NATURAL GAS EXPLOSION IN MOTEL
Hagerstown, MD
February 18, 1990

FIRE INVESTIGATIONS
NATIONAL FIRE PROTECTION ASSOCIATION

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FIRE INVESTIGATION REPORT

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HAGERSTOWN, MARYLAND
FEBRUARY 18, 1990

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Publishers of the National Fire Codes® and National Electrical Code®
A non-profit membership organization dedicated to promoting safety from fire, electricity, and related hazards through research, codes and standards, technical advisory services, and public education since 1896.
ABSTRACT

On Sunday, February 18, 1990, a natural gas explosion and subsequent fire in the Hagerstown Super 8 Motel resulted in the deaths of four guests and minor injuries to ten others. Three of the four fatalities occurred in rooms affected by the explosion and the fourth victim was found in a corridor approximately 35 feet from the area of the explosion.

The three-story wood frame structure was designed to meet, among other codes, the requirements of the 1985 Life Safety Code® which the city had adopted and was enforcing when the building was constructed in 1987. The building had 62 guest rooms and was provided with smoke detectors in the rooms and corridors, a local fire alarm system, sprinklers in hazardous areas, a standpipe in each stairway, fire extinguishers, emergency lighting, and operable windows. In addition, the exit access corridors and the exit stairways were enclosed with fire-rated walls and doors. Further, staff had been trained in firesafety (evacuation, use of extinguishers).

At approximately 5:10 a.m. two guests reported the smell of gas to the hotel desk clerk. After confirming that there was a gas leak, the desk clerk called the gas company and attempted to stop the gas that was escaping from a damaged hot water heater valve. Neither the clerk nor the gas company dispatcher called the fire department, and the building evacuation alarm was not activated until after the explosion.

The explosion occurred at approximately 5:30 a.m. when the build-up of gas was ignited from an unknown source. The explosion heavily damaged several guest rooms, two utility rooms, and a laundry room. The rooms that were damaged by the explosion were also damaged by the ensuing fire that continued to burn until the gas source was shut off (approximately one hour after the explosion), and it was suppressed by the fire department.

Three of the victims were in rooms that were damaged in the initial explosion. Their location with respect to the explosion area appears to be a major factor leading to their deaths. The last victim had apparently entered the corridor to escape and was overcome by the heavy smoke from the ensuing fire.

Even though the building was damaged by the gas explosion and subsequent fire, the interior fire-rated walls maintained tenable conditions sufficiently long to allow over 90 percent of the occupants to escape without assistance from fire fighters and contained most of the fire to the immediate fire area.
INTRODUCTION

The National Fire Protection Association (NFPA) investigated the Super 8 Motel fire in order to document and analyze significant factors that resulted in the loss of life and property.

This study was funded by the NFPA as part of its ongoing program to investigate technically significant incidents. The NFPA's Fire Investigation Division documents and analyzes incident details so that it may report lessons learned for life safety and property loss prevention purposes.

The NFPA became aware of the Super 8 Motel fire on February 19, 1990, the day after its occurrence. Michael S. Isner, Fire Protection Engineer, of NFPA's Fire Investigations Division, traveled to Hagerstown, Maryland to document the facts related to this fire. His one day on-site study and subsequent analysis of the event were the basis for this report. Entry to the fire scene and data collection activities were made possible through the cooperation of the Hagerstown Fire Department.

This report is another of NFPA's studies of fires having particularly important educational or technical interest. All information and details regarding firesafety conditions are based on the best data available and observations made during the on-site data collection phase and during the report development process. It is not NFPA's intention that this report pass judgment on, or fix liability for, the loss of life or property resulting from the Super 8 Motel fire. Rather, the NFPA intends that this report present the findings of the NFPA data collection and analysis effort and highlight the factors that contributed to the loss of life or property.

Current codes and standards were used as criteria for this analysis so that conditions at the Super 8 Motel on the day of the fire could be compared with state-of-the-art fire protection practices. It is recognized that these codes and standards may not have been in effect during construction or operation of the motel. NFPA has not analyzed the facility as to its compliance with
the codes and standards that were in existence when the building was constructed or during its operation.

The cooperation and assistance of Fire Chief Gary Hawbaker, Fire Marshal Charles T. Brown, and Battalion Chief Richard Kipe of the Hagerstown Fire Department are greatly appreciated.

Special thanks are given to the department secretary for her assistance during the preparation of this report.
II. BACKGROUND

Applicable Codes and Occupancy Classification
The Hagerstown Super 8 Motel was constructed in 1987. At that time, the City of Hagerstown was enforcing the 1984 National Fire Protection Association (NFPA) National Electrical Code®, the 1982 NFPA Fire Prevention Code, and the 1985 NFPA Life Safety Code. According to that edition of the Life Safety Code, the facility was classified as a residential occupancy, and Chapter 16, "New Hotels and Dormitories" was applied at the time of construction. The city had also adopted and was enforcing the 1984 Building Officials and Code Administrators (BOCA) Building Code, the 1984 BOCA Plumbing Code, and the 1984 BOCA Mechanical Code.

The Building
The motel is a three-story structure that is approximately 50-feet wide by 140-feet long. (See Figure 1.) The first floor contains the office area, a laundry room, an electrical room, a mechanical room, and 19 guest rooms. The second floor housed 21 guest rooms and a storage room, and the third floor has 22 guest rooms. Each guest room is approximately 22 feet long and 12 feet wide and has an 8 ft x 6 ft bathroom except for one large guest room on the third floor and one small guest room on the first floor. The guest rooms typically contain two double beds, upholstered chairs, a chest of drawers, and a desk.

The wood frame structure has a stucco exterior finish applied over composite sheathing material. The interior surfaces of the exterior walls are covered with 5/8-inch, Type X, gypsum wallboard. Similarly, interior partitions are framed with wood studs and covered with 5/8-inch, Type X, gypsum wallboard. The floor system is constructed of 2 x 10 inch floor joist with two (2) layers of gypsum wallboard fastened to the underside of the joists (1 layer of 5/8-inch Type X and 1 layer of 1/2-inch gypsum board). The top of the floor system consists of 5/8-inch subfloor plywood nailed and glued to the top of the floor joist and another layer of 3/4-inch poured gypcrete over all plywood floor areas. The interior partitions run from the gypcrete and carpet covered floors to the bottom of the floor joists and are covered with 5/8-inch Type X gypsum board on both sides.
The building's gable type roof is covered with asphalt shingles over plywood sheathing. The roof's structural frame is wood trusses constructed with 2 X 4 inch members fastened together with metal gusset plates. The area under the roof is an unusable combustible concealed space and has been divided into areas no larger than 3,000 square feet. This was accomplished by securing 5/8-inch, Type X, gypsum wallboard to the wood trusses.

Since the exterior bearing walls have no apparent fire rating and the roof support members are combustible, the building most closely resembles Type V (000) construction according to NFPA 220, Types of Building Construction, 1985.¹

Means of Egress
The walls between guest rooms, enclosing hazardous areas, and between the exit access corridor and the guest rooms all have a one-hour fire-resistance rating. The entrance doors to the guest rooms are self-closing solid-core wood doors with a 20-minute fire-resistance rating, and the doors to hazardous areas have a one-hour fire-resistance rating. The exit stairways are also enclosed by one-hour fire-rated gypsum wallboard on wood stud wall assemblies, and the solid core wood doors for the stairway have a one-hour fire-rating and are self-closing. The maximum travel distance to the exit stairways, which are located at each end of the corridor, is 53 feet.

Battery operated emergency lighting units are installed in both the exit access corridors and in the exit stairways. Internally illuminated exit signs capable of operating during building power outages mark the location of the exit stairway.

¹ The NFPA system for building type classification lists the minimal fire-resistance rating for the exterior bearing walls (first digit), for the structural frame (second digit), or for the floor assemblies (third digit), and those ratings are included in the numbers appearing in the brackets. A Type V (000) structure has no fire rating for at least one of those categories.
Special Provisions
In addition to the two means of egress, each guest room is provided with operable windows that can serve as an emergency means of escape. The window frames are 3 feet 10 inches high and 4 feet 10 inches wide (inside dimensions) and contain two pieces of single-pane ordinary glass that are the full height of the window frame. The window sill is 38 inches above the floor. One pane of glass is fixed, and the other slides. The resulting opening is 3 feet 10 inches high by 2 feet 2 inches wide. The sliding window is held stationary by a pin located at the bottom of its frame near a center mullion. To open the window, the pin must be lifted, and no special tools are required.

Firesafety Information
Emergency evacuation plans and firesafety information are located on each guest room door. These plans show the location of the guest’s room, nearest exit, fire extinguishers, and manual pull stations.

Fire Protection Systems
Hard-wired smoke detectors are installed in all rooms and corridors. Manual pull stations are also provided in the exit stairways, office area, and lobby. The room smoke detectors provide an alarm signal in the room only, and the corridor smoke detectors and the manual pull stations initiate both audible and visual alarms throughout the building.

Fire department notification is not automatic. On-duty staff call the fire department using a stationary office telephone or portable telephone.

A partial automatic sprinkler system was installed in the building’s hazardous areas, which are the mechanical, electrical, and laundry rooms. Sprinklers are not provided in any other area. In addition to the sprinkler system, the building has a standpipe in each stairway. The standpipes have gated 2 1/2-inch connections intended for use by fire department personnel.
HVAC System and Gas Supply
Each guest room has a wall-mounted heating and air conditioning unit so there are no ducts between guest rooms. The bathrooms are naturally vented through pipes that are common to bathrooms that are vertically aligned between floors. Fresh air is apparently brought into the building through the air conditioning unit and by natural air flows.

Two 100-gallon hot water heaters located in the first floor mechanical room and several dryers located in the nearby laundry room are gas fired. An underground gas main supplies the natural gas for this equipment. The gas meter and main shutoff valve are located outside of the mechanical room. (See Figure 2.)

Staff Training
Every Super 8 Motel owner and supervisor is required to attend a 3-week management course at corporate headquarters. Though it is primarily oriented toward facility management, a portion is dedicated to the preparation for and the response to a variety of emergencies including fire. The firesafety training is presented by a fire officer and includes procedures for notifying emergency services, use of fire extinguishers, and occupant evacuation. The course does not contain a discussion of specific steps to take during nonfire emergencies such as a natural gas leak. Course attendees are also informed that the corporation requires all employees to receive firesafety training every six months, that proper written documentation of this training must be kept on file, and that the corporation has a 30-minute firesafety training video that must be kept at the facility.

In addition, the Hagerstown Fire Department public firesafety educator has prepared a 90-minute hotel/motel firesafety program. He intended that this training be annually presented to hotel staff in their respective facilities throughout the city. However, this program has been presented to the Super 8 Motel staff at least twice each year since the motel and staff are relatively new. The most recent program was presented on June 15, 1989, and 25 staff were in attendance.
During these programs, the fire department instructor begins with a walk through the building and a discussion of fire protection systems and firesafety conditions. In addition, the instructor typically reviews the importance of properly operating fire doors and emergency lighting, and of keeping fire extinguishers and standpipe connections accessible.

Employees are told to sound the local fire alarm system immediately in the event of any suspected fire emergency and to notify the fire department. After accomplishing these tasks, employees may then attempt to locate the area and determine the nature of the problem, isolate any fire by ensuring that doors are closed, and assist in the evacuation of occupants if necessary.

**Fire Department Inspections**

In November, 1986, the construction plans were submitted to the Hagerstown Fire Marshal's Office for review, and the review revealed that several discrepancies existed, such as the guest room windows were not specified as being operable. In the following months, the Fire Marshal's Office approved plans for the fire alarm system, witnessed the successful test of the standpipe and sprinkler systems, and performed the final building inspection on November 9, 1987. During this inspection, emergency lighting units were tested, the fire alarm system was activated, and inspectors ensured that all previously noted discrepancies had been corrected.

The Hagerstown Fire Department requires an annual “in-service” inspection of hotels and motels by fire companies. Since the Super 8 Motel was a relatively new facility, the fire companies had performed in-service inspections at approximately six-month intervals in order to familiarize fire fighters with the building and its firesafety equipment.
Occupant Activities
An exact count of guests in the building was not available. Some of the motel's guest records were destroyed in the fire, and a couple of private gatherings that included unregistered people were in progress at the time of the explosion. It appears, however, that most of the 40 to 45 people who were in the building were registered guests sleeping in their respective rooms. In addition, a desk clerk was in the office area when the gas leak occurred.

Weather Conditions
The temperature in Hagerstown at 5:30 a.m. was 25°F, and winds were from the south at approximately 2 mph. Skies were clear.
III. THE INCIDENT

Discovery and Explosion
At approximately 5:10 a.m. two guests were walking along the first floor corridor when they smelled gas. The men went to the motel office and reported the smell to the desk clerk. The clerk went to investigate and did not smell gas until he opened the door to the laundry room. He returned to the lobby area, entered the laundry through his private office entrance, and confirmed the smell of gas in that room.

One of the guests, who had told the clerk about the odor, suggested that he dial “911” and call the fire department. Reportedly, the desk clerk remembered that the gas company was included on a list of emergency numbers and decided to call them because he felt they should know what to do. According to gas company records, the call was received at 5:21 a.m. The gas company dispatcher reportedly told the clerk to try to determine what the source was and told him that a service man was on the way.

When the clerk entered the mechanical room, he heard a hissing noise and determined that gas was leaking from the valve for water Heater #1. (See Figure 2.) He put his hand down near the valve and could feel the pressurized gas escaping from a crack in the valve. The clerk discovered that he could stop the flow of gas by putting his finger over the rough area or by slightly moving a vertical pipe in the supply line to the valve.

While moving the vertical pipe, part of the valve casing where the pipe was attached broke loose, the leak became worse, and the clerk realized he had an extremely dangerous situation developing. He left the mechanical room and called the gas company back at about 5:30 a.m. to report that the conditions were getting worse.
During this conversation, the clerk reportedly requested information regarding a means to shut off the gas. The dispatcher told the clerk that there might be a shutoff valve in the mechanical room and that there was one on the outside gas meter. The clerk decided that he would try to use the valve on the meter, and since the clerk was using a portable telephone, these men remained in contact while the clerk searched for the valve. Once he found it, the clerk ended his conversation with the dispatcher.

The clerk realized that he needed a tool to shut off the gas. Knowing that some of his tools were in the mechanical room and that another shutoff valve might also be in that room, the clerk went back to the mechanical room and turned on a fluorescent light. He immediately thought that it may have been a mistake to have used the switch and turned around to leave the area. He took about three steps when the explosion occurred, and he was blown into the laundry room.

Crawling over debris, the clerk was able to reach the lobby area, where he pulled a manual pull station. Using the portable phone, he called the fire department. Before leaving the building, he retrieved the guest log and brought it with him. In addition, the clerk called his supervisor to notify her about the explosion, and he did what he could to assist the hotel guests.

**Patron Response**

The majority of the guests in the building were able to escape without the assistance of fire fighters. Witness statements indicate that many occupants who were able to readily evacuate did so in an orderly manner. However, the actions selected by occupants and their means of escape varied.

For example, occupants from two different rooms attempted to rescue trapped occupants. In one case, the occupants of Room 301, who were volunteer fire fighters, heard the occupants of Room 304 trying to get out of their room but their door would not open. These fire fighters attempted to force open the door, but thick black smoke quickly filled the exit access corridor and forced them to leave. In the other instance, a guest from
Room 302 reentered the building after having safely evacuated in order to assist the trapped guests. Heavy smoke also forced this man to leave before he could open any room doors.

Most of the survivors were able to escape through the normal egress system. (See Table, Appendix II.) Of the 28 people who exited through the exit access corridors and exit stairways, only 5 used the east stairway or entered the lobby area. The other 23 survivors left the building through the west exit stairway.

Occupants who could not leave the building through the normal egress system resorted to less typical means to leave the building. Some people reportedly threw mattresses from their windows and attempted to jump onto them. A couple in Room 222 indicated that they could not open their room door because it was jammed in the closed position. In addition, they had difficulty determining how the window opened, so they attempted to break the window with a chair but were unable to do so. Eventually they operated the pin mechanism and opened the window. They were rescued by fire fighters over a ground ladder.

The occupant of Room 213 could not open his window, and attempted to join his friend in Room 211. When these men opened their doors, the smoke in the corridor was extremely heavy. The man in Room 213 left his room without his key and even though the two men could talk to each other, the man in the corridor became disoriented. The heavy smoke forced the man in Room 211 to close his door, and the man in the corridor was overcome by smoke.
Fire Department Notification and Response
The Washington County Fire and Rescue Communication center received the "911" telephone call from the desk clerk at 5:34 a.m. During this call, the clerk reported an explosion had occurred and indicated that he needed all three services, i.e., fire, ambulance, and police, at the motel. Three engines, one truck, a medic unit, and a battalion chief were dispatched.

As one engine, Engine 3 (E-3), approached the scene, the driver/operator who was by himself, could see the fire even though he was several blocks from the scene. This fire fighter requested a second truck company and additional ambulances at 5:36 a.m. When he arrived on the scene, he found a large section of the building front was involved in gas-fired flames, debris was scattered over the front parking lot, and several occupants were in need of rescue.

Moments later Truck 1 (T-1) carrying three fire fighters arrived. Since the debris covered the front parking lot, this company drove around to the back of the building in order to reach a position where they could use their ladders. Two fire fighters raised the aerial ladder and rescued five occupants from the window of Room 318. The occupants had broken out this window before the fire fighters arrived. The third T-1 fire fighter used a ground ladder to rescue the two occupants of Room 222 through their window which they had slid open.

The battalion chief arrived about the same time as T-1 and assumed command of the fire ground. While performing his size-up, the battalion chief entered the lobby area and found a married couple and their daughter taking refuge there. Even though the mechanical room that was just a few feet away was fully involved in fire, these people wanted to remain in the building because it was cold outside. The battalion chief insisted that they evacuate the building and wait for medical assistance in his car.
The battalion chief directed E-3 to the west end of the building, and the E-3 operator connected to a hydrant. He then stretched two 1 1/2-inch hose lines. A fire fighter from T-1 and another fire fighter brought the hose line up to the third floor, and a second fire fighter from T-1 began attacking the exterior fire with the other hoseline from E-3.

The two volunteer fire fighters who had attempted to rescue the occupants of Room 304 found the battalion chief and told him of the trapped occupants. In response to this, he directed three of the six fire fighters from E-101 which had responded from Funkstown to begin search and rescue on the third floor. The Funkstown fire fighters went up the east stairway, forced their way into the third floor rooms, and found one victim in Room 304. The second occupant was covered with debris and was found during a subsequent search of the building. While part of the E-101 crew searched for victims, the rest of the crew set up a monitor nozzle supplied by 2 1/2-inch hoselines in front of the building and discharged into the fire area.

When Engine 1 (E-1) arrived, the battalion chief directed this crew to advance a handline up to the third floor by the east stairway. Equipped with a 1 3/4-inch handline, these fire fighters entered the building and found some debris in the stairway. As they reached the top of the stairway they began to suppress ceiling level fire and gradually advanced their handline down the corridor.

As other fire crews arrived, the fire fighters began to support the operations already in place. Additional water supply lines were provided and more hoselines were put into position outside the building. These lines were used to protect undamaged areas of the building from the fire being fed by the broken gas main. After searching the third floor, the second arriving truck company set up a ladder pipe to help the engine companies contain the fire, and the Hagerstown rescue and medical units established a triage area for evacuees. The commander for the triage area initiated mutual aid requests for additional personnel to assist in the care of the evacuees.
Fire suppression personnel were able to extinguish the fire only after the local gas company turned off the gas flow in the gas main discharging into the fire area. This occurred about one hour after the fire fighters arrived on scene.

In addition to fire suppression and caring for evacuees, fire fighters performed three complete searches of the building to ensure all occupants were out of the building. Apparently one guest appeared on the guest roster and was not found. Fire fighters later learned that this individual was not in the building at the time of the explosion.

The Hagerstown Fire Department sounded one alarm and made a special call for their second truck company. In addition, the department called for mutual aid assistance. This request brought assistance from the county, five communities, and a volunteer rescue service. A total of six fire apparatus, seven medical units, a county air supply unit, 50 fire fighters, and 50 EMS personnel responded to this incident.

Casualties
Four motel guests died in this incident. The body of the 70-year-old female patron from Room 206 was found in the first floor electrical room. (See Figure 3.) Two bodies, one of a 26-year-old male, and the other of a 27-year-old female, were found in the remnants of Room 304. (See Figure 4.) All three of these bodies had thermal burns. The fourth victim, a 35-year-old male, was found in the corridor outside of Room 213. (See Figure 5.) The Washington County Medical Examiner reportedly stated that three victims died of asphyxiation, and the fourth died of thermal burns.

Ten other occupants were injured. Five were treated for smoke inhalation, and three were treated for wrist, foot, and head injuries, respectively. One person suffered head and neck pains, and the last person was treated for minor injuries and smoke inhalation. One fire fighter injured his head but was not admitted to a hospital.
Damage

The explosion heavily damaged several rooms, and the fire extended damage into other areas. The mechanical and electrical rooms were destroyed, and the laundry room was heavily damaged. In addition, it appeared that the explosion destroyed walls between several rooms, moved the corridor wall near the mechanical room almost a foot toward the north, and caused sections of both the second and third floor assemblies to collapse. The rooms on the south side of the building and adjacent to the explosion area were heavily damaged by fire, and the fire damage extended into the attic and the second floor corridor adjacent to Rooms 204 and 206. There was no noted flame damage in the first or third floor corridors.

Unlike the fire damage, smoke damage occurred in all three corridors. The lightest smoke damage was in the first floor corridor. The third floor corridor also had a light coating of soot over all surfaces, but it became slightly heavier in areas close to the rooms affected by the explosion. The second floor corridor had a layer of heavy black soot deposits covering the ceiling and upper wall surfaces over the full length of the corridor. The smoke and heat damage increased in the areas adjacent to rooms affected by the explosion. Little or no smoke damage occurred in most of the guest rooms.

2 Even though it was evident that the explosion and fire caused extensive damage, the exact amount of damage was not determinable since heavy equipment had been used during the search for victims. That equipment destroyed evidence with respect to explosion and fire damage, and it also caused some additional damage in the explosion/fire area.
ANALYSIS

Cause and Origin
The Hagerstown Fire Department investigators have determined that the explosion and fire was accidental and the result of a leaking natural gas valve on a hot water heater. Though the explosion occurred seconds after the building clerk used a light switch in the room of origin, investigators were unable to establish conclusively that the operation of the light switch caused the spark that ignited the gas in the room.

Fire and Smoke Spread
The explosion resulted in a large section of the building falling into the front parking lot, and in a gas-fed fire that burned for about one hour spreading freely both horizontally and vertically in the immediate explosion area. Since the explosion severely damaged both interior partitions and sections of the floor assembly, some of the wood frame components were exposed and contributed to the fuel in the explosion area.

The fire in the attic caused heavy damage to the wood trusses directly above the explosion area. However, there was no evidence of the roof trusses collapsing. Most of the bottom chords of the roof trusses were not burned even though the top chords and webs of several trusses were totally consumed or heavily damaged by the fire. This damage pattern indicates that the ceiling for the third floor rooms remained in place following the explosion and that the ceiling materials and the loose insulation material protected the bottom chords from the fire in the attic.

Since much of the the third floor ceiling remained intact after the explosion, it appears that the fire spread into the attic through the combustible roof soffit. Once in the attic, the fire extended to the east end of the building. However, the fire extension in the attic was limited in the westerly direction and basically did not reach areas beyond that affected by fire and explosion in the rooms below.
Emergency Actions

Three people smelled the leaking gas and had an opportunity to react before the explosion occurred. The two guests who first noticed the gas odor responded by informing the desk clerk. Following this report, the clerk confirmed the gas smell and was immediately confronted with the need to choose actions that would mitigate the hazard and reduce the risk to guests. It was after 5:00 a.m. on a cold morning, and most of the guests in the hotel were asleep.

The clerk’s training reportedly discussed the general response to emergencies and emphasized the response to fire emergencies. Facing only the smell of gas and not a fire, the clerk remembered that the gas company should be called in the event of a gas leak. Even though the two patrons suggested that he call the fire department, the clerk called the gas company thinking that personnel there should know the most appropriate actions. One of the patrons who reported the smell of gas felt the leak was severe and became concerned when the clerk did not call the fire department. Despite this concern, the man left the motel and did not call the fire department.

When the clerk called the gas company, he reached an individual who had been specifically trained for the response to gas-related emergencies. The gas company dispatcher obtained basic information about the incident and immediately dispatched a local service person. Reportedly, the dispatcher also told the clerk about methods for shutting off the gas when the clerk requested that information. There was no discussion between the clerk and the dispatcher regarding fire department notification or building evacuation.

The first communication that the gas company had with the Hagerstown Fire Department occurred after the explosion when the fire department called the gas company and reported the gas explosion.
DISCUSSION

Unfortunately, three of the four victims were directly above the area where the explosion occurred. Their position with respect to the explosion seems to be a primary factor contributing to their deaths. Any attempt to theorize as to whether sprinkler protection or alternative types of construction would have improved the survival potential for those three individuals would be speculation.

The 1985 Life Safety Code required operable windows in new hotels and the fire department inspectors ensured that windows that met this requirement were installed. The code recognizes that windows may serve as a means of escape, particularly where ladders can be raised by fire fighters or others. Even where the location is such as to preclude the use of windows for escape, they may provide air for breathing in a smoke-filled room while trapped occupants are awaiting rescue.

The 1985 Life Safety Code also requires that the windows be operable from the inside without the use of tools. The windows in this facility appear to have met this intent, and at least ten survivors used the windows during their escape or were rescued through windows. However, the survivors from two rooms stated that they had experienced difficulty in operating the windows (See Table, Appendix 2), and the fire fighters on T-1 stated that the occupants in a third floor room broke out the windows before the fire fighters reached them with their aerial ladder. It also appears that the victim who was from Room 213 also experienced difficulty operating the window. Instead of waiting in his room with the window closed, he left his room and was overcome by conditions in the corridor.

Though the previous discussion has focused on gas explosion and the factors that appear to have contributed to the deaths of the four patrons, the real emphasis with respect to this incident should be placed on the fact that about 90 percent of the building population survived.
Following the explosion, the desk clerk immediately began his fire emergency procedures. He activated the building alarm system, called the fire department, and retrieved the guest list for the fire fighters. He also assisted the escaping guests whenever possible.

Fire department officials worked closely with the designers and owners to ensure that the building was conforming to state-of-the-art codes. As a result of their efforts, fire-rated partitions and other assemblies in the building contained the majority of the fire to the areas damaged during the explosion. The integrity of the building's egress system was such that most people were able to escape through normal means before fire fighters arrived, and a means of escape was available for those who needed it. Fire fighters indicated that the large windows enhanced their ability to rescue the few remaining occupants.

The fire-rated assemblies also reduced the risk to fire fighters. The first arriving Hagerstown fire fighters were assigned to simultaneous rescue and suppression operations. With the contribution provided by the fire-rated partitions and other assemblies, very few fire fighters were needed to contain the fire, and other fire fighters could search for possible victims with minimal risk to their own safety.
APPENDIX I

FIGURE 1  First Floor Plan
FIGURE 2  Area of Origin
FIGURE 3  Damage - First Floor
FIGURE 4  Damage - Third Floor
FIGURE 5  Damage - Second Floor
Figure 1: First Floor Plan

Note: Dimensions are in Feet
Figure 3: Damage - First Floor
### SURVIVOR ESCAPE METHOD*

<table>
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<tr>
<th>ROOM NO.</th>
<th>NUMBER OF OCCUPANTS</th>
<th>ESCAPE PATH</th>
<th>EXPERIENCED TROUBLE WHILE OPENING WINDOW**</th>
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<td>NC</td>
</tr>
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<tr>
<td>301</td>
<td>2</td>
<td>Corridor to East Stairway</td>
<td>NC</td>
</tr>
<tr>
<td>302</td>
<td>3</td>
<td>Corridor to West Stairway</td>
<td>NC</td>
</tr>
<tr>
<td>318</td>
<td>5</td>
<td>Window</td>
<td>Yes</td>
</tr>
<tr>
<td>Unknown</td>
<td>2</td>
<td>Corridor</td>
<td>Yes</td>
</tr>
</tbody>
</table>

*Based on information from Fire Department interviews, Fire Department questionnaires, and newspaper accounts. Not a complete list of all survivors.

**NC means the survivors made No Comment about attempts to use the window.