National Construction Safety Team Investigation

The Station Nightclub Fire

Federal Advisory Committee
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NIST

Rationale to form Investigative Team

The Director of NIST is authorized by the NCST Act to form a Team to establish the likely technical causes of the building failure, and to evaluate the technical aspects of emergency response and evacuation procedures in the wake of the building failures that results in substantial loss of life:

- Rapid spread of fire and smoke requires technical investigation to determine how life safety features of building may have impacted evacuation process, leading to 100 fatalities.
- Depending upon findings, potential exists to mitigate future building failures like this with changes in building practices and/or building standards, codes, and regulations.
- Technical competencies required for successful investigation are available at NIST and its community of collaborators, and no local or state investigation with equivalent analytical quality exists.
- Funds on hand are sufficient to conduct an investigation.

Elements of NIST Technical Investigation

1. Establishment of initial conditions
2. Materials testing
3. Reconstruction of thermal and tenability environment
4. Examination of possible impact of sprinklers
5. Determination of evacuation process
6. Documentation of emergency response
7. Recommendations for specific improvements to model building standards, codes and practices

1. Establishment of Initial Conditions

Geometry (3/4 established)

- Dimensioned floor plan
- Vent locations, doors, windows
- Ceiling height above stage and in sunroom

Materials and Building Contents (1/3 established)

- Ceiling Tiles – wood fiber based or non-combustible?
- Wall Lining – fraction covered by wood panel and fraction covered by foam?
- Sample of an acoustic foam for small scale tests on heat release properties
- Was more than one type of "foam" used; i.e. rigid foam as opposed to the flexible "egg crate" foam?
- Was foam painted or treated in any way?

Useful Documentation

- Construction drawings of building and renovations
- Fire alarm system plan with types and location of detectors, emergency lights
- Recent photographs or videos of inside and outside of the building prior to fire

2. Materials Testing

Objectives:

- Develop source term data for modeling
- Assess material burning behavior to determine a correlation to the materials in the nightclub

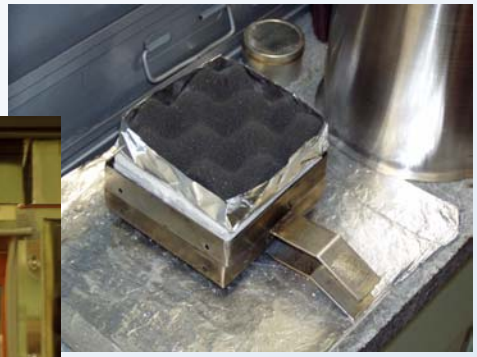
Pyrotechnic "Gerbs:"

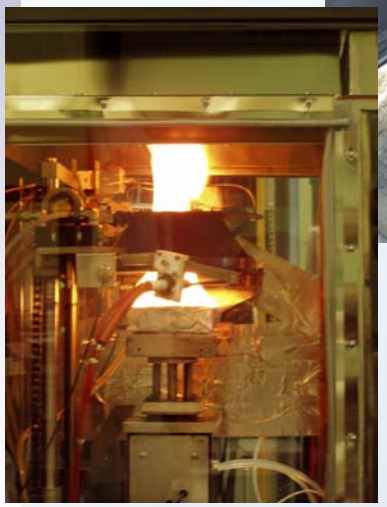
- White color, 15 second duration, 15 foot throw
- Examine ignition properties
- Plan to measure heat flux to surface

Cone Calorimeter Experiments

3 types of convoluted foam tested
- 2 – ether based polyurethane
- 1 – ester based FR PU foam

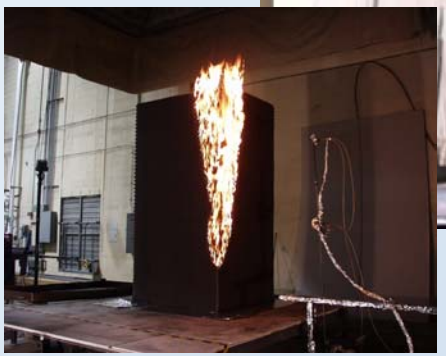
incident heat flux: 35 & 70 kW/m^2





Panel Experiments

- small flame ignition
- inside and outside corner configurations
- measuring HRR, mass loss and heat flux



Preliminary Simulation of Fire Environment

3. Reconstruction of Thermal and Tenability Environment

Construction

- Similar dimensions to stage area of nightclub (~ 36 ft x 24 ft x 13 ft high)
- Convoluted non-fire retarded polyurethane foam, plywood paneling
- Carpeted stage & drummer's platform, gypsum ceiling over dance floor area

Measurements: Temperature, CO, CO_2, O_2, HCN, heat flux, heat release rate

Full-scale Recreation of Stage Area Fire

4. Examination of Possible Impact of Sprinklers

Impact on environment being examined had sprinkler system been installed, all other conditions being the same.

Sprinkler system installed in test room (same geometry and materials) by commercial supplier according to current NFPA 13 standards:

- spacing – 12 ft X 12 ft (144 ft^2 coverage per sprinkler)
- total number of heads - 5
- design flow rate – 0.10 gpm/ft^2 (14.4 gpm)
- activation temperature - 165 ^oF

Measurements: Temperature, CO, CO_2, O_2, HCN, heat flux, heat release rate, activation time

Full-scale Recreation, Stage Area Fire + sprinklers

5. Documentation of Evacuation Process

Objective: to better understand impediments to safe egress encountered by occupants

Preliminary evacuation calculations

- Simulex
- CRISP
- EVACNET4

- Hypothetical occupancy rates and evacuation scenarios examined:
  404 people w/all four exits available for use in evacuation but with 90% of occupants using most familiar front exit.

- Results: 4 minutes 30 seconds for complete evacuation; no prediction of doorway pile-up

List of survivors compiled by Providence Journal

Contract to assist in egress study

Ove Arup & Partners of Massachusetts: evaluating limitations to egress through doorways in emergency situations.

- help document egress events (including building timeline from video and photographic records, field data, interviews conducted by the media, and other oral and written accounts from building occupants, emergency responders, and other witnesses);
- help document role of life safety features in the structure in assisting safe egress; and
- compare/contrast egress process and outcome to other similar events.

6. Documentation of Emergency Response

- Collect emergency response data in cooperation with local fire department to document procedures and operation of equipment.
- Review West Warwick Police Department dispatch recordings.
- Identify successful operations and technical difficulties.

7. Recommendations for specific improvements to model building standards, codes and practices

Contract let to Koeffel Associates, Inc., of Maryland, for analysis of model building/fire codes and practices applicable to a building like The Station nightclub:

- review national model building and fire codes that would have governed the building design, construction, and modification of structural and fire safety systems;
- identify substantive and relevant differences, if any, among these historical requirements and provisions of current national model building and fire codes; and
- document practices and procedures used for the operation, maintenance of and modifications to structural and fire protection systems.

Team to recommend specific areas for improvement in model building and fire codes, standards and practices (as warranted) based upon technical findings from all tasks.

Press Briefing in Providence, RI, Nov. 25, 2003

Provided update on investigation: 5 newspapers, 7 TV stations, 3 radio stations

Requested information from public:

- details of building geometry, materials and finishes
- description and location of furniture
- positions of windows and doors prior to and during evacuation
- observations of fire and smoke spread, and operation of fire alarm
- number and location of employees and patrons present at start of fire
- difficulties encountered during evacuation
- casualty reports
- number and type of emergency response units and approximate timeline of activities

Requested format: photographs, videos, recordings, plans, documents, samples, recollections

Contact Information for NIST Investigation

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Responses to date

tip line: 15 e-mail: 6 mail: 1

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