

National Construction Safety Team Investigation

**Press Briefing: Draft Report on
The Station Nightclub Fire**

Providence, Rhode Island
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Technology Administration
U.S. Department of Commerce**

Duties of National Construction Safety Teams

To establish likely technical causes of building failure;

To evaluate technical aspects of evacuation and emergency response procedures;

To recommend specific improvements to model building standards, codes, and practices based on findings; and

To recommend research and other appropriate actions needed to improve structural safety of buildings, evacuation and emergency response procedures, based upon findings of this investigation.

Conduct of Investigation into The Station Fire

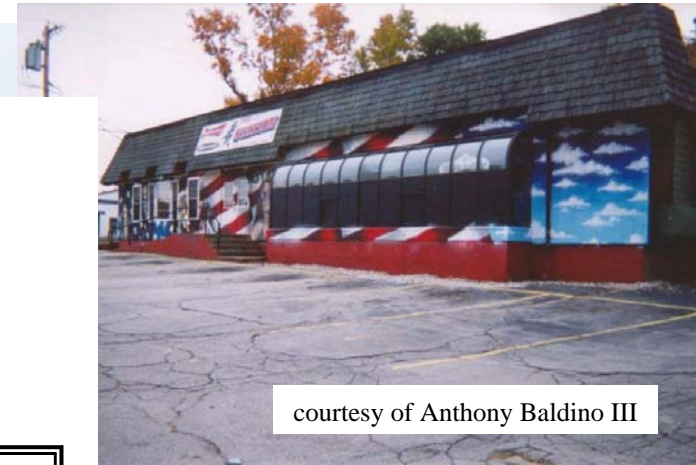
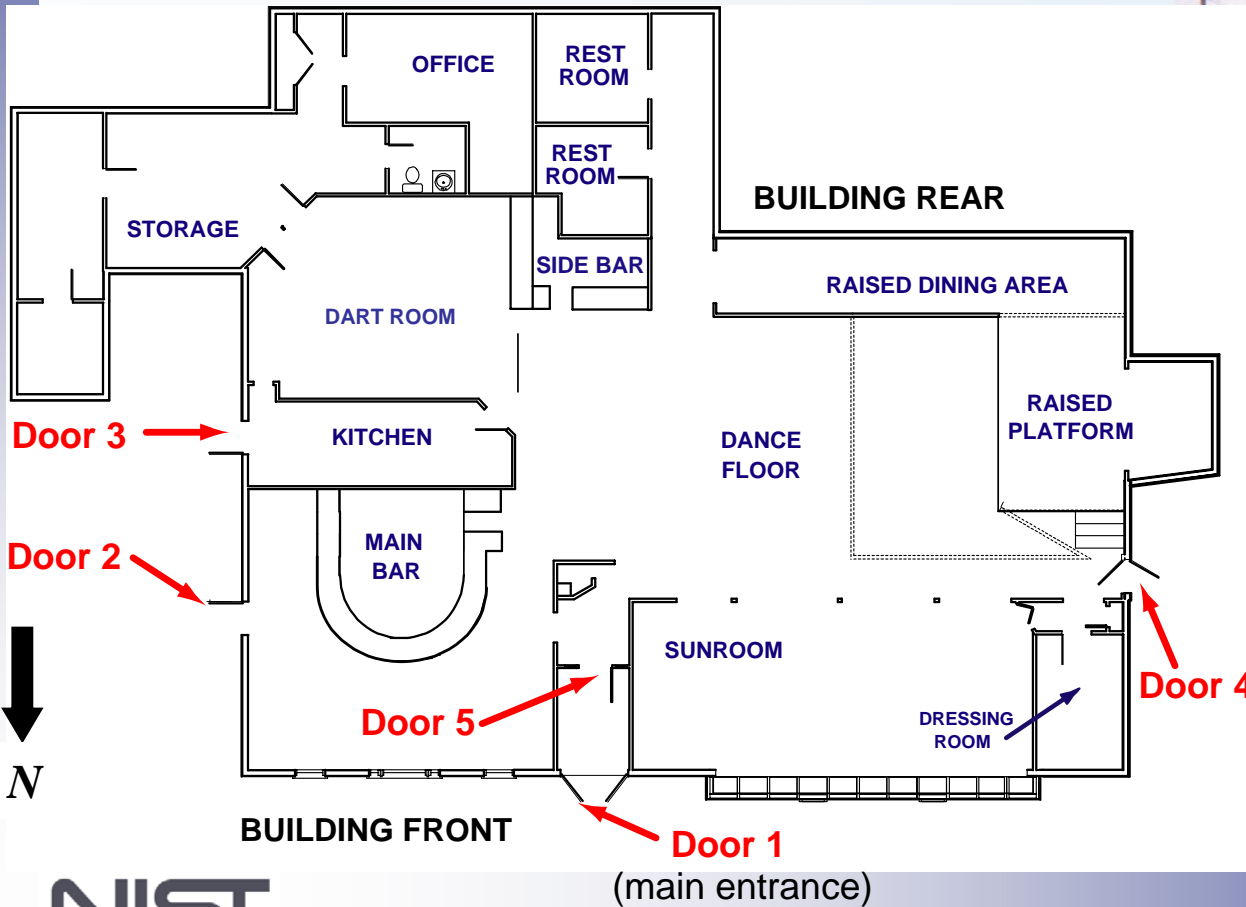
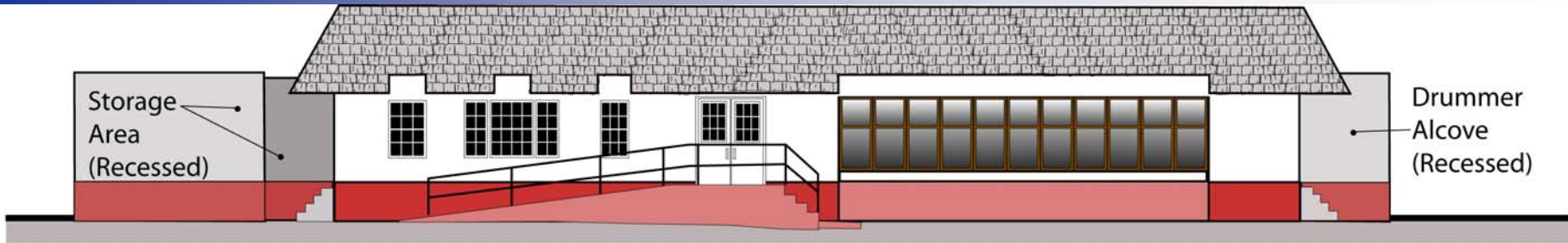
Identified technical issues through consultations with experts in fire protection engineering, emergency evacuation, and members of other investigative teams.

Collected data from the site, local authorities, contractors, building design documents, video/photographic data, telephone/radio transmissions, oral and written accounts.

Compared model building and fire codes and practices, and reviewed practices used in operation of building.

Simulated and analyzed fire spread, smoke movement, tenability, evacuation, and operation of fire protection systems.

Conducted tests to support analysis and simulation predictions.



courtesy of Anthony Baldino III

Views of Building

Overall Timeline

<u>Time</u>	<u>Event</u>
11:08 pm	<ul style="list-style-type: none">- ignition of foam by pyrotechnics- band stops playing, crowd begins to evacuate
11:09	<ul style="list-style-type: none">- cell phone callers report fire to 911- fire alarm sounds and strobes begin to flash- report received of fire at Station nightclub; off-duty police on scene- people caught in doorway, smoke pouring out above
11:10	<ul style="list-style-type: none">- 4 fire engines, a ladder truck and battalion chief assigned and dispatched
11:13	<ul style="list-style-type: none">- Engine 4 on scene; running first hose line (1 3/4")
11:20	<ul style="list-style-type: none">- master stream off Engine 2 operational
11:23	<ul style="list-style-type: none">- Fire Chief 1: implement mass casualty plan
11:32	<ul style="list-style-type: none">- roof over main bar appears down
12:15 am	<ul style="list-style-type: none">- partial collapse of pool room area begins
~ 12:45	<ul style="list-style-type: none">- State Fire Marshal on scene
~1:00	<ul style="list-style-type: none">- all patients transported

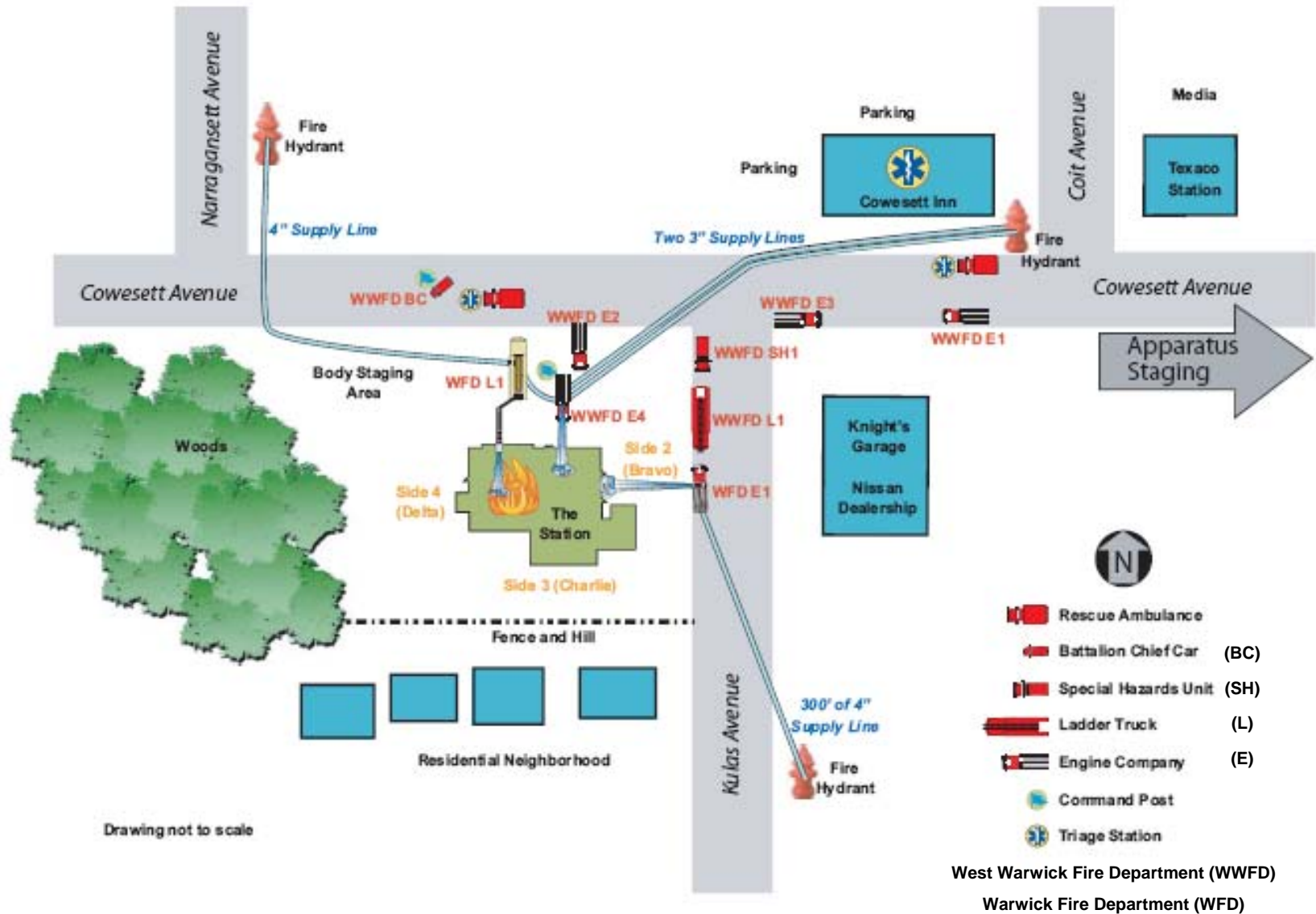


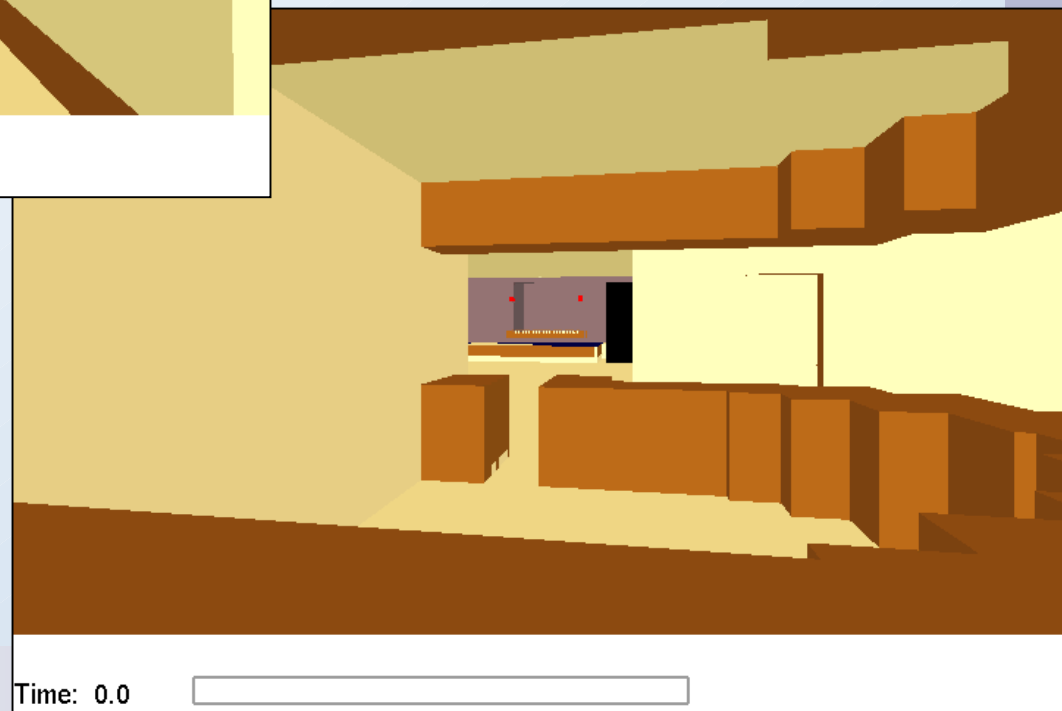
Figure 3-1. Schematic of primary apparatus deployment

Computer Simulation of The Station Fire

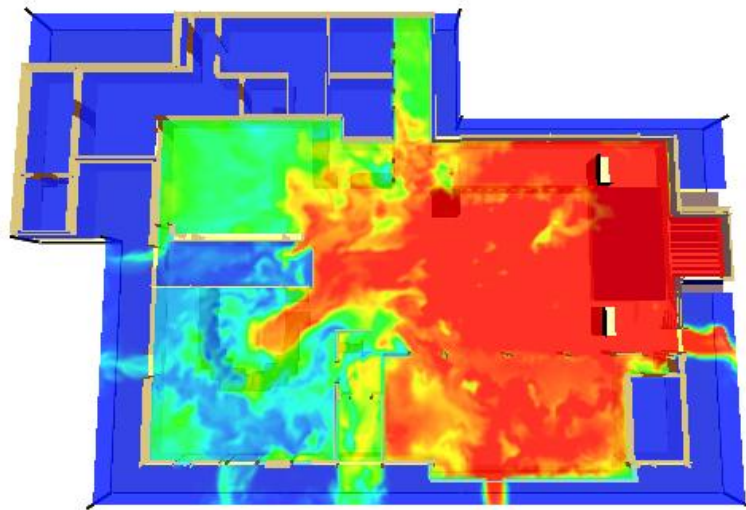


← View of fire from near entrance to front vestibule (near floor)

View of fire from far side of main bar (head height)



temperature
°C

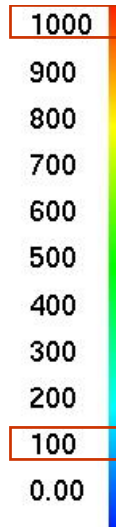


5 ft above floor

NIST

Temperatures in The Station at 90 seconds

(from computer simulation)

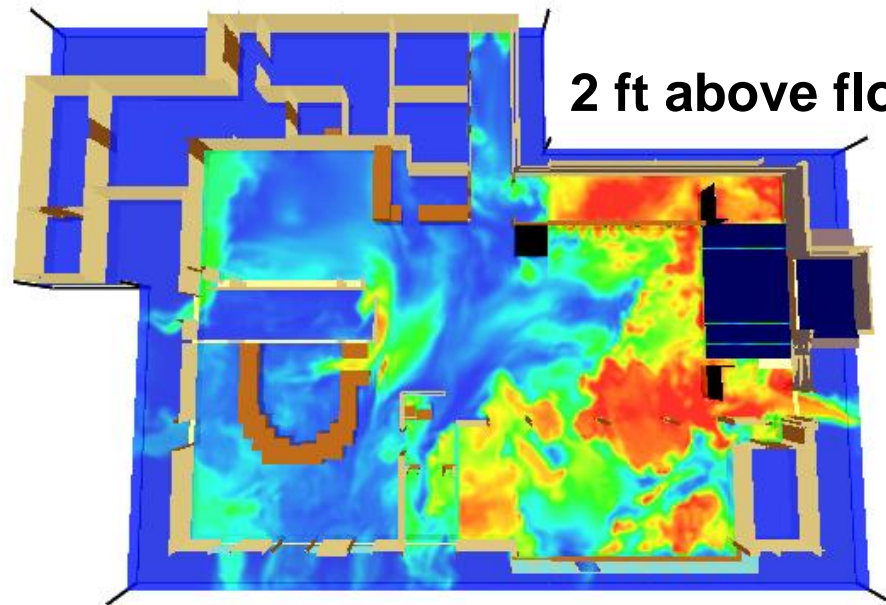


Time: 90.0

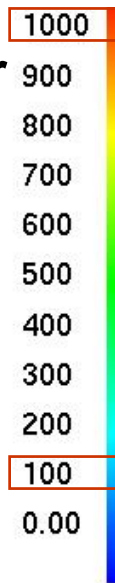
Peak temperatures in red exceed 1000 °C (1832 °F)

Light blue indicates temperatures around the boiling point of water (100 °C, or 212 °F)

temperature
°C



2 ft above floor



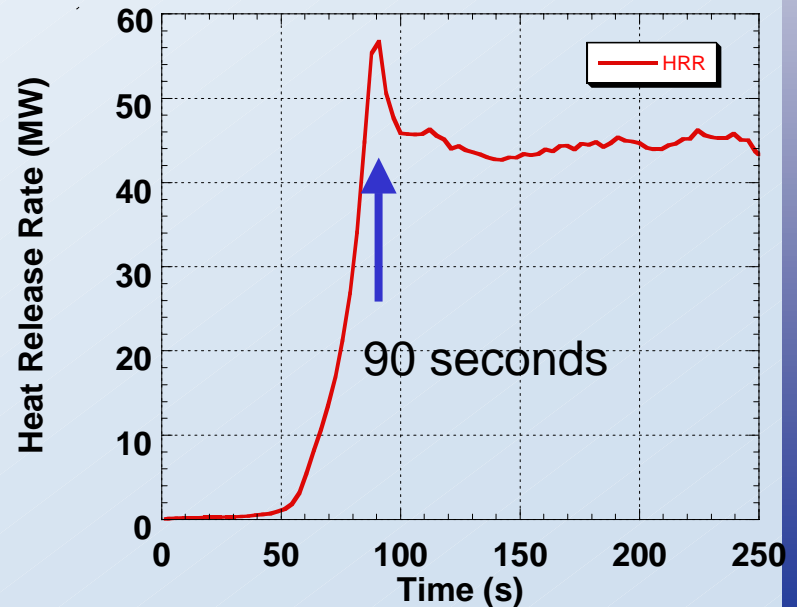
Time: 90.0

Direct contributors to substantial loss of life in The Station fire

- Hazardous mix of building contents
- Inadequate capability to suppress fire during its early stage of growth
- Inability of exits to handle all of the occupants in the short time available for such a fast growing fire

Key Findings Regarding Building Contents

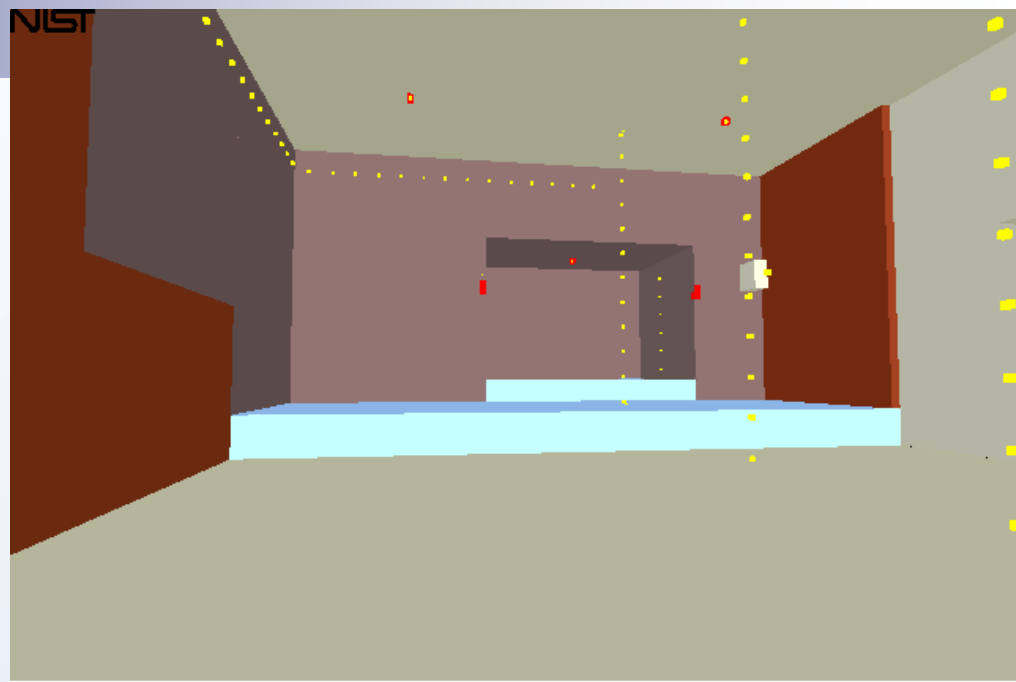
- Non-fire retarded foam sample purchased by NIST ignited within 10 seconds when exposed to a pyrotechnic device; under similar condition, fire retarded foam sample did not ignite.
- Computer simulation of the nightclub fire shows that flames spread rapidly over foam finish material, igniting the wood paneling adjacent to the foam and generating intense heat in the first 90 seconds.
- Fire transitioned to more traditional, ventilation-limited wood frame building fire in about 2 minutes.



Key Findings Regarding Fire Protection Systems

- Experiments conducted at NIST demonstrated that a sprinkler system installed in test room in accordance with NFPA 13 was able to control a fire initiated in non-fire retarded polyurethane foam panels.
- Sprinklers were not installed in The Station, nor would they have been required for such existing structures under 2003 editions of the model codes
- A heat detection/fire alarm system was installed in the building and was activated (sound and strobe) by the fire 41 seconds after the fire started.

Computer simulation of platform area mock-up with sprinklers



Time: 0.0



Key findings regarding emergency egress

- First patrons recognized danger 24 seconds after ignition of foam; bulk of crowd began to evacuate around time band stopped playing (30 seconds).
- 2/3 of occupants attempted to leave through main entrance; many were unsuccessful.
- Prior to 90 seconds, a crowd-crush occurred at main entrance which disrupted flow through front exit.
- Event precipitating crowd crush likely related to arrangement of single interior door with merging streams of traffic and pressure to escape rapidly deteriorating conditions in nightclub.

Key findings regarding emergency egress (cont.)

- Measurements in a fire test of a reconstructed portion of the platform and dance floor produced, within 90 seconds, conditions well in excess of accepted survivability limits.
- Computer simulation of the full nightclub fire suggested that conditions around the dance floor, sunroom, and assembly area behind kitchen would have led to severe incapacitation or death within about 90 seconds after ignition of the foam.

Areas of recommendations for improvements to model building & fire codes, standards and practices in nightclubs

- Strengthen requirements for installation of sprinklers*
- Tighten restrictions on flammable materials as finish products, and further limit use of pyrotechnics*
- Increase factor of safety on time to egress*
- Other areas referred to in draft report*

*And that state and local authorities adopt these provisions.

Recommendation 1: That model codes require sprinkler systems for all new and existing nightclubs regardless of size.



Computer simulation of The Station fire had sprinklers been installed

Recommendation 2: Regarding building contents and finish materials, that the model codes:

(a) specifically forbid (with no exceptions) certain classes of materials (including non-fire retarded flexible polyurethane foam) that are known to easily ignite and rapidly propagate flames from all new and existing nightclubs;

(b) provide greater guidance for when large-scale tests are required to demonstrate that materials pose no undue hazard for the use intended, and establish pass/fail criteria using best measurement and prediction practices; and

(c) strengthen provisions in NFPA 1126 regarding use of pyrotechnics.

Recommendation 3: That the factor of safety on the time to egress be increased in the model codes by

(a) computing the number of required exits and permitted occupant loads assuming at least one exit will be inaccessible in an emergency;

(b) increasing the capacity of the main entrance to accommodate, at a minimum, $2/3$ of the maximum permitted occupant level during an emergency; and

(c) eliminating trade-offs between sprinkler installation and factors that impact the time to evacuate buildings.

Recommendation 4:

That new life-safety provisions apply to existing as well as new nightclubs, and that the practice of grandfathering older structures be eliminated....

Recommendation 5:

That model codes and standards require redundancy in passive and active fire protection systems....

Recommendation 6:

That proper account should be taken of the soundness of and safety factor provided by the existing provisions in light of the history of similar building failures....

Recommendation 7:

That the model codes increase the number of portable fire extinguishers required....

Recommendation 8:

That the model codes provide specific guidance on how to implement an effective fire inspection program....

Recommendation 9:

That fire departments comply with minimum apparatus staffing, that emergency services maintain robust, interoperable communications to support major incident operations, and that mass casualty operations be conducted utilizing appropriate command structures and practices....

Recommendation 10:

That research be conducted to better understand human behavior in emergency situations, and to predict impact of building design on safe egress in emergencies.

Recommendation 11:

That research be conducted to understand fire spread and suppression better in order to provide the tools needed by the design profession to address above recommendations.

Recommendation 12:

That research be conducted to refine computer-aided decision tools for determining costs/benefits of alternative code changes and fire safety technologies, and to develop computer models to assist communities in allocating resources.

NIST welcomes comments on Draft Report

Web site to view draft final report: <http://www.nist.gov/ncst>

(All comments received by April 4 will be considered prior to issuing the NIST Final Report)

Submit comments to:

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