Appendix B: Workshop Presentations

THE STATION NIGHTCLUB FIRE – Impetus for Workshop on the Use of Portable Fire Extinguishers

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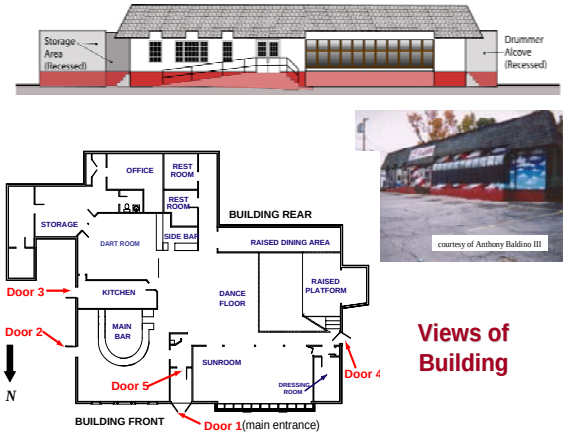

Views of Building

Overall Timeline

Time	Event
11:08 pm	- ignition of foam by pyrotechnics
	- band stops playing, crowd begins to evacuate
11:09	- 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	- 4 fire engines, a ladder truck and battalion chief assigned and dispatched
11:13	- Engine 4 on scene; running first hose line (1 3/4")
11:20	- master stream off Engine 2 operational
11:23	- Fire Chief 1: implement mass casualty plan
11:32	- roof over main bar appears down
12:15 am	- partial collapse of pool room area begins
~12:45	- State Fire Marshal on scene
~1:00	- all patients transported

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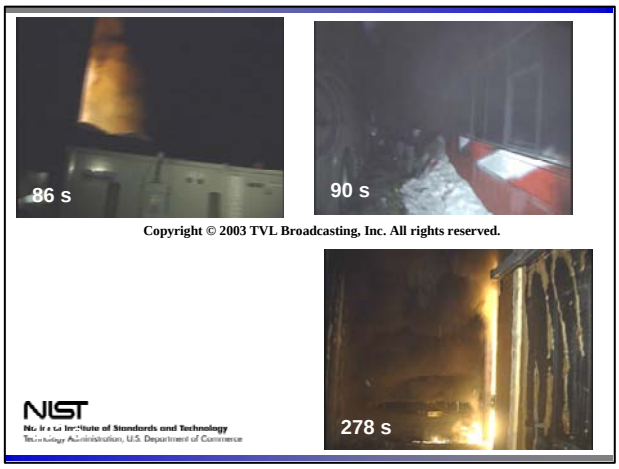
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90 s
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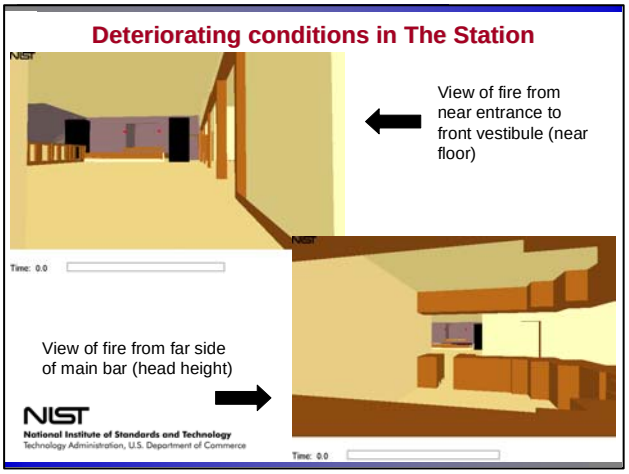
Deteriorating conditions in The Station
View of fire from near entrance to front vestibule (near floor)
View of fire from far side of main bar (head height)
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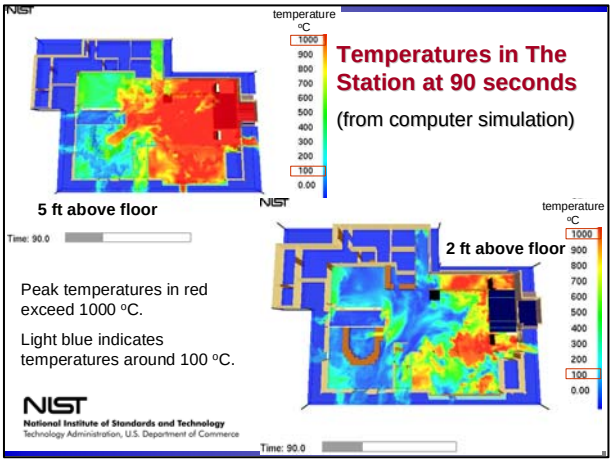
temperature
°C
1000
900
800
700
600
500
400
300
200
100
0.00
Temperatures in The Station at 90 seconds
(from computer simulation)
5 ft above floor
2 ft above floor
Peak temperatures in red exceed 1000 °C.
Light blue indicates temperatures around 100 °C.
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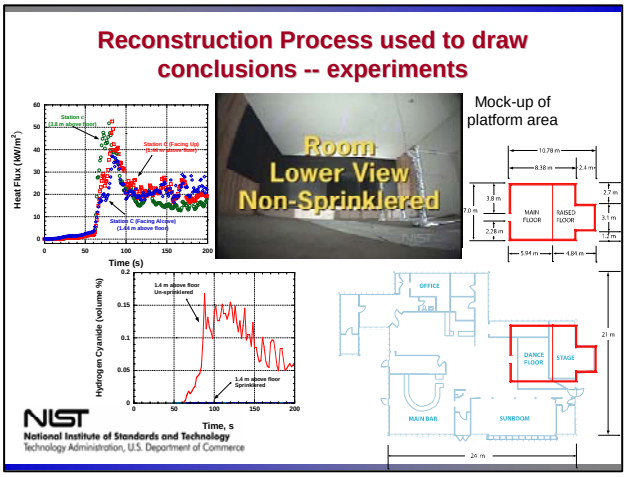
Reconstruction Process used to draw conclusions -- experiments
Heat Flux (kW/m²)
Time (s)
Room
Lower View
Non-Sprinklered
Mock-up of platform area
Hydrogen Cyanide (volume %)
Time, s
OFFICE
DANCE FLOOR
STAGE
MAIN BAR
SUNROOM
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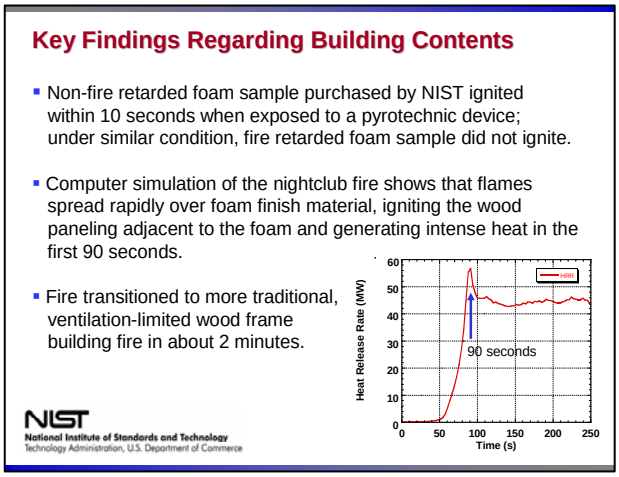
Key Findings Regarding Building Contents
Non-fire retarded foam sample purchased by NIST ignited within 10 seconds when exposed to a pyrotechnic device; under similar condition, fire retarded foam sample did not ignite.
Computer simulation of the nightclub fire shows that flames spread rapidly over foam 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.
Heat Release Rate (MW)
90 seconds
Time (s)
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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).
- Up to 2/3 of occupants may have 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.

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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.

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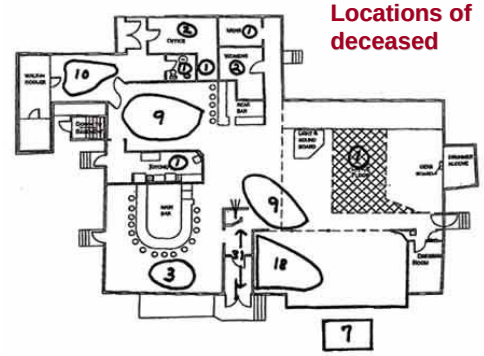
Locations of deceased



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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.

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Locations of exit signs, heat detector, and portable extinguisher (prior to and after fire)

Portable fire extinguishers located at fire scene

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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

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Recommendations

Model Code Adoption and Enforcement

All state and local jurisdictions
- adopt building/fire code covering nightclubs based on model codes
- implement aggressive/effective fire inspection and enforcement programs with enough fire inspectors, qualified to NFPA 1031

Sprinklers

Require sprinkler systems for all new nightclubs regardless of size, and for existing nightclubs with occupancy limit > 100.

Building Contents and Finish Materials

Target non-fire retarded flexible polyurethane foam, provide more explicit guidance, and ensure that pass/fail criteria for flame spread tests are meaningful.

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Recommendations

Occupancy Limits and Emergency Egress

Increase factor of safety on time to egress by
- establishing threshold building area/occupant limits using best practices for estimating tenability and evacuation time (1-1/2 minutes max. evacuation time for small nightclubs);
- computing number of required exits and permitted occupant loads assuming at least one exit will be inaccessible;
- increasing minimum capacity of main entrance to accommodate 2/3 of maximum permitted occupant level;
- eliminating trade-offs between sprinkler installation and factors that impact time to evacuate buildings;
- requiring staff training and evacuation plans for nightclubs that cannot be evacuated in less than 1-1/2 minutes; and
- providing improved means for occupants to locate emergency routes for when standard exit signs become obscured by smoke.

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Recommendations

Indoor use of pyrotechnics

Tighten requirements in NFPA 1126 regarding sprinklers, minimum area, and clearance.

Emergency Response

Adhere to model standards on communications, mutual aid, command structure and staffing

Conduct Research to
- better understand human behavior in emergency situations and predict impact of building design on safe egress in emergencies;
- understand fire spread and suppression better to provide tools needed by design profession; and
- refine computer-aided decision tools for determining costs/benefits of alternative code changes and fire safety technologies.

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Recommendations

Portable Fire Extinguishers

Perform a study to determine minimum number and appropriate placement (based upon time required for access and application in fully occupied building) of portable fire extinguishers for use in new and existing nightclubs, and level of staff training required to ensure their proper use.

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NIST Actions

- Working with codes and standards organizations, regulators, building owners and managers groups, the engineering profession, materials industry, and the fire services to identify recommendations with a technical foundation sufficient for implementation in the next code revision.
- Conducting research, leveraged with other government, commercial and university efforts, to
  - (i) predict fire spread and suppression better;
  - (ii) understand human behavior in emergency situations;
  - (iii) refine computer-aided decision tools; and
  - (iv) develop computer models to assist communities in allocating resources.
- Tracking progress on recommendations on the NIST web site.

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