## INTRODUCTION TO PART ONE

# BAPTISM BY FIRE

### HOW FIRES IN BUILDINGS BURN

Fires happen when three factors come together: fuel, oxygen, and heat or an ignition source. Every combustible or flammable substance, typically a carbon-based material (natural, like wood, or synthetic, like polyurethane foam) has its ignition temperature, the temperature at which it oxidizes fast enough to produce energy in the form of flames. However, each fuel also has its temperature of mass decomposition, also called pyrolysis. At this temperature, the chemical bonds break, and gaseous products of pyrolysis diffuse off the surface of the fuel rapidly. These gases are easily ignited (methane, for example), highly toxic,or corrosively irritating and incapacitating (hydrogen chloride from polyvinyl chloride, for example). The pyrolytic products usually ignite first and spread the fire.[1]

Fires grow exponentially in time. This means that the early flame stage grows slowly until a critical size is reached, and then growth accelerates rapidly. The exponential pattern of growth makes every second count in terms of hazard to life, health, and property. Fires in buildings are constrained by the building materials and design. Heat and smoke are trapped by ceilings and roofs, accumulating under these barriers and moving outward from the fire along them. The toxic fumes from decomposition and burning may reach great distances from the fire itself. People on the floors above the fire may be poisoned or killed by the smoke and fumes which rise through the various openings for plumbing and electrical systems, elevators, and heating/cooling systems. People who don't even know there's a fire and see no flames are often the ones to die from smoke inhalation. In the 1980 MGM Grand Hotel fire in Las Vegas, the great majority of the 85 people who died were on the top floors, though it was the ground floor that was burning.[2]

## ADEQUATE FIRE SERVICE RESPONSE

The object of designing a municipal fire control system is rapid assemblage of an adequate team to control most fires quickly. The definition of an "adequate team" differs with varying conditions such as building use (residential, industrial, commercial), building size and age, the building code in force when it was constructed, crowding, whether the people can get out, and whether the building contains an especially vulnerable population (schools, hospitals, nursing homes, and jails).

For most multiple dwellings, three engines and two ladders plus a battalion chief is an adequate team, as long as the staffing of these units is also adequate. Five firefighters and an officer per engine company, and six firefighters plus an officer per ladder company constitute adequate staffing for New York City conditions. The first engine and ladder should arrive at a multiple dwelling in a multiple-dwelling neighborhood within 3–4 minutes after the alarm is turned in. The entire team should be assembled within 5–6 minutes. The dispatcher must be able to find enough nearby units to do this quickly; for each address in the city, the following units are assigned for response: first-due engine, first-due ladder, second-due engine, and second-due ladder.

The first-due team enters the fire floor. The second engine and ladder companies enter the floor above. Engine companies extinguish the fire, usually with water from a hose and nozzle, with the company officer acting as nozzle-man. Ladder companies effect entry, vent the smoke, search, and rescue. An engine company may arrive very quickly, stretch and charge the hose and be totally useless if the ladder doesn't arrive to effect entry. The third engine "stands fast" (is available just in case) unless the fire requires such lengthy firefighting that the first-due engine company needs relief or unless the fire is so large that it requires two nozzles on the fire floor for control.

Multiple dwellings present more problems than one- or two-family homes: finding the fire, stretching many lengths of hose, gaining entrance, evacuating large numbers of people, potential for huge fuel loads, and prevention of fire spread both from apartment to apartment within the building and between abutting buildings. Older buildings have no standpipes, so that hose must be stretched all the way from the street hydrants to the fire. New buildings have steel doors to the apartments and oven-like, tight, low-ceiling construction. Entry is time-consuming and exhausting, and the heat and smoke debilitating and impenetrable. Multiple-dwelling fires require a much more rapid assemblage of a larger team than one- and two-family residence fires.

Fire-control resource levels also determine fire-prevention inspections and training-and-familiarization programs. If the busy units are either out on alarms

or resting between frequent alarms, they can't inspect very much or go on training drills. If the area is busy, the dispatchers will keep the companies from going out on inspection and training. Companies have to be available in busy areas if there aren't enough of them, so they essentially train on the job. The neighborhood residents become unwitting teachers.

## NOTES FROM THE FRONT

The following 1976 interview with a veteran battalion chief shows how these factors come together on the fireground and how fire-response policy became disconnected from fire-company workload. Chief X, now retired, had served in the South Bronx during its famous ordeal-by-fire. The fires of the South Bronx attracted international attention and were the subject of a BBC-TV special, "The Bronx Is Burning," in 1976. This battalion chief participated in the Uniformed Fire Officers Association's workload committee, which also analyzed risks to citizens from inadequate levels of fire control resources.

Q When the dispatcher transmits the alarm to the station what happens?

A The house officer takes the alarm-box address or house address and turns the men out. The men get into their gear and onto the unit in an average of one minute, but at night it takes a little longer. We maneuver the unit into the street and go.

Q You say go. Is it that easy?

A It's not easy getting to a fire in New York City. We have to slow down at intersections because we used to have frequent accidents. Some streets are always jammed with double-parked cars. During rush-hour, all major streets are jammed, but some streets are jammed nearly all the time. Sometimes we can go the wrong way on a one-way street, but many times we can't because of traffic. The Fire Department doesn't always use the latest maps which show all the intersection obstructions such as subways rising out of the ground. Getting around a construction site can lose you half a minute along the way.

Q So you get to the alarm box. What next?

A Then we look for the fire. Usually we have someone waving us in the right direction. It we don't, we'll be lucky to see the fire or smoke from the street. If the fire's in the rear of a tenement and no one stayed at the box to show us where it is, we're in trouble.

Sometimes people who phone in alarms give the wrong address. It's hard to see addresses on tenements and the fire search can be slow. The one- and two-family houses in Queens and Staten Island don't cause this problem. You can see where the fire is right away.

Q After you find the fire, what happens?

A The engine maneuvers to the nearest hydrant. One man hooks up and waits for the order for water. The other men begin to stretch hose. If the fire's in front, the attack is simple, but if we have to stretch extra lengths of hose to the back or stretch up the fire escape, it just sends the men into the attack already tired and out of breath. It takes ten lengths of hose to get to the back of the top floor of a six-story tenement—that's 360–600 pounds. Each man wears 30–50 pounds of gear besides. The people who live on the top floor of Old Law tenements have the least fire protection of all. It takes longest to get the hose stretched and the men are already out of breath. We get a lot of civilians jumping out of windows of the top two stories because they can't take the heat anymore.

Q So you're stretching hose. You get to the apartment door. What then?

A That ladder truck better have rolled up by now or we don't get in. All the forcible-entry equipment, the rescue equipment, the venting gear, and all the manpower to do these jobs are on the ladder truck. An engine can do very little by itself, especially since the manning reduction of July 1975. A ladder can do very little by itself. Once the apartment door is open, that water has to beat back the fire enough for search-and-rescue. That little girl that died in East Elmhurst—the ladder rolled up and forced the door but had to wait for the engine. Fire activity was so heavy that the nearest available engine came from 60 blocks away and took 15–20 minutes.

It's hard to get into tenement apartments. Most tenants have several locks on the door, chains, wires, and bars. They have gates on the windows. It takes 1–3 minutes longer to get inside an apartment than into a private home. Some of the apartment doors are steel and deform from the heat so that you can't open them. Then you have to go in by the window or from above.

That fire is spreading all the time and raising the temperature of the air in that apartment. If you're lucky, it'll be only about 500° F when you go in. If it's been burning five minutes, it'll be near 1000° F in the room. According to the *Handbook on Fire Protection*, a human can take 300° F in dry air for a minute or two, or about 200° F in moist

air. Then the pain gets too great. That's why people jump out windows. My men have been trained to go into 1000° F. I remember how we did it when I was a young firefighter. We'd put some water on the fire. Then when the steam came up and scalded us, we'd crawl along the floor until things cooled a little. We'd get some more water on the fire and hit the floor again. It didn't always cool down, and we'd be in trouble. We couldn't breathe. We'd stick our noses into our coats and breathe that way or look for a pipe projecting from the wall and breathe in the space between the pipe and the wall.

**Q** The time it takes to stretch hose and get at the fire in a multiple dwelling (3–4 minutes)—how important is that?

**A** If you don't get water on the fire within three minutes of ignition, you could have a problem. The National Fire Underwriters let a fire burn through an old abandoned tenement. Within three minutes, it had spread from the ground to the top floor. Within 47 minutes, the building was destroyed. We have areas of rapid-fire-spread potential not only within the building, but between buildings. Some buildings share a common cockloft. Others have less than ten feet of space between them, some only one or two feet.

**Q** The population density in some areas must be pretty high?

**A** After all these studies, no one came up with a standard for the maximum number of people who should be served by a fire company. In the South Bronx, the average number of people per engine is over 44,000. In Staten Island, it's 17,000. There is no standard for manning in areas of multiple dwellings as opposed to one- and two-family residences.

**Q** The fire situation of your area, the South Bronx, has become a proverb. What led to the present situation?

**A** The population in the South Bronx is one of the densest in the City, and the housing conditions among the worst. The alarm rate rose slowly during the early 1960's until 1968 when it simply took off. By 1966, the city-wide workload was so heavy that the state Public Employees Relations Board ordered the City to open 16 new fire companies, of which 13 were opened by 1970. This eased the load, but the alarm rate continued to climb. The Lindsay administration brought Rand in to analyze the situation. Rand began eliminating fire companies.