Indoor Environmental Resilience: Update of 2015 Report

Andrew Persily (Retired Associate)
National Institute of Standards and Technology
Gaithersburg, Maryland USA

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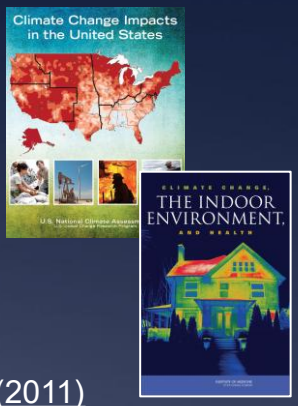
BACKGROUND ON IEQ AND RESILIENCE



Indoor built environmental needs
Thermal comfort
Limit contaminant concentrations
Isolation from exterior (precipitation, pests, …)
Amenities (light, power, food storage, …)

National Climate Assessment (2015)
Highlights extreme weather, human health, infrastructure

IOM Study of Climate Change and Indoor Environmental Health (2011)
Opportunities to improve public health while mitigating or adapting to alterations in IEQ induced by climate change.

Many discussions of resilience focus on major disasters (e.g., fires, windstorms, earthquakes), structural issues, community services…
But what about indoor environmental quality?

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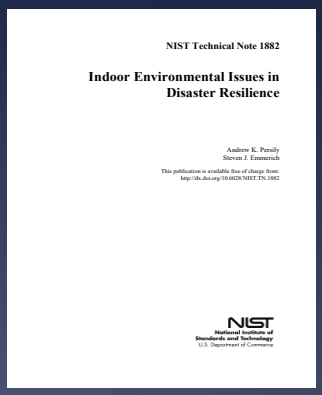
2015 NIST REPORT ON INDOOR ENVIRONMENTAL RESILENCE (IER)

Reviewed extreme events impacting IER

- Described scope/impacts
- Identified existing standards and programs, gaps, research needs

NIST Technical Note 1882
http://dx.doi.org/10.6028/NIST.TN.1882


NIST Technical Note 1882

Indoor Environmental Issues in Disaster Resilience

Andrew K. Persily
Steven J. Emmerich

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National Institute of Standards and Technology
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A lot has happened since 2015!

EVENTS CONSIDERED IN 2015 REPORT

Type of event	Indoor environmental exposure
Heat waves	High indoor temperatures/heat stress High outdoor levels of outdoor pollution
Storms causing power failure	Lack of heating, cooling, ventilation leading to heat/cold stress and elevated indoor contaminant levels CO exposure from portable generators
Floods and mold exposure	Microbial growth affecting occupants and remediation workers
Wildfires	Particulate exposure
Airborne releases of chemical, biological or radiological agents	Exposure to agent

<u>Topics not discussed in as much detail</u>

Pandemics and airborne infection control

Indoor environmental conditions in safe rooms

HEAT WAVES

Description and Issues

Prolonged periods of high outdoor temperatures, often with high humidity, typically 2 or more days

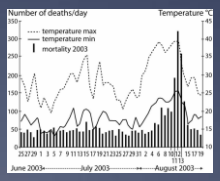
Health effects range from mild, e.g., dehydration and cramps, to severe, e.g., heat exhaustion and heat

Elderly, infants & children, overweight individuals, and people with chronic medical conditions more susceptible

Body of work on heat stress in industrial settings

Building features related to heat exposure: insulation levels, lack of air conditioning, passive cooling features, …

Extreme Heat incident, year	Deaths
Philadelphia heat wave, 1993	118
Chicago heat wave, 1995	739
European heat wave, 2003	70 000
California heat wave, 2006	650
Russian heat wave, 2010	11 000 to 50 000



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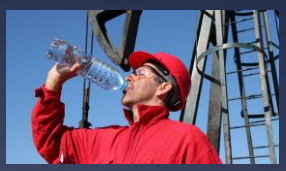
HEAT WAVES

Standards and Guidelines

Recommendations on heat stress in occupational settings from ACGIH, no OSHA standard for working in hot environments

ASHRAE Standard 55, Thermal Environmental Conditions for Human Occupancy: focused on commercial buildings operated as designed, not extraordinary events



Current activities

Guidance from national & local governments & other organizations on heat wave preparation & response

Passive building design approaches to avoid overheating

Urban planning guidance to reduce heat island effects

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UPDATES NEEDED SINCE 2015

New information on all events, but major work needed on

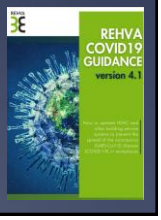
- **Pandemics and Airborne Infectious Disease Transmission**
- **Wildfires and Prescribed Burns**

PANDEMICS AND AIRBORNE DISEASE TRANSMISSION

<u>Description and Issues</u>
Before COVID-19, body of work on indoor transmission of influenza, TB, ...
During & since pandemic, research on reducing risk with administrative & engineering controls
Building/system features related to exposure & control: ventilation, filtration, ...
More measurement of indoor CO_2, and more misinterpretations

<u>Standards and Guidelines</u>
In real-time & since from national & local governments & other organizations
ASHRAE 241 Control of Infectious Aerosols; REHVA COVID-19 Guidance; ...

<u>Current activities</u>
Research into control measures and their effectiveness
Technology development and demonstration
Continuing development of guidance and standards



WILDFIRES AND PRESCRIBED BURNS

Description and Issues

Particulate & gaseous pollutant exposures, near fires/burns and 100s of km downwind

Respiratory health effects and variations in individual susceptibility

Relevant building features: airtightness, ventilation system type and outdoor air intake rates, system and space level filtration, ...

Standards and Guidelines

ASHRAE Guideline 44-2024, Protecting Building Occupants from Smoke During Wildfire and Prescribed Burn Events

Other guidance from national & local governments & other organizations

Current activities

Research into control measures and their effectiveness

Technology development and demonstration

Continuing development of guidance and standards

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CONCLUSIONS

2015 NIST IER report needs updating to reflect pandemic and wildfire experience and activities

Other IER events also need updating to reflect recent information

Scope of IER issues still underappreciated by some, but more awareness than in 2015

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QUESTIONS AND INPUT FOR UPDATE

Please email me at andyp@nist.gov.