Recent Fire Research Activities at NIST

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Anthony Hamins, Chief
Fire Research Division
Engineering Laboratory
anthony.hamins@nist.gov

Recent Fire Research Activities at NIST

- November 8, 2010 – NIST Fire Research Program overview
- November 16, 2011 – NIST WUI Fire Research overview
- Today – Recent Fire Research Activities at NIST
  1. Fire Protection Roadmap
  2. SCBA Research Update
  3. Ember Fire Research Update
  4. Reduced Flammability of Upholstered Furniture Project
  5. Status of NIST's National Fire Research Laboratory (NFRL) Expansion

1. Prioritizing NIST Fire Research

Strategic Roadmap

- Traceable national priorities
- Stakeholder perspective
- Literature review and systematic analysis
- Measurement science to support the technical basis for standards, codes, guidelines, software decision-tools, SRMs, etc.
- Impact focused
- Research prioritization with defined program outputs and outcomes for short, medium, and long-term timeline
- Standards and codes strategy

NIST Special Publication 1130

Reducing the Risk of Fire in Buildings and Communities: A Strategic Roadmap to Guide and Prioritize Research

Fire Research Division
Engineering Laboratory

April 2012

U.S. Department of Commerce
John E. Bryson, Secretary

National Institute of Standards and Technology
Patrick D. Gallagher, Under Secretary of Commerce for Standards and Technology, and Director

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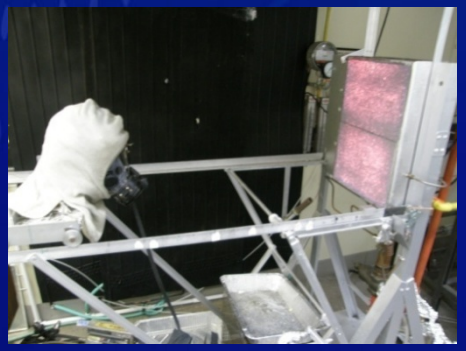
DRAFT

2. SCBA Research Update

NIST, with funding from DHS/USFA, has studied the conditions encountered by fire fighters and recommended a new test methodology and performance criteria to the NFPA technical committee

Develop performance metrics and standard testing protocols for respirator masks for fire fighters and other first responders under high temperature conditions

- respirator mask often represents the weakest component of a first responder's protective ensemble.
- performance of the transparent viewing section has not been characterized under high thermal flux.



Lab Scale

Full Scale

Field Experiments

2. SCBA Research Update

NIOSH identified multiple firefighter fatalities in which thermal degradation of the SCBA Facepiece lens was likely a contributing factor

NFPA has drafted a Safety Awareness Notice for SCBA Facepiece

- SCBA lenses may deform or degrade in severe fire fighting conditions
- over last 30 years fire fighting environment changed significantly
- Turnout gear now has higher thermal performance
- Modern structure fires produce significantly higher heat release rates

2. SCBA Research Update

NFPA 1981 Standard on Open-Circuit Self-Contained Breathing Apparatus for Emergency Services has been revised to incorporate for the 2013 edition:

- additional convective heat and flame test at higher temperature for the whole SCBA
- radiant heat test specifically for the facepiece lens

NFPA recommended action *(draft)*

It is important to only use SCBA lenses that are free from mechanical, chemical or thermal damage. The lens should have no cracks, crazing, bubbling, deformation, discoloring, gaps or holes. A lens showing any damage should be replaced with a new lens. Fire departments should consider upgrading to or purchasing SCBAs which are certified as compliant to NFPA 1981, 2013 Edition when such SCBAs become available.

3. Ember Fire Research Update

The third annual NIST experimental campaign on ember fire ignition hazards was conducted from Feb to May 2012 in the Fire Research Wind Tunnel Facility at Building Research Institute in Tsukuba, Japan

- Experiments used the NIST continuous firebrand generator
- Previous studies - roofs, vents, siding, glazing, eaves
- Recent experiments examined ignition of decking and firebrand generation from burning structures
  - Decking design was based on stakeholder input during 2011 Workshop at LA Chapter of ICC
  - Parametric study determined worse-case conditions:
    - Re-entrant corner configuration
    - orientation of the deck wall assembly
    - orientation of deck board alignment
    - wind speed
  - Cedar, Douglas-Fir and Redwood deck ignition after several minutes
  - Accumulated glowing firebrands caused ignition
  - Wind promoted fire spread and growth

4. Reduced Flammability of Upholstered Furniture

Project Objective: By 2014, develop the measurement science to allow prediction of peak heat release rate for a wide range of upholstered cushions based on the component material properties used in their construction. In addition, develop and maintain standard tests for reducing ignition by cigarettes and a standard for the effectiveness of fire barrier materials.

FY2012 activities

- Planning to conduct small-scale and mock-up furniture tests at ATF to investigate role of fabrics, fire barriers, fiber fill, type of polyurethane foam, and sewing thread and to assess the potential for predicting real-scale fire performance from small-scale tests.
- Complete testing on performance of fire barrier materials and other technologies in furniture
- Determine alternate substrates for testing of reduced-ignition propensity cigarettes ASTM 118
- Develop a standard test method for effectiveness of barrier materials (cone calorimeter, TPP test, thermal conductivity test)
- Workshop on Quantifying the Contribution of Flaming Residential Upholstered Furniture (RUF) to Fire Losses in the United States held March 22-23, 2012. (proceedings in preparation)
  - Concluded that flaming RUF is responsible for large fraction of residential fire losses

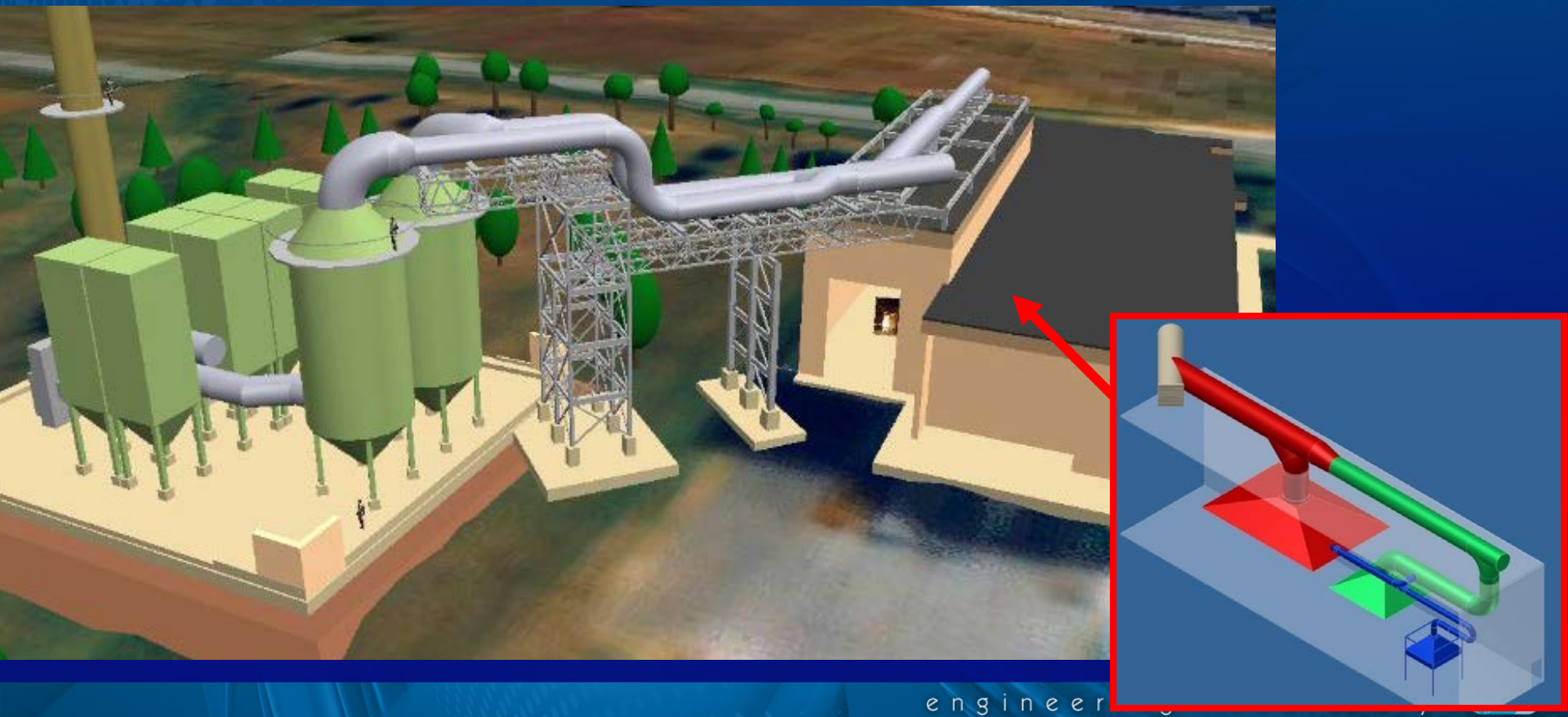
4. Reduced Flammability of Upholstered Furniture

- Quantify RUF contribution to U.S. fire loss profile several ways:

- Estimate fire losses (deaths, injuries, and property) utilizing existing NFIRS data
- Survey groups of people responsible for coding NFIRS forms to determine how items are coded when presented with pictures or descriptions of various conditions.
- Organize an NFIRS Special Study Focused on RUF Fire Behavior in Room of Fire Origin. A single page containing five to ten carefully formulated questions could be developed for incorporation into the NFIRS questionnaire for a one year pilot study on this topic
- Probabilistic Modeling of RUF Room Fires Incorporating Experimental Observations.

5. NIST National Fire Research Laboratory (NFRL)

- Advance real-scale fire metrology
- Develop metrics for performance-based standards and codes
- Enable model validation
- Support post-incident disaster and failure studies
- Advance understanding of structural fire resistance



5. Recent Fire Experiments at the National Fire Research Laboratory (NFRL)

Bus Fires

Wind Effects on Fire

World Trade Center Study

Mattress Fires

Compartment fires

Fire Brands

NIST National Fire Research Laboratory

- 2,000 m^2 (20,000 ft^2) addition, providing capability to test the performance of real-scale structures under realistic (20 MW) fire/mechanical loading in controlled conditions.
- A unique facility allowing examination of the fire performance of structures ranging in size from connections to large systems up to 2 stories in height.
- Enable validation of complex predictive models of structural fire performance.
- Support development of performance-based standards and codes for the design of structures and foster innovation in design and construction of buildings.

5. NIST National Fire Research Laboratory

Specification	Existing Laboratory	New Laboratory
Total Floor Area	10,800 sq. ft.	21,400 sq.ft.
Fire Capacity	1 MW (small hood) 3 MW (medium hood) 10 MW (large hood)	20 MW
Strong Floor/Strong Wall	None	60 ft. x 90 ft. x 3.5 ft. thick strong floor and 60 ft. x 30 ft. x 4 ft. thick strong wall.
Structural Loading	None	Reconfigurable hydraulic loading system, 55-330 kip actuators; 30 inch stroke

Questions?