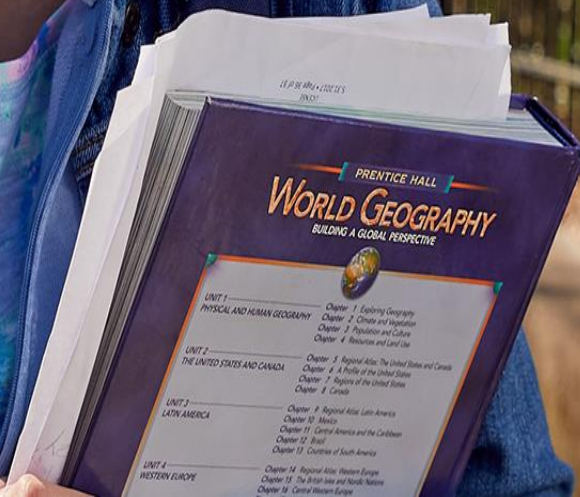


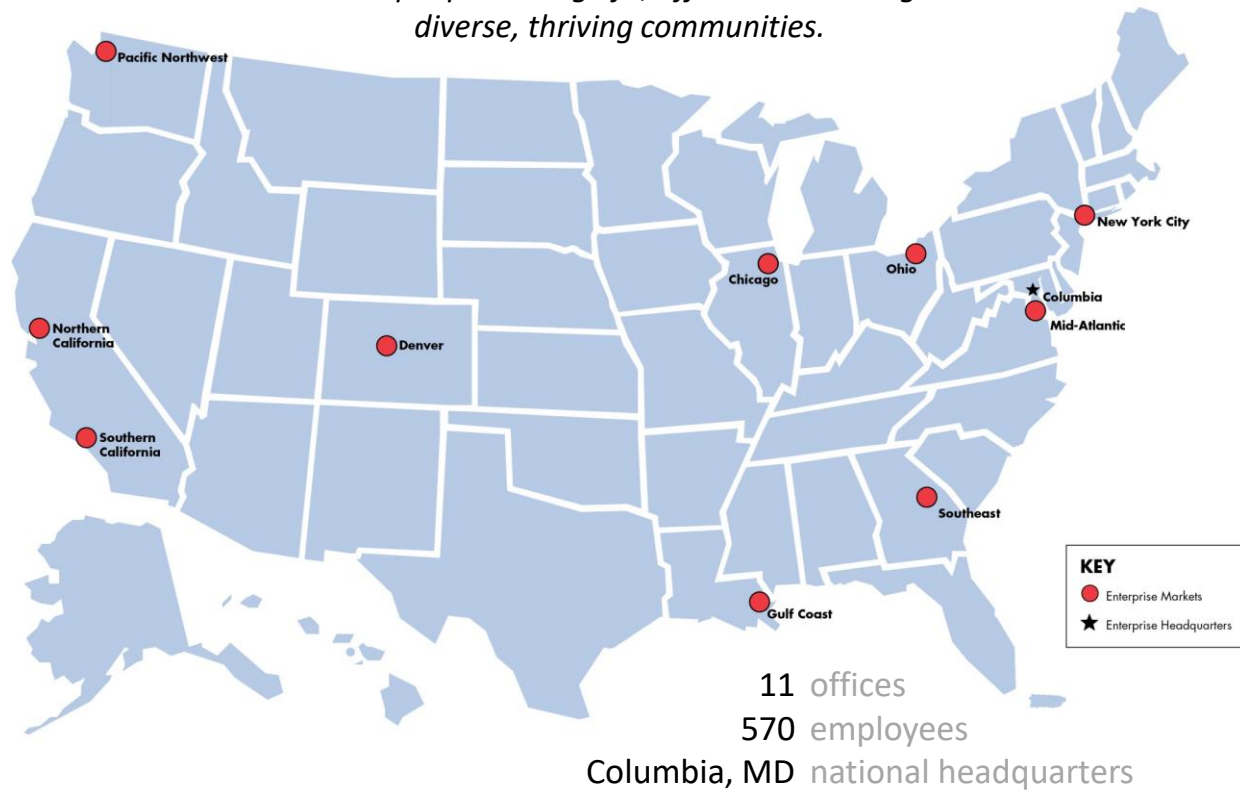


How to Restore Your Flooded Home: A Webinar Addressing Mold & Other Health-Related Hazards



Enterprise: Who We Are

Create opportunity for low- and moderate-income people through fit, affordable housing in diverse, thriving communities.





“People who are already vulnerable, including lower-income and other marginalized communities, have lower capacity to prepare for and cope with extreme weather and climate-related events and are expected to experience greater impacts”

-National Climate Assessment 2019

How Enterprise Supports Communities

Policy

- CDBG-DR Standing Allocation
- National Flood Insurance Program
- Local

Solutions

- Technical Assistance
- Developing Guidance Tools for Resilient Housing
- Piloting Housing Innovative

Capital

- Grants for Recovery
- Grants for Resilience
- Loan Capital
- Investment

Tools and Resources

SAFER AND STRONGER CITIES

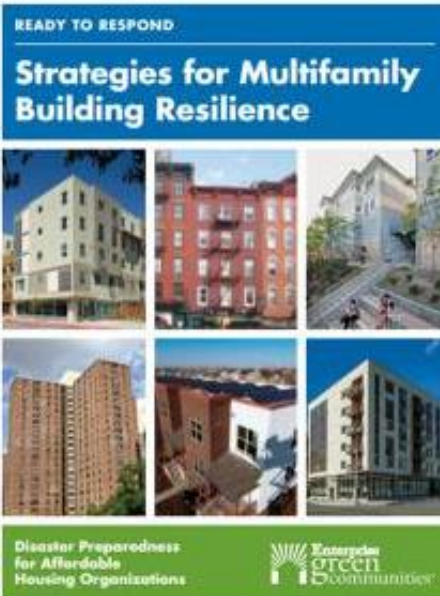
STRATEGIES FOR ADVOCATING FOR
FEDERAL RESILIENCE POLICY



Enterprise



REBUILD
BY
DESIGN



Disaster Preparedness
for Affordable
Housing Organizations

Enterprise

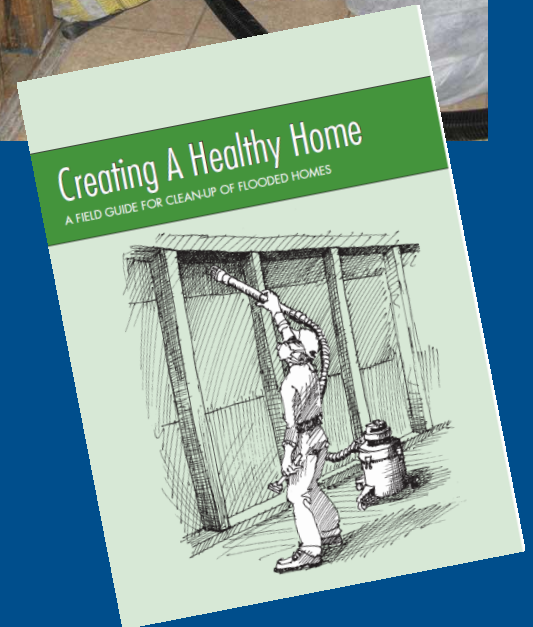
Impacts of Mold on Health of Communities



- Elderly
- Immune Compromised
- Children and Families



Jonathan Wilson,
Deputy Director
National Center for
Healthy Housing
www.nchh.org
jwilson@nchh.org



How To Restore a Flooded Home



Addressing Mold
& other health
related hazards

Thanks to:

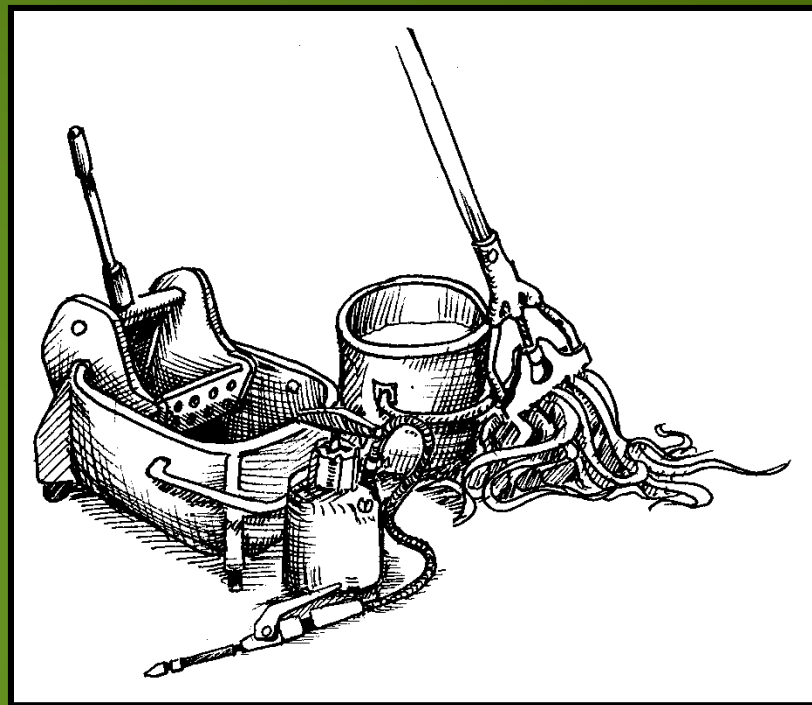
- Enterprise Community Partners
- The National Center for Healthy Housing
- And..... A download link to a digital version of this presentation will be provided at the end of the session.

Presented by:

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Where are we?

By a show of hands - Who or whose clients:

- had water above the first floor level?
- has had access to their flooded house?
- has removed the flood damaged materials?
- has observed mold?
- had sewage present?
- has someone in their households with respiratory problems?
- intends to do renovation work themselves?

Agenda

1. Health and Safety Concerns
2. Safe Clean-Up and Rebuilding Strategies
3. Opportunities for Resilient, Healthy and Sustainable Housing
4. Resources

Basic Rules 1 (clean-up)

- Worker protection is Crucial, there are many health risks to avoid.
- It helps to understand how mold, grows.
- Standard cleaning methods may work fine on mold.
- Sewage is extremely hazardous and requires disinfecting exposed surfaces

Basic Rules 2 (rebuilding)

- The structure must be dry before you close in gutted walls
- There are additional treatments that will help to avoid future problems
- This is an opportunity to renovate to a healthier and more sustainable standard

When are People Exposed to Health Hazards?

1. When people return to inspect
2. When anything is disturbed
3. During clean-out
4. Living in the building
(during clean-out and construction)
 1. During construction
 2. Living in the building post-construction



Potential Health & Safety Hazards from Flooding

- Mold (active or inactive)
- Bacteria/Black Water
- Standard Housing Hazards Compounded by Flooding & Demolition
 - Electrical
 - Structural
 - Contaminants

Health Issues During Clean-up and Renovation

- Lead Paint Hazards
- Asbestos
- Pests
- Bird droppings (e.g. Pigeons)
- Lack of Appropriate Personal Hygiene
- Risk of Physical Injury (structural, electrical, etc.)



The Major Health Risks When Working on Water-Damaged Homes

Physical Injuries

- Structural problems are common
- Open wounds are invitations to infections
 - Wear Protective Equipment
 - Current Tetanus Shots
 - Clean the Cut with Antiseptic
- Electric Shocks
 - Turn off the power
 - Generators present several hazards, follow directions
- Food and water is easily contaminated

The Major Health Risks When Working on Water-Damaged Homes

Mold's Health Effects

- Damp homes and mold associated with:
 - Asthma development
 - Respiratory infection
 - Asthma exacerbation (asthma attacks)
- Suggestive evidence of association with:
 - Bronchitis
 - Allergic rhinitis (inflammation of nasal airways)

Source: World Health Organization

The Major Health Risks When Working on Water-Damaged Homes

Symptoms from exposure to Mold

- Upper respiratory tract symptoms (runny nose, watery eyes, sore throat)
- Coughing
- Wheezing
- Dyspnoea (shortness of breath)

Source: World Health Organization

The Major Health Risks When Working on Water-Damaged Homes

- Lead Dust
 - Often shows no symptoms
 - Watch for listed symptoms in Adults
- Carbon Monoxide
 - Fuel burning equipment (generators)
- Propane tanks
- Car batteries

Mold Quiz

1. The most important factor influencing mold growth is:

- A. Temperature
- B. Light
- C. Moisture or water
- D. Organic matter

Mold Quiz

2. Molds have the potential to cause health effects such as allergic reactions.

- True
- False

Mold Quiz

3. Personal Protective Equipment (PPE) is worn in order to limit mold exposure. Minimum PPE for mold remediation includes:

- A. A helmet and gloves
- B. Safety glasses, an N-95 respirator and protective shoes
- C. A half-face negative-air respirator with a magenta (HEPA) filter, gloves, and goggles

Mold Quiz

4. Water-damaged furnishings and building components should be dried within 24-48 hours to prevent mold growth.

- True
- False

Mold Quiz

5. Mold cannot be eliminated from indoor environments. Some mold spores will be found floating through the air and in dust; however, they will not grow if moisture is not present.

- True
- False

Health Effects of Mold Exposure

- Allergic reactions and asthma attacks
- Effects from toxins released by molds
- Most vulnerable are:
 - Young children
 - The elderly
 - People with respiratory problems
 - Immune-compromised individuals
 - Pregnant women



Health Effects of Mold Exposure

An example of mold - **Aspergillus**

A genus of mold which can be found within indoor environments. Certain species are **pathogenic** (harmful to human health) and cause **Aspergillosis** (an infection, a growth, or an allergic response)



<http://www.aspergillus.man.ac.uk>

How Mold Grows

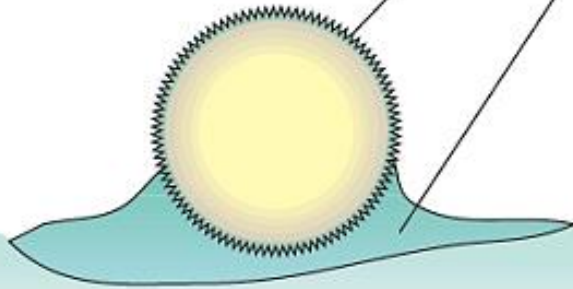
- Let's spend a little time on the science behind mold growth.
- This is important to avoid making false assumptions about both the potential for growth and the strategies for treatment.

Phase 1 of Mold Growth

Moist food source

Spore lands on a moist surface

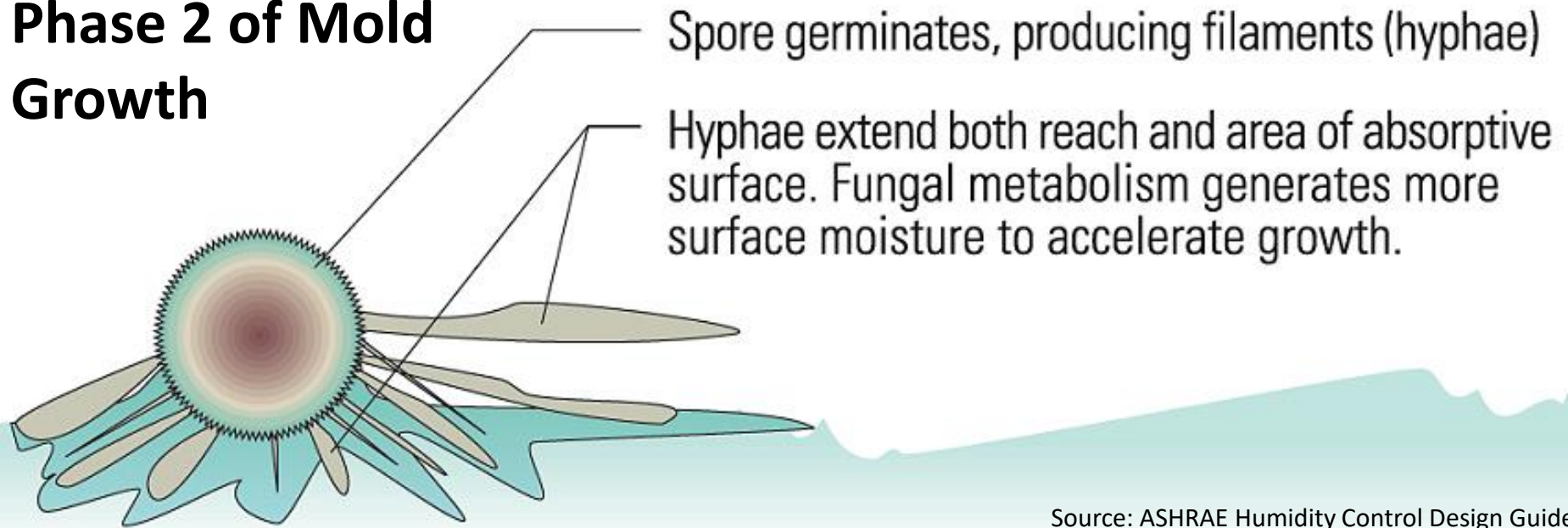
Enzymes use surface moisture to dissolve food



Source: ASHRAE Humidity Control Design Guide

- The spores have enzymes on their surface that break down the damp organic matter into a food source.
- Even “dry” spores can begin to absorb the food source.

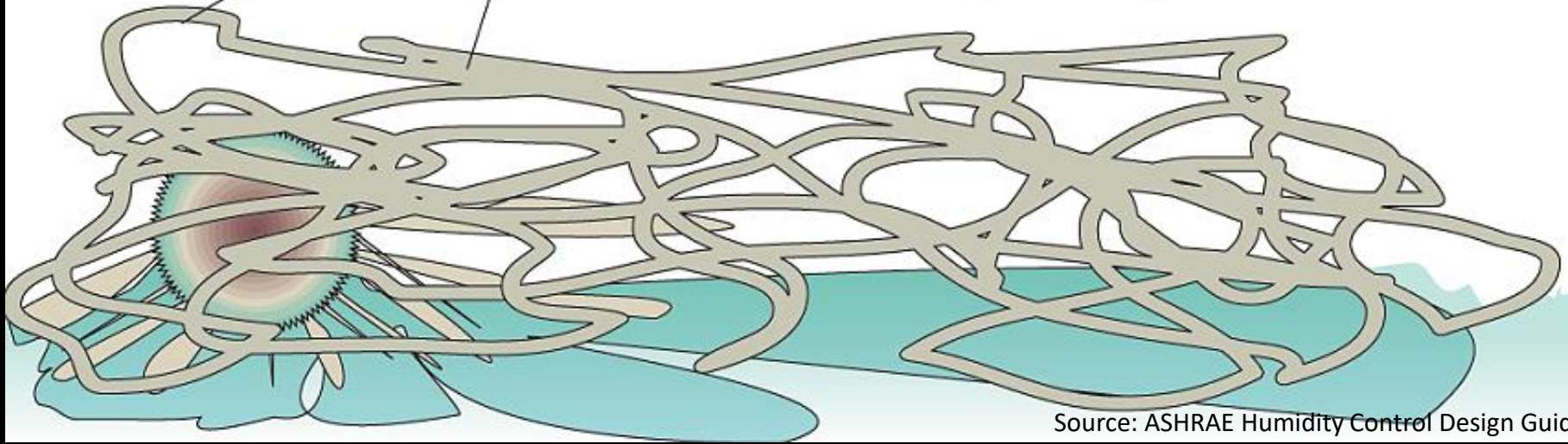
Phase 2 of Mold Growth



- The combination of moisture and a food source allows the spore to germinate.
- The filaments (Hyphae) have enzymes that dissolve and absorb food as well, accelerating mold growth.

Phase 3 of Mold Growth

Hyphae grow thickly, digging into the surface and forming a protective mat (mycelium) that keeps the surface moist even if surrounding air is dry.

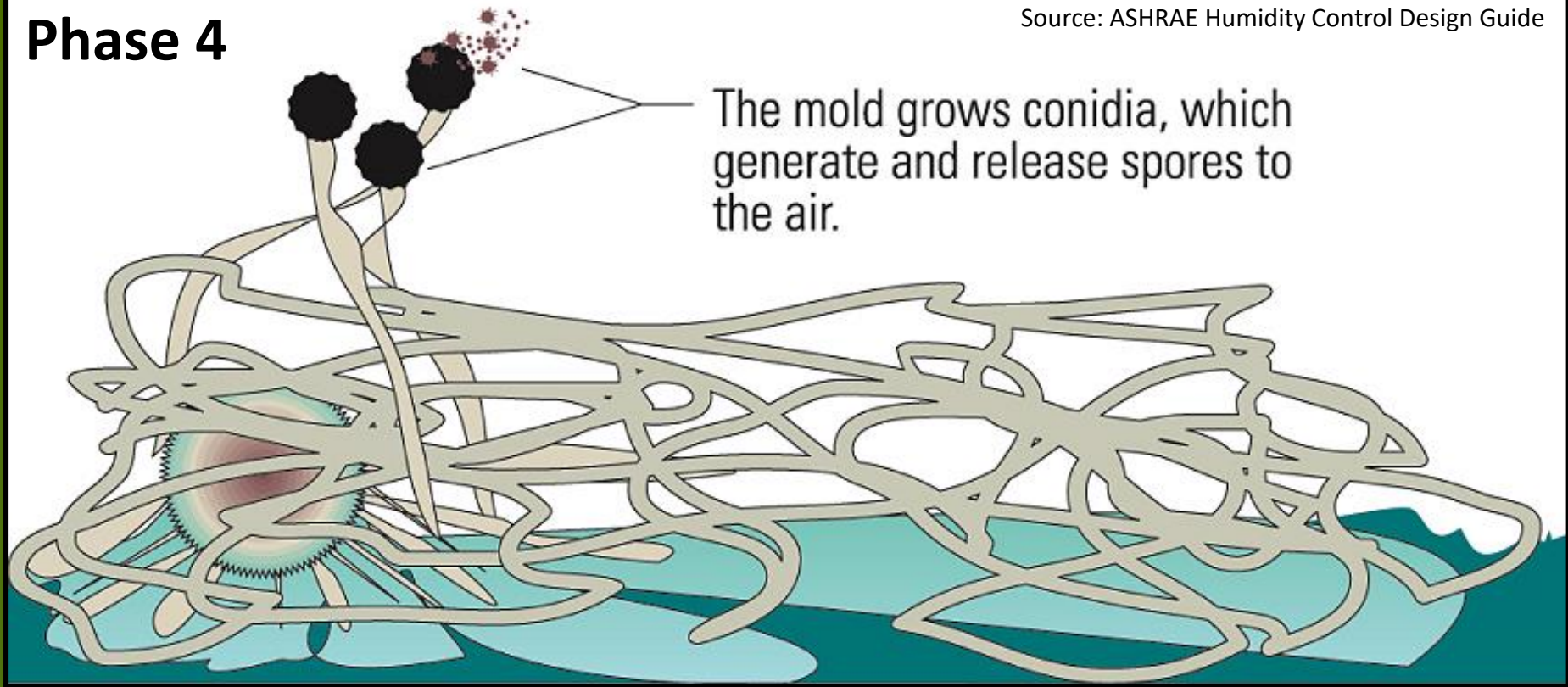


Source: ASHRAE Humidity Control Design Guide

- As the filaments continue to grow over a damp food source the organism generates additional water, helping to digest even more food.

Phase 4

Source: ASHRAE Humidity Control Design Guide



The mold grows conidia, which generate and release spores to the air.

- When the food source runs out, or when the moisture goes away, mold growth slows or stops.
- The spores then focus on reproduction, generating billions of offspring. And it begins again.

Other terms and thoughts:

- The hyphae extend and intertwine to form a mass, which is called the mycelium.
- Mold spores can remain dormant for long periods of time, until the right growing conditions are available.
- Fragments of broken hyphae can also be transplanted to start growing new mold colonies.
- Remember that it's the moisture on the surface of the food source that gets things started.

When are Mold Levels Highest?^J

Examples of 2 Flooded Homes

- Two homes located in the Gentilly neighborhood of New Orleans. *
- Owner occupied
- Each experienced different levels of flooding

HOME #1

- 2 story home
- Built in 1987
- Slab on grade construction
- Received up to a foot of flood water
- 2-3 ft of mold growth on first floor



HOME #2

- 1 story home
- Approximately 100 years old
- Raised on piers
- Received at least 5 ft of flooding
- Mold growth to ceiling



Mold Sampling Results: Home #1

approximate live mold levels (CFU/m³)

	<u>Living Room</u>	<u>2nd Floor</u>
Possession Removal	1,229,000	313,000
Before work next day	35,000	
During demolition	594,000	15,000

CFU/m³ = Colony Forming Units/Cubic Meter

Mold Sampling Results: Home #2

approximate live mold levels (CFU/m³)

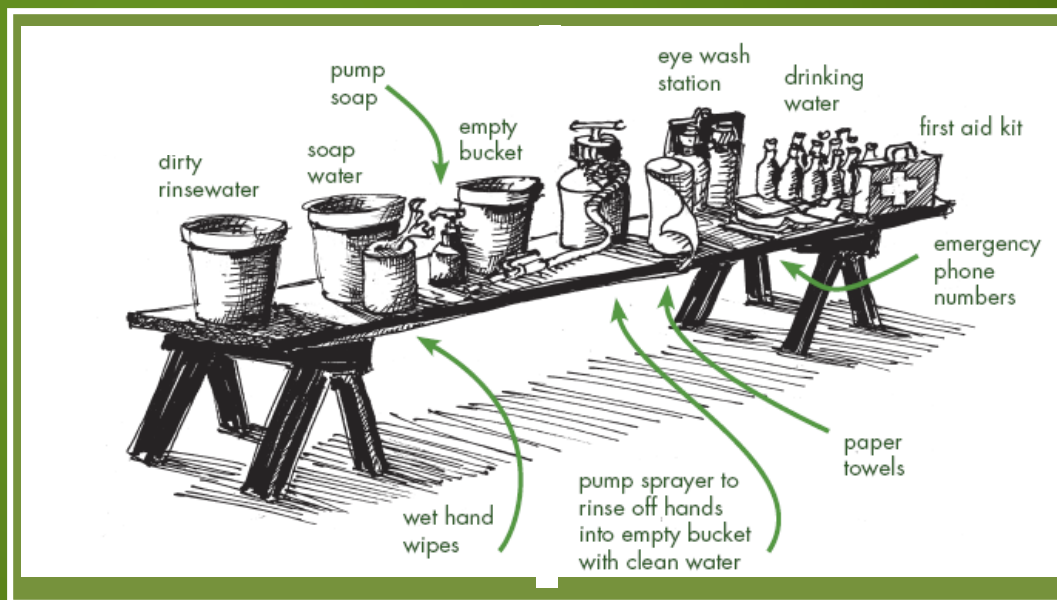
	<u>Living Room</u>	<u>Outside</u>
Pre-Work 11/1	34,000	
Pre-Work 11/15	17,000	24,000
During demolition	>6,000,000	36,000

< 1,000 CFU/m³ is typical
indoor reading

1,000 CFU/m³ = 1,000 Colony Forming Units/Cubic Meter

Personal Hygiene is Very Important!

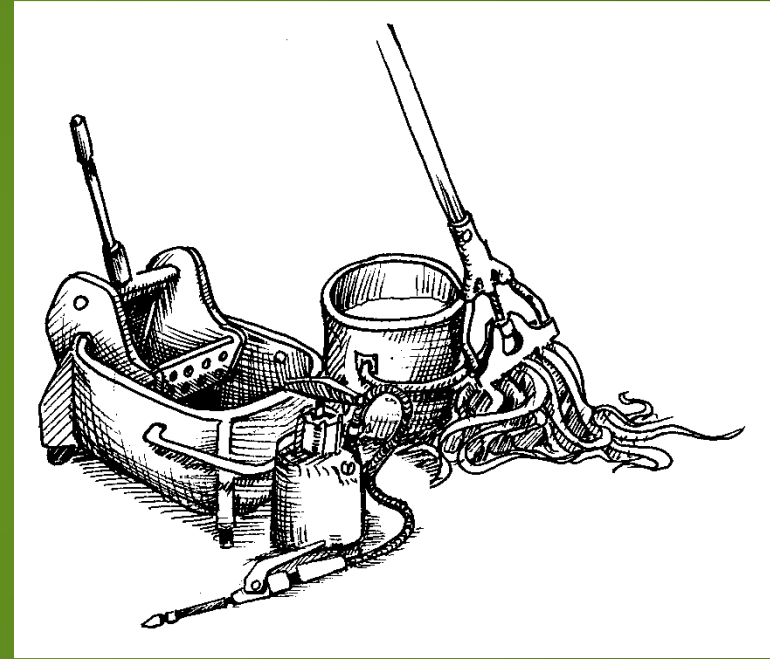
- Hand washing - towelettes
- Clean “Break Areas”
- Protective Clothing can spread all the Bad Stuff



Creating a Healthy Home

A Field Guide for Clean-Up of Flooded Homes

Created by the National
Center for Healthy
Housing



Please read the Acknowledgements and Disclaimer

- Created by three national housing organizations
 - National Center for Healthy Housing
 - NeighborWorks® America & its local affiliate Neighborhood Housing Services of New Orleans
 - Enterprise Community Partners
- Funding by the Home Depot and Robert Wood Johnson Foundations.
- 4 homeowners volunteered their homes
- Other participating organizations:
 - Columbia University and Tulane University
 - Little Sisters of the Assumption Family Health Services, Inc. and Microecologies, Inc
 - URC, Inc.
 - Community Resources

What Can You Do Yourself & When to Hire a Professional

It is our recommendation that trained mold remediation professionals do the mold clean up if mold growth covers more than 100 square feet, or a 10 ft. by 10 ft. area.

Tips for Hiring Mold Remediation Professionals (P. 1)

- Know your State regulations. Some states require licensing.
- Avoid contractors that recommend fogging or spraying
- Whenever possible, get more than one quote
- Get references on similar jobs & **check those references**

Tips for Hiring Mold Remediation Professionals (Cont.)

For the Final Inspection:

- Use a highly qualified person for the final inspection and clearance testing.
- In some States, like Louisiana, that person must not work for the mold remediation contractor
- Require a written report of the inspection findings
- This report lets you know that it is safe to rebuild
- You should also save this report in case you need to show it to prospective buyers or tenants

Tips for Hiring Mold Remediation Professionals (Cont.)

Two Agencies that Certify Mold Professionals:

- The Restoration Industry Association - Mold Remediation Technician (MRT) and Mold Remediation Supervisor (MRS) - <http://restorationindustry.org/>
- American Council for Accredited Certification www.acac.org - Investigator & Contractor Certifications

Tips for Hiring Mold Remediation Professionals (Cont.)

Other Professionals:

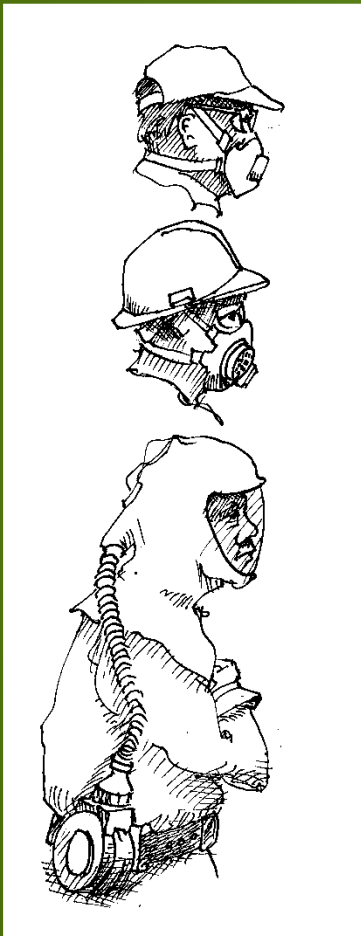
Asbestos must be removed by a certified professional.

In some states, contractors who apply borate solutions, like Termite Prufe or BoraCare, need to be licensed pest control operators.

Worker & Occupant Safety

People with asthma, mold allergies or other respiratory conditions, people with weakened immune systems, children and pregnant women **SHOULD NOT** do this work and **MUST** remain out of these homes until the work is complete. They are especially vulnerable to the hazards found in flooded homes.

Protection from Environmental Health and Safety Threats (P. 4)



Wear a Respirator

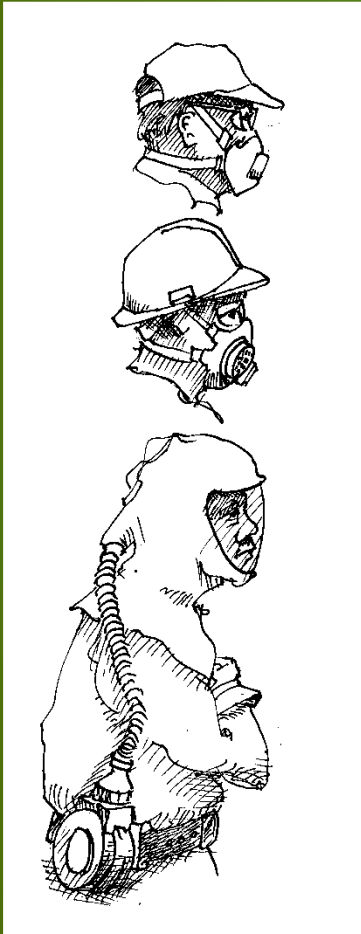
- N95 or N100 only for < 15 min Exposure when you are not disturbing mold
- Half-face Negative Air with a HEPA Filter (magenta)
- Powered Air Purifying Respirator (PAPR)
- Carefully follow instructions for the device you use

Protection from Environmental Health and Safety Threats (P. 4)

Wear a Respirator,

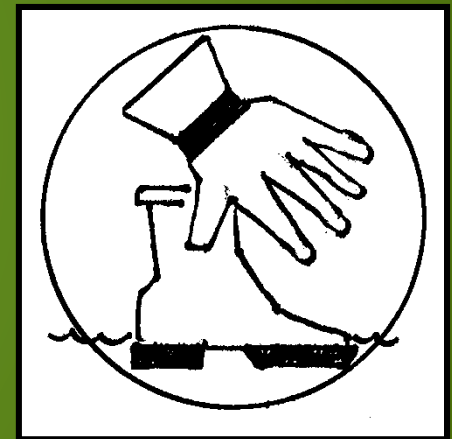
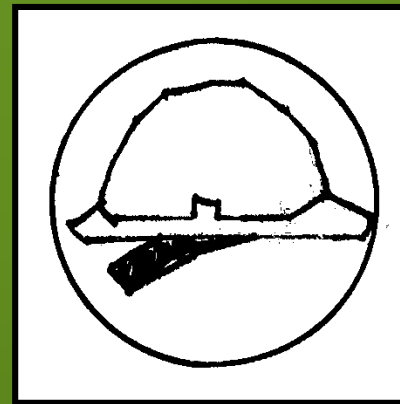
But..... not everyone's respiratory system is up to the task. Please consult your physician prior to using a respirator, or if you experience respiratory discomfort wearing a respirator.

OSHA regulations regarding respirators and other PPE apply for contractors.



Protection from Environmental Health and Safety Threats

- Eye Protection
 - Wear goggles, safety glasses or full face shield
 - Wear a hat with a brim
 - Keep eyewash handy
- Ears
 - Use earplugs
- Feet
 - Heavy work boots
 - Not tennis shoes



Protection from Environmental Health and Safety Threats

- Head
 - Use coverall with a hood, and/or a hat with a brim
- Hands
 - Use heavy, waterproof, cut resistant gloves
 - Wash your hands and face before eating, drinking or smoking

Protection for the people you go home to

- Wear disposable coveralls
- Clean all reusable equipment
- Wash clothing in hot water & detergent separately

Work Stages in the “Creating a Healthy Home” Field Guide

1. Pre Work Inspection - Pages 6, 7, 8
2. Before Work Begins - Pages 8, 9
3. Site Preparation - Pages 9, 10, 11
4. Clean-Out — Page 11
5. Gut Tear-Out Procedure - Pages 12, 13
6. Pre Construction Cleaning and Treatment - Pages 13, 14, 15
7. Selective Tear Out and Prep before Restoration - Pages 15, 16, 17
8. Restore Possessions Page 17

1. Pre Work Inspection

- Check for Hazards
 - Structural
 - Electrical
 - Natural Gas
 - Water
 - Etc.
- Where is the Water Damage?
- Where is the Mold?
- Are there LBP or Asbestos Risks?
- Can Architectural Details be saved?
- Can Personal Belongings be Saved?

2. Before Work Begins

- Purchase and order tools and supplies
- Plan for trash removal
- Set up a storage area for items to be saved
- Set up electricity
- Set up secure tool storage area
- Turn off gas
- Provide bathroom access

A Word about Basements and Black water

- Basements present unique issues and risks.
- Blackwater is contaminated with sewage or has begun to support bacterial growth, and often collects in basements. (AKA Category 3 water.)

Dealing with Black Water (sewage)

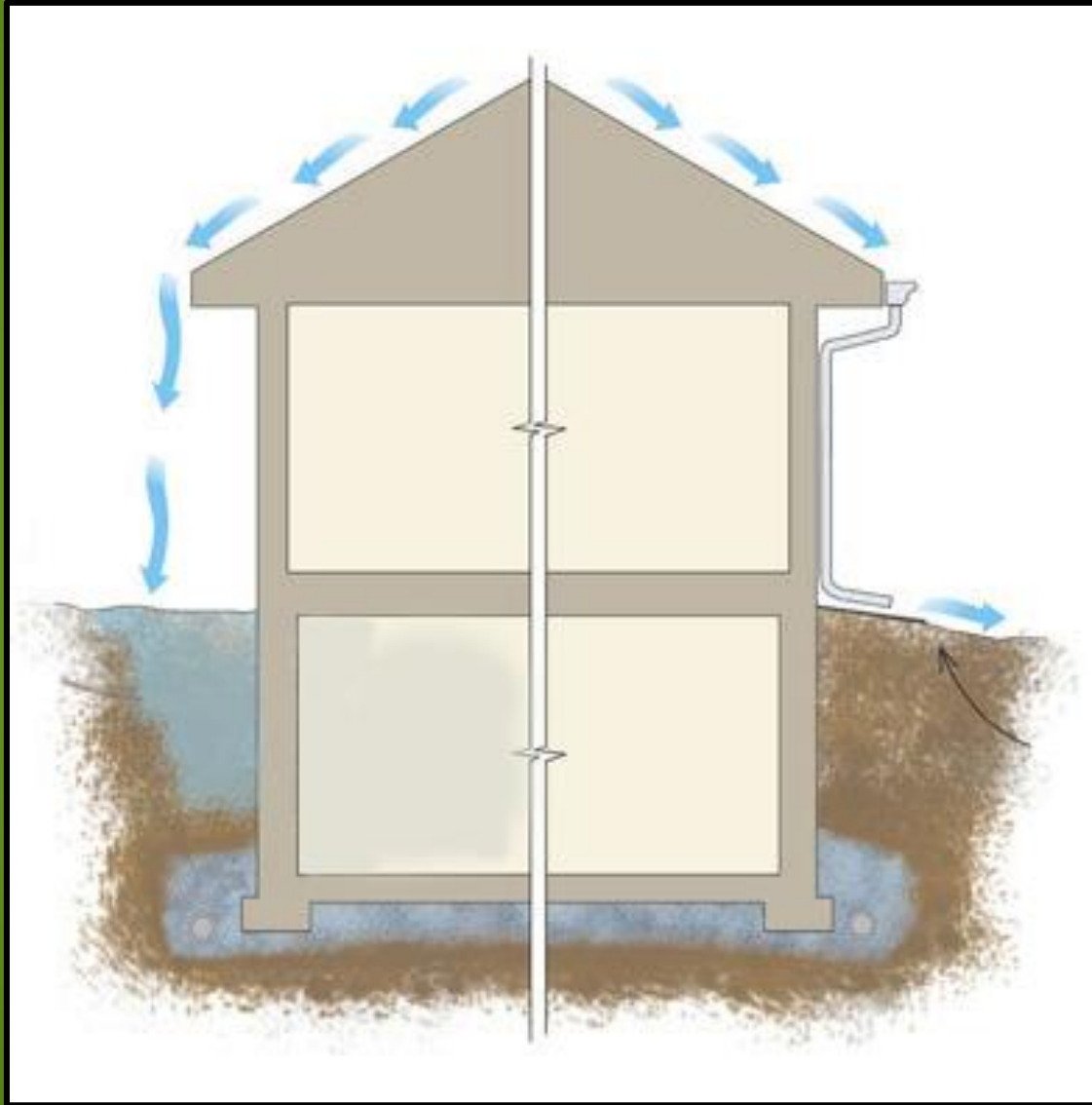
- You'll need waders of some sort & respiratory protection
- Pump out the water (methane is a hazard!), and shovel out the remaining solids
- Scrub down the walls (working floor drains help)
- CDC recommends cleaning with hot water and laundry or dishwashing detergent
- A bleach solution 1 cup to 1 gallon of water is an option, remember bleach can damage some materials. (wear your respiratory protection & do not mix with ammonia)

Dealing with Black Water (sewage)

- Ventilate basements **EXTREMELY** well (big fans and all access doors and windows kept open for a period before entry and the entire time during cleanup).
- Unfortunately, there are no air-purifying respirators that protect against sewer gas exposure.
- There may be insufficient oxygen.
- At least one additional person would need to be present immediately outside the space in case the person in the basement needs help

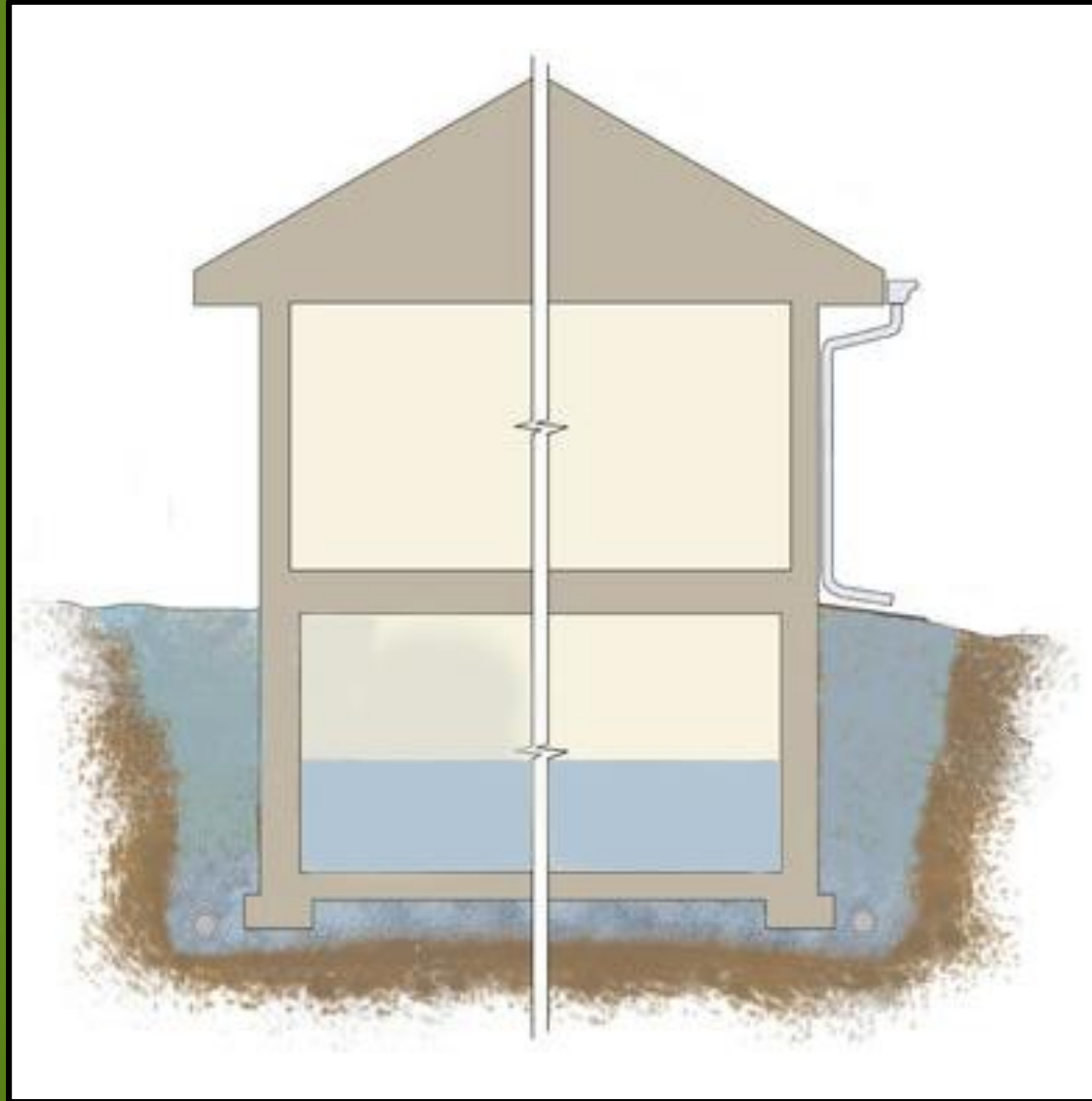
Removing Standing Water

- Normally, the water table outside a basement is below the foundation.
- Rain saturated ground can raise the water table



Removing Standing Water

- When basements flood, that water helps to fight the pressure from the water table
- Removing the basement flood water too quickly can weaken the basement walls



FEMA'S Recommendations

1. Begin pumping when floodwaters are no longer covering the ground outside.
2. Pump out one foot of water. Mark the water level and wait overnight.
3. Check the water level the next day. If the level went back up it is still too early to drain your basement.

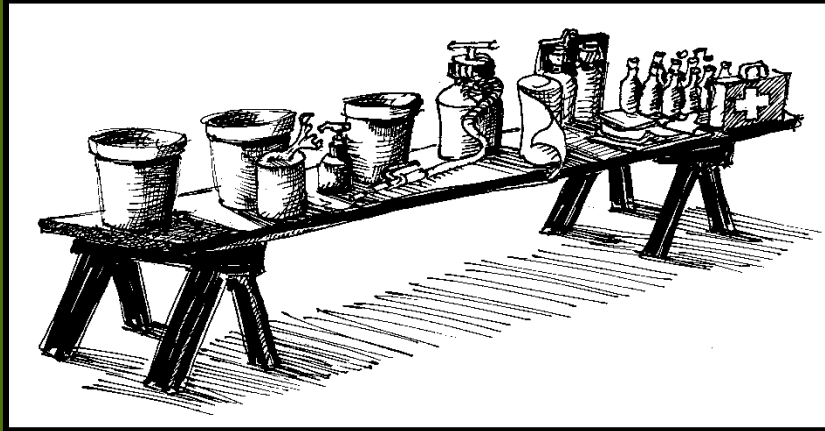
FEMA'S Recommendations

4. Wait 24 hours, and then pump the water down one foot again. Check the level the next day.
5. When the water in the basement stops returning to your mark, pump out two to three feet and wait overnight.
6. Repeat daily until all the water is out of the basement.

FEMA Release on Pumping out Basements

[www.fema.gov/news-
release/2011/07/09/dont-pump-out-
basements-too-early-or-too-fast](http://www.fema.gov/news-release/2011/07/09/dont-pump-out-basements-too-early-or-too-fast)

3. Site Preparation

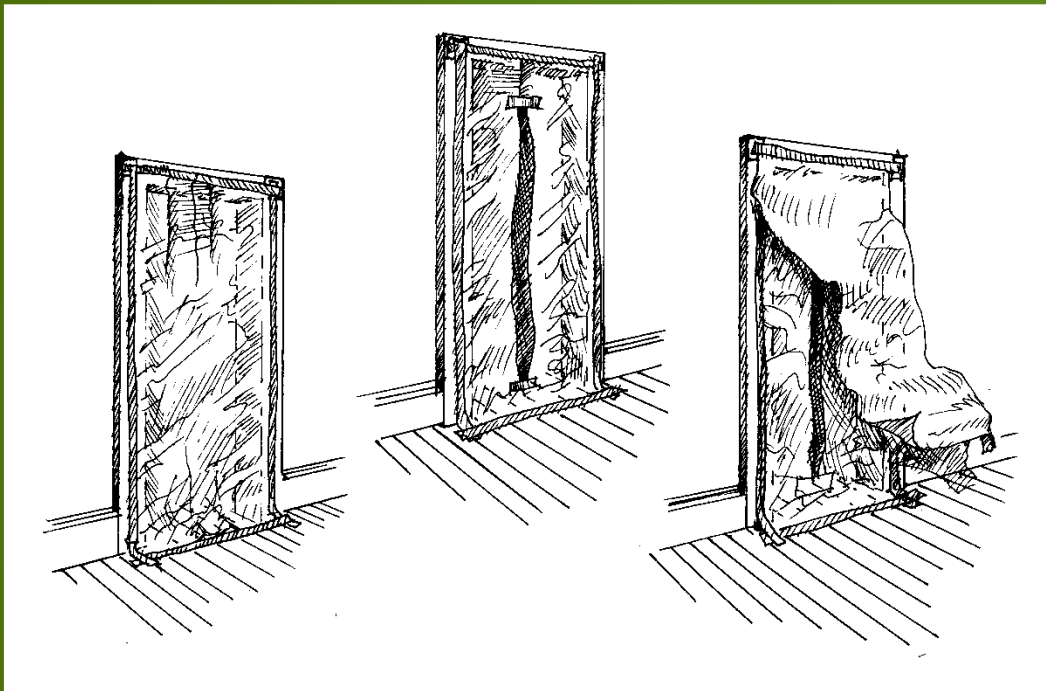


Set up a
safety and
cleanup
area

Put on your personal
protection equipment



3. Site Preparation

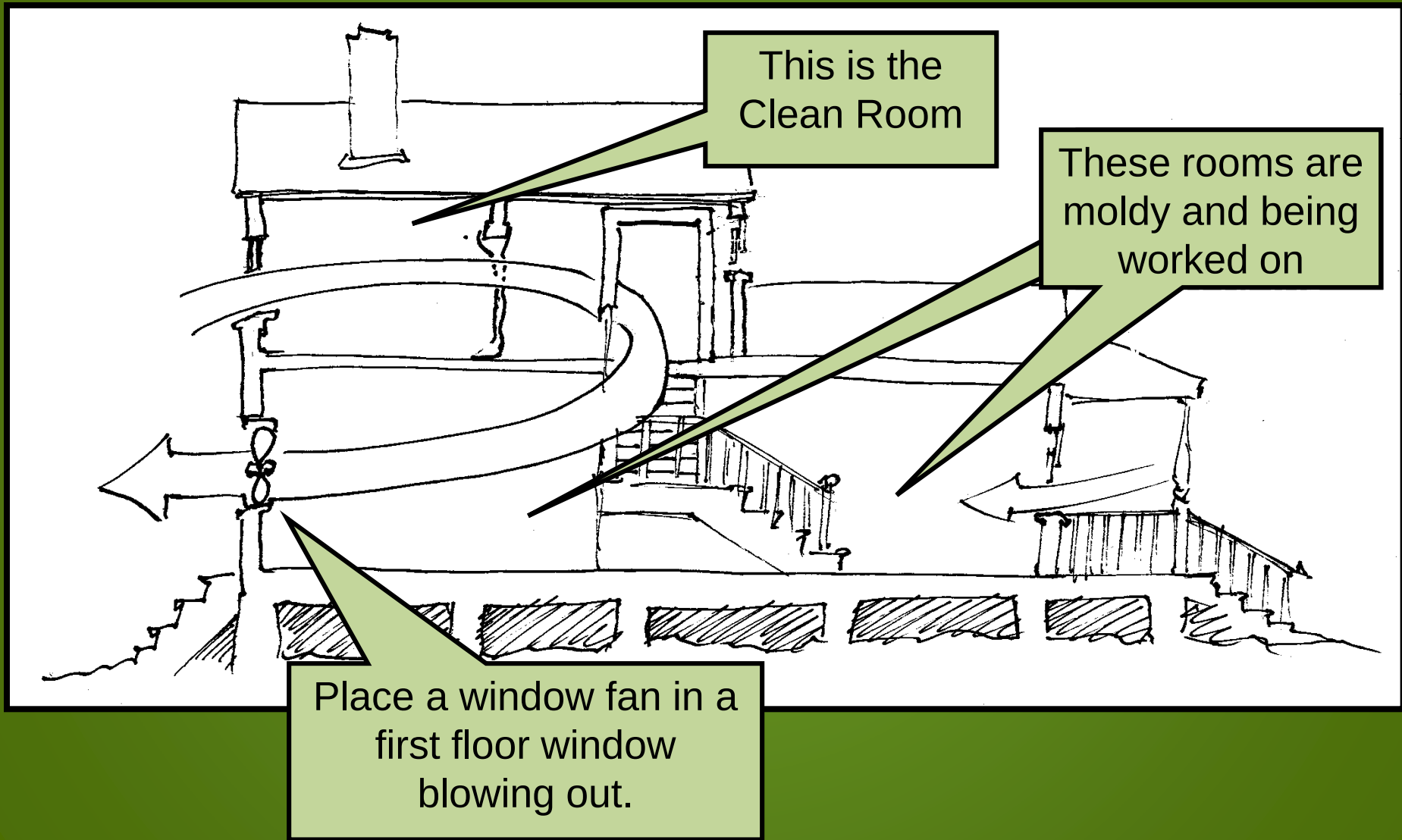


Keep clean
areas separate
from the work
areas

Set up a “things-to-
be-saved table”

Lay a plywood
path

3. Site Preparation (Ventilation Example)



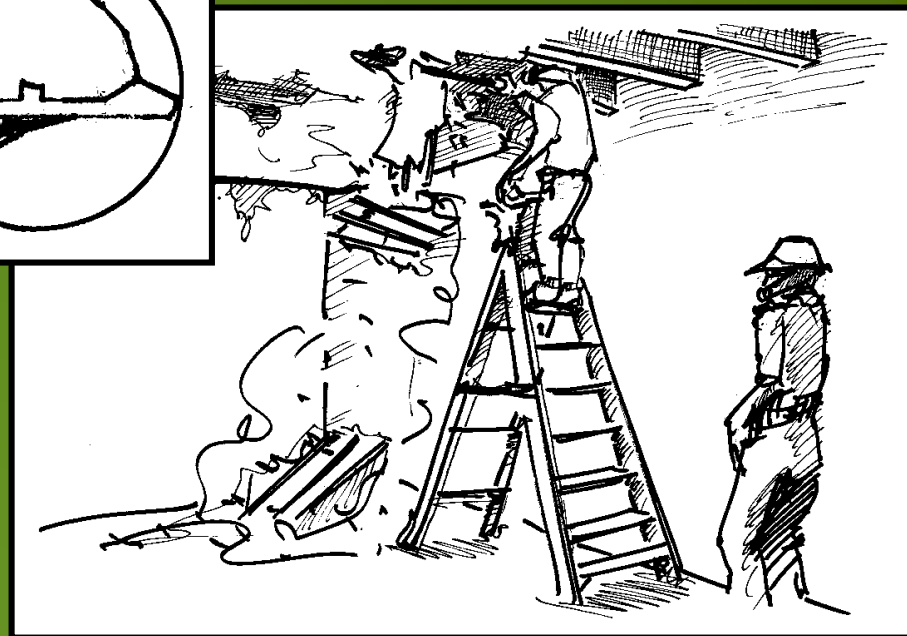
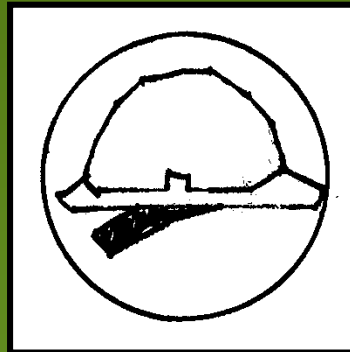
4. Clean-Out

- Ventilate
- Remove small furniture and objects on the floor
- Remove large furniture
- Remove appliances
- Cut and remove wall to wall carpet
- Clean out closets, shelves, storage areas, and kitchen cabinets

5. Gut Tear-Out

- Many damaged homes contain valuable & historic architectural materials that are often of higher quality than what you can buy as a replacement.
- Saving historic materials that are in good condition and can be cleaned makes sense
- But..... it may be less expensive to dispose of moldy building components.
- If you choose selective tear out, see Section 7

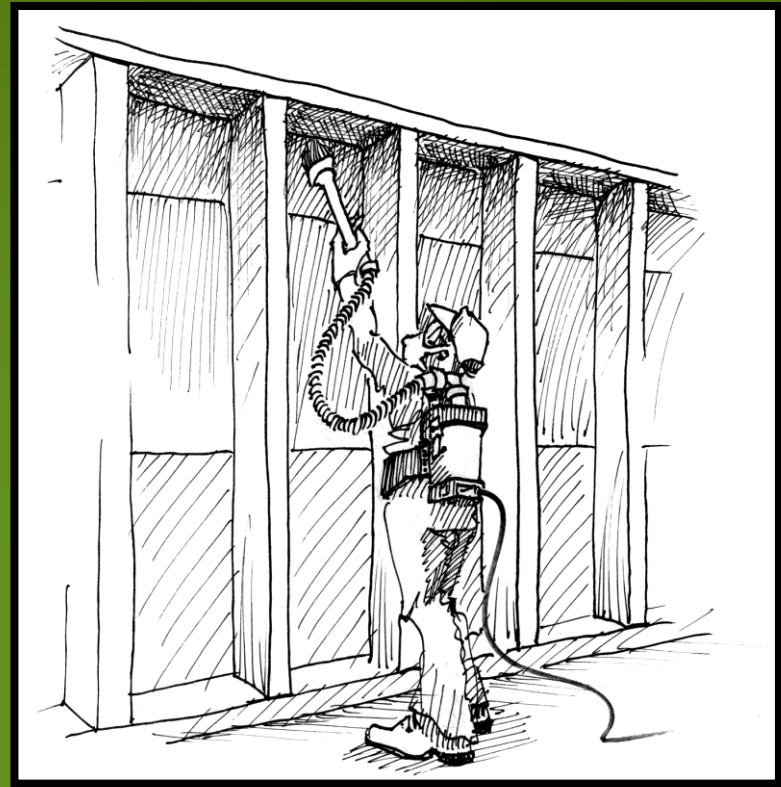
5. Gut Tear-Out



- Remove and dispose of cabinets, shelves, doors and trim
- Tear down drywall or plaster ceiling
- Remove drywall or plaster from walls
- Clean up as you go
- Remove insulation
- Remove layers from floor
- Remove all dirt and debris

6. Pre Construction Cleaning & Treatment

- Prepare surfaces
- Vacuum all surfaces
- Wet clean wooden surfaces
- Disinfect all hard surfaces
- Treat surfaces with Borate solution
- Dry out the building
 - < 15% moisture content for wood
- Treating with fungicidal coatings carries risks.
- Do not apply impermeable coatings
 - < 5 PERM rating

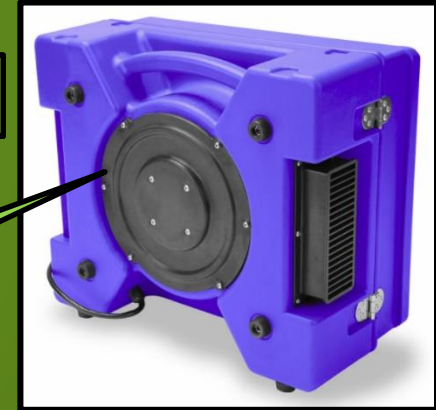


6. Pre Construction Cleaning & Treatment

- Drying out the building may be a challenge, especially in hot humid climates.
- If you can afford the cost, commercial dehumidifiers and other restoration industry equipment will speed the process.
- If the commercial equipment is not an option, the LSU Ag Center recommends combining of air-conditioning & electric resistance heat post cleaning & treatment stage



Dehumidifiers



Air
Scrubber

Moisture Meters

- Most moisture meters have a scale that is calibrated on wood and covers a range of moisture content as a %.
- When testing the moisture content of materials other than wood, some meters have a reference scale to adjust the %.
- Some meters accurately read multiple substrates

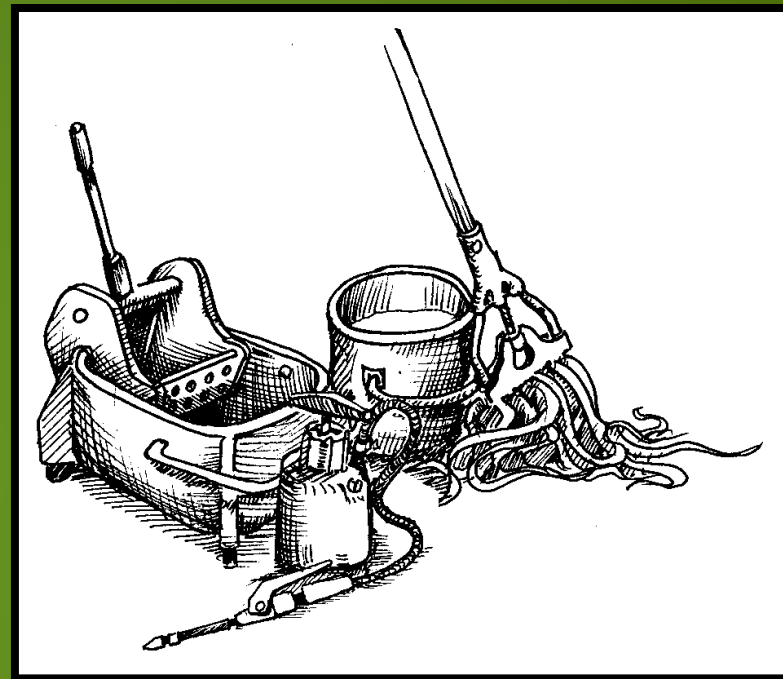


HEPA Vacuum

- True HEPA vacuums are expensive investments for homeowners
- A reasonable level of HEPA Vacuuming can be performed using a Wet-Dry Vacuum with a HEPA filter.
- All of the major home centers carry several wet-dry vacuums that accept HEPA rated filters
- Similar products manufactured by Shop-Vac and Sears.

Wet Cleaning Terms and Tips

- Wet Cleaning
 - Bleach may damage wood & some metals
 - Clean bare wood and metals with a non phosphate detergent. CDC recommends laundry or dishwashing detergent
 - Allow surfaces to dry
- Disinfect hard surfaces with bleach & non phosphate detergent, 1 cup household bleach with 1 gallon of water



- Use the 3 bucket system

Regulatory Issues & Chemicals^J

Every product that we might recommend (borates, bleach, or the class of antimicrobials called quats (quaternary ammonium compounds like DDAC used in disinfectants) are regulated by EPA under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).

Regulatory Issues & Chemicals^J

We strongly recommend caution in the use of regulated chemicals. Even when applied by mold professionals. Check the Safety Data Sheets (SDS) for information on health risks.

Regulatory Issues & Chemicals

The category of chemicals called quats (quaternary ammonium compounds) are disinfectants used in mold clean-up.

2 Examples:

- DDAC
(didecyl dimethyl ammonium chloride)
- ADBAC
(alkyl dimethyl benzyl ammonium chloride)

Moldex - A Disinfectant Example^J

Ingredients: From Safety Data Sheet (SDS)

Alkyl dimethyl benzyl ammonium chloride (ADBAC)

Didecyl dimethyl ammonium chloride (DDAC)

Alkyl dimethyl ammonium chlorides

Dioctyldimethylammonium chloride



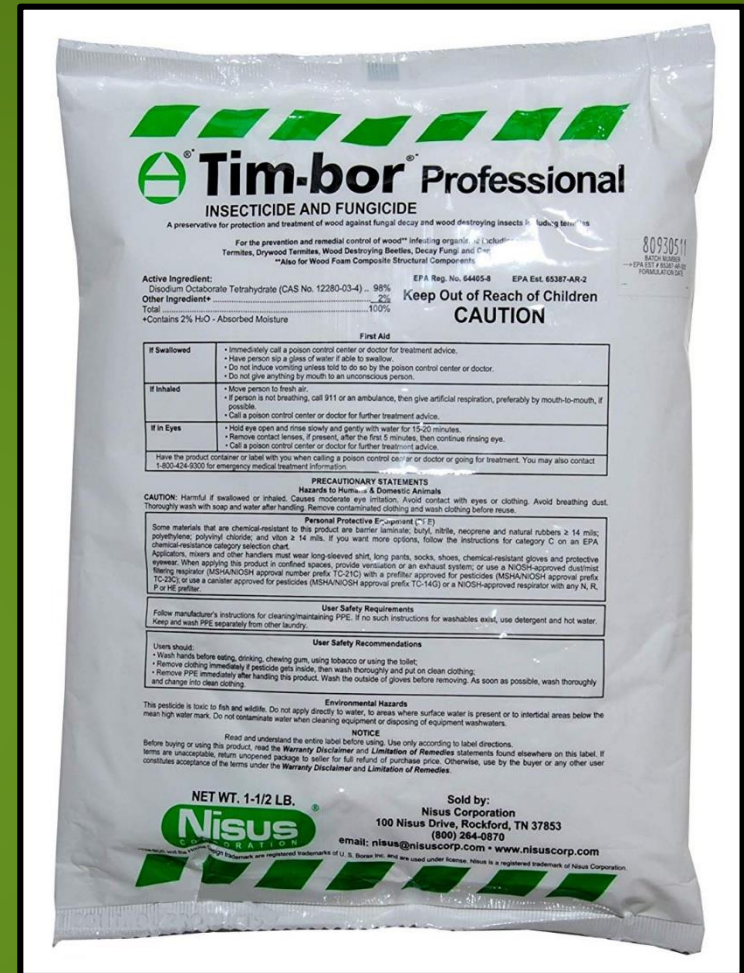
Hazard Statement: Harmful if swallowed. Toxic in contact with skin. Causes severe skin burns and eye damage. Causes serious eye damage. Harmful if inhaled. May cause damage to organs. Very toxic to aquatic life. Toxic to aquatic life with long lasting effects.

Borate Treatment Products

Tim-bor by Nisus

- Comes in a 1.5 pound packet, which makes 1 or 1.5 gallons of treatment solution, at a 10% or 15% solution (\$18).
- 1 gallon of solution will cover about 200 square feet.
- About 14 pounds is needed for an average house, at a cost of about \$250

Tim-bor Professional Borate Application



<http://nisuscorp.com/log-homes/products/tim-bor-professional>

Borate Treatment Products

- Bora-Care: Nisus Corporation, 100 Nisus Drive, Rockford, TN 37853, (800) 264-0870. (www.nisuscorp.com).
- The Nisus Corporation website lists local distributors.
- Also marketed as “Boracare/Moldcare” a combination Borate and DDAC treatment.
 - Provides additional protection over Borates alone (for areas that are likely to see regular elevated moisture levels).

Recommendations

- Clean and dry surfaces, & wood dried to 15% moisture content or less is the highest priority.
- Wood that is likely to be subject to high moisture levels, such as in unsealed crawl spaces, would benefit from treatment with the Bora-Care/Moldcare product, but in some states it must be applied by a Licensed PCO.
- Any other wood surfaces would benefit, but follow the instructions!

Recommendations (cont.)

- Again, clean and dry surfaces and wood dried to 15% moisture content or less is the highest priority.
- An easy to apply Borate treatment such as Tim-bor, applied as a Fungicide, adds additional protection at minimal cost.

Foster's 40-50

Note: Fosters makes numerous products that might be useful in rehabilitation post flooding.

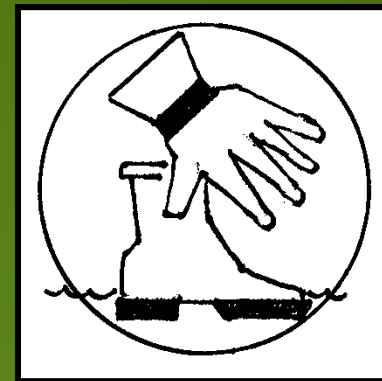
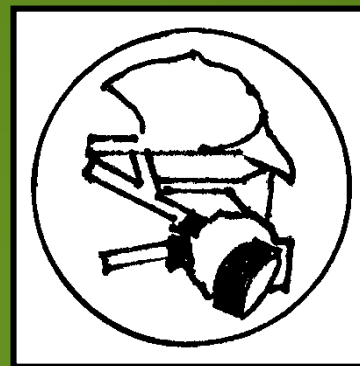


<http://fosterproducts.com/foster-products/>

7. Selective Tear-Out & Prep Pre-Restoration

- Clean up as you go
- Open attic
- Open crawl space
- Components to consider for removal:

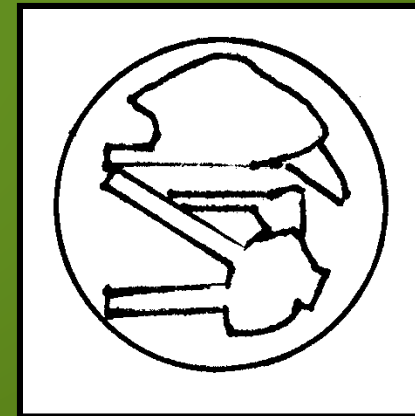
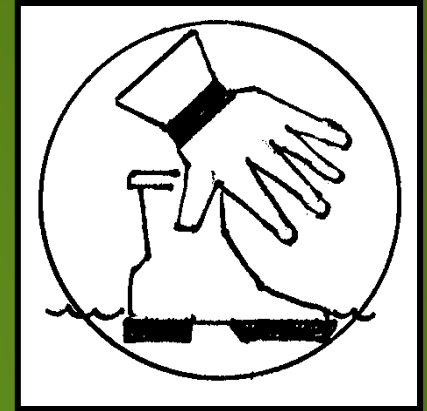
- Drywall
- Plaster walls
- Insulation
- Kitchen cabinets and countertops
- Kitchen and bathroom fixtures



- Wood flooring
- Ceramic Flooring
- Wood windows, doors and trim
- Repair/replacement T & G Floor
- HVAC

8. Restore Possessions

- Wood furnishings
- Clothing, drapery and other cloth
- China, glass, jewelry, porcelain and metal possessions
- Electric appliances
- Small valuables



Rebuilding with Resiliency and Sustainability in mind

Choose components that:

- Have a longer life cycle
- Are resistant to moisture damage
- Contain fewer contaminants
- Are easily cleanable
- Require less maintenance

Consider These Options

- Insulating
- Air Sealing
- Low VOC products
- Spot & Whole House Ventilation
- HVAC and Domestic Hot Water Upgrades
- Better finishes, especially in high use areas

Materials for Rebuilding

- Insulation of the building envelope:
 - Fiberglass, Rockwool, Cellulose, Rigid Foam Boards or Spray Foam?
- Wall finishes
 - Standard drywall or Paperless drywall?
(\$7.70 versus \$16 for ½" 4'X8' sheet)
- Flooring
 - Carpet? Resilient? Ceramic? Wood?



Air Sealing

- Many air leaks are effectively chases in the wall framing that act like chimneys sucking hot air.
- The Stack Effect adds to the problem

Air Sealing – 7 Reasons (a 7-fer)

1. Air leaks waste energy
2. Air leaks are a comfort issue (drafts)
3. Air sealing is also fire stopping (a code requirement)
4. Air leaks transport moisture at very high levels
5. Many pests can be kept out by careful sealing of air leaks (IPM)
6. Air leaks can carry contaminants (from attic, crawl space, garage, etc.)
7. Addressing air leaks has a very good cost/benefit ratio

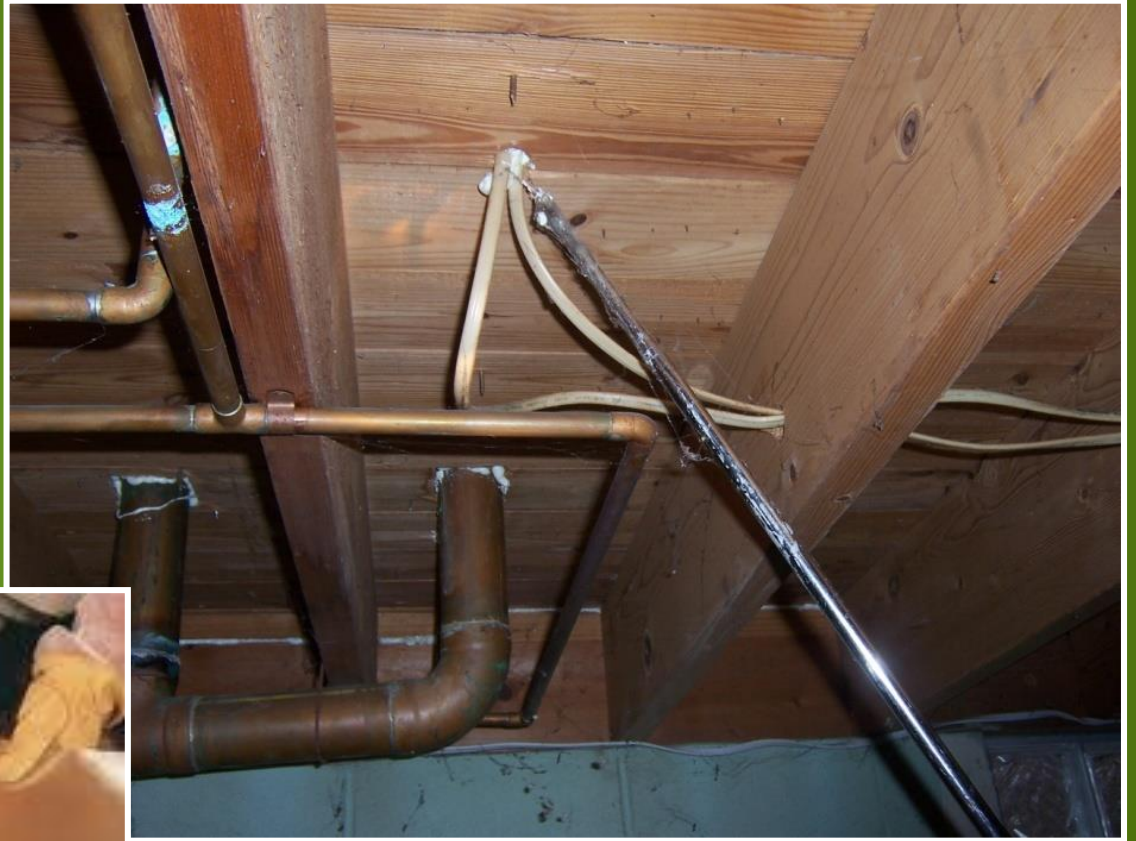
Air Sealing

Typical examples of leaks:

- Plumbing chases
- Holes drilled for electrical cables
- Wall penetrations for electrical boxes, etc.
- Space around ductwork and flues

Seal Plumbing & Electric Penetrations

- Seal penetrations with expanding foam or caulk
- Seal flues with sheet metal



Insulation

Issues with batt insulation

- It costs more to do it well, but it pays to install batt insulation correctly.
- Batts are a challenge to install around obstructions.
- 40 to 60% improvement in performance if you do it well.
- Small gaps in insulation, say 5%, can create almost a 50% performance penalty.

**What's wrong
with this picture?**



Poorly Installed Batts

Insulate the Attic



This is a Cellulose snow storm.

- **Low cost**
- **Green**
 - Recycled
 - Pest proof
- **Requires little equipment**
Machines available through distributors/home centers
- **Note the baffles in the eaves**

Spray Foam on Cathedral Ceiling



2 Types of Spray Foam

Open Cell

- Greater Yield
- Aprox. R 3.5/inch
- Complete Cavity Fill
- Faster Applications
- Track Housing
- Noise Reduction
- Air Barrier
- 6-10 perms @ 3"
- May require vapor retarder

Closed Cell

- Higher R-Value – Aprox. R6/inch
- Increased Structural Strength
- Better Application Accuracy
- Basement/Foundation Insulation & Waterproofing
- Air Barrier
- .95 perm @ 2.00"
- .88 perm @ 3.00"

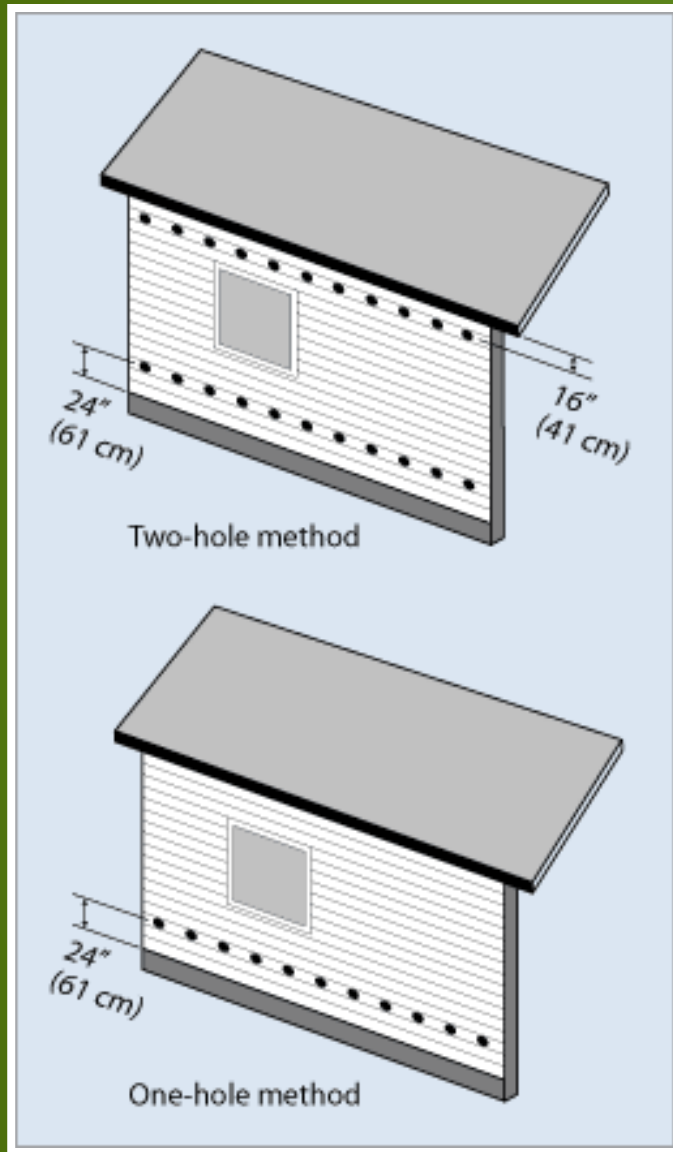
Spray Foam on Frame Walls



Damp Spray Cellulose or Fiberglass



Dense Packing Cellulose or Fiberglass

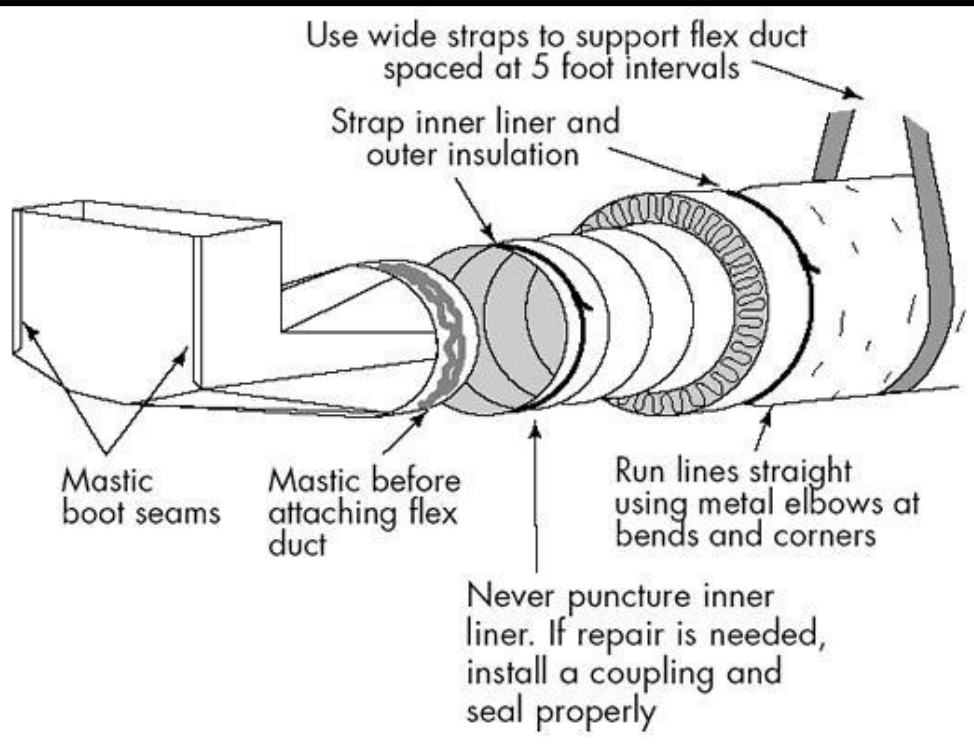


- Dense Packing = 3.5 lb/ft^3
- Use 2 holes per wall cavity per level
- Dense Packing also accomplishes air sealing

Windows and Doors

- The “pay back” for replacing windows and doors is rarely as high as insulation and air sealing
- There are of course other reasons to replace them:
 - LBP
 - Market expectations
 - Security
 - Maintenance
 - Tilt windows are easier to clean
 - They’re missing.....

Sealing Ductwork



Use duct mastic on seams & joints of ductwork, and between flex duct liner and metal boots



Healthy Living Environment

The 8 Principles of Healthy Housing

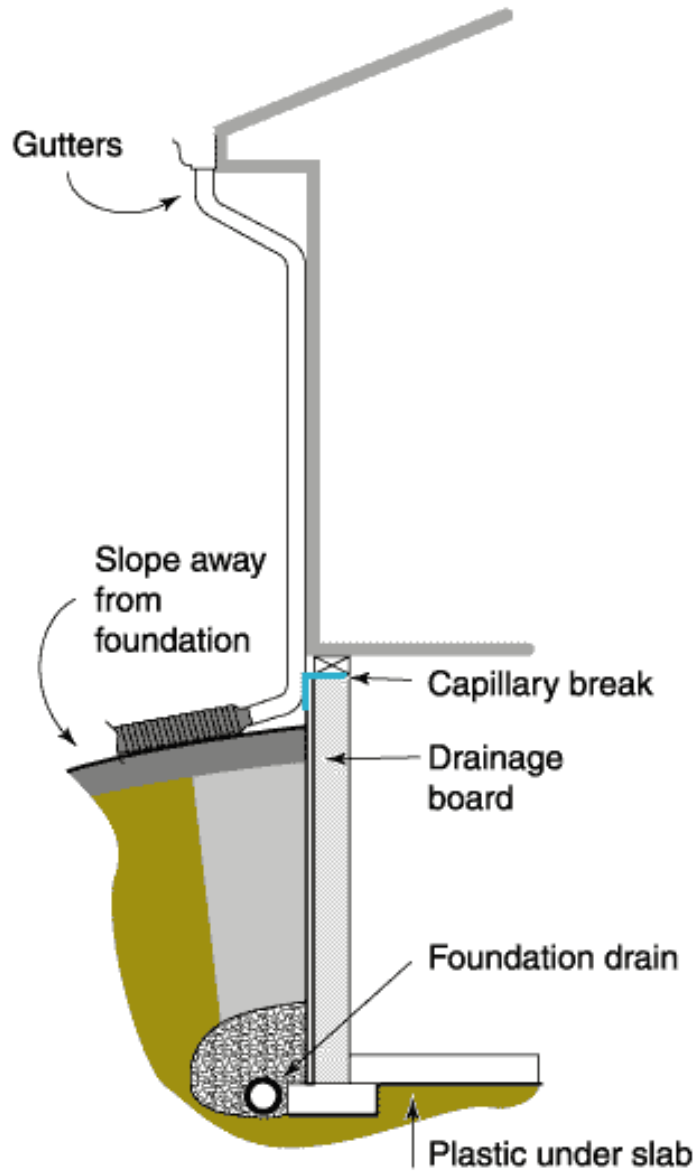
1. Dry
2. Clean
3. Safe
4. Well ventilated
5. Contaminant-free
6. Pest-free
7. Well maintained
8. Thermally controlled

Healthy Living Environment

- Control Moisture
- Provide Ventilation
 - Bathroom fans
 - Kitchen Fans
 - Whole house ventilation
 - Sometimes, make-up-air
- Use IPM to control Pests
- Size HVAC Equipment appropriately
- Control hazards like CO, LBP and Radon
- Use Low VOC paints, caulks & sealants
- Use Low formaldehyde materials

Site Improvements that Control Moisture

- Drainage away from the foundation is crucial
- Gutters, Downspouts and Grading work together
- Look for signs of drainage issues and opportunities to move water away from the house



Vent Exhaust Fans to the Exterior

- Replace existing bath fans with new energy rated fans vented directly to the outside
- Replace existing range hoods with new energy rated units vented directly to the outside



Whole House Ventilation Options

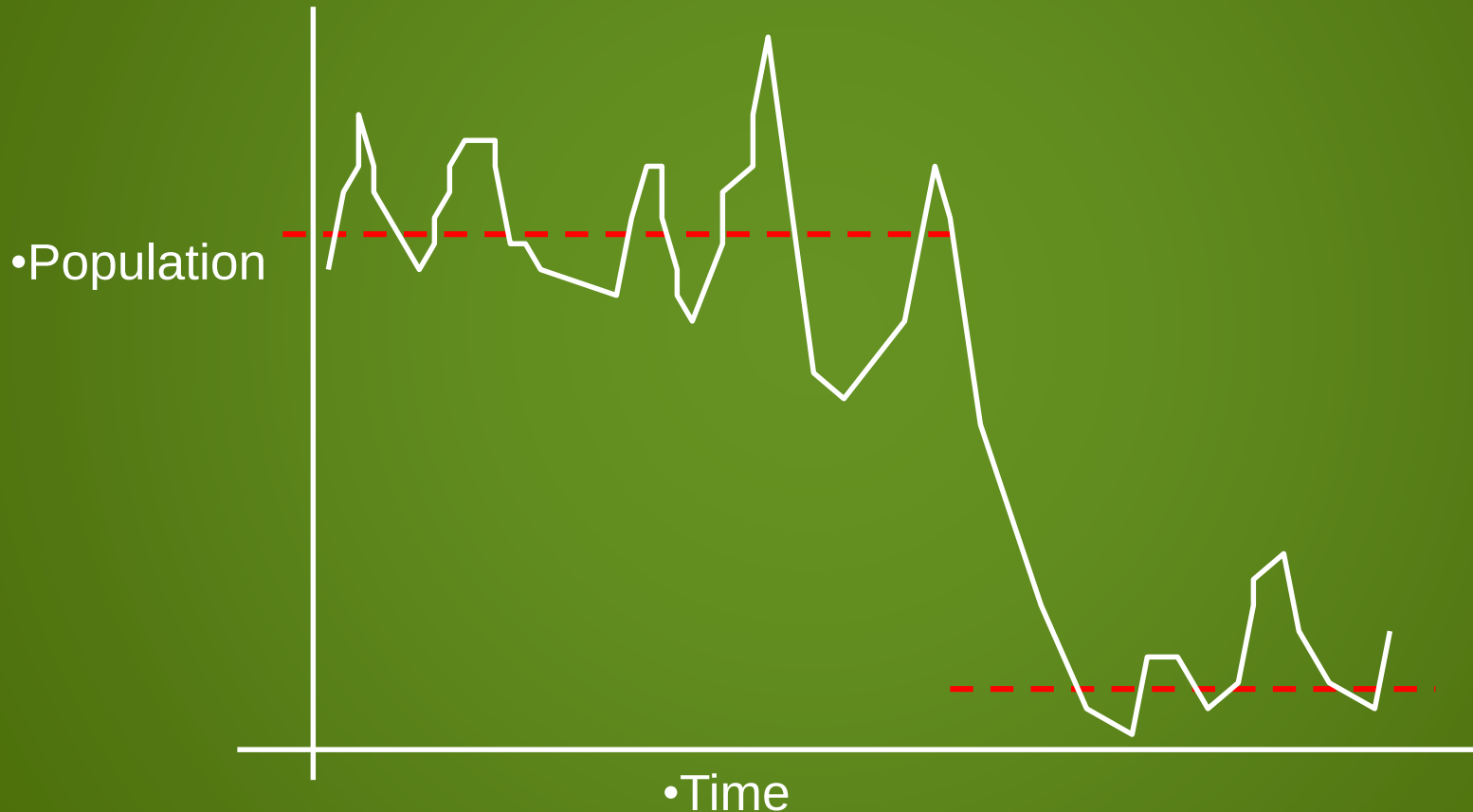
- Constant background exhaust ventilation from a centrally located bathroom fan
- Supply ventilation by adding a fresh air intake to the return air system
- Balanced ventilation from a Heat Recovery Ventilator (HRV) or Energy Recovery Ventilator (ERV)
- Possibly adding make-up air inlets if the house is tightly air-sealed

Dryer Vent Ducted to the Outside

- Replace plastic ductwork with metal
- Vent clothes dryer to the outside
- The dryer vent must be rated for gas if the clothes dryer is gas
- Make dryer vent runs as short as possible

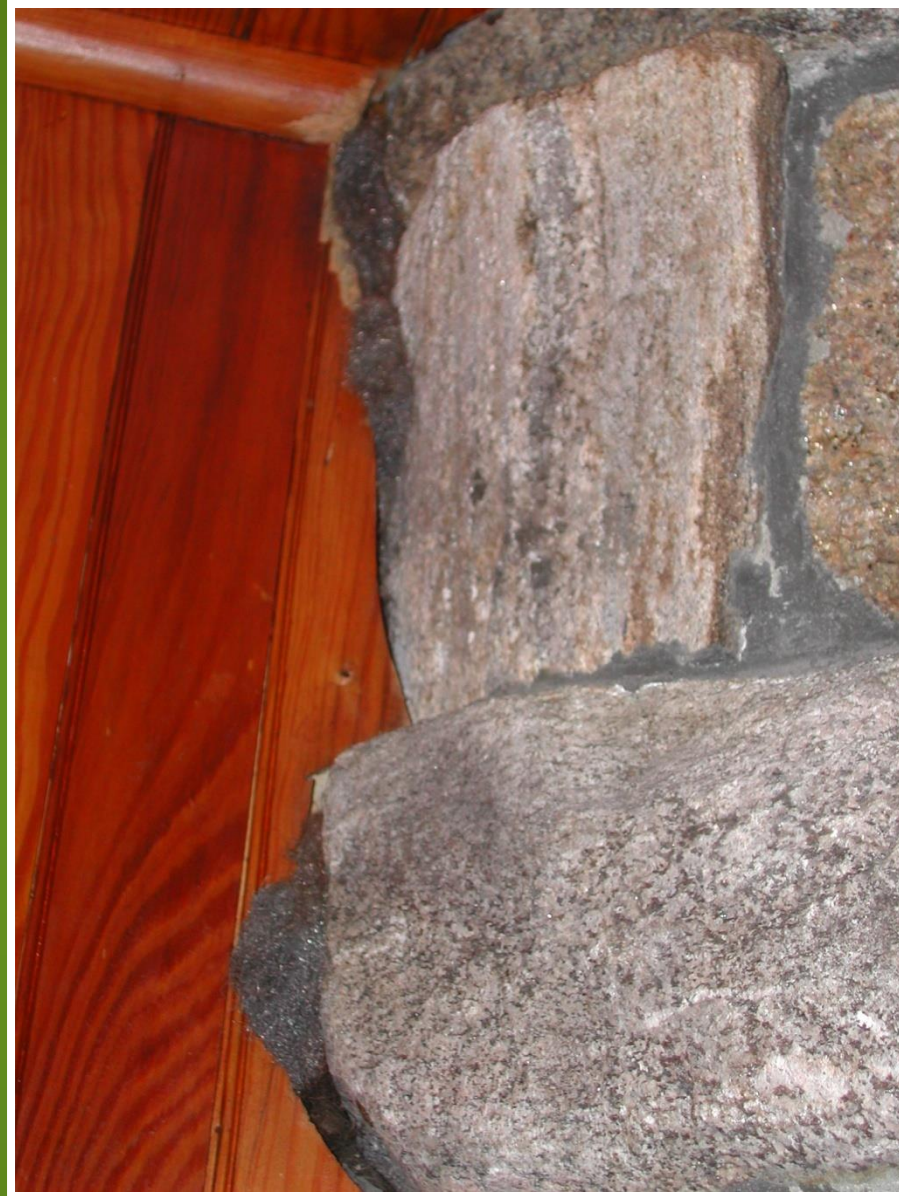
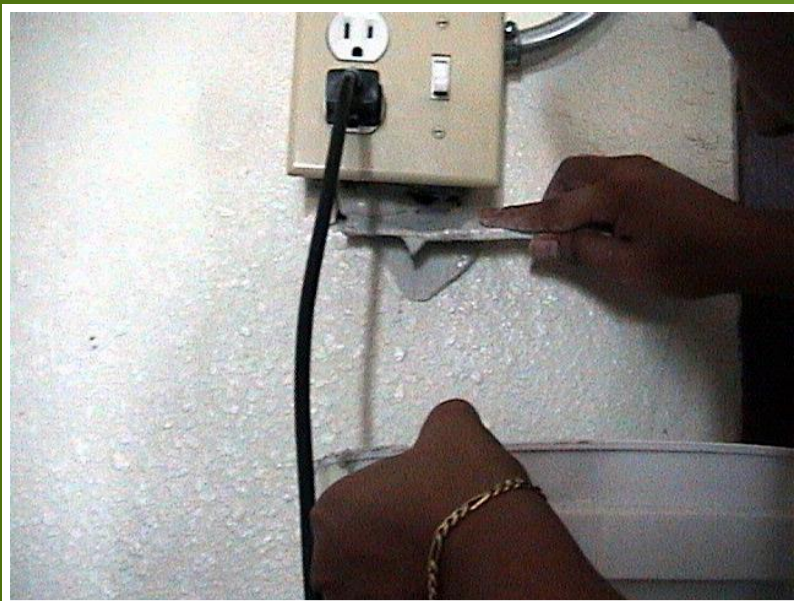


Colonizing organisms must be controlled by changing the carrying capacity of the building – intervening in food, water, shelter or dating bars.





Tools of the IPM Trade



Allen Special Products (800-848-6805)

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Sealing
penetrations
in the building
envelope

Resources

- National Center for Healthy Housing www.nchh.org
- Enterprise Community Partners www.enterprisecommunity.com
- HUD www.hud.gov/sites/documents/REBUILD_HEALTHY_HOME.PDF
- FEMA – www.fema.gov/homeowners-guide-retrofitting
- EPA – Flooding www.epa.gov/natural-disasters
- ARC: https://www.redcross.org/content/dam/redcross/atg/PDF_s/Preparedness_Disaster_Recovery/Disaster_Preparedness/Flood/repairingFloodedHome.pdf
- EPA: www.epa.gov/homeland-security/epas-role-disaster-recovery
- CDC: www.cdc.gov/disasters/hurricanes
- EPA Mold Remediation in Schools & Commercial Buildings www.epa.gov/mold
- LSU AgCenter - <http://www.lsuagcenter.com/>
www.lsuagcenter.com/profiles/sfiser/articles/page1474660090140

Enterprise Multifamily Tools For Resilience



<https://www.enterprisecommunity.org/solutions-and-innovation/disaster-recovery-and-rebuilding>