Energy-Related Mold and Moisture

. . . awareness and impacts for weatherization

U.S. Department of Energy

Low-Income Weatherization Program

Energy-Related Mold and Moisture

. . . awareness and impacts for weatherization

Training Overview & DOE Guidance

Why Mold Training?

Effective November 12, 2004, the U.S. Department of Energy issued *Weatherization Program Notice 05-1*

Section 5.14 of WPN 05-1 titled **Energy-Related Mold and Moisture Impacts** require that *"weatherization crews receive specialized training in the recognition of conditions that promote mold growth they may encounter in their weatherization work and how best to prevent creating new mold conditions. At the same time, crews need training in how to treat less extensive mold conditions they may encounter in certain homes".*

This training is provided by DOE to meet the training needs of Section 5.14

DOE GUIDANCE regarding "*Mold-Related Weatherization*"

Weatherization Program Notice 05-1

November 12, 2004

5.14 Energy-Related Mold and Moisture Impacts

"*the WAP is not a mold remediation program*"

"*… DOE funds should not be used to test, abate, remediate, purchase insurance, or alleviate existing mold conditions identified during the audit, the work performance period or the quality control inspection …* "

"*weatherization services may need to be delayed until the existing mold problem can be referred to another agency for funding of remedial action*"

DOE GUIDANCE regarding *"Mold-Related Weatherization"*

WPN 05-1 - **November 12, 2004**

5.14 Energy-Related Mold and Moisture Impacts – cont.

"In Program Year 2005, all States will be required to amend their health and safety plans to include a protocol for dealing with mold which will include a specific policy when encountering homes with mold growth."

"Effective immediately, all States should ensure that their local agencies include some form of notification or disclaimer to the client upon the discovery of a mold condition and what specifically was done to the home that is expected to alleviate the condition and/or that the work performed should not promote new mold growth."

DOE GUIDANCE regarding "*Mold-Related Weatherization*"

WPN 05-1 - **November 12, 2004**

5.14 Energy-Related Mold and Moisture Impacts – cont.

"DOE funds may be used to correct energy-related conditions to allow for effective weatherization work and/or to assure the immediate health of workers and clients.

Training Format

To provide crews with a comprehensive background of mold-related weatherization, this training is divided into 6 lessons plus resources:

- **Lesson 1 - Molds Background and Health Effects**
- **Lesson 2 - Conditions of Mold Growth**
- **Lesson 3 - Mold Assessment & Client Disclosure**
- **Lesson 4 - Preventing Mold Growth – *Weatherization Best Practices***
- **Lesson 5 - How to Treat Mold Conditions**
- **Lesson 6 - Optional Lesson - Mold Testing**
- **Mold Resources**

While DOE recommends that crew training include all lessons, if training time or scope is limited, lessons 3, 4 and 5 are required.

Energy-Related Mold and Moisture

. . . awareness and impacts for weatherization

What You Will Learn.

As a result of this training, crews will learn:

- **what DOE requires regarding mold-related weatherization**
- **building science related to molds**
- **recognition of conditions that promote molds**
- **best weatherization practices to prevent molds**
- **client disclosure of molds**
- **how to treat less extensive mold conditions**

Energy-Related Mold and Moisture

. . . awareness and impacts for weatherization

Why Are Molds a Concern?

- While dormant mold spores are always present inside a home, active mold growth indoors is not normal.
- Molds can present health risks for crews and clients.
- Uncontrolled mold growth can cause severe and permanent structural problems.
- Failure to recognize conditions of mold growth may worsen existing mold cases or cause molds to actively grow.

Energy-Related Mold and Moisture

… awareness and impacts for weatherization

Lesson 1 – molds background and health effects

Mold background – part 1

What You Will Learn – Lesson 1

1. Where molds are generally found in a conventional and mobile home.
2. Why molds receive more attention today.
3. Terms related to molds.
4. Health Effects of molds.

Home Molds

they're real!

Mold on crawl space ceiling

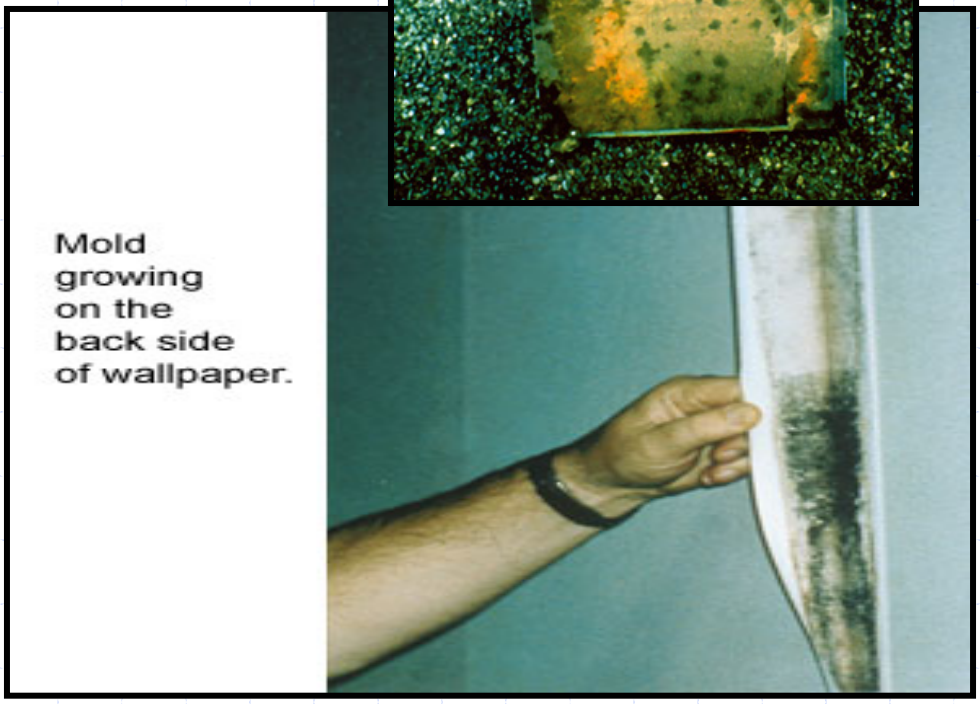
Mold growing on a suitcase stored in a humid basement.

It is important to take precautions to **LIMIT YOUR EXPOSURE** to mold and mold spores.

Hidden Home Molds

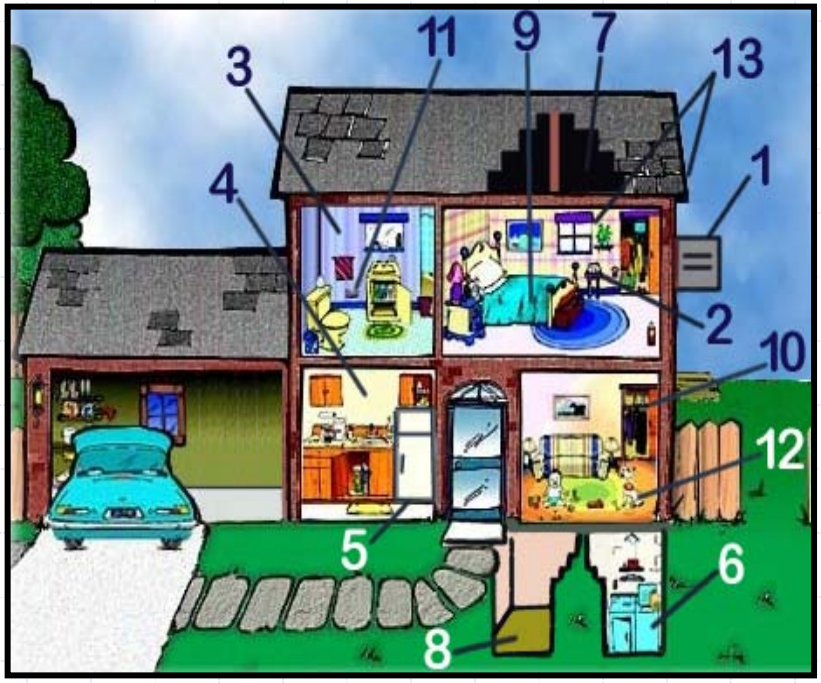
Mold behind a tub-surround.

Mold inside a furnace cabinet



Where mold problems may be found in the home.

1. Dirty air conditioners
2. Dirty humidifiers
3. Bathroom without vents or windows
4. Kitchen without vents or windows
5. Dirty refrigerator drip pans
6. Laundry room with unvented dryer
7. Unventilated attic
8. Carpet on damp basement floor
9. Bedding
10. Closet on outside wall
11. Dirty heating/air conditioning system
12. Water damage (around windows, roof,or basement)



Molds in Mobiles

- Small volume – less dilution of relative humidity
- Many cold surfaces for condensation
- Many sources of processed Wood – mold food
- Roofing
  - No ventilation or ventilation poorly distributed
- Crawl Space
  - No ventilation or poorly distributed/tight skirting
  - Plumbing leaks

Mold - Why Today?

- Always outside “background” levels of mold
- Excessive Building Tightness?
  - (reduced infiltration, reduced ventilation)
- Poor construction practices
- Improper use of building materials
- More media and public awareness

What are we talking about?

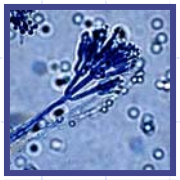
- ***Fungi*** – naturally occurring organisms that are essential to decay of organic matter.
- ***Mold*** and ***Mildew*** – terms used to describe fungi
- ***Biologicals*** - *water source* IAQ problems like fungi
- ***Bio-Aerosols*** (biological aerosols) – Airborne droplets containing mold spores, bacteria, and microbial volatile organic compounds (VOC)

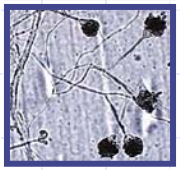
What are we talking about?

Mycotoxins – among most potent carcinogens

Produced by these and other fungi:


Aspergillus

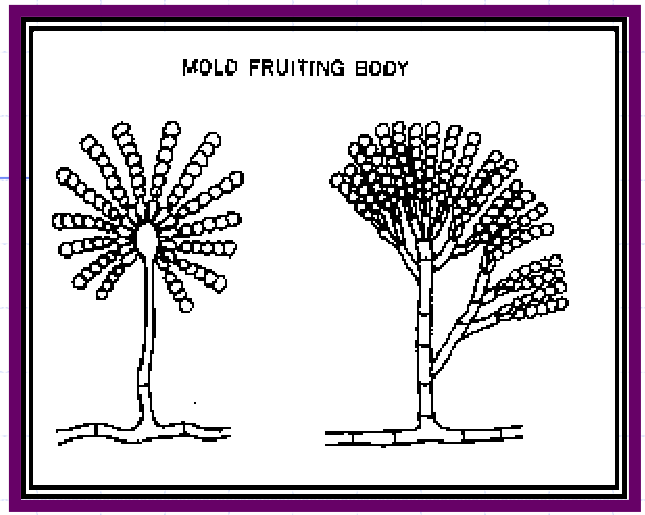

Penicillium


Stachybotrys

Long-known as agricultural threat to livestock and humans from animal feed and grain dust.

Mold Growth

- Release tiny spores
- Spores travel in air, settle on surfaces and get into water
- Multiply in right conditions (see part 2)
- Problems occur when colonies or spore levels are large
- Active MOLD growth indoors is not normal and can present health risks to crews and clients.



Health Effects – People React to:

- Spores (concentration), Fragments, Proteins
- Mycotoxins
- Microbial Volatile Organic Compounds
- People can react if mold is living or dead
- Mold must be dealt with before WX

Mold: A Health Concern

Generally accepted ...

- Response Varies
- Young Children & Elderly More Susceptible
  - especially those with compromised immune systems
- Cumulative Effect

For Crews and Clients – Symptoms Related to Mold Exposure

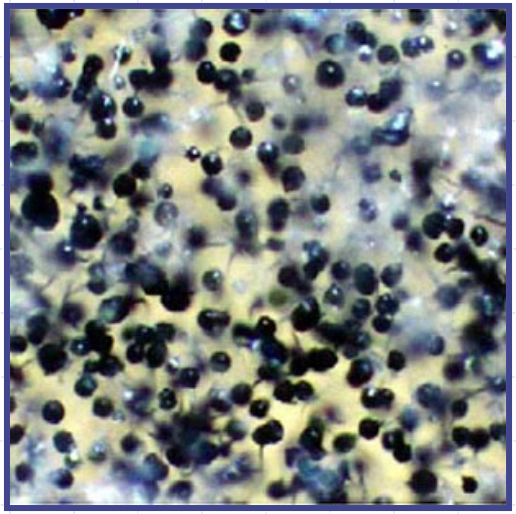
- Nasal & sinus congestion
- Sore throat, coughing
- Shortness of breath, chest tightness
- Eye irritation
- Headache
- Fatigue
- Rashes
- Known asthma trigger

Extreme Health Effect of a Mold

STACHYBOTRYS *atra/chartarum*

"*black-mold*", *bloody-mold*"

- Cleveland, Ohio – 1993-94
  - Impact resulting from flooding
  - Health effect on children
    - bloody ulcers
    - Death of 6 children
- First described in 1837/Prague
  - wallpaper
- Long-saturated cellulose
- Mold is slimy when active
- Mold spores released upon drying



Questions for Discussion – Lesson 1

1. What are health symptoms of mold exposure?
2. What are characteristics of mobile homes that make them more susceptible to mold growth?
3. How does mold growth relate to weatherization?

Energy-Related Mold and Moisture

… awareness and impacts for weatherization

Lesson 2 – Conditions that promote mold growth

Mold background – part 2

What You Will Learn? – Lesson 2

1. What factors influence the growth of mold in homes.

2. How factors that influence the growth of mold relate to weatherization.

Conditions that Promote Mold Growth

- Clues to Mold Control -

Nine *conditions of mold growth* :

1. **Mold spores present – they are everywhere**
2. **Food (organic materials)**
3. **Moisture**
4. **Building Tightness**
5. **Temperature**
6. **Oxygen Range**
7. **Time**
8. **Improper WX assessment, diagnostics & measures**
9. **Lack of home occupant knowledge & maintenance**

Mold Growth

1. Mold spores present

- **Fungi consists of approximately 25% of earth's biomass – spores are everywhere**
- **Estimated fungi species exceed 1.5 million**
- **Dormant spores can survive for many years without germinating and spreading**

Bottom line …

fungi spores will be in the homes you audit and weatherize!

Condition 1

Mold Growth

2. ORGANIC MATERIAL – Nutrient Source

Molds secrete digestive fluids that decompose the material substrate, making nutrients available

- **processed wood/cellulose (sheetrock & insulation paper)**
- **natural fibers such as cotton and wool (carpet, rugs, upholstery)**
- **"dirty" water (i.e. sewage water) is full of organic material**

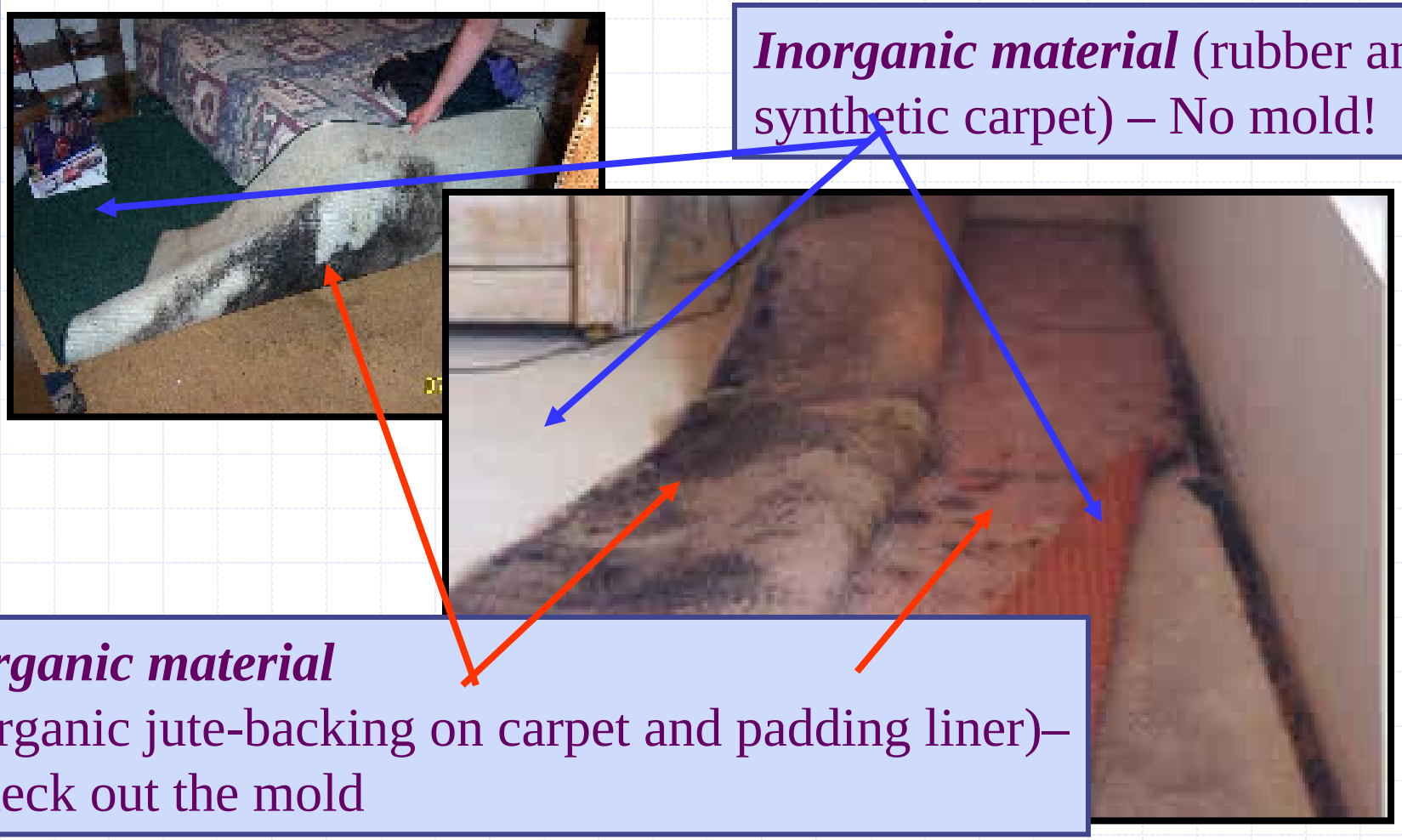
Mold Growth

INORGANIC MATERIALS ...

Molds cannot get nutrients from inorganic materials (metal or glass) but can grow on the dust or soil present on the surfaces.

Condition 2

Nutrient Source Example



Inorganic material (rubber and synthetic carpet) – No mold!

Organic material
(organic jute-backing on carpet and padding liner)– check out the mold

3. Moisture

Control is the Key to Mold Control

Moisture Sources:

1. Excessive Humidity
2. Water Intrusion

Condition 3

Mold Growth

Do not cover up water problems!

MOISTURE

Water Intrusion

- Water from plumbing leaks, sewage back-up and flooding

- Foundational seepage from lawn watering, snow and rain run-off

- Capillary movement (wicking) onto organic materials

- "Dirty-water" is the worst

Condition 3

Basement Mold

Why the mold?

- Cold surfaces causing condensation?
- Exterior water source?

Do not insulate or cover until moisture problem is dealt with!

Condition 3

Ceiling Mold

Check for moisture from these sources:

1. **Ice damming**
2. **Insulation drift**
3. **No insulation**
4. **Improper attic or exhaust venting**
5. **Roof leak**
6. **AC Condensation**
7. **Other ideas**?

Condition 3

Mold Growth

MOISTURE – Excessive Humidity

- 50% and greater RH is optimal for mold growth

  - an average family of four can generate over six gallons of moisture per day

- Humidity is Water Vapor

  - water vapor with cool surfaces is combo for creating condensation (dewpoint)

  - Water Vapor moves into walls and ceilings via. diffusion and air leaks

Humid air + cold surface = condensation

Condition 3

Moisture Flows…

WARM → **COLD**

MORE → **less**

Condition 3

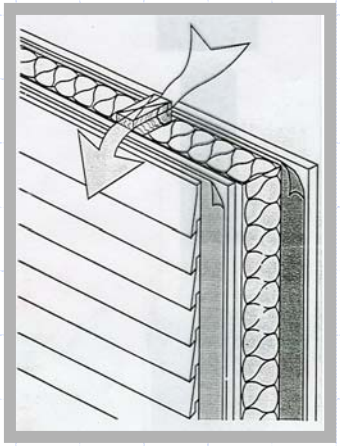
Mold Growth

MOISTURE – Excessive Humidity

Warm Humid air + cold surface = condensation

Hot Climate
outside warm humid air + cold surface on inside wall

Cold Climate
inside warm moist air + cold surface on outside wall



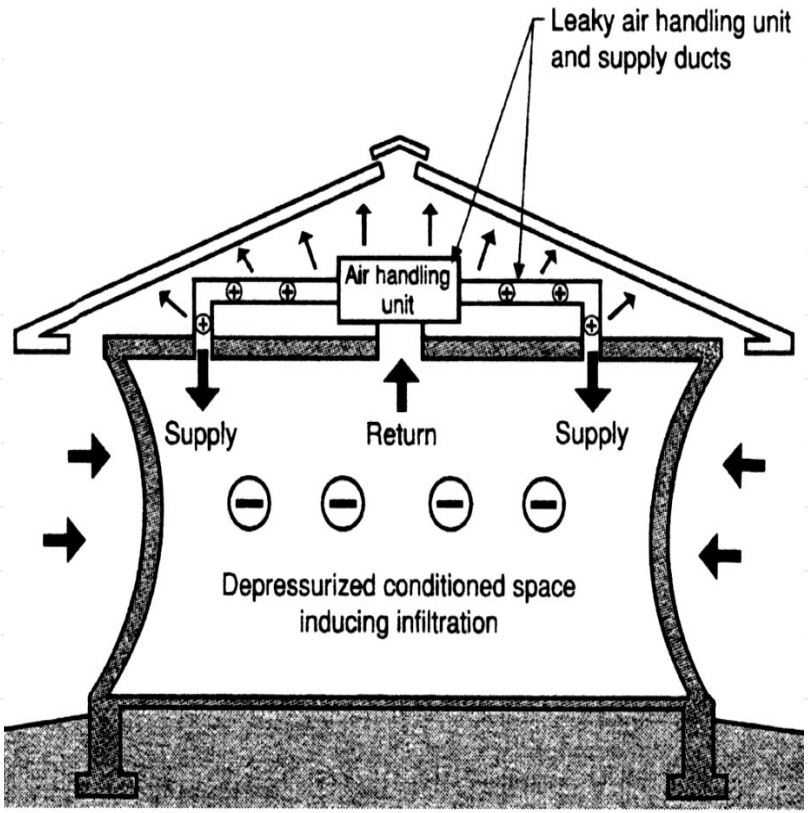
Condition 3

Avoid negative pressures in the south

Infiltration of warm, humid air:

- Into walls
- Through chases
- Into rooms

Condensation on cool surfaces



Negative Pressure Caused by Leaky Ducts

Condition 3

Sources of Home Moisture

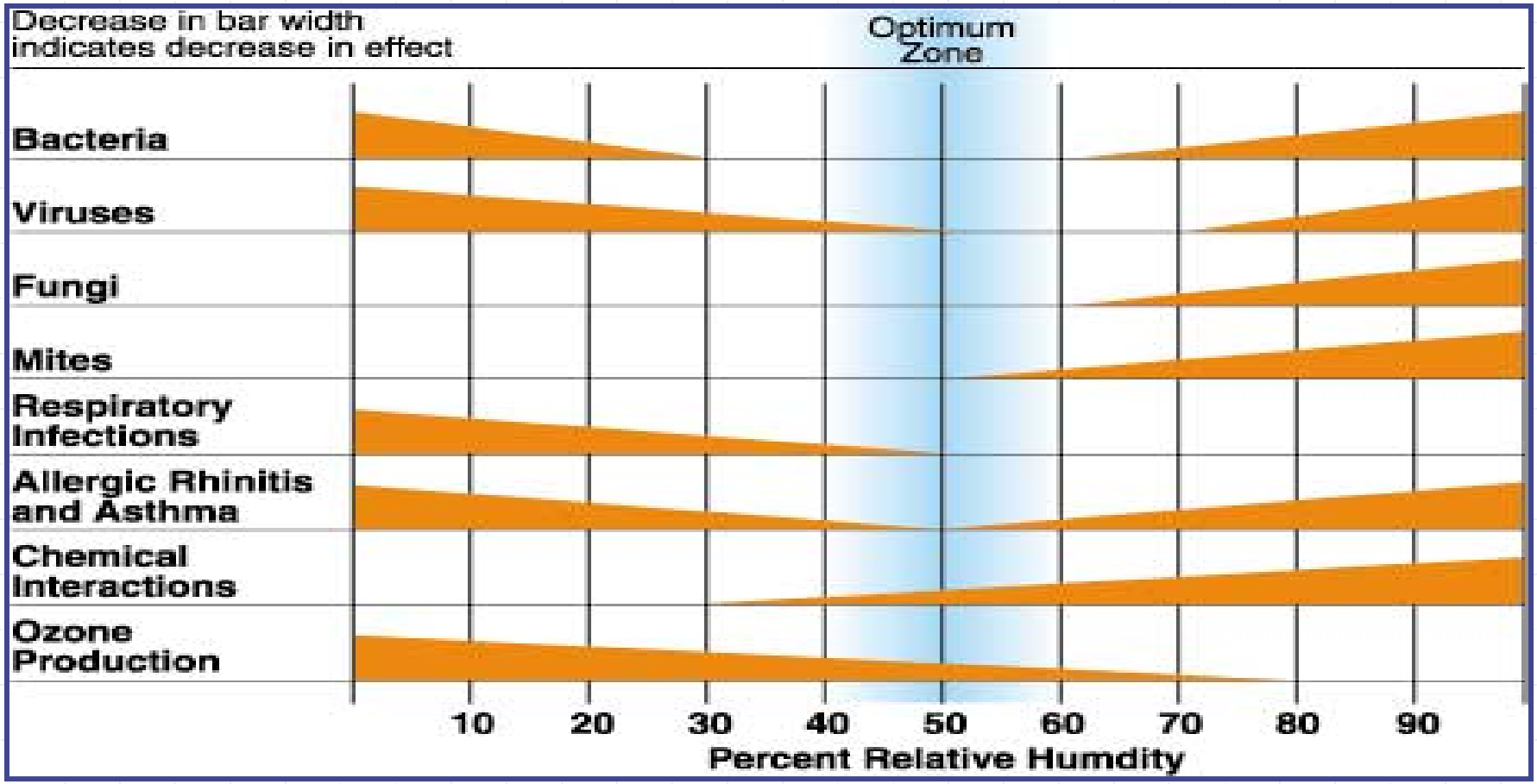
An average family of four can generate over six gallons of moisture per day.

Shower (excludes towels & spillage)	**1.0 pt / 10 minute shower**
Clothes drying (vented indoors)	**5.0 pt/ load**
Combustion (unvented space heater)	**7.6 pt/ gallon of kerosene**
Cooking dinner (family of four)	**1.2 pt(1.6 if gas cooking)**
Floor mopping	**1.5 pt/ 50 sq. ft.**
Respiration (family of four)	**0.4 pt/ hour**
Desorption of materials: seasonal	**6 to 17 pt/ day**
New construction	**10+ pt/day**
Ground moisture migration	**Up to 100 pt/day**

1.0 pint can increase the RH by about 8% in a 1,500 sq. ft. single floor home.

Condition 3

Optimum Indoor Relative Humidity Levels.



In cold climates maintain 35-50% RH.

In hot-humid climates maintain 40-60 % RH.

Condition 3

High Humidity – Window Condensation

The lower the window R-value the cooler the inside surface and greater chance of condensation.

Mold growth

Condensation on the inside of a windowpane.

High humidity – Poor/No Ventilation

Condition 3

Is the exhaust fan working properly?

Is the exhaust fan vented to the outside?

Is the fan operating long enough to remove moisture?

Condition 4

Mold Growth

4. Building Tightness

Since the mid 1970's homes are built tighter, better weatherized and save energy!

Without controlled ventilation …
…tighter = less air exchange
…tighter = less moisture evaporation
…tighter = less pollutant dilution
…tighter = greater chance of mold growth

Condition 4

Mold Growth

Building Tightness

How tight is too tight?

Use Blower Door and Consider:

- number of occupants
- volume of air conditioned area
- mechanical ventilation

Condition 5

Mold Growth

5. TEMPERATURE

Molds love household temps!

Molds germinate and grow best in warm temperatures

77 to 86 degrees Fahrenheit

At cooler temps (below 50 degrees) some molds will germinate but grow slower

Condition 6

Mold Growth

6. OXYGEN

Molds require oxygen,

but not light, for growth!

Think about mold growing inside walls!

Mold Growth

7. TIME

- **Mold can grow fast … some fungi can germinate in as short a period as**

  4 – 12 hours.
- **Mold spores (likes seeds) are released and carried by air or water to new locations.**
- **If not dealt with, molds can spread in 24 to 48 hours.**

Condition 8

Mold Growth

8. Improper WX Assessment, Diagnostics & Measures

The work you do may increase moisture levels and contribute to mold growth.

WX Examples:

- improper blower door diagnostics
- over-tightening the house – creating moisture build-up
- improper ventilation levels
- improper installation of exhaust fans
- failure to apply energy-related H & S measures

Can you think of more?

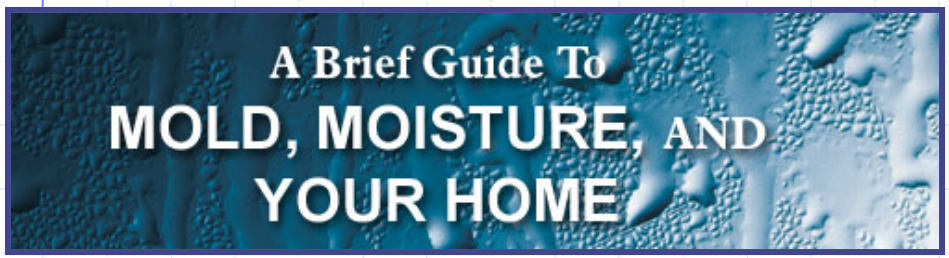
Condition 9

Mold Growth

9. Home Occupant Awareness

Alert occupants of home mold growth and possible conditions that may create moisture problems and mold growth.

Resource for the Public



EPA Publication #402-K-02-003

U.S. EPA, Office of Air and Radiation Indoor Environments Division (6609J)
1200 Pennsylvania Ave., NW,
Washington, DC 20460

http://www.epa.gov/iaq/molds/moldguide.html

Questions for Discussion – Lesson 2

How are each of these factors (that influence the growth and spread of molds) related to weatherization work?

1. **Mold spores**
2. **Organic materials**
3. **Moisture**
4. **Building Tightness**
5. **Temperature**
6. **Oxygen Range**
7. **Time**
8. **WX Assessment, Diagnostics & Measures**
9. **Occupant Knowledge & Maintenance**

Energy-Related Mold and Moisture

… awareness and impacts for weatherization

Lesson 3 – mold assessment and WX applications

What You Will Learn – Lesson 3

1. What is involved with an energy-related mold assessment.

2. Three steps of client disclosure.

3. Four categories of a home assessment
   - general building envelope
   - outside/site
   - HVAC
   - occupied space

Mold Testing

Reminder …

5.14 Energy-Related Mold and Moisture Impacts

"*the WAP is not a mold remediation program*"

"*… **DOE funds should not be used to test …** existing mold conditions identified during the audit, the work performance period or the quality control inspection … ”*

WX Building Assessment

As part of the energy audit a mold *"assessment"* should be done to …

- **to assure existing mold conditions are noted, documented and disclosed to client**
- **to assure existing building envelope conditions do not contribute to mold growth when weatherization measures are applied**

Mold Assessment means:
… a visual building survey related to WX
… WX assessment does not include testing

WX Building Assessment

Conduct energy-related mold assessment (using "checklist"*) as part of the wx energy audit

A non energy-related mold assessment is …

- **beyond the scope of weatherization**
- **not an allowable DOE cost**
- **implies to the client you are a "mold expert"**

***see sample form enclosed with training materials**

WX Building Assessment

Protect Yourself!

Documentation of Current Situation

- Use Assessment Checklist
- Take Photos or Video
- Record in Client File

Disclose what you know *and* don't know

Your business is weatherization not molds

- don't make claims you are not qualified to make
- provide EPA mold publication

Client Disclosure*

"Effective immediately, all States should ensure that their local agencies include some form of notification or disclaimer to the client upon the discovery of a mold condition and what specifically was done to the home that is expected to alleviate the condition and/or that the work performed should not promote new mold growth."

***see sample form enclosed with training materials**

Client Disclosure

Step 1.

- ***Don't Claim Mold Expertise***
- ***Share Checklist results of "Observed" situation***
- ***Share photos of findings***
- ***Stress "no testing was done to verify findings"***
- ***Obtain signature of disclosure on Checklist***

Client Disclosure

Step 2. - If appropriate indicate that …

"weatherization services may need to be delayed until the existing mold problem can be referred to another agency for funding of remedial action"

Weatherization Program Notice 05-1

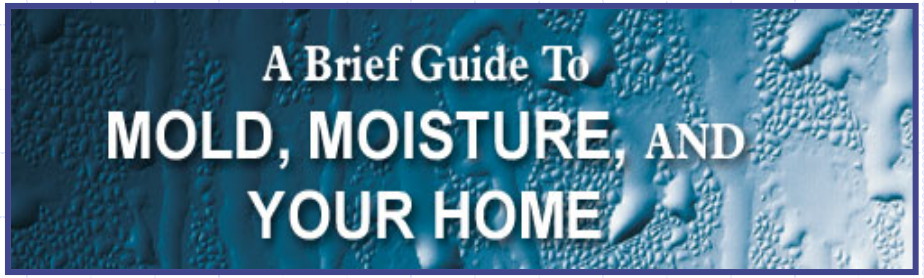
November 12, 2004

Client Disclosure

Step 3.

- Provide EPA Publication

- Use Publication Distribution Verification Form



EPA Publication #402-K-02-003

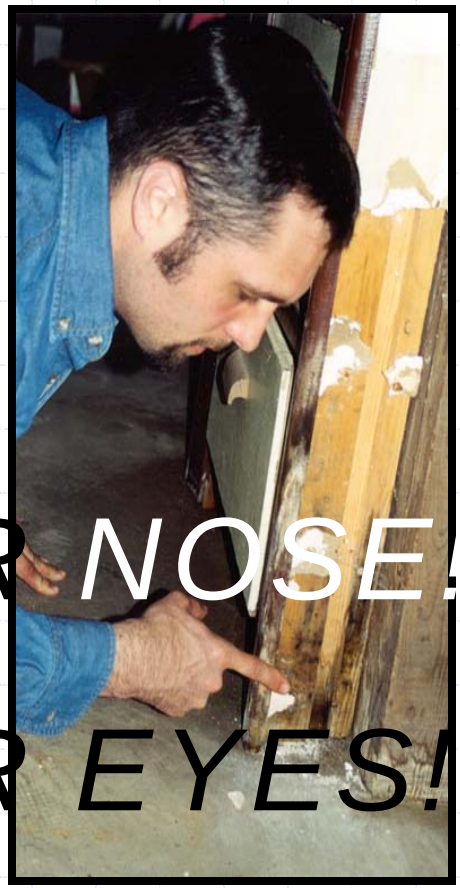
Client Disclosure

Client tips to remedy molds

- Clean, disinfect, and dry surfaces
- Lower humidity levels
- Clean and disinfect humidifiers, dehumidifiers, refrigerator pans and air conditioning coils
- Exhaust the dryer to the outdoors
- Run a bathroom exhaust fan during bathing or showering
- Use a range-hood to exhaust cooking moisture
- Fix plumbing leaks and seepage
- Raise temp. of cold surfaces with insulation or storm windows
- Increase air circulation by opening closet doors and moving furniture away from walls

WX Building Assessment

FOLLOW YOUR NOSE!



FOLLOW YOUR EYES!

If you can see it or smell it, molds are likely present

WX Building Assessment

General examination of building

- ✓ Examine structure, maintenance activities, occupancy patterns
- ✓ Visually look for mold and water staining
- ✓ Look for evidence of standing water
- ✓ Look for evidence of condensation
- ✓ Check basement or crawl space and attic for proper venting and exhaust

WX Building Assessment – *Outdoors*

- ✓ Soil grade or drainage toward foundation
- ✓ Standing water adjacent to foundation
- ✓ Wall and roof damage allowing water intrusion
- ✓ Missing or blocked rain gutters
- ✓ No downspout extensions
- ✓ Firewood stacked adjacent to house
- ✓ Excessive shrubbery around foundation

WX Building Assessment – *HVAC System*

- ✓ Air intakes: debris (organic) vs. clean air
- ✓ Filters: dirty, damp, poor type
- ✓ Heat exchangers: dirty & damp coils, condensate pans, drainage, stagnant water
- ✓ Ducts: contamination, moisture

WX Building Assessment - *Occupied Space*

- ✓ Plumbing leaks
- ✓ Water stains on walls, ceilings and around windows
- ✓ Musty odor
- ✓ Surface Condensation (especially during mild weather)
- ✓ Mold on Carpeting
- ✓ Humidifiers
- ✓ Window Air Conditioners
- ✓ Lack of bathroom, kitchen exhaust
- ✓ Clothes dryer not vented to outside
- ✓ Firewood stored indoors
- ✓ Wet clothes drying indoors

Questions for Discussion – Lesson 3

1. What is involved with an energy-related mold assessment.
2. Review the three steps of client disclosure.
3. When assessing a home for energy-related molds discuss four common area of the home were mold problems may exist:

   - general building envelope
   - HVAC
   - outside/site
   - occupied space

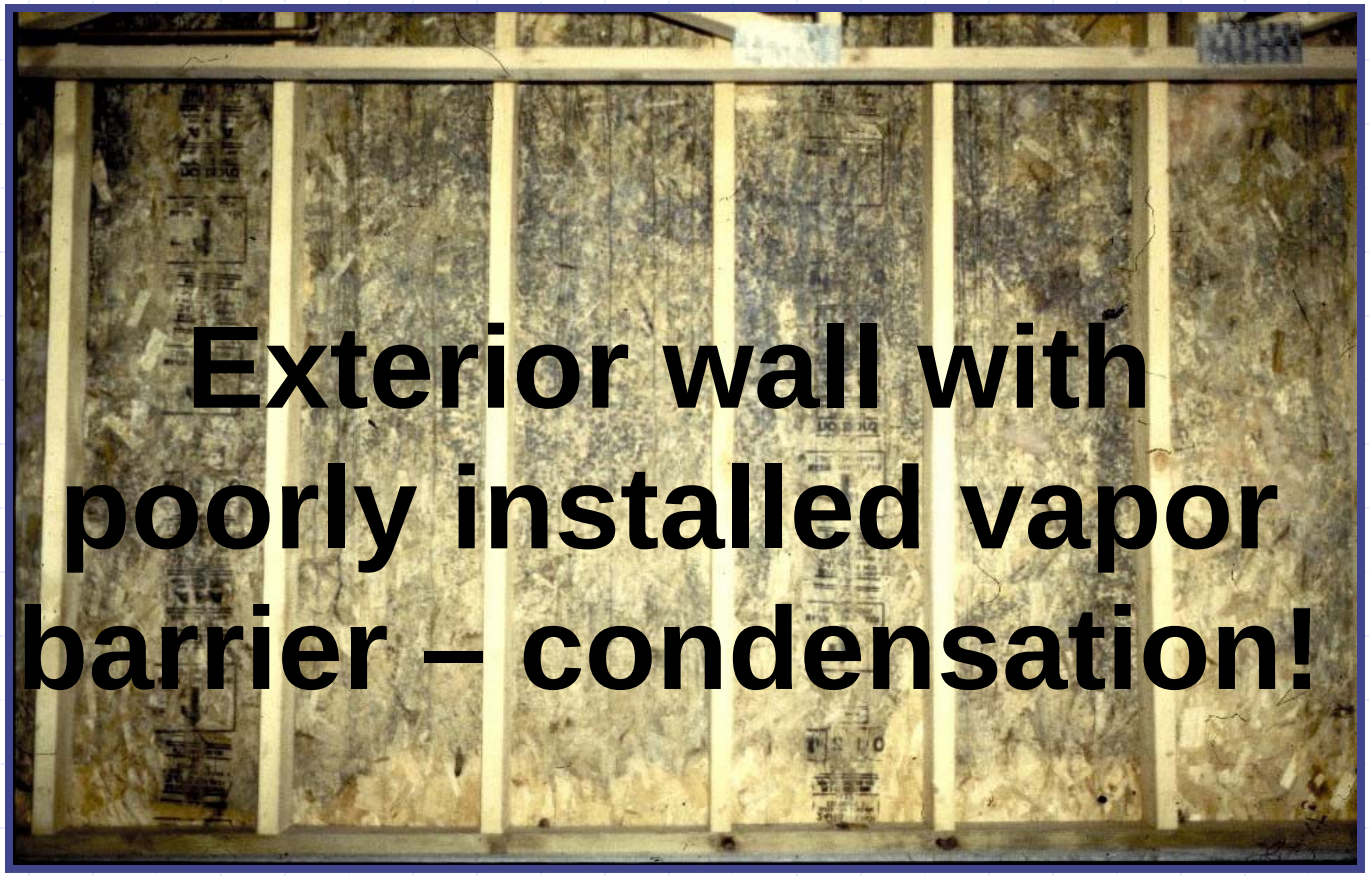
4. Slides 70-81 provide you with an opportunity to assess home mold problems. The slides are divided into pairs – the 1st slide showing a problem situation and the 2nd slide identifying the cause of the mold problem.

   Review each pair of slides, discussing how they may relate to weatherization.

Exterior Wall Mold

test your assessment skills

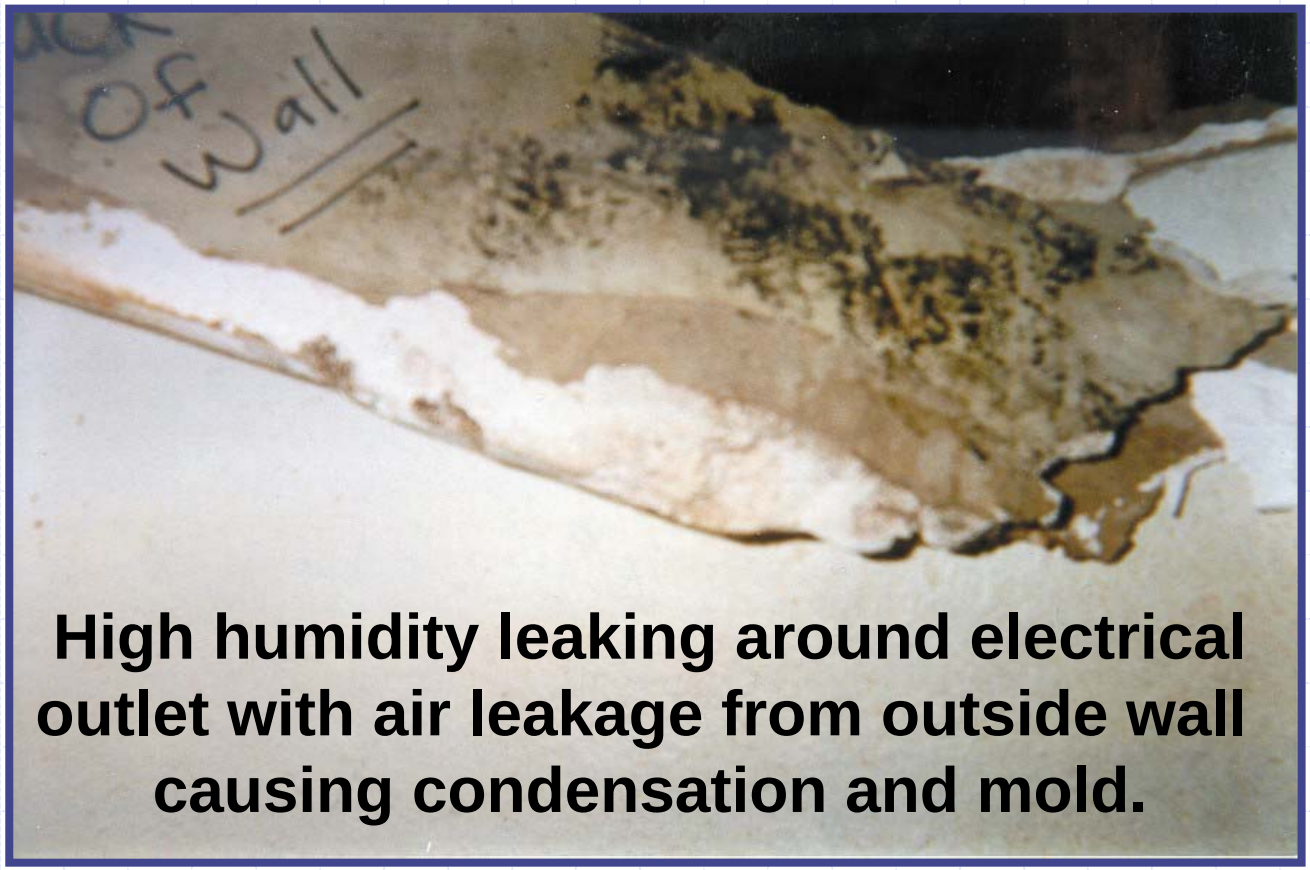
Exterior Wall Mold



Mold on Insulation

test your assessment skills

Mold on Insulation



High humidity leaking around electrical outlet with air leakage from outside wall causing condensation and mold.

Mold in Attic

Problem and Solutions?

test your assessment skills

Mold in Attic

Mold in Bathroom –
remember these pictures and tips?

Carpet Mold

test your assessment skills

Carpet Mold


Laundry room –
washing machine
overflowed one time.
Consumer should get
rid of carpet!

Mold Evidence on Wall

Extensive Mold in Wall Cavity

Just a simple pinhole pipe-leak.

Is this mold?

test your assessment skills

Energy-Related Mold and Moisture

… awareness and impacts for weatherization

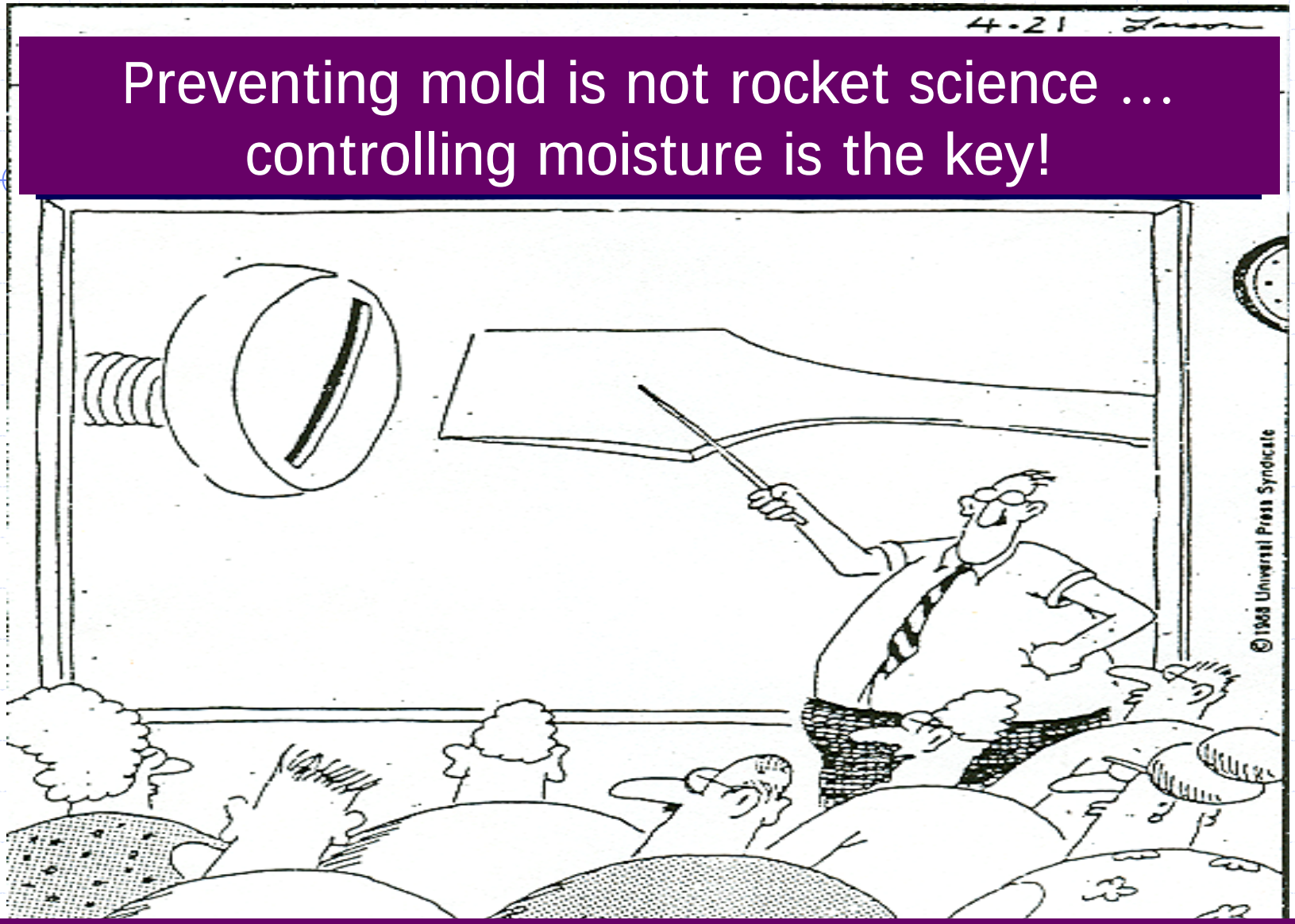
Lesson 4 – preventing mold growth …

weatherization best practices

What You Will Learn – Lesson 4

1. The importance of controlling indoor moisture
2. Suggested humidity levels
3. Kitchen and bath moisture control and ventilation
4. Air tightness and pressures as it relates to moisture
5. Crawlspace and attic ventilation
6. Structural drying

Preventing mold is not rocket science … controlling moisture is the key!



NOTE: When controlling moisture and dealing with molds always refer to your State WX Standards.

Why Clients Need to Control Indoor Home Moisture

an average family of four can generate over six gallons of moisture per day

Shower (excludes towels & spillage)	**1.0 pt / 10 minute shower**
Clothes drying (vented indoors)	**5.0 pt/ load**
Combustion (unvented space heater)	**7.6 pt/ gallon of kerosene**
Cooking dinner (family of four)	**1.2 pt(1.6 if gas cooking)**
Floor mopping	**1.5 pt/ 50 sq. ft.**
Respiration (family of four)	**0.4 pt/ hour**
Desorption of materials: seasonal	**6 to 17 pt/ day**
New construction	**10+ pt/day**
Ground moisture migration	**Up to 100 pt/day**

1.0 pint can increase the RH by about 8% in a 1,500 sq. ft. single floor home.

Monitor Relative Humidity

recommended for greater accuracy

In cold climates maintain 35-50% RH.

In hot-humid climates maintain 40-60 % RH.

Preventing Mold ...

Kitchen & Bath Moisture Control

- Bathrooms, kitchens and utility areas should be vented to the “outside” – never to attic or crawl space.
- Exhaust vents rarely discharge rated cfm

NOTE: When controlling moisture and dealing with molds always refer to your State WX Standards.

Exhaust Timer Options

Single pole timer

Light and Fan Timer Switch

NOTE: When controlling moisture and dealing with molds always refer to your State WX Standards.

Clothes Dryer - a mold maker

- Lint = organic material
- Exhaust air = pounds of moisture
- Temperature = typically 70 to 100+ degrees F

Clothes Dryer

Dryer Rules:

- Always vent to outside
- With mobiles vent beyond the skirting
- Do not vent into crawl spaces
- If possible direct vent to outside using smooth metal piping
- If elbows are needed, limit to two

NOTE: When controlling moisture and dealing with molds always refer to your State WX Standards.

Exhaust Vent Rules

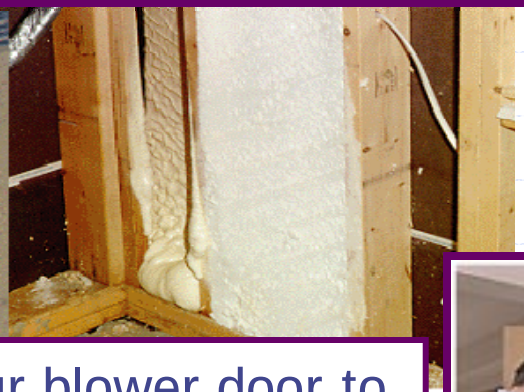
1. **Size correctly**
   - 50 cfm bathroom venting standard (*20 cfm)
   - 100 cfm kitchen venting standard (*25 cfm)

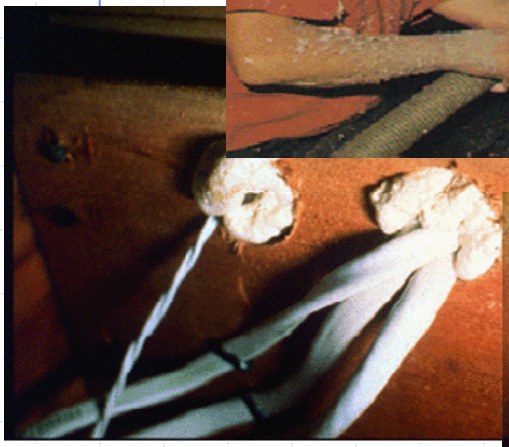
* If venting is continuous

2. **Exhaust to outdoor – never into attic**
3. **Shortest vertical distance to outside or direct vent through wall**
4. **Control bathroom exhaust with timer or humidistat**
5. **Use aluminum piping without screws and taped joints**

NOTE: When controlling moisture and dealing with molds always refer to your State WX Standards.

Air sealing can keep humid air and moisture from entering the home however, over tightening can cause elevated relative humidity





Use your blower door to monitor air tightness

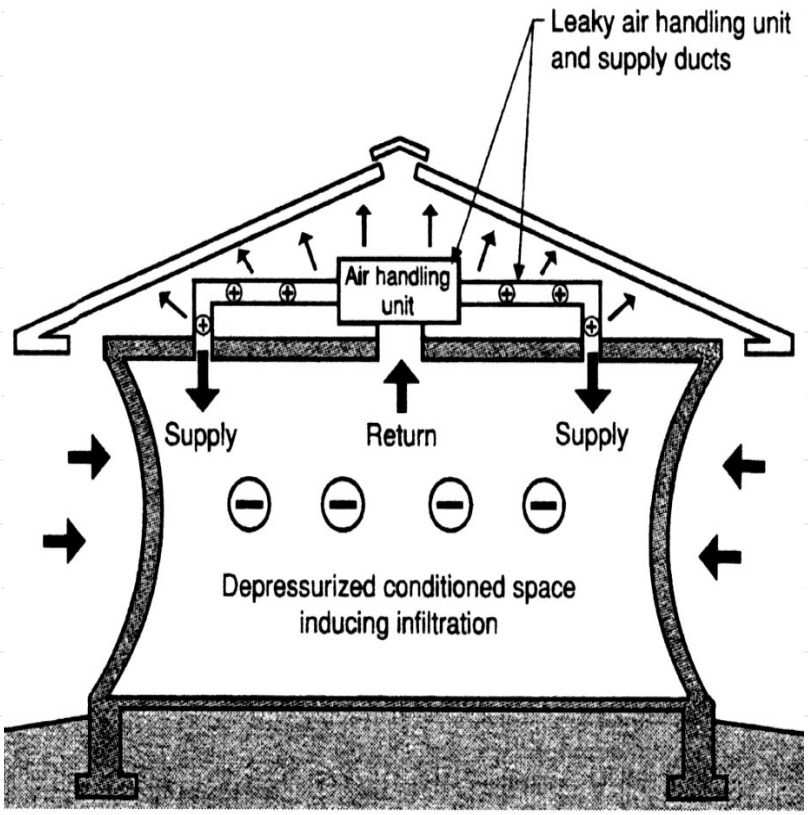
NOTE: When controlling moisture and dealing with molds always refer to your State WX Standards.

Avoid negative pressures in hot-humid climates

Infiltration of warm, humid air:

- Into walls
- Through chases
- Into rooms

Condensation on cool surfaces



Negative Pressure Caused by Leaky Ducts

Controlling Moisture ...
Foundation Drainage

Where does foundation moisture come from?

- **1 inch of rain on 1,000 sq. ft. roof = 623 gallons**
- **High water table**
- **Foundation plants**
- **Leaking water spigot**

Recommend to Clients:

Install Gutters and Downspouts

Extend downspouts

Slope ground 1 inch per foot away from the house

NOTE: When controlling moisture and dealing with molds always refer to your State WX Standards.

Preventing Mold ...

Crawl Space Moisture Control

- Need cross-ventilation in crawl space
- Should have at least 4 vents
- 1 square foot of NFA ventilation/150 square feet of floor space
- Never exhaust interior mechanical into crawl space – like a clothes dryer
- 6 mil poly moisture barrier is a must

NOTE: When controlling moisture and dealing with molds always refer to your State WX Standards.

Preventing Mold ...

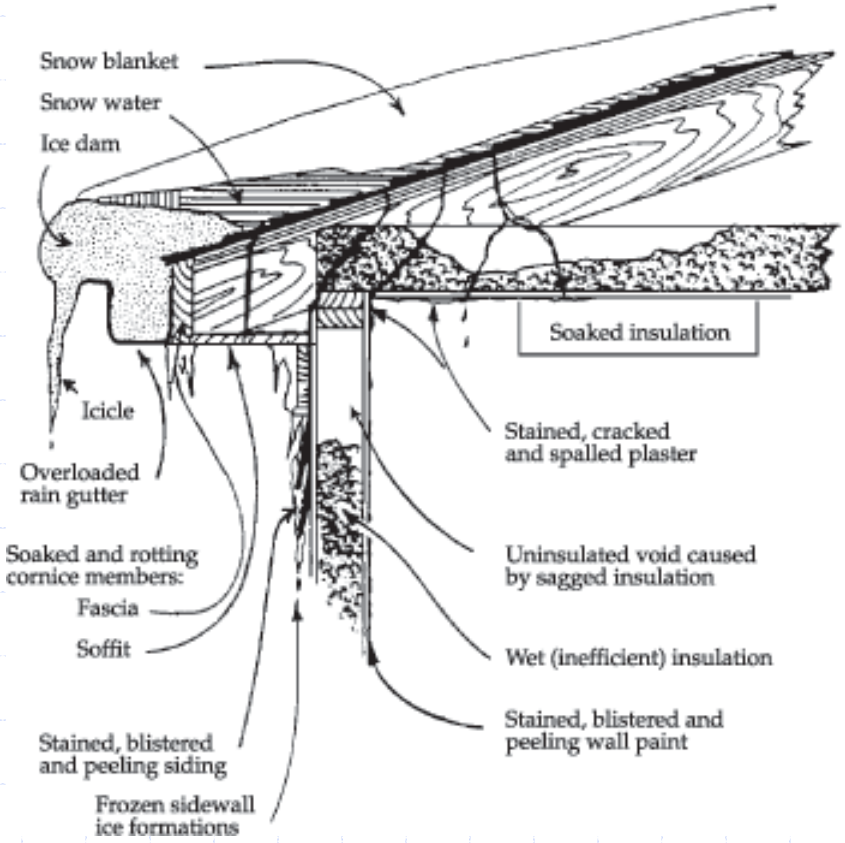
Attic Ventilation

- Need cross-ventilation in attic
- Need high and low ventilation
- 1 square foot of NFA ventilation/150 square feet of attic area
- Never exhaust interior mechanical into attic

NOTE: When controlling moisture and dealing with molds always refer to your State WX Standards.

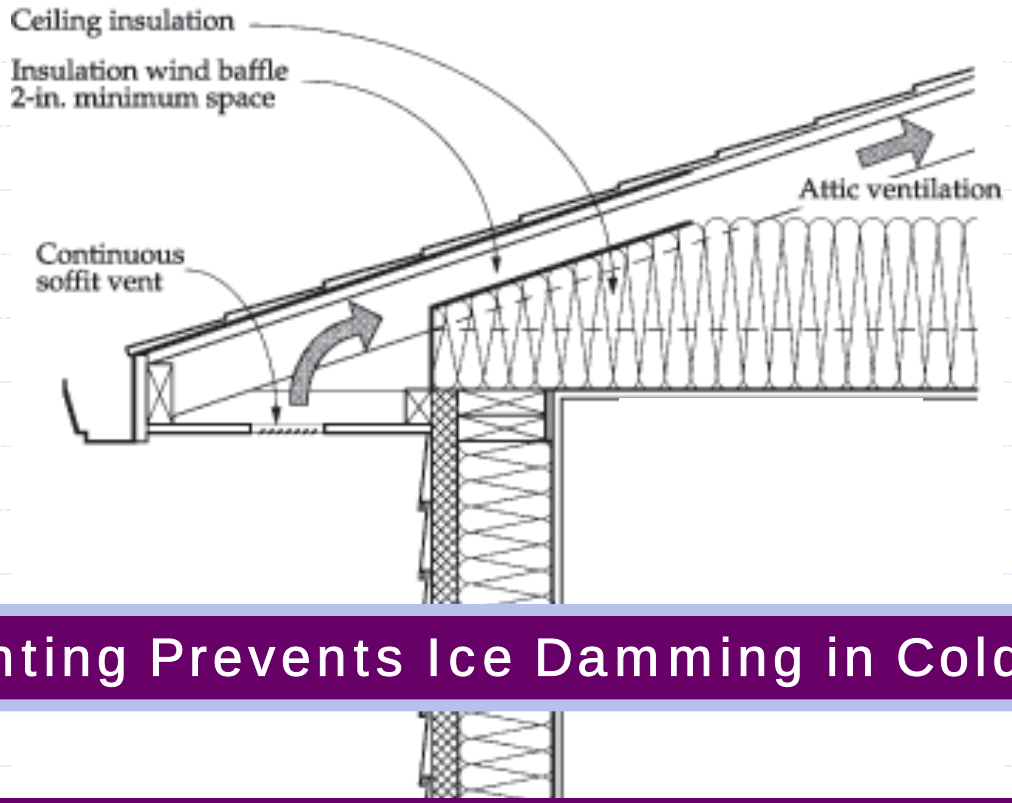
Preventing Mold ...

Attic Ice Damming – cold climates



Preventing Mold ...

Ice Dam Control



Attic Venting Prevents Ice Damming in Cold Climates

NOTE: When controlling moisture and dealing with molds always refer to your State WX Standards.

Preventing Mold ...

Air Cleaners – Inform Clients ...

- Molds spores are very tiny!
- Molds stay air-borne for days!
- Filters remove only some spores & do not remove proteins or VOCs
- Ozone units should not be used in an occupied space

Preventing Mold ...

Clients should be encouraged to reduce humidity with a dehumidifier

NOTE: When controlling moisture and dealing with molds always refer to your State WX Standards.

Structural Drying

- Open enclosed areas – like closets and cabinets
- Ambient temperature 68-72°F
- Circulate air across damp surfaces (use fans to move air)
- Exhaust moist air to outside
- Drying may take several days or longer

NOTE: When controlling moisture and dealing with molds always refer to your State WX Standards.

Questions for Discussion – Lesson 4

1. How does indoor relative humidity affect mold growth?
2. Discuss cases in which it might be useful to find out the indoor relative humidity.
3. Where should kitchen and bath fans be vented?
4. How much crawlspace and attic ventilation is generally suggested?
5. Do your state weatherization guidelines vary from these recommendations? Discuss the reasons this may be true.

Energy-Related Mold and Moisture

… awareness and impacts for weatherization

Lesson 5 – How to treat energy-related mold conditions.

What Will You Learn – Lesson 5

1. DOE guidance pertaining to conditions that may be corrected by Wx agencies.
2. When cleanup is necessary prior to beginning work.
3. Basic sequence for cleanup
4. Cleanup guidelines
5. Personal protective equipment for level 1 cleanup
6. A commonly used biocide and how to use it.
7. Four steps to respond to a mold problem.

Energy-Related Mold and Moisture

. . . awareness and impacts for weatherization

WPN 05-1 - **November 12, 2004**

5.14 Energy-Related Mold and Moisture Impacts

*"DOE funds may be used to correct **energy-related** conditions to allow for effective weatherization work and/or to assure the immediate health of workers and clients".*

"crews need training in how to treat less extensive mold conditions they may encounter in certain homes".

Treatment of energy-related conditions …

… refers to stabilizing an energy-related situation so effective WX can be done.

In some energy-related situations, clean-up may also be necessary in-order to effectively weatherize. DOE

Treatment of energy-related conditions…

How should you proceed?

Each State WX Program must determine the extent of treatment allowable to safely and effectively weatherize homes versus work to be referred to the homeowner or other agencies before WX is done.

WX Case

WX Need

-Insulate Attic

Problem

-Wet insulation, damp and moldy drywall

Determine Cause

-Leaking roof

Treatment

-Patch roof
-Remove wet insulation
-Replace section of drywall
-Apply proper insulation

WX Case

WX Need

-Insulate Attic and Ventilate

Problem

-Wet insulation and wet rafters

Determine Cause

-Bathroom fan exhausted into attic, no attic ventilation

Treatment

-Remove wet insulation
-Provide proper attic venting
-Dry area by circulating air with fans
-Correctly vent exhaust fan to outside
-Apply proper insulation

WX Case

*Who's responsibility is it?

WX Need

-Vent and Insulate Crawl Space

Problem

-Standing Water in Crawl Space
-Light Mold on Floor Joists

Determine Cause

-Flood Water

Control/Treatment*

-Pump out water
-Remove/dispose of debris
-Structural Dry Crawl Space
-Treat mold with biocide
-Insulate and Vent Crawl Space

In some energy-related situations, clean-up may also be necessary in-order to effectively weatherize.

Leaky window - mold is beginning to rot the wooden frame and windowsill.

If you already have a mold problem -

ACT QUICKLY.

Mold damages what it grows on. The longer it grows, the more damage it can cause.

Mold Cleanup GUIDELINES

- New York City Department of Health
  "Guidelines on Assessment and Recommendation of Fungi in Indoor Environment"
- American Conference of Governmental Industrial Hygienists (ACGIH) - "Bioaerosols: Assessment and Control"
- The Institute for Inspection, Cleaning, and Remedial Certification (IICRC) IICRC S500
  "Standard and Reference Guide for Professional Water Damage Restoration"
- EPA – "Mold Remediation in Schools and Commercial Buildings"

Clean-up Criteria
based on mold area to be cleaned

Level 1 - small isolated areas (10 sq.ft. or less)

Level 2 - mid-sized areas (10-30 sq.ft)

Level 3 - large isolated areas (30-100 sq.ft)

Level 4 - extensive contamination (> 100 sq.ft.)

Level 5 – remediation of HVAC systems

"from Guidelines on Assessment and Recommendation of Fungi in Indoor Environment" -- New York City Department of Health

Clean-up Criteria

based on mold area to be cleaned

Level 1 - small isolated areas (10 sq.ft. or less)

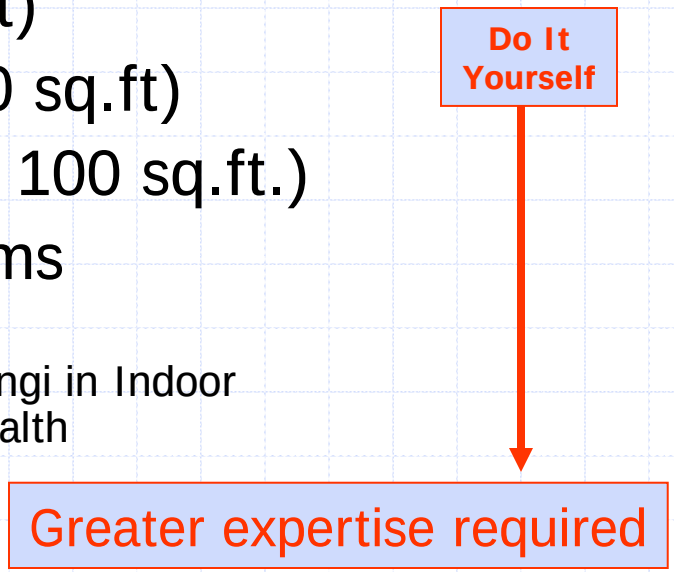
Level 2 - mid-sized areas (10-30 sq.ft)

Level 3 - large isolated areas (30-100 sq.ft)

Level 4 - extensive contamination (> 100 sq.ft.)

Level 5 – remediation of HVAC systems

"Guidelines on Assessment and Recommendation of Fungi in Indoor Environment" -- New York City Department of Health



Beyond Level 1 – You Are Doing Abatement/Remediation

Personal Protection Equipment

- Less than 10 sq. ft.
  - N-95 respirator, gloves, goggles
- Between 10 and 100 sq. ft.
  - N-95 or half face respirator with HEPA filter, gloves, disposable overalls, goggles
- Greater than 100 sq. ft.
  - Full-face respirator with HEPA filter, gloves, disposable full body clothing, head gear, foot coverings and containment

Mold Cleanup – Level 1

- **Household non-ammonia detergent and brush – for cleaning**
- **Biocide – kills mold**
- **N-95 face mask**
- **Leak-proof eye protection**
- **Rubber hand & arm gloves**

What is a Biocide?

- "Proven chemicals that kill molds"

  Alcohol, sodium hypochlorite (chlorine bleach), hydrogen peroxide, iodine, quternary ammonium chloride, synthesized phenolic compound

- Must be used according to label
- Must be applied to clean surface
- Must have required exposure time
- Must use PPE

Most Common Biocide Used …

5.25 percent sodium hypochlorite

Household chlorine bleach

Never Mix Chlorine Bleach and Ammonia

The fumes are toxic

Level 1 Mold Cleanup

- Surface molds
  - 5.25 percent sodium hypochlorite (household chlorine bleach)
  - No fragrance please
  - Typical use – 1/10 ratio (one cup bleach in 10 cups water)

Level 1 Mold Cleanup Procedure

- Scrub with a brush and detergent solution.
- Ventilate the work area.
- Disinfect with a chlorine bleach solution.
- Leave bleach solution on surface for 15 minutes, then rinse with water and dry quickly.

Clean-Up Will Also Depend on Type of Surface

- Non-porous surfaces (ceramic tile)
  - Clean with HEPA Vacuum
  - Disinfect/kill mold
  - Wash surface with a detergent (biocide) solution
  - Thorough drying, repainting
- Porous Materials - (ceiling tiles, carpeting, upholstered furniture, wallboard)

  Remove and replace
- Semi-porous (floor joist, sill plates)

  Remove mold (sanding), disinfect, wash, dry and seal

Clean-up – other criteria

Category of Water

- Clean Water – Category 1
  - Broken water pipes, rainwater, etc
- Gray Water – Category 2
  - Contains contamination & microorganisms
  - Toilets with urine, sump pump, dishwashers
- Black Water – Category 3
  - Contains pathogenic agents
  - Sewage, surface water flooding, pesticides

Other Mold Clean-up Guidance for Clients

Contaminated Water Clean up

- Discard carpet saturated with category 3 water
- Category 2 water carpet contamination may be cleaned with hot water extraction and biocide
- Remove floor if water reached subflooring
  - Subflooring must be cleaned, disinfected, dried

Basic Four Steps for Responding to Mold Problems

1. Respond quickly to stop moisture/mold damage and limit exposure to occupants.

Basic Four Steps for Responding to Mold Problems

2. Identify:
    1. Cause of the moisture problem
    2. Extent and size of contamination
    3. Type of surface with mold
    4. Safety precautions for clean-up

Four steps for Responding to Mold Problems

3. Implement clean-up (based on surface type):

   Remove and properly dispose damaged materials that cannot be effectively cleaned.

   Clean and salvage materials that are not severely damaged

Four steps for Responding to Mold Problems

4. Repair and replace removed materials incorporating the necessary changes to correct the underlying moisture problem.
   - Dry out the area before closing up a wall or ceiling.

Mold Remediation

- Trained Personnel
- Area “MUST” be Contained
- Negative Pressurization
- Minimize Dispersal
  - HVAC System sealed-off
  - HEPA Vacuum
  - Bagging of all debris
  - Control Tracking
  - Control Equipment

Professional Personal Protection

Personal Protective Equipment

- Respirator with HEPA & organic vapor cartridges
- Rubber gloves
- Eye protection
- Protective suit
- Rubber boots

Questions for Discussion – Lesson 5

1. Discuss conditions in which mold would be cleaned up using Wx funds.
2. Explain the basic cleanup sequence.
3. Describe the personal protective equipment required for level 1 cleanup
4. What is the most commonly used biocide, how is it mixed and how long should it be left on the surface?
5. Discuss examples when cleanup is beyond the scope of Wx work and how these situations are handled.

LESSON 6 – OPTIONAL LESSON

Mold Testing

background for crews

Reminder …

5.14 Energy-Related Mold and Moisture Impacts

"*the WAP is not a mold remediation program*"

"*… **DOE funds should not be used to test …** existing mold conditions identified during the audit, the work performance period or the quality control inspection … ”*

Testing for Mold

let clients know …

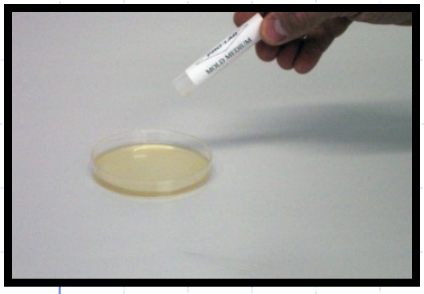
- **No Federal Threshold Mold Limits or Standards**
- No criteria or requirements for inspectors
- False negative evaluation
  - Compare quantity and types at various locations
  - Compare to outside types and levels
- ***Quality*** mold testing requires special training, special equipment, is expensive AND is not the job of weatherization

What Clients Can Expect from Professional Testing

Use professional trained and experienced using sample and analytical methods of the *American Conference of Governmental Industrial Hygienists* (ACGIH) or the *American Industrial Hygiene Association* (AIHA).

Justification for Testing:

- Verification
  - Real estate, insurance and clean-up
- Documentation of type and concentrations of molds
- Documentation of physical conditions
- Medical Investigation

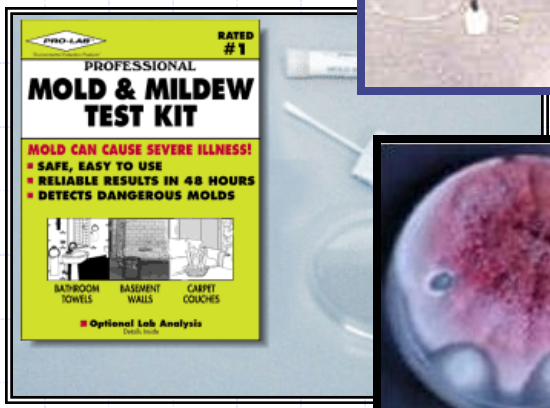


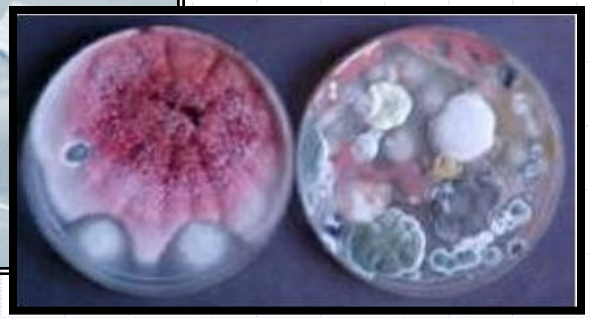
Testing for Mold

For Accurate Result Multiple Test Methods are Typically Used

Testing Methods:

- Moldy Piece (ID type)
- Contact Sample (tape)
- Swab Sample
- Air Sampling





Do Not Recommend DIY Testing to Clients!

Moisture Meters

used to measure moisture on/in
building envelope (i.e. wall surface and cavity)

12.5-16% is too high!

Testing Interpretation Is Tricky

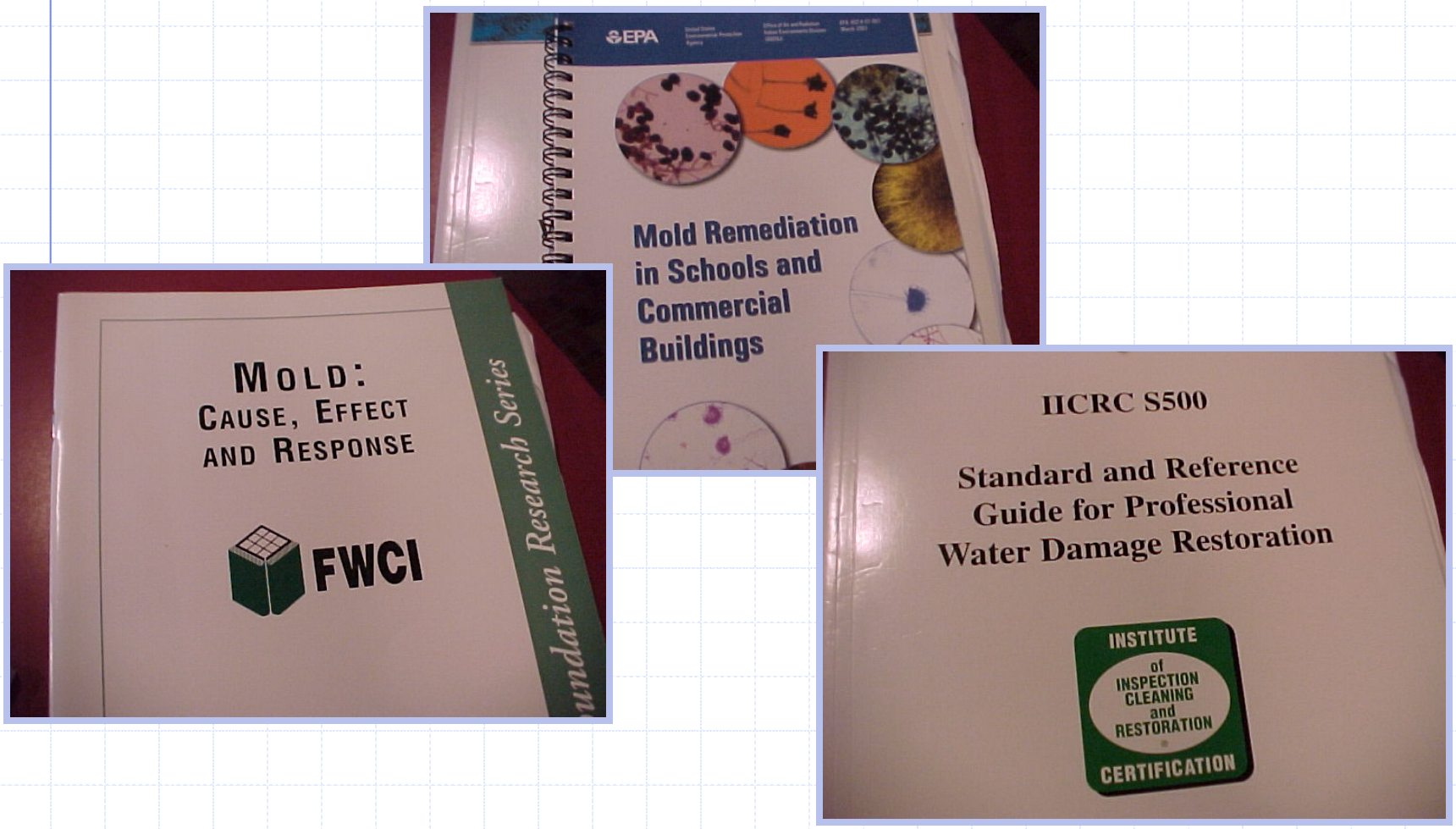
- Remember there are no standards
- Mold spores are everywhere – compare indoor levels to outdoors
- Consider "non-microbial Particulate debris"
  - can mask presence of spores
  - actual spore values could be up to 10 X higher than reported.

Energy-Related Mold and Moisture

… awareness and impacts for weatherization

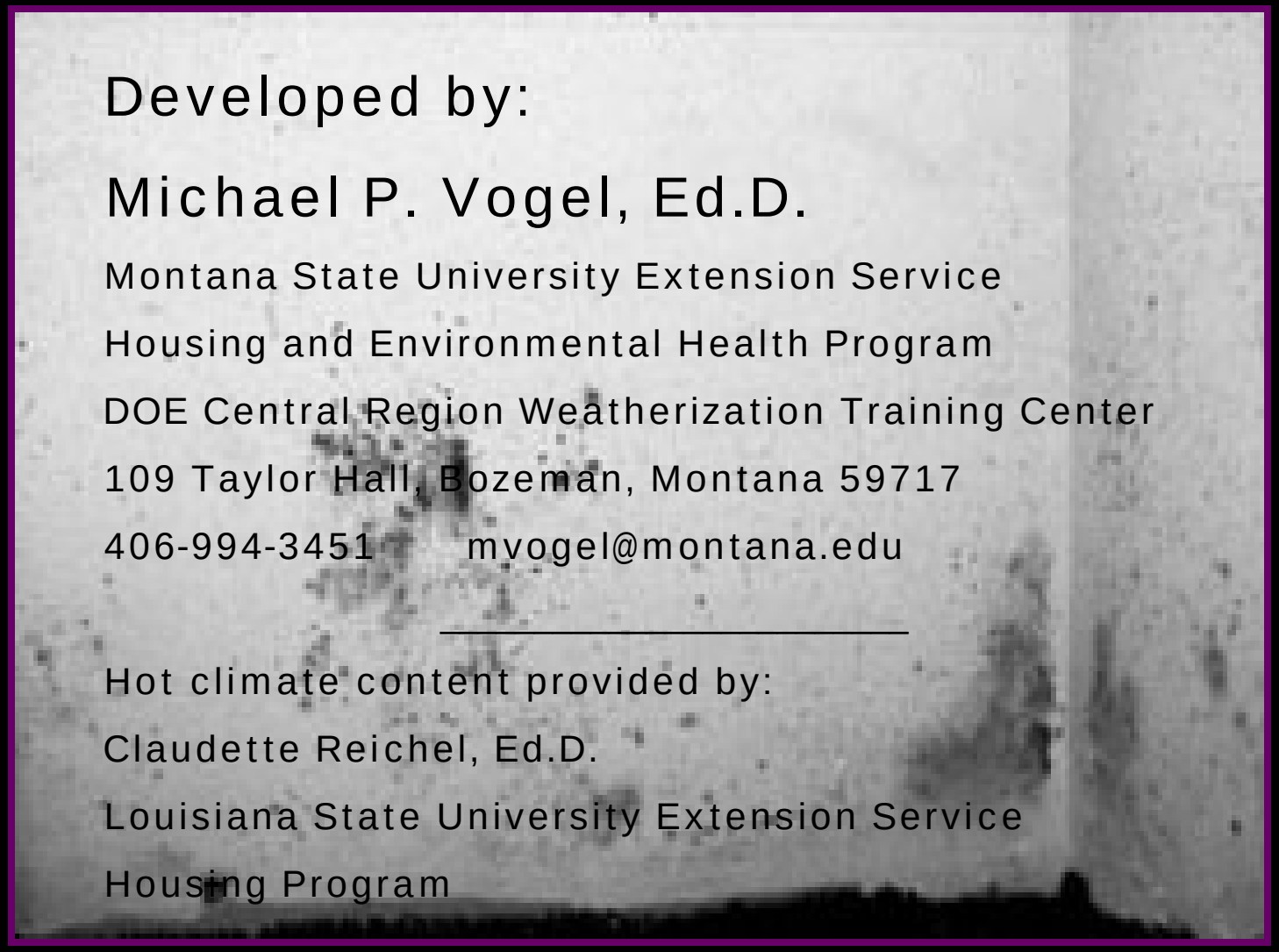
mold & moisture resources

Mold and Moisture Resources



Mold and Moisture Resources

- www.healthyindoorair.org
- www.affordablecomfort.org
- www.buildingscience.com
- www.homemositure.org



Developed by:

Michael P. Vogel, Ed.D.

Montana State University Extension Service

Housing and Environmental Health Program

DOE Central Region Weatherization Training Center

109 Taylor Hall, Bozeman, Montana 59717

406-994-3451 mvogel@montana.edu

Hot climate content provided by:

Claudette Reichel, Ed.D.

Louisiana State University Extension Service

Housing Program