



Center for Indoor Environments and Health

**Recovery from Catastrophic Weather: mold exposure and health-related training \***

## **Workshop: Hurricanes and Mold**

July 23, 2014      1:00PM -4:30PM

Savin Rock Conference Center West Haven, CT 06516

- 1:00 PM Hurricane Sandy and mold – Paula Schenck*
- 1:15 PM Small group discussion: Priorities*
- 1:40 PM It is all about Health: Mold and health basics- Paula Schenck*
- 2:10 PM Reducing risk: Protecting your and others' health when you work in moldy places- Paul Bureau*
- 2:50 PM Break*
- 3:00 PM Providing a future: Moving toward resilient building construction- William A. Turner*
- 3:50 PM Small group discussion:*
  - PPE: Donning respirators and doing self-check; What are impressions, features, and differences among respirators?*
  - Mold and moisture cleanup guide – Paul Bureau*
- 4:15 PM Hurricane Play and wrap- up- Paula Schenck, William A. Turner*

\*This project is funded under the Centers for Disease Control and Prevention's National Institute for Occupational Safety and Health (NIOSH) Hurricane Sandy Cooperative Agreement 1U01OH010627-01. This workshop is solely the responsibility of the workshop faculty and does not necessarily represent the official views of NIOSH.

# Before we begin

- Introductions
- Cell phones on vibrate, please
- Acknowledgements:
  - National Institute for Occupational Safety and Health
  - UCONN Health Center
  - Cristina Mullin and Kelly Wallace, Research Assistants
  - Mike Fitts and Pamela Puchalski, ConnectiCOSH
  - Krista Veneziano, CT Department of Public Health
- Evaluation materials

# Workshop faculty



**Paul Bureau, MS, MS, CIH**

Industrial Hygienist, Lecturer/Advisor  
UCONN Department of Allied Health Sciences,  
and UCONN Health Center, Division of  
Occupational and Environmental Medicine



**William A. Turner, MS, PE, LEED® AP**

President / CEO Turner Building Science, LLC



**Paula Schenck, MPH**

Director Indoor Environments and Health Programs  
UCONN Health, Division of Occupational  
and Environmental Medicine

# Workshop Learning Objectives:

*Attendees will:*

- 1. be able to identify health symptoms of concern for individuals who are involved in hurricane/storm recovery activities that include work in flooded buildings,*
- 2. be able to select personal protective equipment (PPE) and work practices that reduce health risks from exposure to bioaerosols, and*
- 3. become acquainted with types of adaptive building design in response to storm damage and flooding.*

# Catastrophic Wet Weather



NASA/Goddard Space Flight Center Scientific Visualization Studio <http://svs.gsfc.nasa.gov/cgi-bin/details.cgi?aid=3251> August 2005



GOES View of Hurricane Sandy.  
<http://earthobservatory.nasa.gov/NaturalHazards/view.php?id=79553> October 28, 2012

Katrina, cost over \$100 Billion  
Sandy, cost over \$65 Billion

[Climate Change, Severe Weather Events, and Human Health](#)

<https://www.facebook.com/weatherandhealth>

# Recovery from Catastrophic Weather - Hurricane Sandy Project



GOES View of Hurricane Sandy. acquired October 28, 2012 earthobservatory.nasa.gov



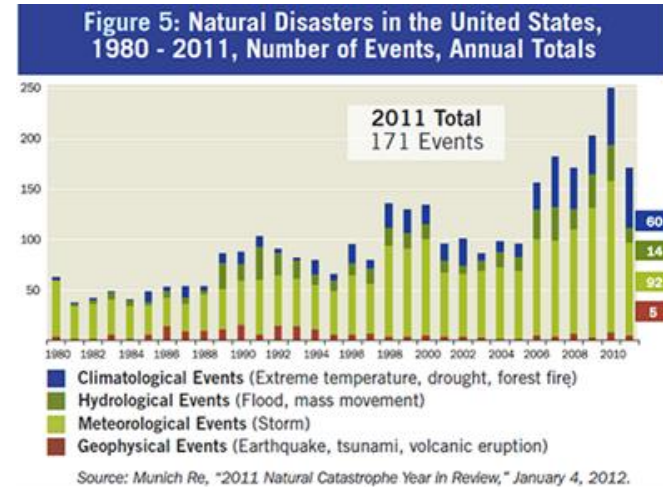
A street on the shoreline of Milford, Connecticut, floods at high tide as Hurricane Sandy approaches on Monday. October 29, 2012  
[www.rt.com/files/usa/news/hurricane-cape-new-jersey-517/high-tide-begins-flood.jpg](http://www.rt.com/files/usa/news/hurricane-cape-new-jersey-517/high-tide-begins-flood.jpg)



[http://www.fema.gov/media-library-data/20130726-1622-20490-4869/fema\\_606.pdf](http://www.fema.gov/media-library-data/20130726-1622-20490-4869/fema_606.pdf)

# What are we tackling today?

- Climate Change = more severe storms, rain bombs!!
- Water/damage higher up in buildings, and buildings affected farther from coastline and waterways.
- Mold tells us moisture is supporting biological growth; agents may be mold, bacteria, breakdown substances from building materials.
- Post Sandy anecdotes about “Sandy Cough”; longer term studies after Katrina show no increases in mold allergy (Rabito et al. 2010)
- March 2013 post -Sandy scientific forum reports “testimony ..from volunteers, workers, and their union representatives regarding troublesome industry practices, lack of training, and what would be deemed improper personal protective equipment (PPE) or unavailability of even simple respiratory protection (i.e., “paper masks”).” (Johanning et al. 2013)
- Moisture/mold exposure from wet interior environments is associated with respiratory disease and the exposure may directly result in asthma in some individuals.



**Let's learn how to protect our respiratory health when exposed to mold and moisture, and how to rebuild in ways that will lesson the chances for future exposure when we respond to the next storm!**



# Does mold exposure mean illness????



[http://www.fema.gov/media-library-data/2747c675-6945-41e2-9577-b4c8010f1546/49186\\_medium.jpg](http://www.fema.gov/media-library-data/2747c675-6945-41e2-9577-b4c8010f1546/49186_medium.jpg)



<http://www.epa.gov/mold/hiddenmold.html>



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Saturday, Nov 8th 2014 4AM 33°F 7AM 32°F 5-Day Forecast

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## Beware the Sandy cough: Storm victims and clean-up workers plagued by cough as local hospital sees rise in lung infections

By DAILY MAIL REPORTER

PUBLISHED: 10:34 EST, 29 November 2012 | UPDATED: 13:04 EST, 29 November 2012



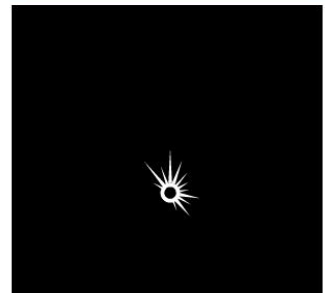
[View comments](#)

Hurricane Sandy victims continue to be plagued by rashes, asthma and coughing as cleanup efforts continue and mold problems in affected areas persist.

'I feel totally drained, tired,' Patrick Zoda told **NBC 4 New York**. 'Every morning I wake up coughing.'

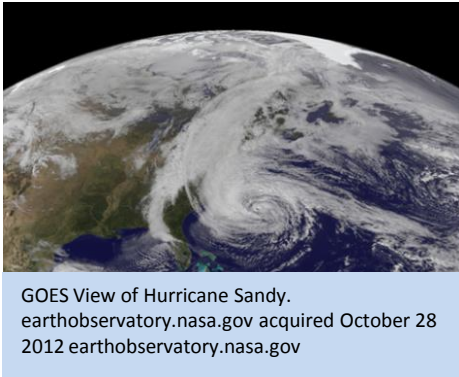
Zoda has been working to save his Staten Island home for the last month after it was damaged by Sandy. As he rips up damaged floors and insulation and scrubs away mold growth, he's exposing himself to thick clouds of debris that are settling in his lungs and making it hard for him to breathe.

[Site](#) [Web](#) Enter your search  [Search](#)



# Not just about “mold”

This workshop focuses on mold in the indoor environment and the relationship between exposure and health... other microbes grow on wet substrates in indoor environments and may contribute to workers' health symptoms.



## **Hurricanes and Mold**

### **Small group discussions “Priorities”**

Each group designates a discussion leader and a reporter.  
A UCONN team member as an information resource only.

#### **Goal:**

**Develop two important messages to share in preparation for (or to respond after) a wet weather event/hurricane.**



Center for Indoor Environments and Health

# It is all about health: Mold and health basics

*Paula Schenck, MPH*

*Center for Indoor Environments and Health* [http://doem.uchc.edu/consultation\\_outreach/indoor\\_environments/](http://doem.uchc.edu/consultation_outreach/indoor_environments/)

*Division of Occupational and Environmental Medicine*

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*Farmington, Connecticut 06030-8077*

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# What determines health?

# What determines health?

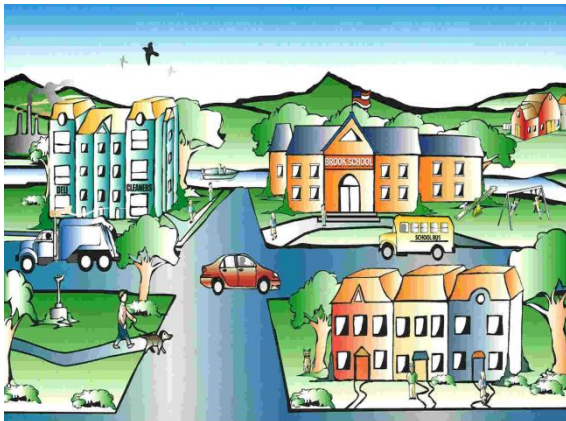


<http://www.nlm.nih.gov/medlineplus/magazine/issues/winter13/images/quitsmoking.jpg>



[http://www.nlm.nih.gov/images/inside-nimh/double\\_helix\\_146030\\_2.png](http://www.nlm.nih.gov/images/inside-nimh/double_helix_146030_2.png)

behavior  
environment  
genetics  
healthcare



<http://toxtown.nlm.nih.gov/flash/town/flash.php>



[https://www.acf.hhs.gov/sites/default/files/styles/acf\\_asset\\_medium/public/assets/photo\\_of\\_doctor.jpg?itok=Gx2Gvk0C](https://www.acf.hhs.gov/sites/default/files/styles/acf_asset_medium/public/assets/photo_of_doctor.jpg?itok=Gx2Gvk0C)

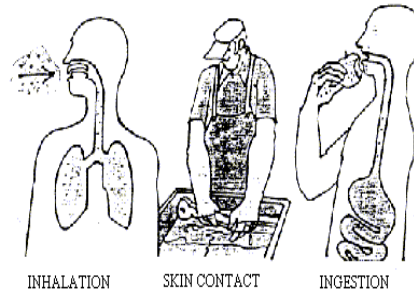
What determines exposure?



# What determines exposure?



[http://www.fema.gov/media-library-data/20130726-1622-20490-4869/fema\\_606.pdf](http://www.fema.gov/media-library-data/20130726-1622-20490-4869/fema_606.pdf)



activity  
route  
behavior  
substance



National Center for Preservation Technology and Training, Mold hazard in a historic New Orleans home post Hurricane Katrina <https://ncptt.nps.gov/wp-content/uploads/mold.jpg?1ef327>

Fungi/mold has forms:

- single cells

- microscopic filaments

- visible mats

- visible spore producing fruiting bodies (mushrooms)



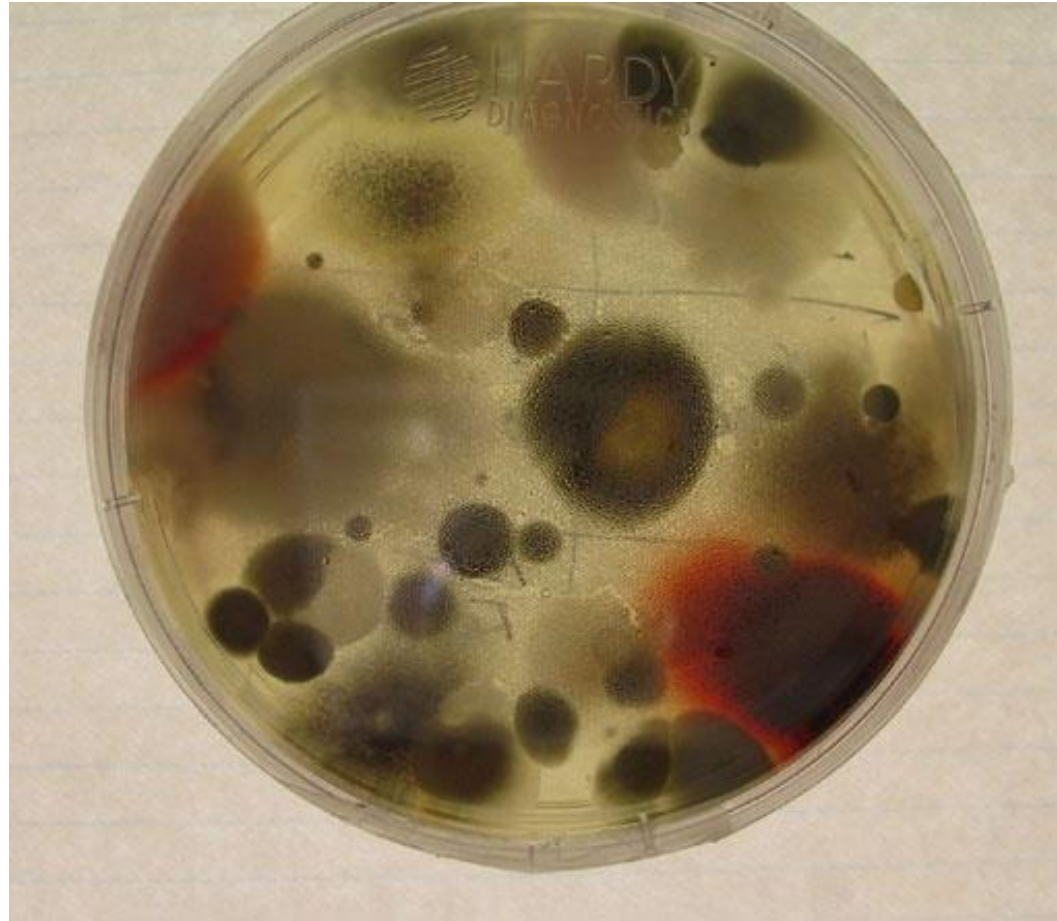
**Magnified mold spores.**

(photo courtesy of John Martyny, Ph.D.)

<http://www.epa.gov/mold/moldcourse/imagegallery2.html>



[Stachybotrys chartarum](http://www.uamh.devonian.ualberta.ca/)  
<http://www.uamh.devonian.ualberta.ca/> Acquired 7/22/2015



Mixed cultures of *Penicillium chrysogenum* and *Stachybotrys chartarum* recovered from water-damaged, moldy dry wall. (Image courtesy of Dr. De-wei Li from the CT Agriculture Experiment Station. )

Ubiquitous in the natural environment, fungi have a critical ecological role —to degrade organic material



**Mushroom: Grey Ink Cap mushroom  
commonly found in gardens and on compost.**

(photo courtesy of Terry Brennan)

<http://www.epa.gov/mold/moldcourse/imagegallery1.html>



**Mold and mildew**

<http://www.epa.gov/mold/moldcourse/imagegallery5.html>



# More about fungi

- constituents and products
  - proteins have allergenic properties
  - e.g. 1, 3,  $\beta$  glucan, volatile organic compounds, toxin
- nutrition and growth
  - influenced by moisture, nutrition, light, oxygen and temperature
  - different species amplify/**grow** depending on **available moisture/hydrophylic**
    - High (*Stachybotrys* sp., *Chaetomium* sp., *Trichoderma* sp., *Memnoniella* sp., *Acremonium* sp., *Fusarium* sp., *Rhizopus* sp., *Mucor* sp.)
    - Medium (*Cladosporium* sp. and *Alternaria* sp. )
    - Low (*Aspergillus sydowii*, *A. versicolor* and *Penicillium* spp.)



Mushrooms produced on hardwood floor where there has been long-term water incursion. (Unknown or anonymous author. Image courtesy of Dr. Chin S. Yang *Guidance for Clinicians on the Recognition and Management of Health Effects Related to Mold Exposure and Moisture Indoors* Page 15)

# Why is moisture so important?

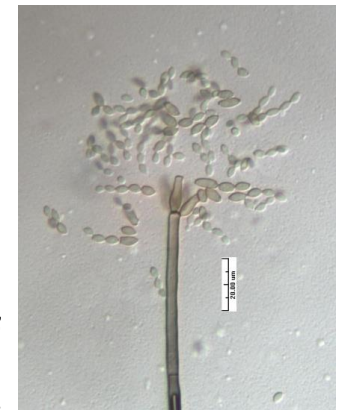
**Without water many microbes  
(not only mold) can't live and  
others can't grow!**

Mold actively growing indoors may:

degrade the surrounding materials, weaken  
the structure, and add unhealthy fungal  
products and bioaerosols to the indoor air.

When mold is growing other agents are likely to be present:

bacteria and their products, dust mites, other animal proteins such as  
cockroach droppings and pet animal dander  
chemicals/degradation products from damaged materials.



***Cladosporium cladosporioides***

(Image courtesy of Dr. De-Wei Li  
with the CT Agricultural Experiment  
Station.)

# Mold in indoor environments indicates moisture is available for biological growth.

- The higher the moisture content, the more severe the illnesses (Sahakian et al. 2008). Mold that grows in settings of high moisture in dust correlates with respiratory illness (Park et al. 2008).
- Mold may be:
  - 1) a direct factor influencing illness;
  - 2) an indicator of other biological agents and bioaerosols that proliferate in conditions of excessive moisture; or
  - 3) acting on building materials to release chemicals and dusts of concern (Nevalainen and Seuri 2005).
- Characteristics that contribute to determining what mold will grow indoors include:
  - Climate, geography, season, location
  - Building construction, maintenance, use, ventilation, moisture control materials, occupants. (Nevalainen et al. 2015).



# Mechanisms

- Infectious
  - flu-like illnesses
  - skin and nail conditions
- Allergic or hypersensitivity reactions
  - upper and lower respiratory disease  
rhinitis, sinusitis, asthma, hypersensitivity pneumonitis
  - dermatitis
- Irritant
  - eye, nose, throat, chest pain, cough, dermatitis, fatigue, headache
  - Skin irritation
- Toxic??????

# Toxicity is complicated!

Allergy and irritation is more likely an explanation for health symptoms from mold exposure than “toxicity” when working in flooded buildings.

There is documentation for illness after ingestion of moldy feed in animals and contaminated food in humans, BUT

under usual indoor circumstances -homes, offices, schools- most experts agree there isn't enough “dose” to cause toxicity by breathing in mold toxin. The likely dose workers experience working in flooded buildings hasn't been addressed.

Inhalation by-passes the body's major detox pathway so it isn't clear what dose could effect a illness response.

**Research is needed.**

“Possible illnesses from mold toxicity”

Organic dust toxic syndrome: large doses required; not usual in indoor settings; documented in farm and compost workers

Infant pulmonary hemorrhage: homes with water damage and mold growth; secondary smoke likely a factor- maybe synergistic, maybe causative, maybe less significant

Interest and concern increasing about neuro-toxic effects: symptoms-headaches, nervousness, difficulty concentrating, dizziness and excessive fatigue

# What about mold/moisture, health and climate change?



## Damp Indoor Spaces and Health 2004

- Upper respiratory symptoms, cough, wheeze, asthma exacerbation.
- Hypersensitivity pneumonitis in susceptible individuals.
- Immune compromised persons are at increased risk for fungal infections.



## Damp and Mould 2009 World Health Organization

- Allergic and irritant upper and lower respiratory illnesses; calls for study on toxicity with inhalation exposure and on inflammatory mechanisms.
- Visible mold and moldy odors are associated with health effects.
- Environmental guidance suggests local recommendations for different climatic regions.



## Climate Change, the Indoor Environment, and Health 2011

- Climate change may worsen indoor environmental problems and introduce new ones.
- Mitigating or adapting to alterations in indoor environmental quality induced by climate change bring opportunities to improve public health.
- **“Altered climatic conditions ..may make existing indoor environmental problems more widespread and more severe . thus increase the urgency with which prevention and interventions must be pursued.” *emphasis added***

# Key action messages

## Health

Respiratory and skin illnesses primary concern;  
More study suggested to determine role of toxicity when breathing in mold; and  
Inflammatory mechanisms warrant attention.

## Assessment

**Visible mold and moldy odors identify risk to health.**

## Action

Address the moisture in the environment.  
Protect your and others' health when you work in moldy places.



[http://www.fema.gov/media-library-data/20130726-1622-20490-4869/fema\\_606.pdf](http://www.fema.gov/media-library-data/20130726-1622-20490-4869/fema_606.pdf)

# World Health Organization Review 2009



- *WHO GUIDELINES FOR INDOOR AIR QUALITY – DAMPNESS AND MOULD*

<http://www.euro.who.int/document/E92645.pdf>

Executive Summary

<http://www.euro.who.int/Document/E92645sum.pdf>

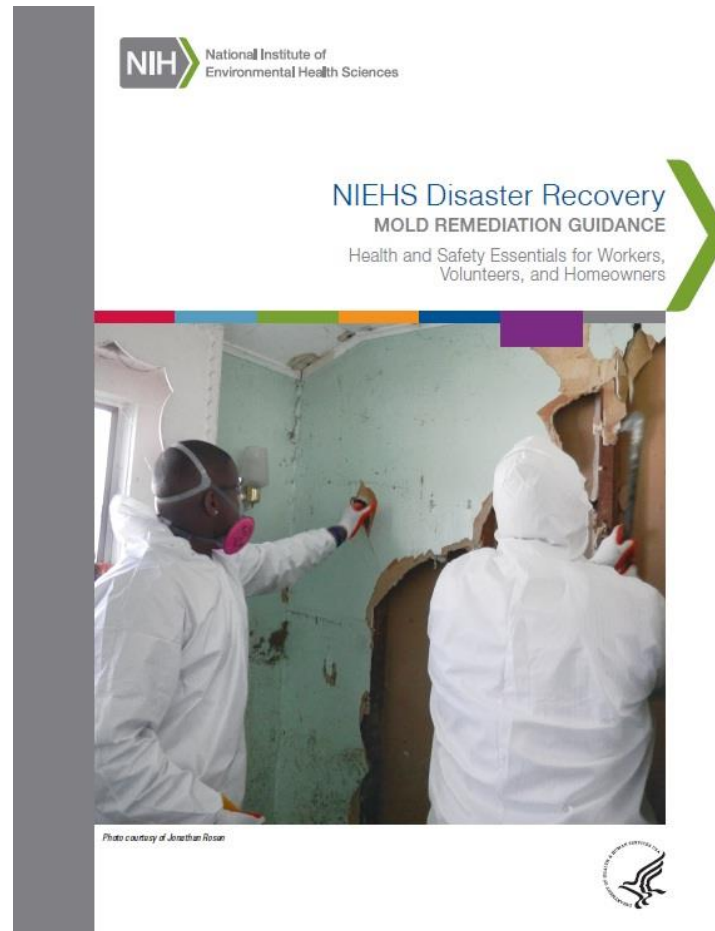
- *DAMP AND MOULD Health risks, prevention and remedial actions*

WHO and the Health and Environment World Health Organization 2009 Alliance

[http://www.euro.who.int/document/HOH/damp\\_mould\\_brochure.pdf](http://www.euro.who.int/document/HOH/damp_mould_brochure.pdf)

# National Institute of Environmental Health Sciences resources

<http://tools.niehs.nih.gov/wetp/index.cfm?id=2472>



## Safety Awareness for Responders to Hurricanes: Protecting Yourself While Helping Others





## Protección personal y ayuda a los demás:



consideraciones de seguridad para participantes en  
operaciones de auxilio tras el paso de un huracán



National Institute of  
Environmental Health Sciences

## Mold Clean-up and Treatment Orientation

National Institute of Environmental Health Sciences  
**NIEHS Disaster Recovery**

# Health and Safety Essentials for Workers, Volunteers, and Homeowners



**June 2013**

WORKER EDUCATION & TRAINING PROGRAM



# US EPA <http://www.epa.gov/asthma/publications.html>

## Resources for professionals and the public

### *A Brief Guide to Mold, Moisture, and Your Home*

[www.epa.gov/mold/moldguide.html](http://www.epa.gov/mold/moldguide.html)

- English and Spanish pdf versions
- Audience: homeowners and renters
  - How to clean up residential mold
  - How to prevent mold growth

### *Mold Course*

[www.epa.gov/mold/moldcourse/index.html](http://www.epa.gov/mold/moldcourse/index.html)

### *Mold Remediation in Schools & Commercial Buildings*

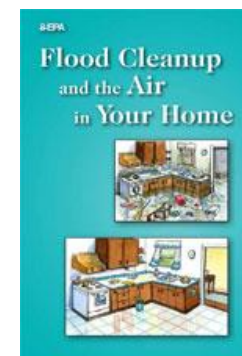
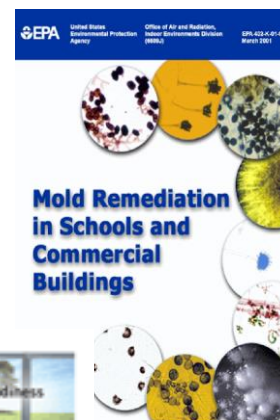
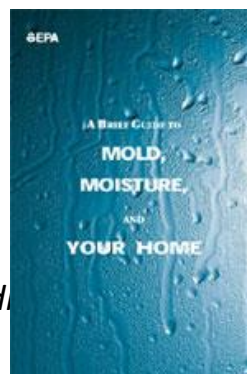
[www.epa.gov/mold/mold\\_remediation.html](http://www.epa.gov/mold/mold_remediation.html)

- Audience: building managers and those responsible for building maintenance
- Reference for remediation contractors

### *Flood Cleanup and the Air In Your Home*

[http://www.epa.gov/iaq/flood/flood\\_booklet\\_en.pdf](http://www.epa.gov/iaq/flood/flood_booklet_en.pdf)

English, Spanish and Vietnamese versions



Climate change, which is caused by natural factors and human activities, refers to any significant change in measures of climate, such as temperature, precipitation or wind, lasting for an extended period. These changes impact the air quality indoors. Poor indoor air quality can lead to an increased risk of asthma and other respiratory and health problems.



Buildings will not be sheltered from the impacts of climate change. But what if our environments and buildings offer under climate change conditions? Buildings will be placed to reduce their contributions to climate change by making them more energy efficient and to help protect us from some of the changes associated with climate change. During new construction or remodeling using energy efficient building stock, it is essential to ensure that measures are taken to improve and maintain indoor air quality.



Attention will also be made to the building stock to help shelter people from climate change, including by reducing some impacts of climate change by filtering the outside air for particulate generated by wildfires, or adding moisture control features to sensitive materials.



It is clear that as climate change impacts increase, it will become even more important to adapt indoor environments appropriately to maintain healthy indoor air quality.

**How Could Climate Change Impact Indoor Air?**  
Indoor environments can be significantly impacted by climate change such as: large increases or decreases in winter and summer weather; high or low temperatures; and changes in the severity of storms. Increased rainfall may lead to increased risk of flooding and dampness indoors, and growth of mold indoors. Increased rainfall or droughts may lead to wildfires that can create particulate air pollution that can seep indoors. Extreme temperatures and storms may also cause people to close windows to protect themselves from the elements, and increase their use of heating, ventilation and air conditioning (HVAC) systems.

### *Indoor Air and Climate Readiness*

[www.epa.gov/iaq/climate readiness/weatherization.html](http://www.epa.gov/iaq/climate readiness/weatherization.html)



A Landsat satellite image of the state of Connecticut. The image shows a mix of green (vegetation), brown (bare soil or urban areas), and blue (water). The state's outline is marked with a thin yellow line. The text "Thank You" is overlaid in the upper left quadrant.

# Thank You