

Fire Investigation Summary

Pangnirtung, NWT

**Sprinklered School Fire
March 9, 1997**



A fire in an unoccupied, partially sprinklered school in the Northwest Territories of Canada demonstrated the critical importance of full sprinkler protection.



**National Fire Protection Association
Fire Investigations Department**

A fire occurred in a partially sprinklered school in Pangnirtung, Northwest Territories, Canada, on Sunday, March 9, 1997. The fire resulted in the destruction of the school. There were no fatalities or injuries as a result of this fire. The loss was estimated at \$10 million Canadian (over \$7 million US). Temporary classrooms were obtained to complete the school year. A new school will not be ready until fall of 1998.

The NFPA became aware of the Pangnirtung School fire several days after it happened and responded at the request of the Northwest Territories Fire Marshal to document the incident. Unfortunately, due to harsh weather in Pangnirtung, NFPA's investigator was unable to reach the site. However, working in conjunction with the Fire Marshal for the Northwest Territories, he did meet with contractors, engineers, and public works personnel responsible for the project in Iqaluit and was able to interview witnesses by telephone. In addition, an Assistant Fire Marshal for the Northwest Territories was on site in Pangnirtung and was able to provide information based on his on-site investigation of the fire scene.

The Pangnirtung school was a one-story structure with a combination of wood frame construction and unprotected steel construction. A 34-in. (860-mm) high crawl space was located under a major portion of the building. This crawl space contained utilities such as the domestic water tanks, fire protection water tanks and sewage tanks, as well as piping and wiring for the various utilities.

The roof and exterior wall assemblies throughout the building were composed of 4 ft. by 8 ft. (1,200 mm by 2,400 mm) sheets of 5/8 in. (16 mm) thick plywood, covered with two layers of 6 in. (152 mm) thick, solid polystyrene insulation, covered by another layer of 5/8 in. (16 mm) thick plywood. Cedar siding was placed over the final plywood layer on the exterior of the walls, and a built-up roofing system was placed on the plywood on the roof.

Interior non-bearing walls were constructed of wood studs measuring 58 mm by 89 mm (2 in. by 4 in., nominal) or 58 mm by 140 mm (2 in. by 6 in., nominal) located 400 mm (16 nominal) on center. The interior walls were covered by gypsum wallboard 12.7 mm (1/2 in.) thick or to 16 mm (5/8 in.) thick.

The Pangnirtung School was being renovated at the time of the fire and was scheduled to be turned over to the client department within two weeks. As part of the renovation, a sprinkler system was installed in the occupied space, in the combustible void spaces, and in the combustible crawl space located underneath the building. However, a combustible void space at the roof level near the gymnasium was not properly protected by an automatic fire sprinkler system.

The community of Pangnirtung is located in a relatively remote area of Baffin Island in the Northwest Territories of Canada. The total population of Pangnirtung is 1,300 people. The school plays a vital role in not only educating the residents of the community but also serves as a social center.

Fire protection is provided by a 25 person volunteer fire department with only one pumper truck. There is no municipal water supply and all water (for both domestic use and fire fighting) is provided by tankers.

During the winter months Pangnirtung is only accessible by air. Therefore they are completely reliant upon their own fire fighting resources if a fire should occur. For this reason, a strong effort is being made to provide sprinkler protection because of the limited fire fighting capabilities.

The fire started at approximately 1:30 p.m. on Sunday, March 9, 1997. An electrician and a plumber were working in the crawl space under the industrial arts classroom. They heard the fire alarm system activate, and very shortly afterwards the lighting in the crawl space automatically shut off. (The electrical system was designed so that when the fire pump activated, non-essential circuits were shut down,

which included lighting in the crawl space.) The plumber used a lighter to provide illumination, and both men exited the space through an access hatch in the electrical room in Phase 1.

At the same time, an alarm was automatically transmitted to the Pangnirtung fire station which was located directly across the street from the school building.

Two fire fighters entered the building, advancing a hoseline through the building's south door. They ran out of hose before reaching a point where they could attack the fire and began to exit the building through the south corridor. While exiting, they came across a fire fighter in the corridor who had collapsed for an unknown reason. They removed this fire fighter from the building. No further interior fire-fighting operations were attempted.

The fire-fighting personnel were not successful in their attempt to open the roof in the vicinity of the fire, and a defensive fire-fighting operation was attempted. Since Pangnirtung has no municipal water supply, water had to be trucked in using domestic water tankers that were not designed to supply water for fire-fighting operations in the volumes required. In addition, the discharges on the front-mounted pump on the fire engine froze due to the extremely low temperatures (-40° C/ -40° F), further impeding the fire ground operations.

The fire ultimately spread to the roof structure and spread very aggressively, resulting in destruction of the building and its contents.

It was determined by the fire marshal for the Northwest Territories that a combustible void space near the gymnasium was the area of origin for the fire. This void space was either not adequately protected by the sprinkler system or the sprinkler system failed to control the fire due to failure of the nonmetallic sprinkler pipe. This failure may have resulted in loss of water supply throughout the system. The exact cause of the fire is undetermined.

Based on the NFPA's investigation and analysis of this fire, the following significant factors contributed to the loss of property in this incident:

- Incomplete sprinkler protection
- Combustible void space
- Combustible exterior material and insulation material
- Limited water supply
- Inadequate manual fire-fighting operations

Fire protection in areas such as Pangnirtung create unusual demands upon the community, the builders, and designers. Special considerations might be necessary to blend different fire protection strategies together to provide an adequate level of fire safety, as opposed to relying solely upon one or two features.

As this incident demonstrated, a partial, incomplete and inadequately designed sprinkler system is unlikely to be effective in providing fire control or suppression. This, coupled with difficulties involving manual fire suppression operations, resulted in total destruction of the school. Given the challenging physical environment in Pangnirtung where these buildings are being constructed, it may be prudent to consider including additional passive fire protection features, such as fire-rated assemblies, which would limit the spread of the fire to a given area and reduce the potential for a total loss of the building. Such design, coupled with a properly designed, installed and maintained sprinkler system can provide a high level of reliable fire protection under very challenging conditions.

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The National Fire Protection Association's Fire Investigations Department documents some of the most significant fires and incidents throughout the world. The objective of these investigations is to determine what lessons can be learned from these incidents. This information is then made available to the fire safety community to be used in developing future codes and standards. A complete listing of reports is available, either upon request or can be viewed on our web page.

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