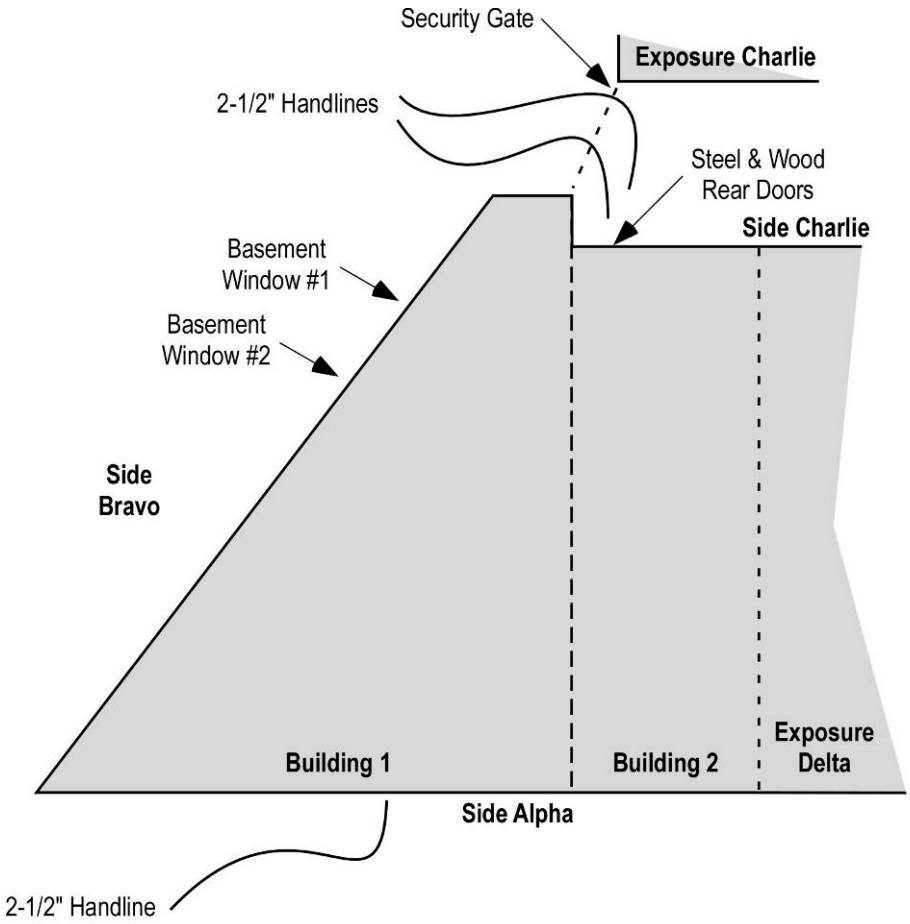
Figure 3. Incident Timeline



**Firefighting Operations**

Initial size-up showed access to the building on Sides Alpha and Charlie. Forcible entry operations were initiated to gain access to the first floor on Side Alpha and direct access to the basement on Side Charlie. This entailed forcing the roll up security doors on Side Alpha and making entry through to Side Charlie through a security gate and then forcing the heavily reinforced (steel and wood) doors to the basement.

Figure 4.Plot Plan




Two 2-1/2” handlines were deployed to Side Charlie in anticipation of making an attack through the rear doors leading to the basement. An additional 2-1/2” handline was stretched to Side Alpha. Access was gained through Side Alpha into the first floor while forcible entry operations continued on Side Charlie. The 2-1/2” handline was extended into the hardware store (building one).

After making entry from Side Alpha, companies operating on floor one encountered moderate smoke and no appreciable heat. They located the interior stairway to the basement and observed black smoke in the stairwell, but no flames. Other companies conducting search on Floor 2 encountered light smoke conditions. Command ordered the companies on floor one to hold their position to prevent extension, but not attack the fire via the interior stairway as other companies were making entry through the door on Side Charlie.

Companies working on Side Charlie forced entry through the security gate and encountered a significant challenge in forcing entry through the rear doors leading to the basement. Shortly before forcible entry operations were successful in (partially) opening the rear doors, a truck crew removed several windows (basement windows #1 and #2) Side Bravo. Companies holding the stairwell, observed the door to the basement door blow open several times with gusts of blue flame. Several minutes later, they opened the door to check conditions and the, the stairwell filled with flames. At this point, the companies holding the stairwell began operating their 2-1/2" line into the stairwell to control fire extension.

Due to the difficulty and delay in fully opening the doors on Side Charlie, Command shifted strategy from making the entry from Side Charlie to an attack down the interior stairwell. At approximately the same time, companies operating on Side Alpha reported smelling the odor of varnish, lacquer, or solvent (organic vapor).

At approximately 1448 an explosion occurred in the basement. The force of this explosion displaced the first floor and caused collapse of the exterior wall on Side Bravo. One firefighter operating on the interior fell into the interior stairwell in Building 1. The collapse on Side Bravo trapped three firefighters who had be conducting ventilation operations.

**Firefighter Rescue Operations**

A personnel accountability report (PAR) indicated that four members were missing. One was located under a store sign and brickwork. Companies quickly located one of the missing firefighters under a sign and brickwork and extricated him. The other two firefighters trapped by collapse of the wall on Side Bravo were located approximately 25 minutes later by manually removing bricks and rubble. Ambulances transported all of the firefighters removed from the collapse hospital. The first firefighter survived, but the other two died from their injuries. Concurrent with the rescue effort on Side Bravo, other companied attempted to rescue the firefighter trapped in the basement through a hole cut in the floor of Building 1 near the interior basement stairs. Severe fire conditions drove firefighters from this working position several times. Eventually companies breached a hole in the basement wall from Exposure Delta and control of the fire in the basement permitted access through the floor in Building 1. Medical personnel pronounced firefighter trapped in the basement dead at the scene.

The firefighters caught by the collapse on Side Bravo died from massive blunt force trauma. The firefighter trapped in the basement died from asphyxia due to smoke inhalation.

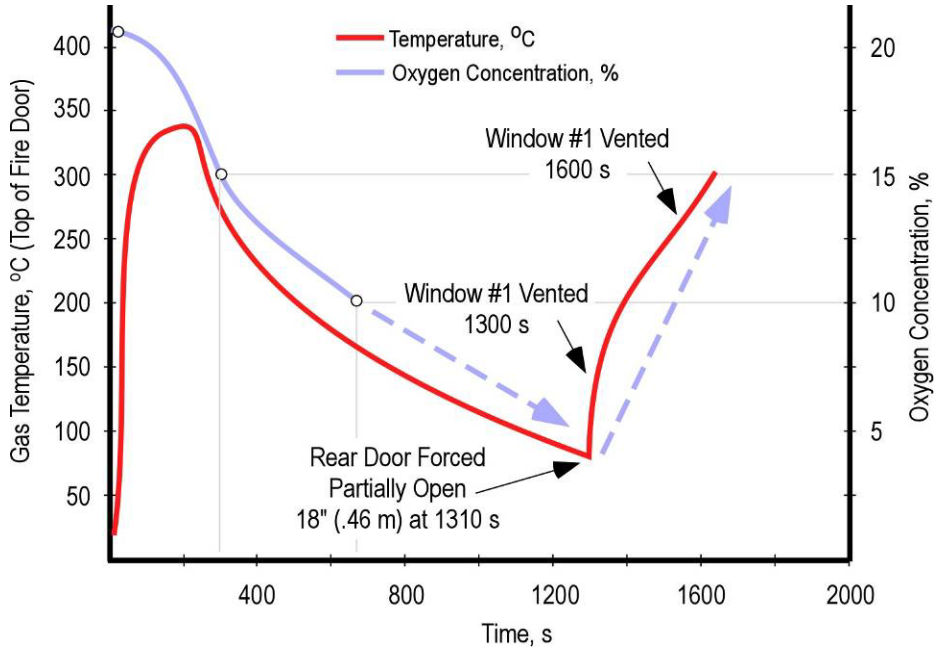
**Simulation of Fire Dynamics**

As part of the investigation into this incident, the National Institute of Standards and Technology (NIST) developed a series of fire dynamics simulations (Bryner & Kerber, 2004) that examined:

- Conditions in the basement (i.e. temperature and oxygen concentration) as the fire spread
- Influence of an operating fire door
- How the variations in heat release rate would have affected conditions and fire spread in the basement

These simulations examined fire growth after ignition and up to the point at which the explosion occurred. The software used for this computer simulation cannot model an explosion. NIST researchers used multiple scenarios based on the fire door in the basement being open or closed, and initial heat release rates from 500 kW to 2000 kW. Selection of this range of heat release rates considered solvents stored in the basement and combustible structural materials (but did not include other building contents). The example used in this Training Bulletin (see Figure 5) uses the scenario with a 2000 kW initial heat release rate and inoperative fire door.

Figure 5.Temperature and Oxygen Concentration




**Questions**

Examine the information provided in the case and develop answers to the following questions:

1. What type of extreme fire behavior event do you think happened in this incident? What leads you to this conclusion?

2. What fire behavior indicators (FBI) did firefighters report? Might any of these indicators have provided a warning of the potential for extreme fire behavior? Think about the B-SAHF categories (Building, Smoke, Air Track, Heat, and Flame).

B

Building

S

Smoke

A

Air Track

H

Heat

F

Flame

3. What other FBI would you have been looking for in this type of situation?

4. Based on the information provided, what do you think caused the explosion in the basement of this hardware store?

5. Identify at least three points at which the firefighters and officers involved in this incident could have taken action that would have potentially changed the eventual outcome? For each point, describe alternative courses of action.