

Operating Strategies for a Healthier Environment

Aug. 8:30-10 am

Laura Kolb, U.S. EPA

&

Terry Brennan, Camroden Assoc.



GovEnergy
www.govenergy.gov



New Orleans

August 5-8

Operating Strategies for a Healthier Environment

GovEnergy 2007

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&
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Don't forget to fill out and drop off your session evaluations

Benefits to Moisture Control Strategy

- Improve indoor air quality - avoid potential health effects from mold and other biological contaminants
- Reduce maintenance costs & damage to building
- Comply with Executive Order 13423 *(2006 FEDERAL LEADERSHIP IN HIGH PERFORMANCE and SUSTAINABLE BUILDINGS MEMORANDUM OF UNDERSTANDING)*



Moisture Control. "Establish and implement a moisture control strategy for controlling moisture flows and condensation to prevent building damage and mold contamination."

Executive Order 13423 - 2006 *FEDERAL LEADERSHIP
IN HIGH PERFORMANCE and SUSTAINABLE
BUILDINGS* MEMORANDUM OF UNDERSTANDING

Mold/Moisture Topics

- Mold & Moisture Overview

 - health effects, damage to bldg.

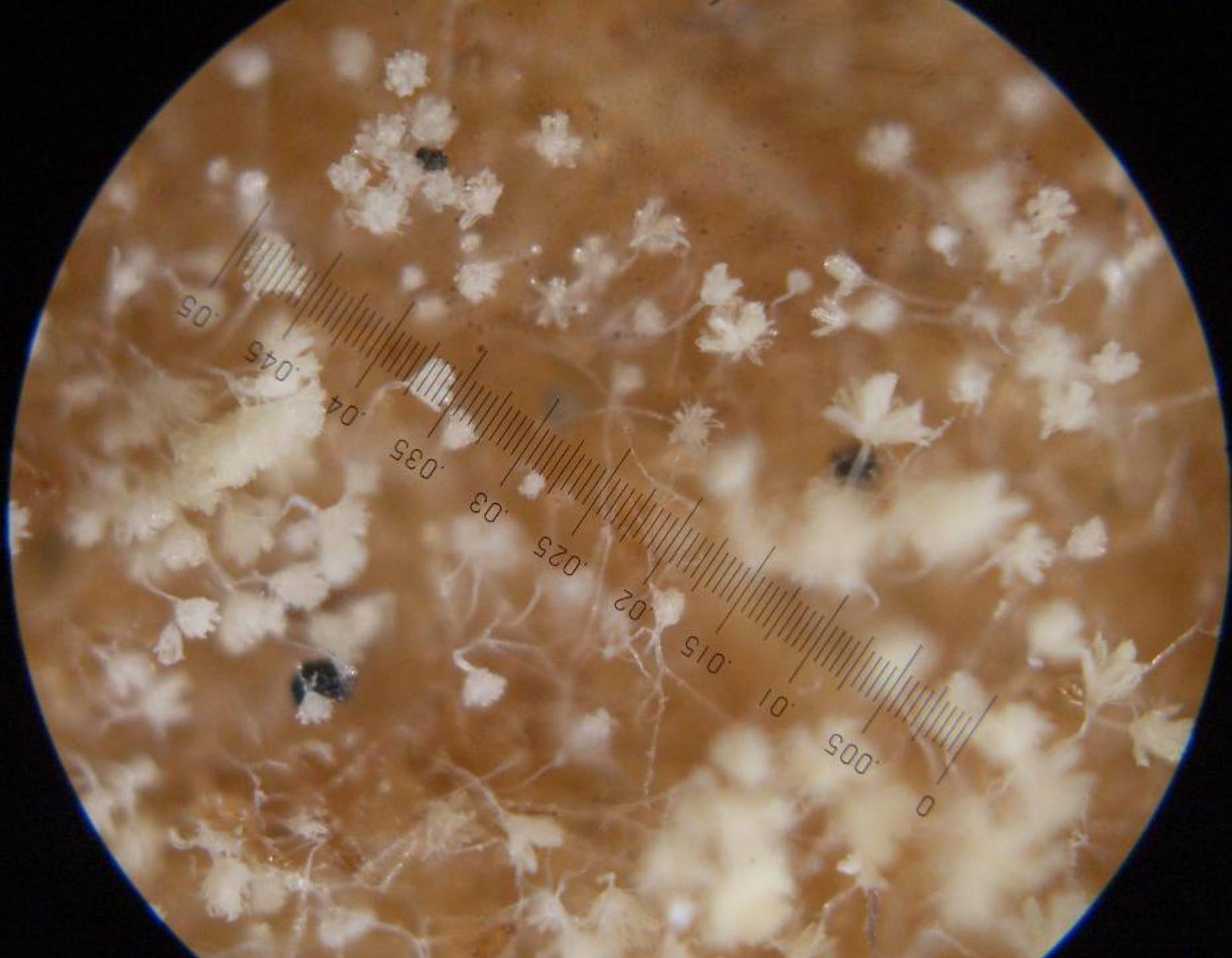
- EPA Voluntary Moisture Control Guidance

 - draft -- Moisture Control in Public and Commercial Buildings: Guidance for Design and Building Professionals

- Additional free resources: mold course, mold remediation guide, mold residential booklet, Mold Clinician's Guide, Flood Materials, I-BEAM







Mold Issues



EPA, INDOOR ENVIRONMENTS DIVISION

this
beauty is a **BEAST**

M
O
L
D



MOLD prevention

The key to mold control
is moisture control.

Dry damp or wet items
within 24-48 hours to
prevent mold growth.

www.epa.gov/mold

EPA Indoor Air Quality (IAQ)
Clearinghouse

800-438-4318

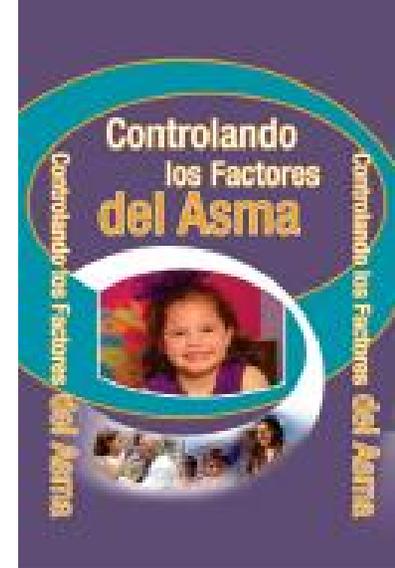


- Insurance, mitigation \$, litigation
- Media – newspapers, television, etc.
- More science and wider knowledge by general public
- Possibly changes in building construction and materials lead to increased water/ mold problems
 - Inappropriate use of modern bldg materials, prevents drying
 - Tighter buildings, inadequate ventilation



Asthma

- >20 million Americans /asthma
>6.3 million are children (CDC, NCEH 2001)
- 1980-1994 asthma prevalence in U.S
increased 75% overall, 74% age 5-14 yrs (CDC)
- >10 million outpatient clinic visits/yr (CDC)
~2 million emergency room visits/yr (CDC)



Asthma

- 3rd most common cause of hospitalization for children <15 yrs (CDC, NCEH)
- 1 in 13 school-age children has asthma (US DHHS)
- ~5,000 deaths/yr (ALA, 2004)



Allergy

- >50 million Americans/allergic disease
- allergies are 6th leading cause chronic disease in U.S.
- health care cost
~18 billion/yr

(NIAID 2004))



Studies Link Dampness and Mold to Significant Respiratory Problems and to High Costs of Medical Treatment (2 recent EPA funded studies)

- Building dampness & mold are associated / 30 - 50% increases in respiratory and asthma-related health outcomes.
- Dampness and mold in buildings have significant public health & economic impacts
- Actions should be taken to prevent and reduce building dampness problems, as recommended by the National Academy of Sciences' Institute of Medicine (IOM).
- ~4.6 million of the 21.8 million U.S. asthma cases (21 percent) are linked to exposures to dampness and mold in homes.
- The national annual cost of treating asthma linked to exposure to dampness and mold in homes is an ~\$3.5 billion.
- Moisture should be controlled in new and existing construction because of the significant health and economic consequences that can result from damp or moldy buildings.

Indoor air and performance

poor indoor air can lead to reduced ability to perform specific mental tasks requiring concentration, calculation, or memory





Mold misperceptions True or False

- 1) “Dead mold can’t be bad for you”
- 2) “Mold is always black”

Mold misperceptions – True or False

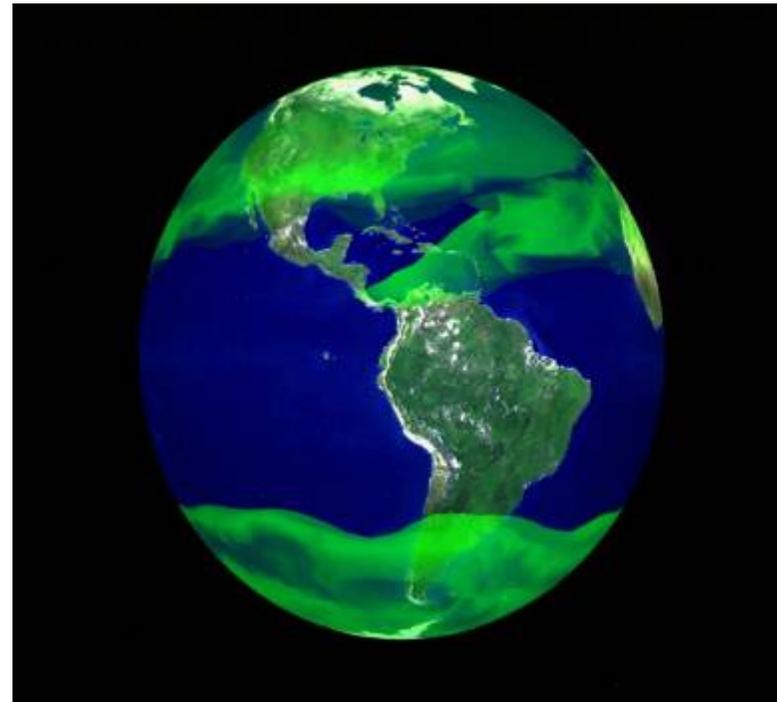
1) False, dead mold can be allergenic, and potentially toxic



2) False, mold comes in many colors, “black mold” is a color of mold, not a kind of mold

Mold – Background Info.

- Mold spores are present indoors and out
- Molds grow in all climates, all parts of the country





partially
decomposed
beech leaves

Molds - part
of natural
environment



To grow, mold needs:

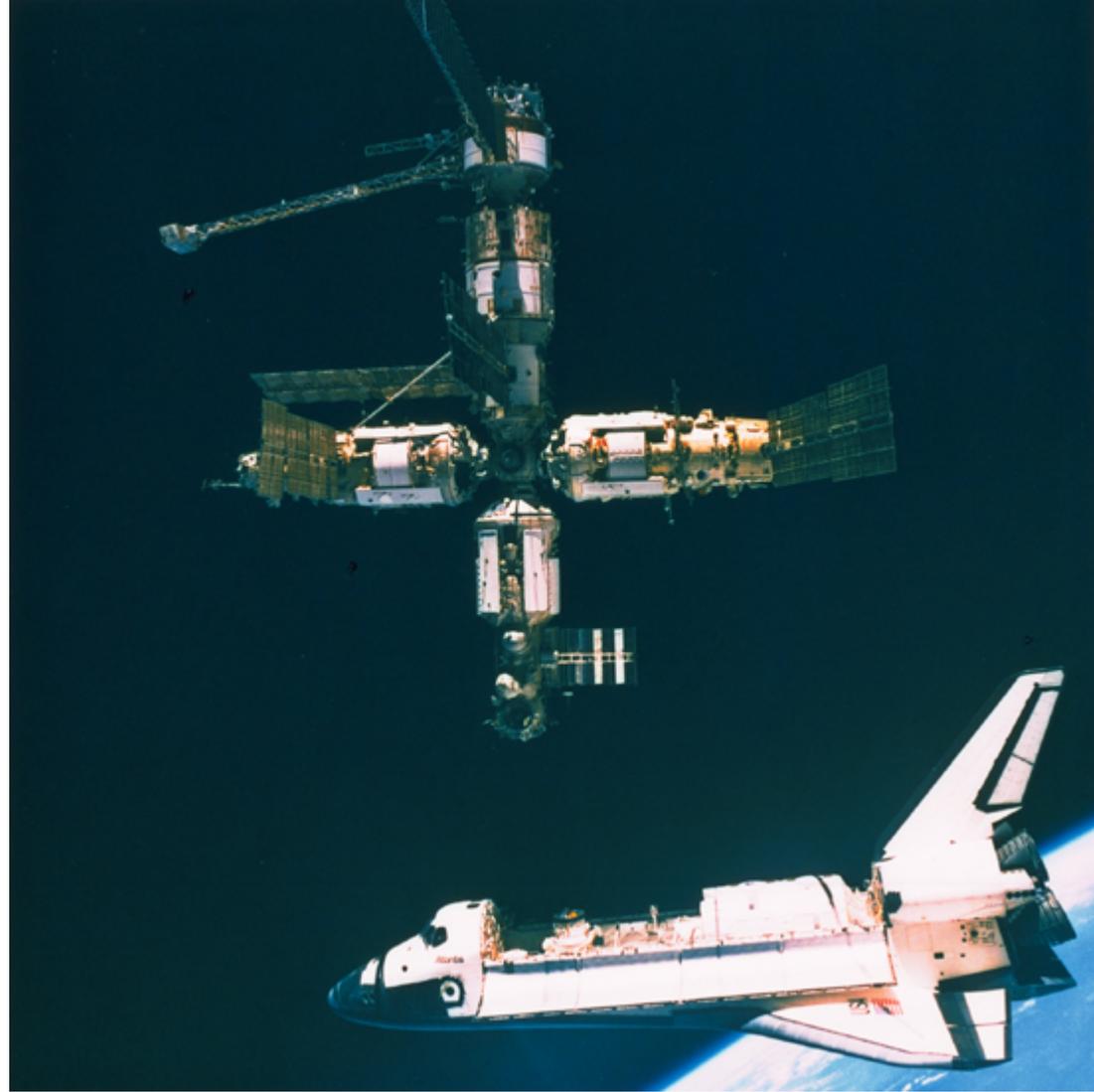
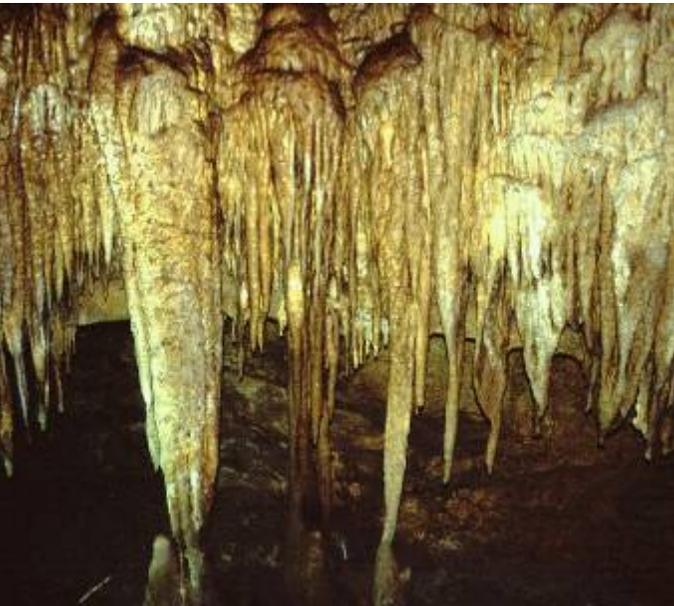
Moisture

**Food: Organic substances - wood,
paper, foods, insulation...**

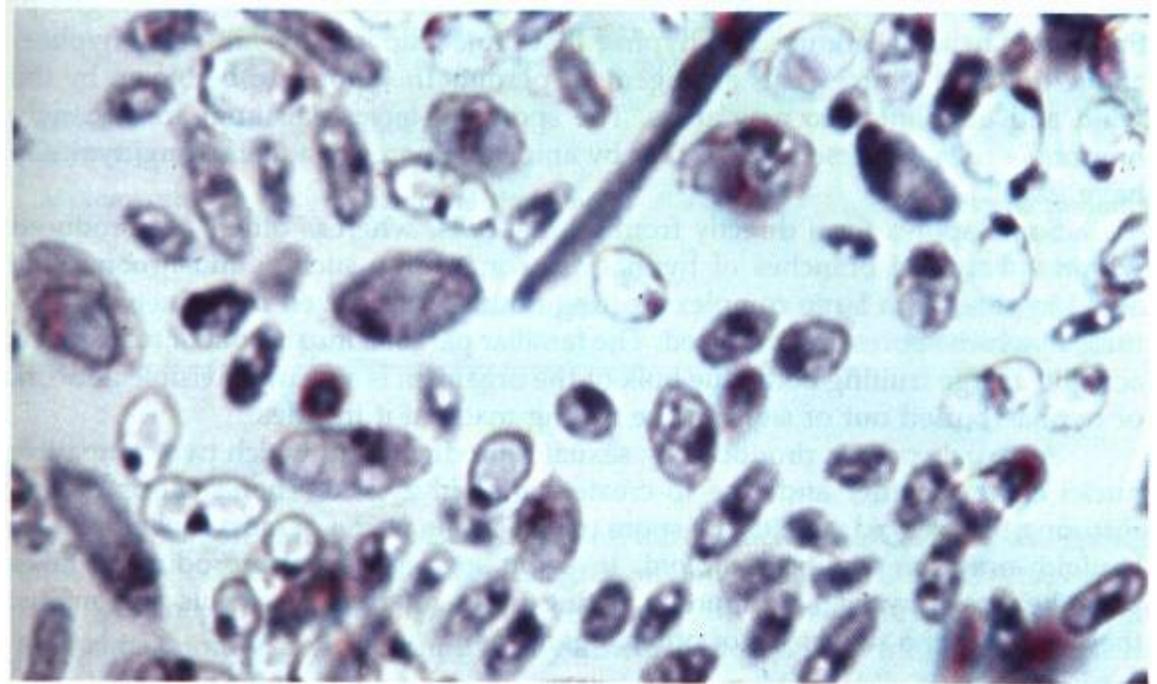
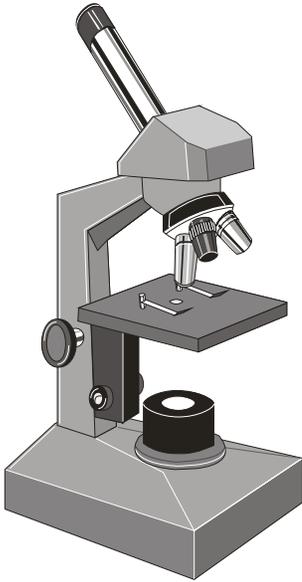
Oxygen



Mold
can grow
virtually
anywhere



Mold Spores



Mold can cause structural damage





Why Care About Mold?

Health effects –Allergic reactions,
Asthma attacks, Toxic and/or irritant
effects, Opportunistic infections
(immune compromised)

Damage to building
materials and
furnishings





Mold & Health Effects

Molds can produce:

Allergens - allergenic whether dead or alive

Irritants

Toxins

- some can produce potent toxins
- few toxins have been identified/characterized
- famous example, Aflatoxin
(known human carcinogen by ingestion route)



“Damp Indoor Spaces and Health”
Institute of Medicine
www.nas.edu

- Both damp indoor environments, and “mold or other agents” are associated with respiratory health effects.
- “...the committee concludes that excessive indoor dampness is a public health problem.”

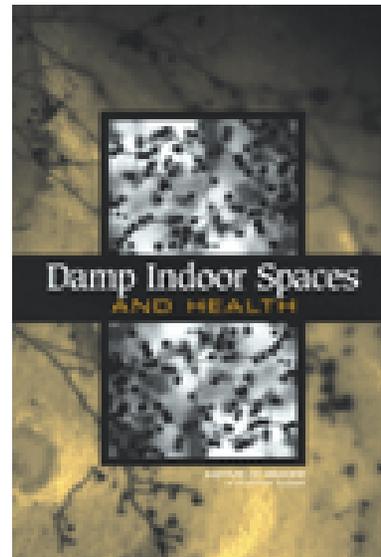
Damp Indoor Space and Health

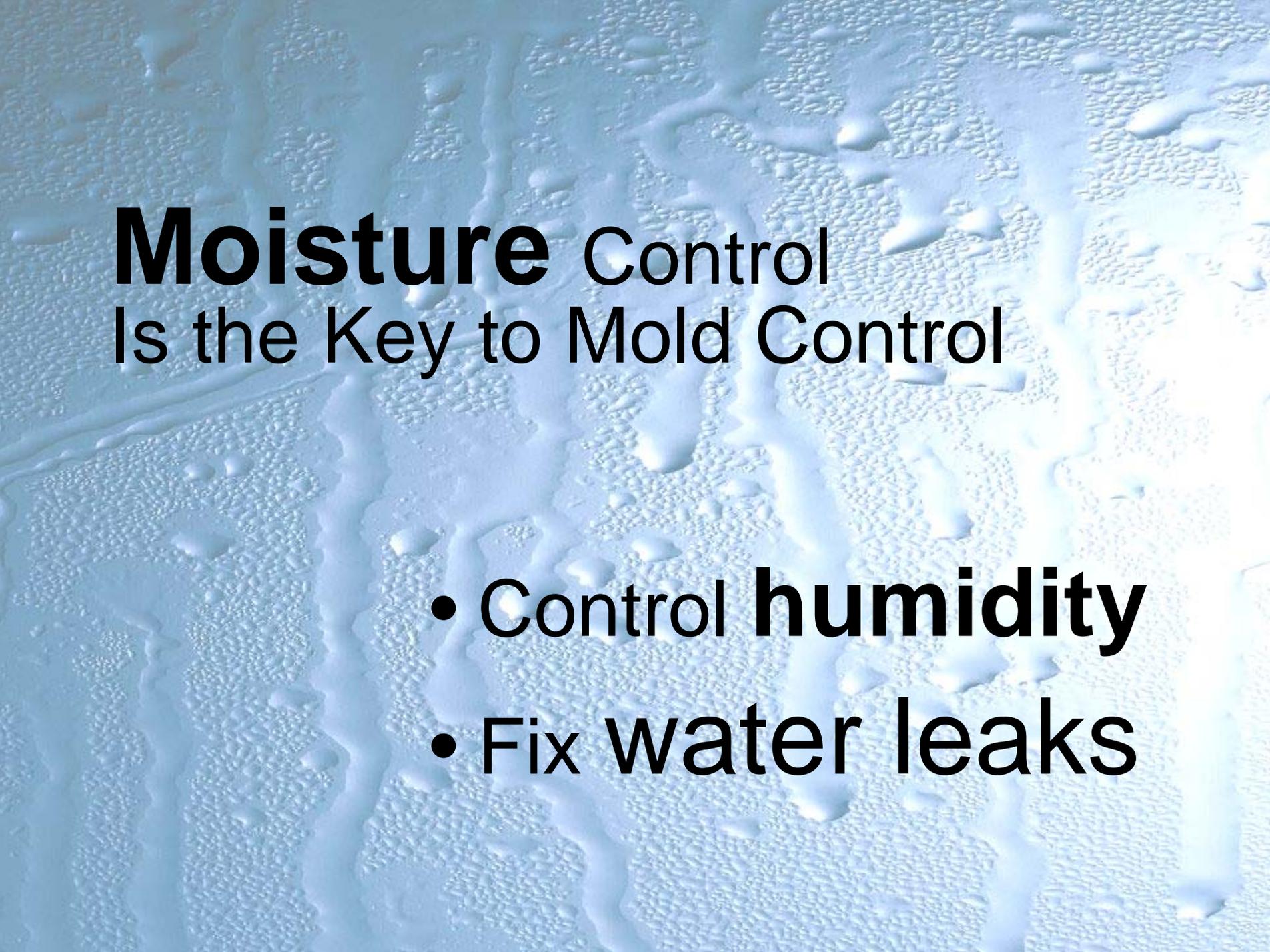
- “When microbial contamination is found, it should be eliminated by means that not only limit the possibility of recurrence but also limit exposure of occupants and persons conducting the remediation.”
- in their summary findings, the committee did not separate mold from ‘other’ agents - other agents might include such things as bacteria, dust mites, chemicals, and nonbiologic substances from building materials.

Damp Indoor Spaces and Health, 2004.
The National Academy of Sciences.
National Academies Press. Washington.
DC.

<http://books.nap.edu/catalog/11011.html>

888-624-8373



A close-up photograph of a glass surface covered in numerous water droplets of various sizes. The droplets are bright and glistening, reflecting light, and are scattered across the entire frame. The background is a soft, out-of-focus light blue color.

Moisture Control Is the Key to Mold Control

- Control **humidity**
- Fix **water leaks**



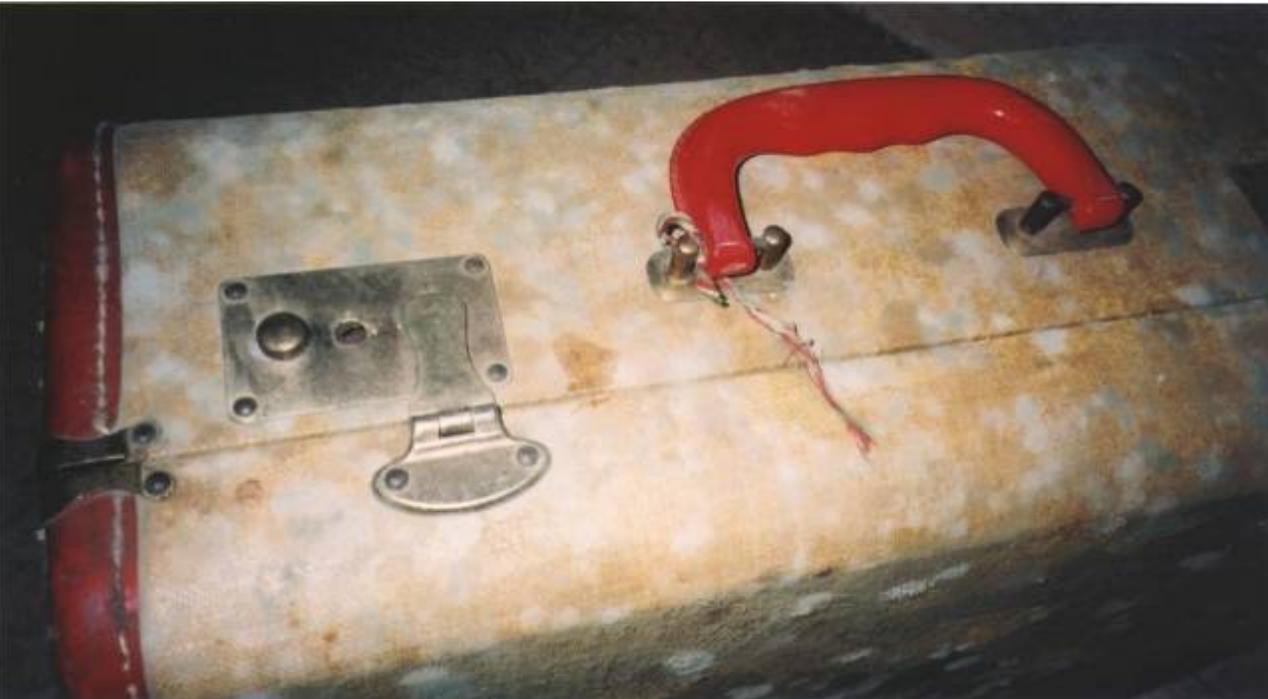


Find or identify the water problem and fix it



Focus on Mold Prevention

SAVE \$\$\$\$\$\$\$\$

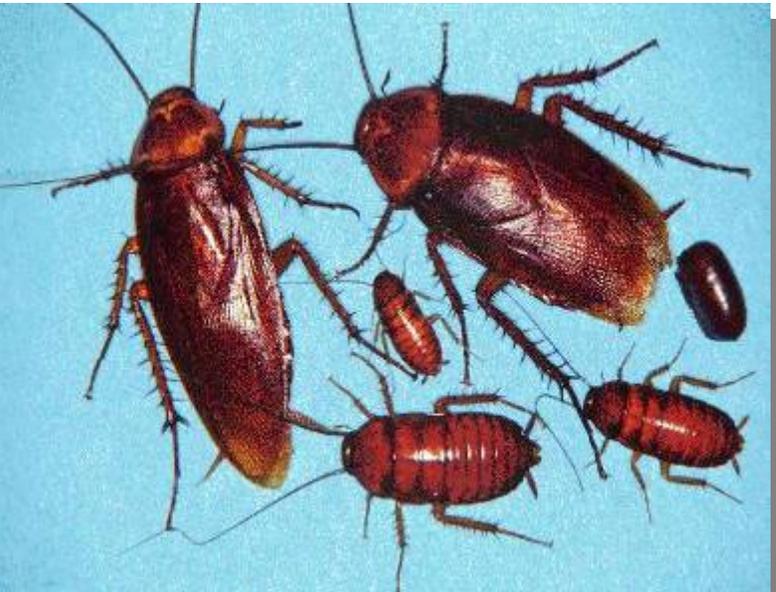


Reduce Indoor Asthma Triggers by reducing Moisture

mold

pests- cockroach, rodent

dust mites



Asthma triggers

Pets - cats, dogs
Secondhand smoke



Consider Moisture Control Before Building Construction Begins

- Site selection, landscaping
- Design of bldg. - should be appropriate for climate, plan for moisture control

residential example, "Houses that Work II, House Design Recommendations by Climate Region"

www.buildingscience.com/housethatwork/default.htm

Design building for occupants and uses - one size doesn't fit all



Summary



- Mold will not grow indoors unless there is a water problem
- Mold is found in all climates and areas of the U.S., both indoors and out
- Molds digest organic substances
- Major issues for indoor mold growth
 - Health effects
 - Structural damage, damage to furnishings
- Thousands of types of molds
- Prevention is Key - plan for moisture control



FREE Resources



EPA Voluntary Moisture Control Guidance

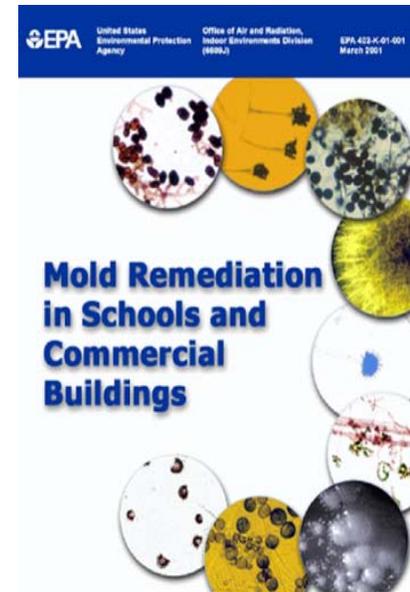
draft -- Moisture Control in Public and Commercial Buildings: Guidance for Design and Building Professionals

Terry Brennan will cover in more detail



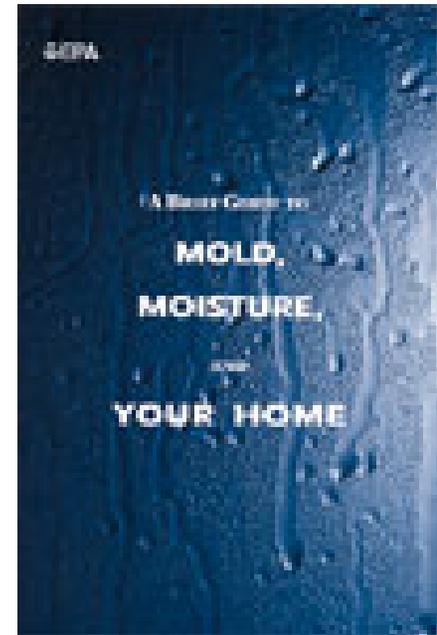
Mold Remediation in Schools and Commercial Buildings

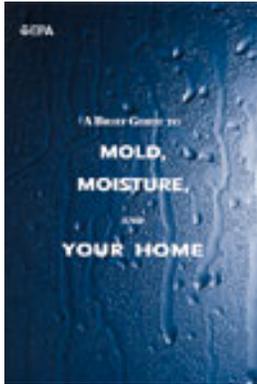
- Non-regulatory guidance
- Audience:
 - Building managers and those responsible for building maintenance
 - Reference for professional remediators
 - Anyone addressing mold problems in buildings



A Brief Guide to Mold, Moisture, and Your Home

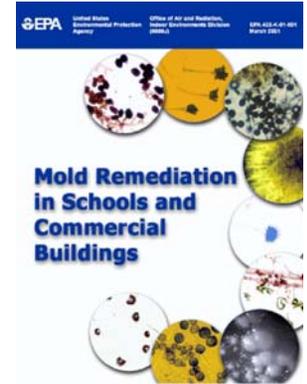
- Non-regulatory guidance
- Audience: homeowners and renters
 - How to clean up residential mold
 - How to prevent mold growth





Mold publications

www.epa.gov/mold



EPA Mold Course



www.epa.gov/mold

Mold Course

Free

Anonymous

Target audience:

environmental and public health professionals



Mold Course



Image Library - mold/ moisture photos may be used for presentations/ educational purposes without contacting EPA

Based on *Mold Remediation in Schools and Commercial Buildings*

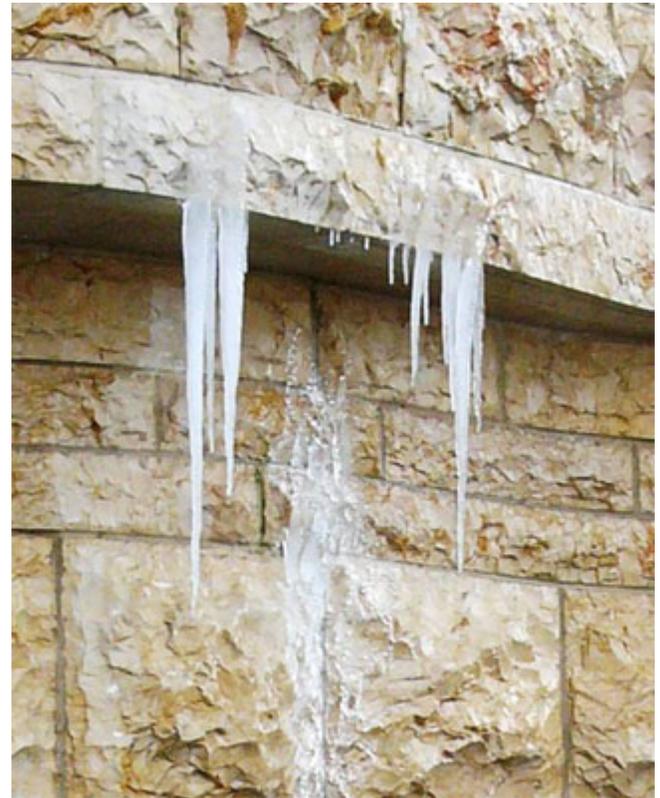
Mold Course

NO CERTIFICATION - EPA will not provide a certificate, certification, or any other credential for viewing the course - it is for informational purposes only. Some organizations may choose to offer continuing education credits (CEUs) for completion of the course. EPA does not track test results or provide the information to any other party.

Voluntary Knowledge Tests

Resource List

Glossary



Mold Course

time to complete ~ 1 hour, 9 Chapters

- 1 - Introduction to Mold**
- 2 - Where and Why Mold Grows**
- 3 - Finding Mold and Moisture**
- 4 - General Remediation Issues**
- 5 - Large Areas and Other Special Concerns**
- 6 - Containment and Personal Protective Equipment (PPE)**
- 7 - Evaluating the Remediation**
- 8 - Communicating with the Building Occupants**
- 9 - Prevention**



Continuing Education Credits (CEUs) from some organizations -
such as the National Environmental Health Association (NEHA)

Available in PDF





Indoor Air - Mold

Contact Us | Print Version Search: GO

EPA Home > Air > Indoor Air > Mold > Mold Course

Mold Home

Mold Course Home

Basic Information
How to Use this Course

Course Chapters

- 1 - Mold Basics
- 2 - Mold Growth
- 3 - Finding Mold
- 4 - Remediation
- 5 - Large Areas
- 6 - Containment
- 7 - Evaluation
- 8 -

Communication
9 - Prevention

Knowledge Tests

Resource List

Image Library

Glossary

PDF Version

Mold Course

Introduction to Mold and Mold Remediation for Environmental and Public Health Professionals

This web course contains information on mold prevention and remediation. It is designed primarily for environmental and public health professionals.

If you would like to take a short quiz on your current mold knowledge, begin with the [Pre-Test](#).

The [Mold Course](#) has nine chapters; these chapters are further divided into smaller lessons. At the end of each chapter there is a voluntary quiz to test your understanding of the material covered. Each chapter may be accessed at any point in the course using the menu on the left side of the page.

You can print a text version of this course (an Adobe Acrobat PDF file ([PDF](#), 202 pp, 6.1MB, [About PDF](#))).

For general information on mold, flooding, EPA mold brochures, and other mold and moisture control related resources see www.epa.gov/mold.

[Start Course](#) >>

[Try the Pre-Test](#) >>

[Image Library](#) >>





Mold - Mold Course

Contact Us | Print Version Search: GO

EPA Home > Air > Indoor Air > Mold > Mold Course > Image Library - Magnified Mold

Mold Image Library - Magnified Mold

Mold Home

Mold Course Home

Basic Information
How to Use this Course

Course Chapters

- 1 - Mold Basics
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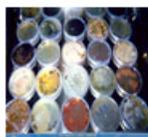
Knowledge Tests

Resource List

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Glossary

PDF Version



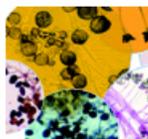
Mold growing in petri dishes. (photo, Stephen Vesper, Ph.D.)

[High Resolution](#)



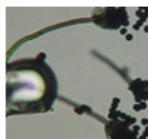
Mold growing in petri dishes. The same type of mold is growing in both photos, but note that molds can change appearance as they age. In this example, the mold on the right has been growing for several days longer than the mold on the left. (photo, Chin Yang, Ph.D.)

[High Resolution](#)



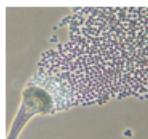
Magnified mold and mold spores. (photo, Chin Yang, Ph.D.)

[High Resolution](#)



Magnified mold spores. (photo, John Martyny, Ph.D.)

[High Resolution](#)



Magnified mold and mold spores. (photo, John Martyny, Ph.D.)

[High Resolution](#)



Highly magnified mold spores, lit from behind. The spores are very small (2-5 microns) and become airborne easily. (photo, Terry Brennan)

Mold in the Environment

Magnified Mold

Moisture and Moisture Damage

Prevention

Mold in Buildings

Finding Mold and Moisture

Cleaning, Remediation

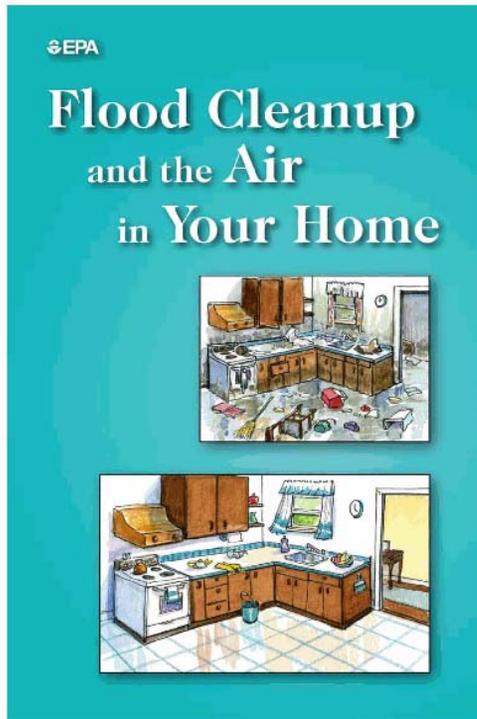
Animated Images

Mold Clinician's Guide

- from University of Connecticut
- Free
- <http://oehc.uchc.edu/clinser/indoor.htm>
or link from EPA page www.epa.gov/mold

Guidance for Clinicians on the Recognition and Management of Health Effects related to Mold Exposure and Moisture Indoors, published by the Center for Indoor Environments and Health at UConn Health Center with a grant from the Environmental Protection Agency.

www.epa.gov/iaq/flood



- booklet and poster available
- English and Spanish versions
- print files online
 - for desktop printer
 - for professional print jobs
- customize and print your own stock



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builders to create better
homes inside and out

Eric Werling

*Indoor Environments Division, U.S. EPA,
werling.eric@epa.gov or 202-343-9495*

WHAT DISTINGUISHES NEW HOMES WITH THE ENERGY STAR INDOOR AIR PACKAGE?

- Moisture & Mold Control
- Radon Resistant Construction
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- Improved Comfort
- Fresh Air Ventilation
- Advanced Filtration
- Low Formaldehyde



To learn more about Indoor Air Package

www.energystar.gov/homes

follow the link for [Indoor Air Package](#)

I-BEAM = Indoor Air Quality Building Education and Assessment Model

software tool designed for use by building professionals
and others interested in indoor air quality in
commercial buildings



[www.epa.gov/iaq/largebldgs/
ibeam_page.htm](http://www.epa.gov/iaq/largebldgs/ibeam_page.htm)

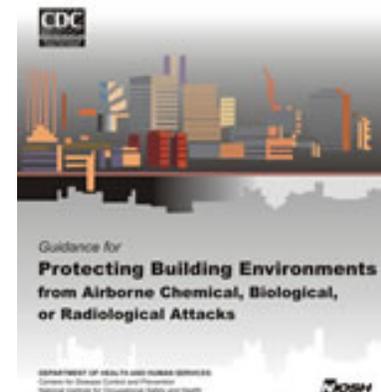
Homeland Security and Indoor Environments

www.epa.gov/iaq/homeland_security.html

Guidance for Protecting Building Environments from Airborne Chemical, Biological, or Radiological Attacks

Guidance for Filtration and Air-Cleaning Systems to Protect Building Environments from Airborne Chemical, Biological, or

Radiological Attacks



Executive Order 13423

- New construction and major renovation complies with Guiding Principle for Federal Leadership in High Performance and Sustainable Buildings MOU
- 15% of Federal capital asset building inventory of the agency as of the end of 2015 incorporates Guiding Principles

*2006 FEDERAL LEADERSHIP IN HIGH
PERFORMANCE and SUSTAINABLE
BUILDINGS MEMORANDUM OF UNDERSTANDING*

Moisture Control. Establish and implement a moisture control strategy for controlling moisture flows and condensation to prevent building damage and mold contamination.

The Whole Building Design Guide

- Indoor Air Quality and Mold Prevention of the Building Envelope – covers fundamentals, enclosure details
- http://www.wbdg.org/design/env_iaq.php

Moisture Control in Public and Commercial Buildings: Guidance for Design and Building Professionals



- Sections for design, construction and operation and maintenance
- Rain, Run-off, plumbing, condensation, HVAC, dehumidification
- Ordinary occupancies – offices, libraries



Guidance for Design and Building Professionals

Design Team



- Architects
- Engineers
- Owners
- Occupants
- Contractors
- Buildings and grounds

**Remember who you
are designing for**



Moisture Sources

- Poorly managed rainwater/groundwater
 - Poor roof, wall, window and foundation drainage
 - Defects in rain barriers
- Plumbing leaks
- Condensation on surface
 - Surfaces chilled by mechanical equipment, earth contact, outdoor air contact, night sky
 - Sun driven rain
- Construction moisture
 - Concrete, wet spray cellulose, gypsum mud
 - Damp earth in crawlspace

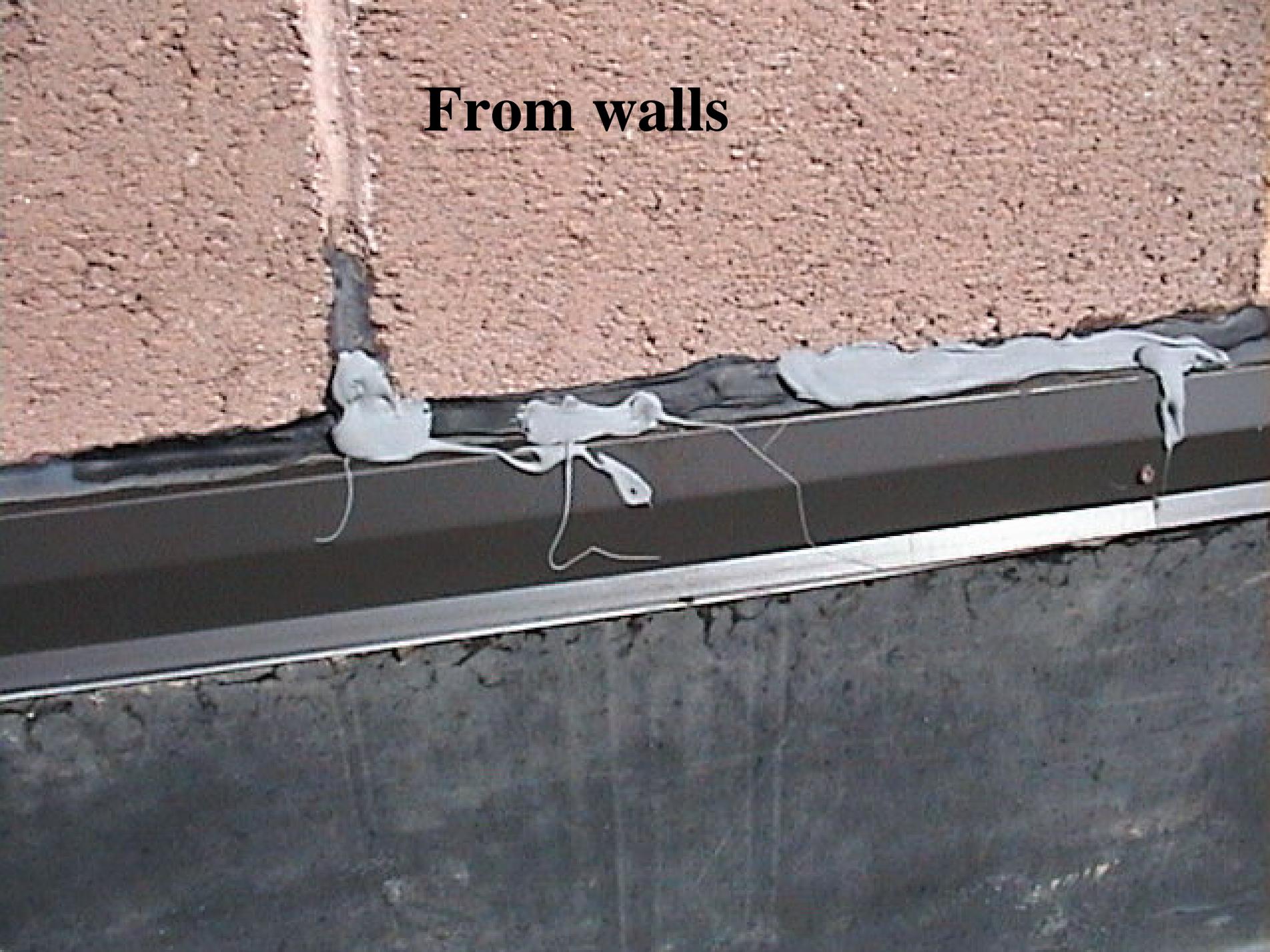
Drain the rain...

From roofs



**Most roof leaks are at
the penetrations and
edges**

From walls





**Where roofs
run into walls**

**Retrofit through wall
flashing - \$150 -
\$400/foot**





The windows



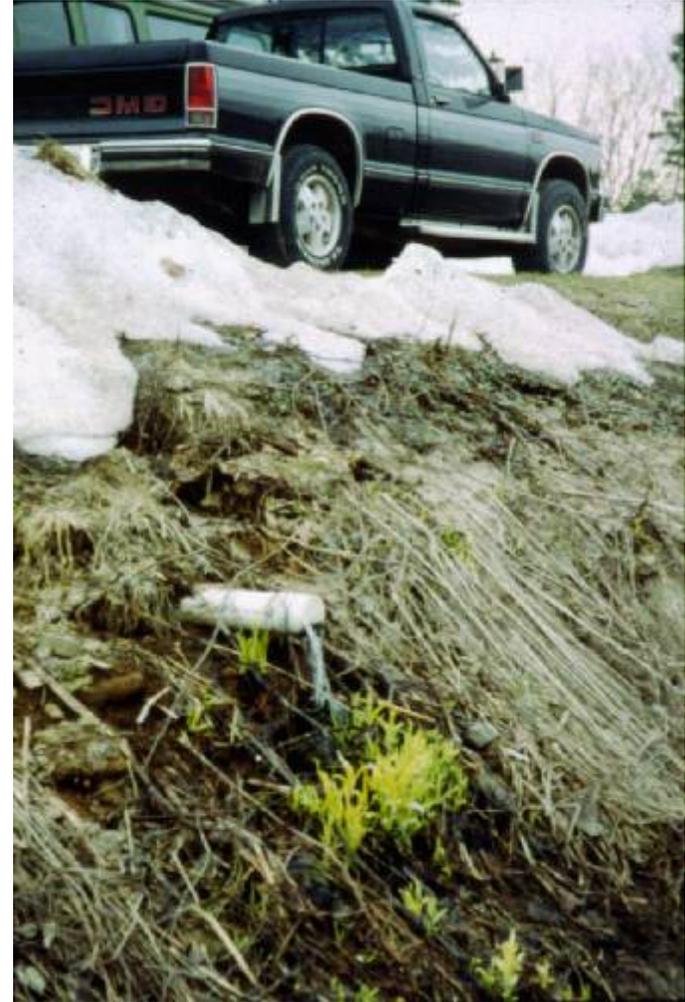
Into the basement?



Or crawlspace?

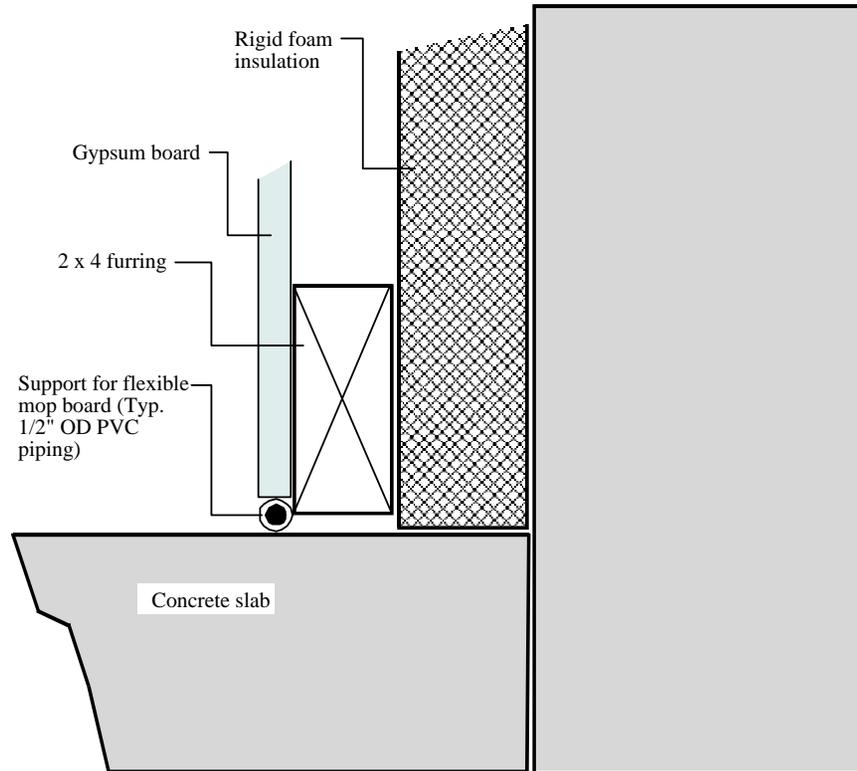


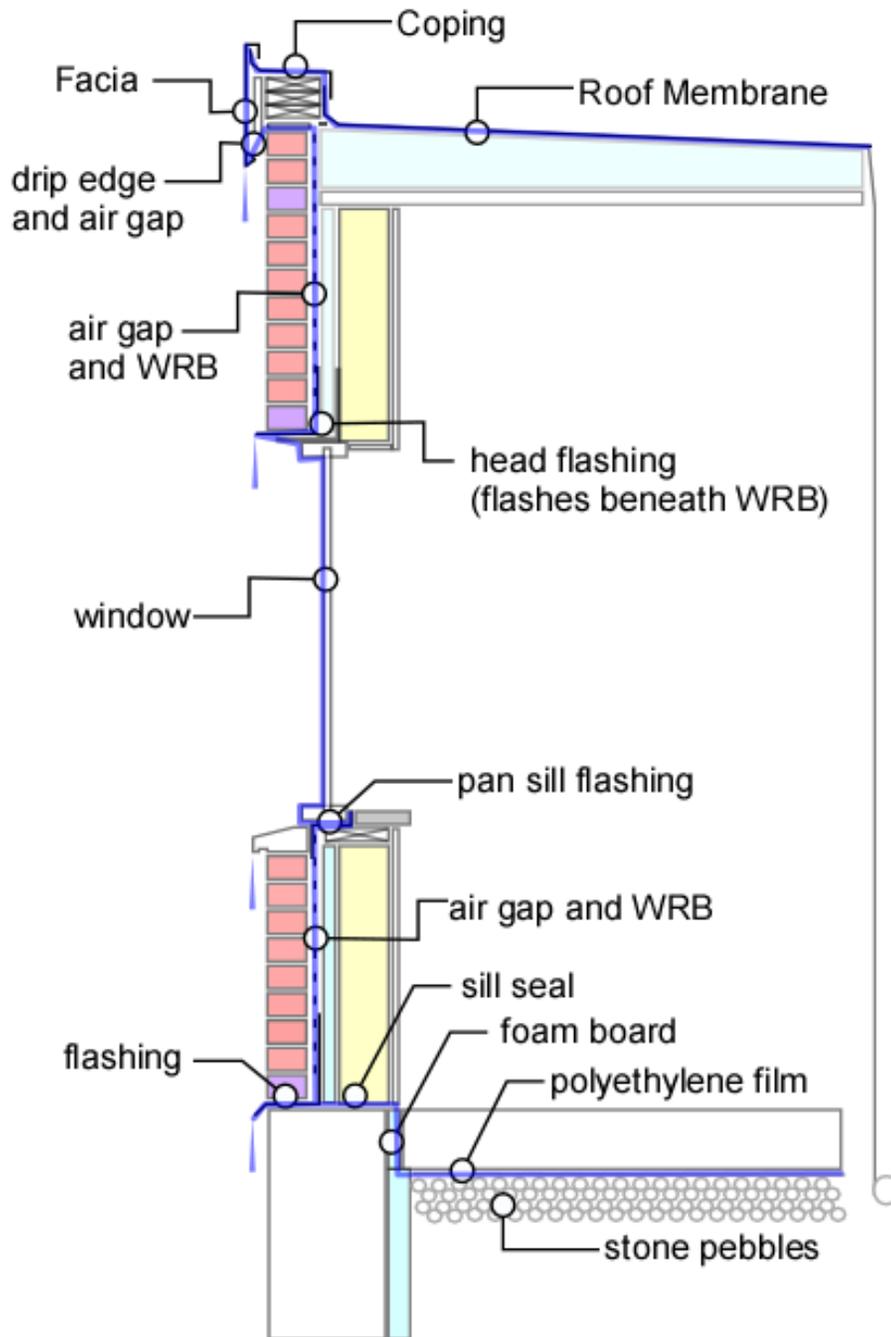
Nope, drain the foundations too





Be careful finishing below grade space





Tracing rainwater control from the center of the roof to the center of the foundation

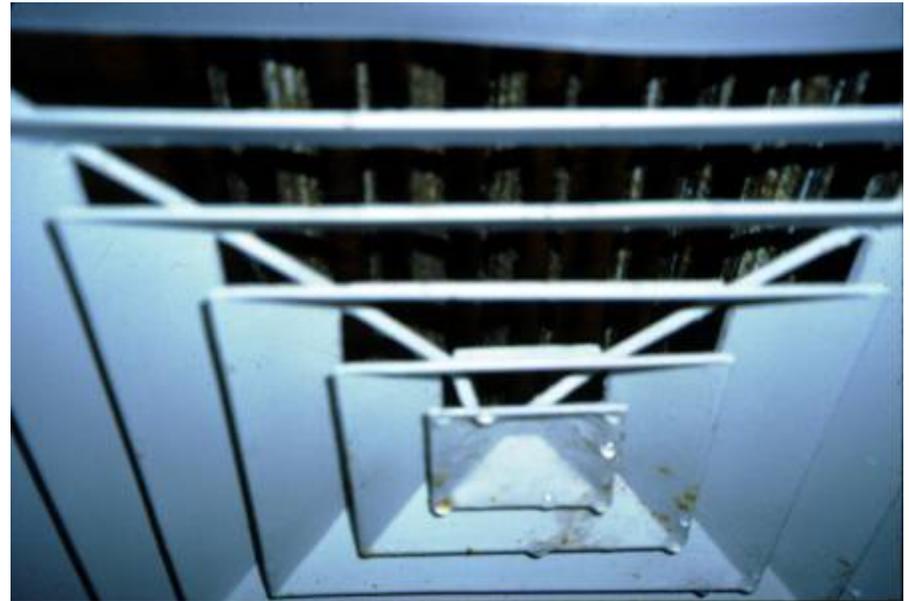
Plumbing

- No plumbing in insulated walls or ceilings
- Provide access to plumbing
- Test supplies, drains, appliances and fixtures



Design to Dehumidify

- Design HVAC using ASHRAE Humidity Control Handbook



HVAC

- Meet ASHRAE 62.1 air handler design criteria
- Air handlers and ductwork inside



**Condensation
in the
enclosure**

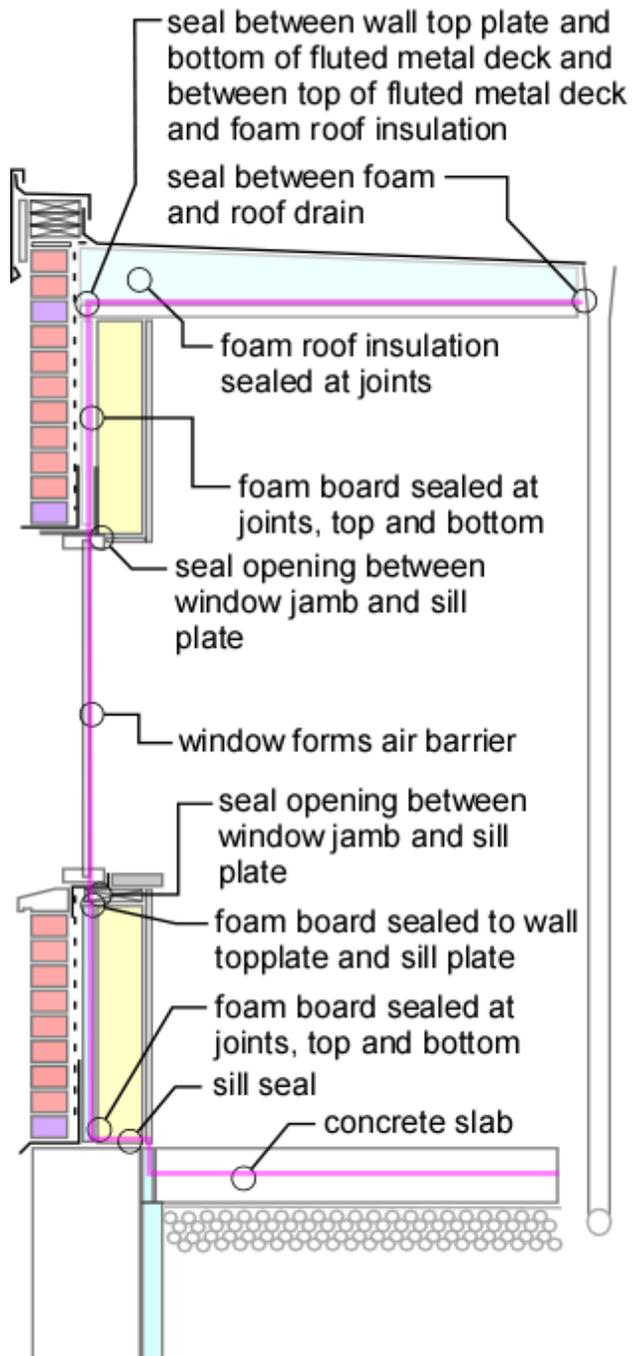




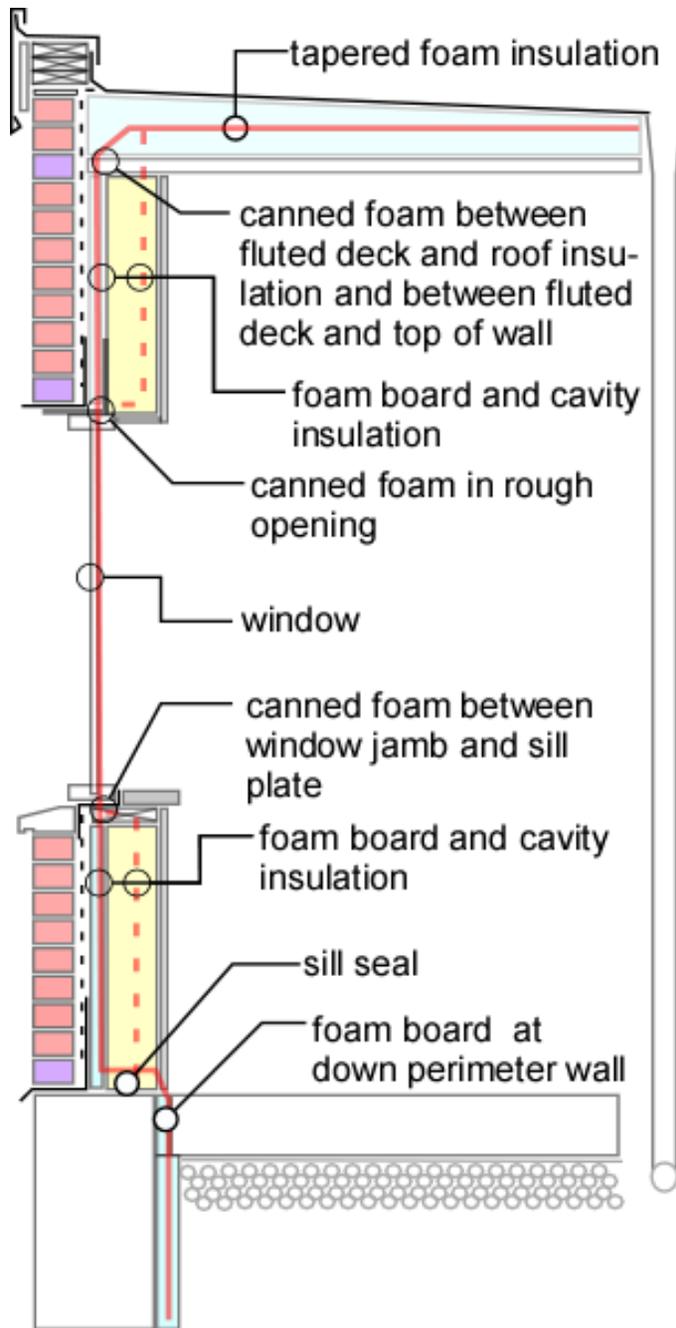


Avoiding Condensation in Walls

- Make it airtight
- Put all the materials with low perm (perm less than 2) on one side or the other of cavity
- Make one of the low perm materials at least an inch foam board
- Winter humidity less than the average January temperature plus 6



Tracing continuity of air flow control from the center of the roof to the center of the foundation floor.



Tracing continuity of thermal control from the center of the roof to the bottom of the foundation.

Be sure it's dry before you cover it





And don't spray the building...