

**RESTAURANT**  
Derby, CT  
December 6, 1985



# **FIRE INVESTIGATIONS**

**NATIONAL FIRE PROTECTION ASSOCIATION**

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Summary Investigation Report

Gas Explosion - River Restaurant  
Derby, CT  
6 Fatalities, 18 Injured  
December 6, 1985

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## ABSTRACT

At 3:56 p.m. on Friday, December 6, 1985, a natural gas explosion occurred at the River Restaurant in Derby, Connecticut. It appears that a gas main may have been damaged during the refilling of a sewer excavation. Before anyone became aware of the leak, escaping gas accumulated in the basement of the restaurant and came in contact with an undetermined ignition source. The resulting explosion killed six people in the restaurant, injured 12 other occupants, and completely destroyed the building housing the restaurant. Three people who were not in the restaurant were also injured by the explosion.

## INTRODUCTION

The National Fire Protection Association investigated the explosion at the River Restaurant in Derby, Connecticut in order to document and analyze the significant factors which may have led to the loss.

The information contained in this report has been based on the best data available following the explosion and additional data obtained in subsequent follow-up. The purpose of NFPA documentation of fire incidents is to identify, analyze, and record factors that have particular educational and technical interest. It is not the NFPA's intention that this report pass judgment on, or fix liability for, casualty or property losses in these incidents.

The cooperation and assistance of TFC Joseph Laput, Connecticut State Fire Marshal's Office; Trooper Henry Renfrew, Connecticut State Fire Marshal's Office; Fire Marshal Joseph Iacuone, City of Derby; and Fire Chief James Butler, Derby Fire Department are acknowledged and appreciated.

## BACKGROUND

Derby, Connecticut is an old industrial community with many mill buildings. A system of aqueducts was constructed so that large quantities of water for industrial and tenant use could be brought to the buildings. Many buildings, such as the one that housed the River Restaurant, were constructed with the aqueduct as part of the basement which allowed water to pass through the structure.

Through the years the use of the building changed; ultimately, it was converted to the River Restaurant. During the changes, the aqueduct system became obsolete and its use was discontinued. Subsequently, the inlet and discharge for the water canal were sealed with stone. The resulting space constituted what was called the lower basement in the River Restaurant and was apparently open for the full length of the building.

The dimensions of the foundation were 57 feet by 46 feet (see Figure 1). Because the building was constructed on a sloping site, it appeared to be a four-story structure in the rear and a three-story structure in the front. The three-story structure had a full basement in addition to the lower basement. Main Street was parallel with the front of the building; Caroline Street was parallel to one side and First Street was parallel with the rear of the building.

Although considered to be Type III (200) construction by NFPA 220 criteria, this building was composed of several types of materials.<sup>1</sup> These included a mortar and stone foundation, concrete-on-unprotected-metal-beam floors, plank-on-joist wood floors, a wood roof assembly, and both wood and

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<sup>1</sup>NFPA 220, Standard on Types of Building Construction, 1985 edition. A Type III (200) structure will have a 2-hour fire rating for the exterior bearing walls (first digit), no fire rating for structural frame or columns and girders, supporting loads for more than one floor (second digit), and no fire rating for the floor assembly (third digit).

masonry interior partitions. The arch-shaped channel for the aqueduct system had walls constructed of stacked stone without mortar. The lower basement reportedly had a seven-foot high ceiling and was being used for miscellaneous storage. A stairway provided access between this space and the full basement above. The full basement contained the rest rooms and several other small rooms used for various purposes. Another stairway provided access between the full basement and the first floor. The construction of and enclosures for the stairways were not determined. The first floor contained the kitchen, bar, and lounge area. Banquet rooms filled the second floor and office space was provided on the third floor. Due to the extensive damage to the building, details regarding the means of egress from floors above grade were not available.

A 12-inch water main, a three-inch gas main, a sewer pipe, and a new storm drain were buried under Caroline Street. To facilitate the installation of these pipes, a part of the aqueduct under Caroline Street had been removed and remaining aqueduct was closed off with a stone wall (see Figure 2). The gas main had been in place since 1893 and had a pressure of 1 psi. It was installed about 40 inches below the surface of Caroline Street. Before the work was started, the locations of the pipes were marked on the surface of Caroline Street. These markings indicated that the gas main and the sewer pipe actually crossed one another near the corner of Caroline and Main Streets. The soil in the area of the excavation was a sand/gravel mixture that also contained stones, broken concrete, and asphalt.

At the time of the explosion, two restaurant employees were in the kitchen and the owner, along with another employee, were in the bar. The location of the remaining 14 occupants is not clearly known, but it is believed they too were on the first floor. The restaurant owner indicated that he had smelled gas for several days before the explosion and that the gas company had been

attempting to locate the source of the smell. It appears that no one in the restaurant sensed any drastic changes in the gas smell before the explosion.

#### FIRE INCIDENT

On the day of the explosion, a contractor was continuing with a project to install new storm drains. Having contacted the "Call B4 You Dig" agency, the contractor was familiar with the location of buried utilities near their excavation on Caroline Street.<sup>2</sup> The contractor's employees finished their work and completed the necessary backfilling without noticing any damage to the gas main.

An off-duty Derby police officer was in his car on Main Street facing the restaurant. Since he was approximately 100 feet from the building, the officer had a clear view of the restaurant. He did not note any abnormal activity among the construction workers or anyone else near the River Restaurant. He then heard a loud noise, and then sections of the building's front wall were blown into the street directly in front of him. At the same time, upper floors began to collapse and fall into the foundation. He stated that he did not see any fire. However, he did note a red/orange haze or dust coming from the building immediately following the explosion. Several occupants were thrown clear of the building and others began to crawl from the wreckage. The police officer went to the building and attempted to aid any people still inside.

The fire department received a box alarm at 3:56 p.m. for Main and Caroline Streets. The first fire officer arrived at the scene approximately

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<sup>2</sup>"Call B4 You Dig" is a privately funded organization that maintains information about buried utility equipment and other underground facilities. The information is then provided to parties who intend to dig. This service is an effort to reduce the number of accidental strikes against underground equipment.

two minutes after the alarm was sounded and found no evidence of fire. He immediately requested mutual aid assistance from two neighboring towns. With victims still crawling out of the wreckage, the officer began to prepare his plan for rescuing trapped occupants.

Some of the first arriving fire fighting units set up the supply lines; units arriving later prepared to protect exposures. As more fire officers arrived, command responsibilities for fire fighting, rescue, triage, and other activities were assigned. About ten minutes into the incident, flames, which eventually reached a height of 50 feet, erupted from the center of the building. This fire lasted for nearly two hours while the gas company attempted to isolate the damaged piping. In addition, several small gas explosions resulted from gas pockets, hampering suppression and rescue efforts. At about 5:00 p.m., gas was discovered in sewer lines up to four blocks away from the fire scene. This resulted in the evacuation of buildings in a four-block by four-block area.

Using information provided by survivors, the fire department personnel gained an understanding of where trapped victims might be found. Actually locating the people was a slow and difficult task because of the amount of debris that had fallen on top of them. The only screams that could be heard came from the area where the kitchen had been. While still searching for others, fire fighters began their efforts to rescue the victim trapped in the rubble. Crews immediately began to remove debris from the surface of the rubble. However, after evaluating the situation and estimating the amount of material above the victim, the officer in charge of rescue decided that a tunnel from the adjacent building might produce quicker results.

A hole about two feet in diameter was cut through the two-foot thick, solid brick, party wall. Fire fighters were preparing to crawl into the basement of the restaurant in order to find the victim when a small explosion

caused the rubble to shift. A refrigerator and other material fell and blocked the hole that had been made. As a result, this attempt was thwarted, and it was decided to continue removal of surface materials in order to make the rescue.

The trapped victim was finally removed at 8:00 p.m., about 3 hours after the explosion. Rescue efforts continued throughout the night and the last body was finally removed at 11:45 a.m. on Saturday morning.

Fire fighting operations lasted nearly 26 hours, and about 250 fire fighters plus other emergency personnel became involved at the fire scene. Approximately 20 pieces of apparatus were provided by Derby and six mutual aid communities. In addition, a crane, two power shovels, two large bucket loaders, and other contractor's equipment were used to remove rubble. Two helicopters and ten ambulances were brought to the scene for the transportation of the injured.

#### Casualties and Damage

Though injured to varying degrees, 11 occupants immediately escaped from the ruins of the restaurant without assistance. The only occupant that was rescued suffered multiple fractures and other injuries. The exact cause of death for the six fatalities was not determined at the time this report was prepared. Two people in a neighboring business and another person outside the restaurant were injured.

The restaurant was completely destroyed by the blast. Floors, the roof assembly, and most interior components collapsed and fell into the foundation. Sections of the front exterior walls were blown into Main Street, leaving most debris within yards of the front of the restaurant. The side wall facing Caroline Street was blown into the street and the rear wall was shattered. Bricks, wood, and other materials from this wall were found nearly 200 feet away. At the corner where the rear wall to the restaurant was



connected to the adjacent building, all the brick from the first floor and below were stripped back to the party wall. However, some brick from the rear wall still remained attached to the party wall at the second and third floor levels. The party wall between the River Restaurant and the adjacent building received some damage but remained standing.

### ANALYSIS

The State of Connecticut Department of Public Utility Control determined that "The probable cause of the incident was excavation activities by (the contractor) which caused a cast-iron pipe to crack."<sup>3</sup> Metallurgists from the National Transportation Safety Board (NTSB) examined a cracked section of the gas main suspected as the origin of the natural gas leak. Their tests revealed that the crack, which extended around the entire pipe circumference, was the result of a force overload. A large stone was found within inches of the pipe near the point of force application. In addition, several smaller stones were found between the large stone and the gas main (see Figure 2). These smaller stones were identified as a path through which forces from the rock could be transferred to the gas main. The investigation could not be determined whether the force transmitted by the large stone was a result of it being dropped during backfill operations, whether the stone was in place from other construction work and tamping operations generated the force, or whether the force was generated through other means.

The natural gas escaped through the resulting crack, seeped through the soil, and then entered the basement through the stacked stone walls of the

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<sup>3</sup>Report of the Engineering Division of the "Examination into the Causes and Circumstances Connected with the Incident at 168 Main Street, Derby, Connecticut..., Accident No. 421, State of Connecticut, Department of Public Utility Control."

aqueduct. Considering the size and type of crack in the gas main, the diameter of the gas main, pressure within the main, the estimated volume of the basement and lower basement, and other factors, state fire investigators concluded that the Lower Explosive Limit (LEL) could have been reached in two minutes if the leak was in open air, all the gas entered the building, and all the gas remained in the basement area. They also indicated that this time has to be adjusted upward to account for the affects of the unquantified variables; such as those previously mentioned. Based on these variables and information obtained in the investigation, the State of Connecticut Report indicated that the leak did not exist 6 1/2 hours before the explosion.<sup>4</sup>

The actual source of ignition has not been determined, though several potential ignition sources were present in the basement. These sources include, but are not limited to, switches, motors, and pilot lights. Once the flammable mixture of gas and air came in contact with the ignition source, the explosion occurred.

In the past, buried utility facilities have been struck and damaged during digging operations. The extent of damage has ranged from minor scratches to major gas leaks that have caused multiple fatalities and property damage. "Call B4 You Dig" and other such programs have been organized throughout the country to reduce the potential for accidental strikes and subsequent losses. It is the responsibility of an excavator to contact these agencies and to obtain information regarding the location of buried utilities. Once the buried utilities are identified, the excavator must exercise care even in the event that his intended work does not directly involve the marked utilities. In this incident, the contractor indicated that his crews never uncovered the gas main, yet, it appears that his activities disturbed the ground surrounding

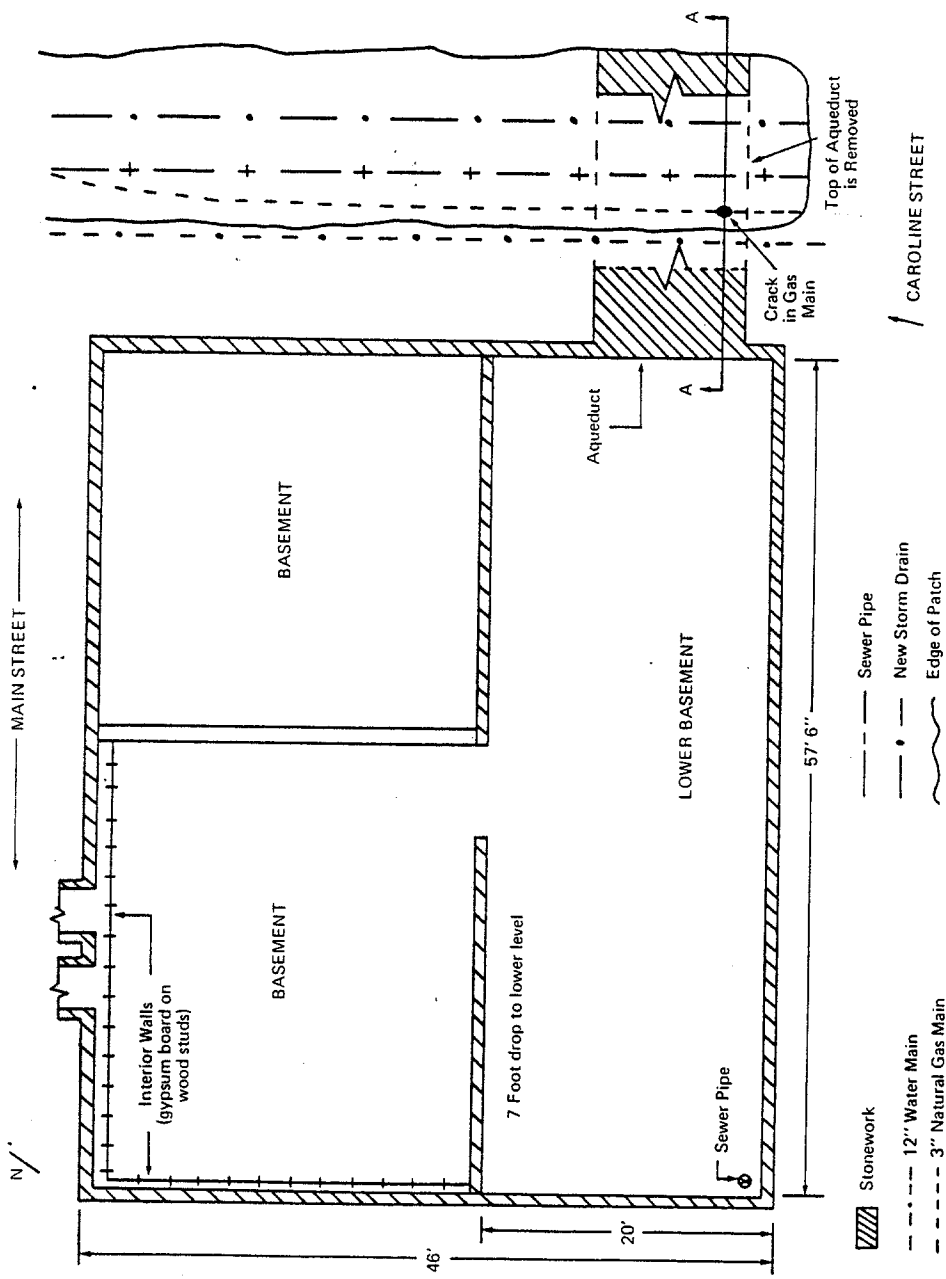
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<sup>4</sup>Ibid, pg. 3

the gas main which resulted in the cracked 3-inch pipe.

The explosion at the River Restaurant reiterates that natural gas can readily pass through soils such as the sand/gravel mixture under Caroline Street. Gas will continue to migrate until it reaches a barrier (pocket, conduit, etc.) and begins to accumulate. In this incident, the accumulation occurred in the lower basement of the River Restaurant, an area that was not normally occupied. Despite the infiltration of the gas, occupants apparently did not detect any unusual odors and were apparently not warned of the significant gas leak.

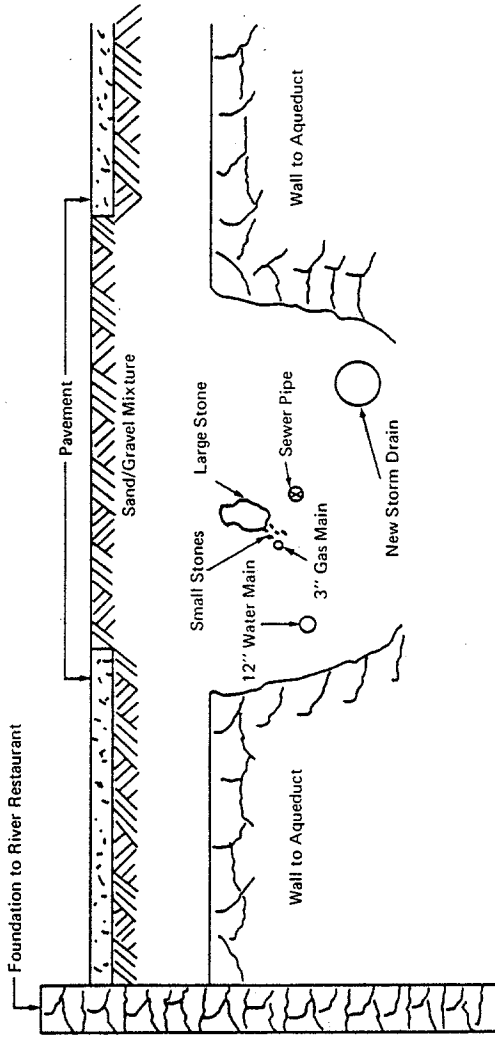
Fire officers should be aware of the ability of natural gas to spread underground and to accumulate in areas remote from the actual leak. When assessing the magnitude of a natural gas leak, fire fighters may have to inspect basements and similar areas near the leak for possible accumulated gas.



-  Stonework
-  12" Water Main
-  3" Natural Gas Main
-  Sewer Pipe
-  New Storm Drain
-  Edge of Patch

NOT TO SCALE

FIGURE 1



Section AA (See Figure 1)

NOT TO SCALE

Cross Section at Point of Crack  
Figure 2