

Steps to Healthier Homes

- Start with People
- House as a System
- Keep It:
 - Dry
 - Pest-Free
 - Safe
 - Maintained
- Making it Work
 - Clean
 - Ventilated
 - Contaminant-Free



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IOM Report Mold & Moisture Related Health Effects

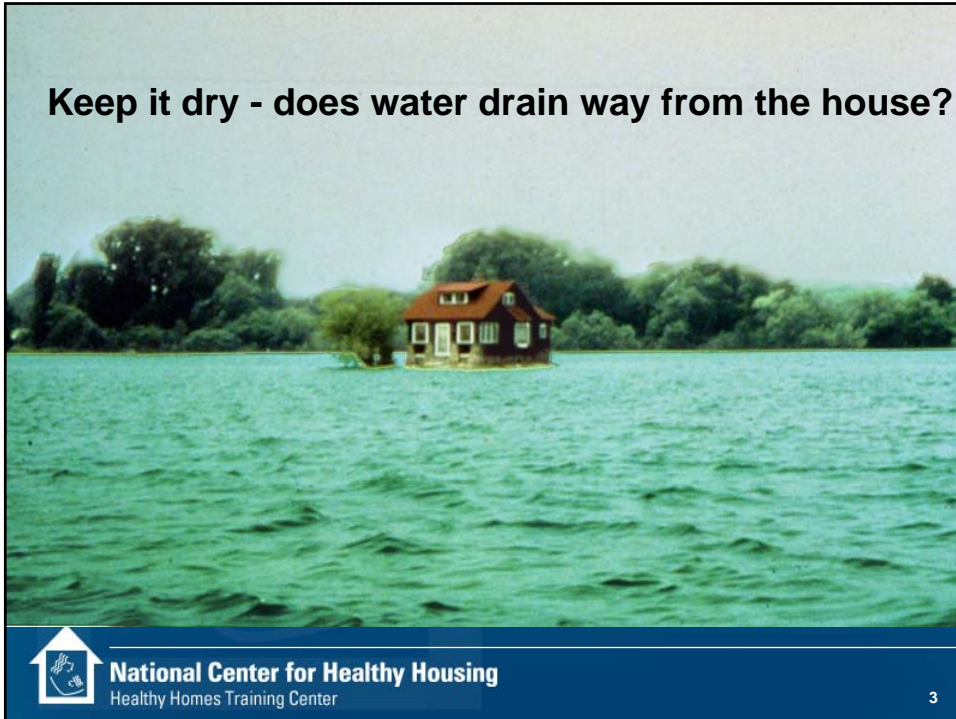
- Upper respiratory tract symptoms
- Coughing
- Wheezing
- Asthma symptoms
- Hypersensitivity pneumonitis



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Keep it dry - does water drain way from the house?



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
- Construction moisture
 - Concrete, wet spray cellulose, gypsum mud
 - Damp earth in crawlspace



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Interior Water Leakage

- 7.9% had interior water leakage in 12 month period
 - 2.1% from fixtures
 - 3.4% from leaking pipes
 - 0.8% from broken water heater
 - 2.0% from other or unknown causes
- The problem was worse for:
 - Renters – 10.7%
 - Manufactured housing – 8.7%
 - New move ins – 9.6%
- 3.8% of homes built from 2003 to 2007
 - Down from 5.5% from 2001 to 2005

From American Housing Survey – 2007



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Exterior Water Leakage

- 10.3% had exterior water leakage in 12 month period
 - 4.7% from the roof
 - 3.5% from the basement
 - 1.7% from the walls, closed windows or doors
 - 1.0% from other or unknown source
- The problem was worse for:
 - Northeast – 16.3%
 - Midwest – 13.3%
 - New move ins – 9.6%
- 5.6% of homes built from 2003 to 2007
 - Down from 6.4% from 2001 to 2005

From American Housing Survey – 2007



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Construction Factors

- Of single family homes excluding mobile homes:
 - 31% have full or partial basement
 - 16% have crawlspace
 - 22% have slab

- Exterior physical condition of homes
 - 17.5% of homes have some physical condition contributing to leaks
 - 2.2% have sagging roof
 - 4.6% have missing roofing material
 - 1.5% have hole in roof
 - 2.5% are missing bricks siding or other outside wall material
 - 1.4% have sloping outside walls
 - 3.5% have boarded up windows
 - 2.5% have foundation crumbling or has open crack or hole.

From American Housing Survey – 2007



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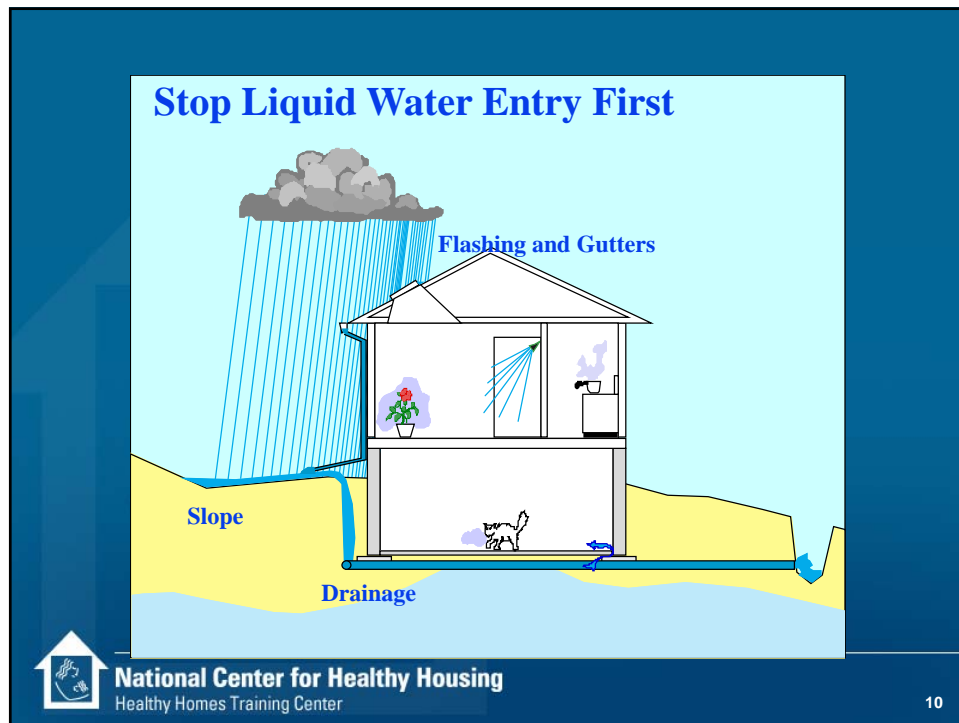
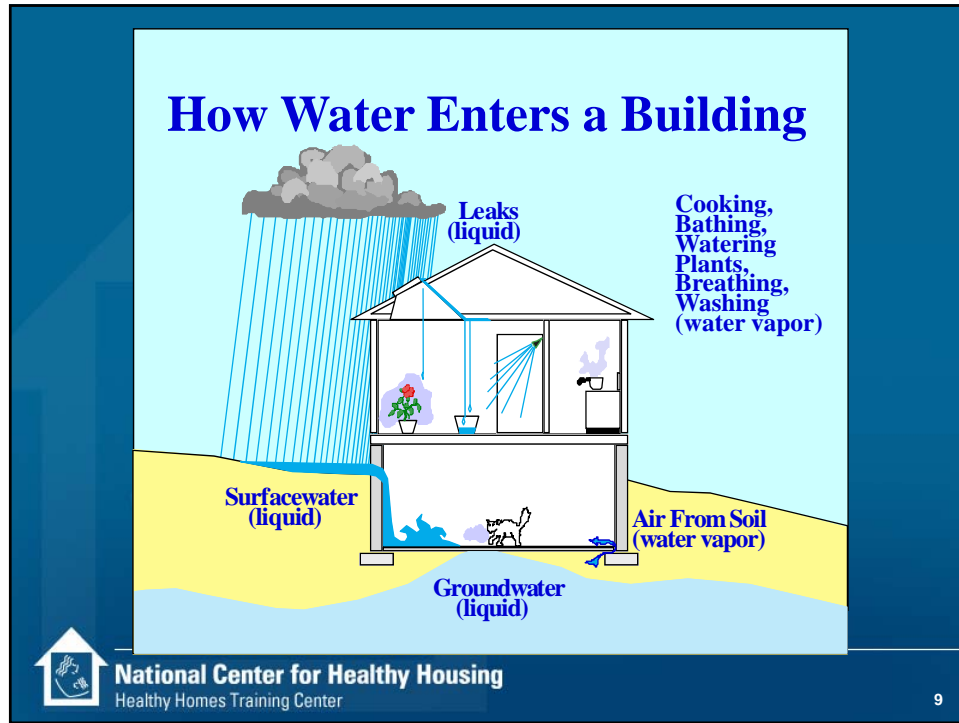
Comfort Levels

- Air temperature: 65°F (active) – 80°F (bathing)
- Air relative humidity: 30% – 70%
- Air motion: 20 – 40 feet per minute
- Surrounding surface temperatures: within 10 – 15°F of room air



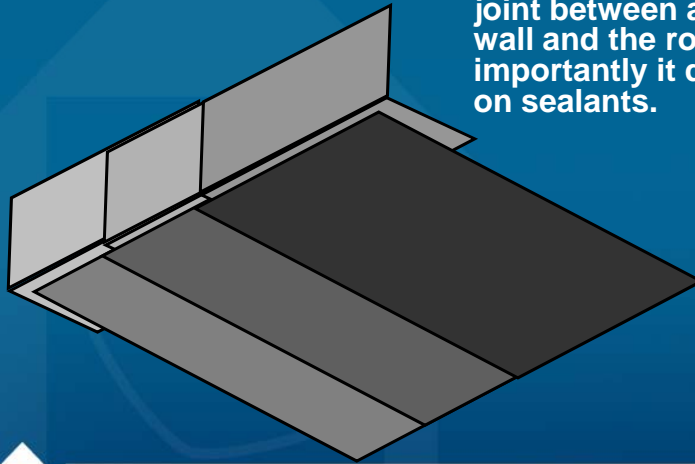
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Step Flashing

Step flashing is layered on top of each course of shingles and flashes the joint between an adjoining wall and the roof. Most importantly it does not rely on sealants.



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Retrofit rainwater protection




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Windows leak?







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Masonry + rain & sun +
air conditioning + vinyl
wallpaper = mold.

Clues on the outside
shape your indoor
inspection





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Air conditioner
condensate drains
into building



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**Porous material
can wick water
from outside**



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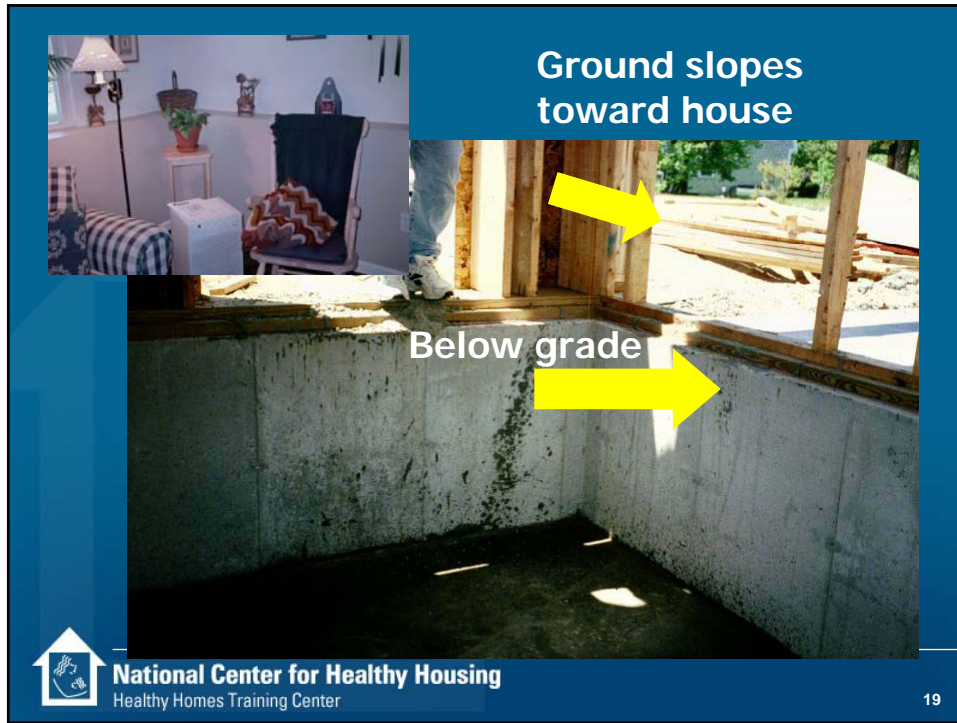
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Moisture meters are useful in determining whether a material is wet or not and tracing the source of problem water.



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Bad Crawlspace

Crawlspaces may contain mold, pests, pesticides, asbestos, lead paint and sewer gas. An apparently dry crawlspace can add excessive water vapor to a house.



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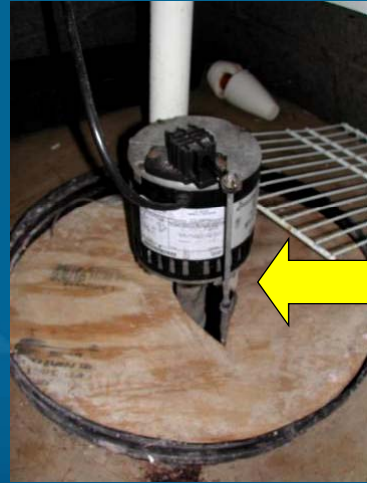
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Good Sealed Crawlspace



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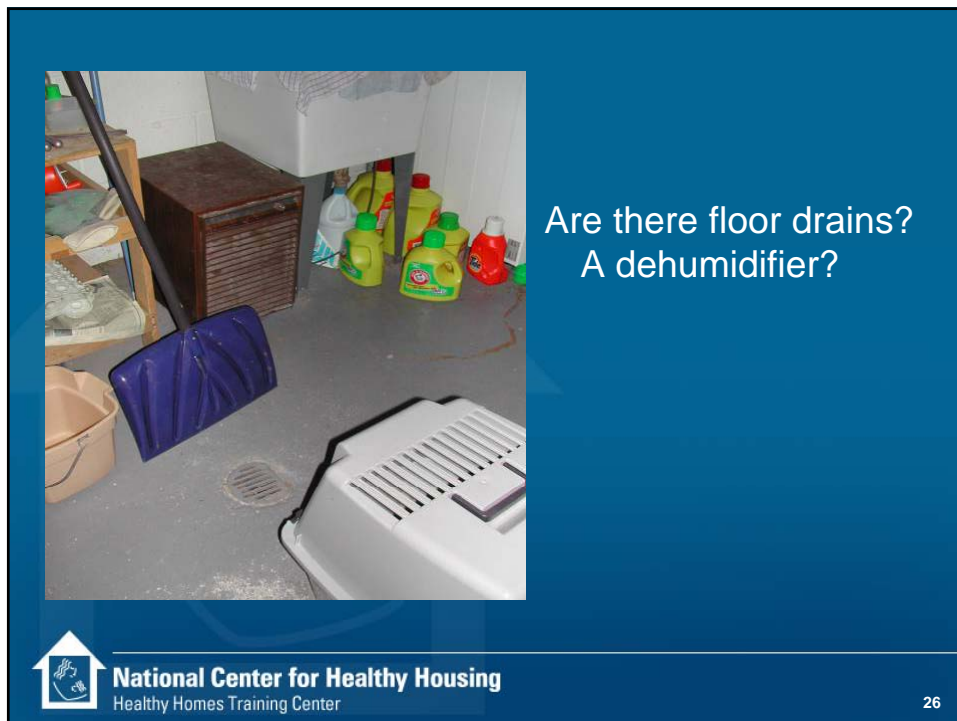


Failed drainage systems.



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Steps to Dry Basements

- Drain, drain, drain
- No paper or wooden materials in contact with foundation
- Keep warm humid air away from earth chilled surfaces
- Dehumidify



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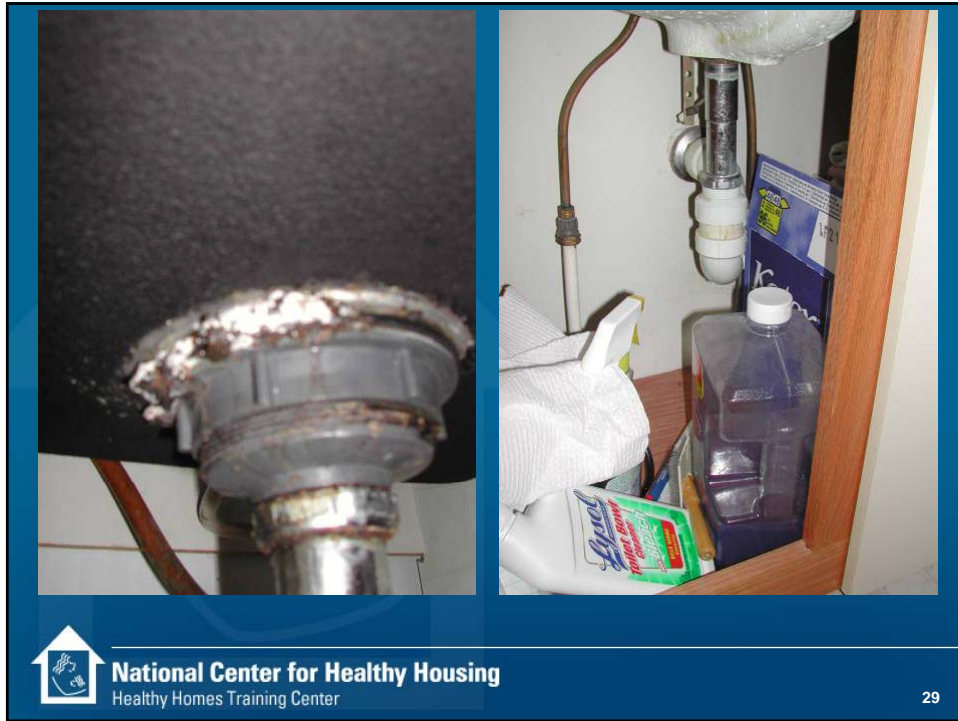
Plumbing problems



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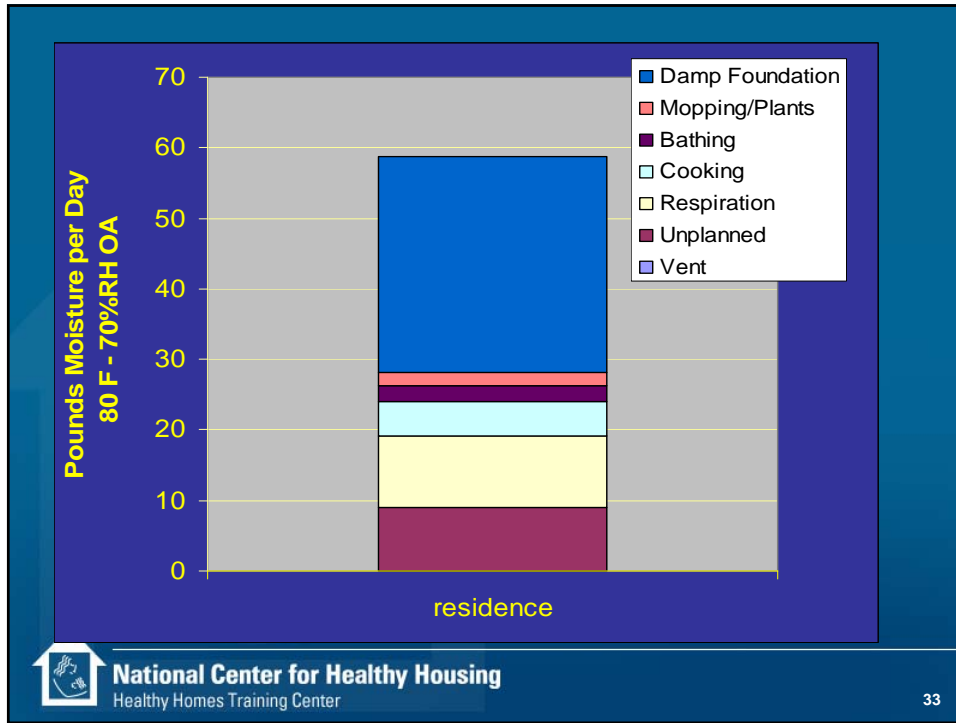
If humidity levels are greater than 95% for three to six weeks...

Vacuum bag with mold

The photograph shows a purple mesh vacuum bag attached to a black vacuum cleaner. A yellow arrow points to a white, fuzzy mold growth on the bag. The background is a blue gradient.

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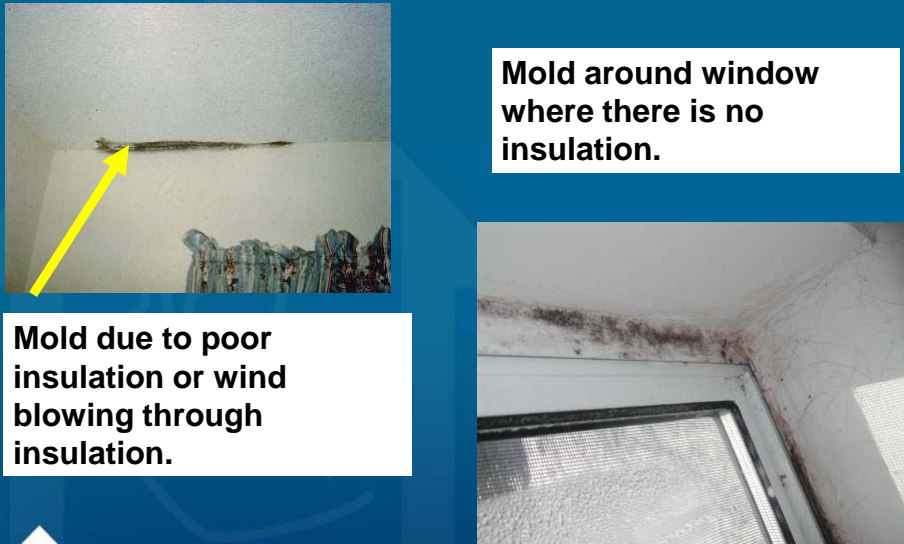


Mold in the air conditioner?

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Condensation when cold outside

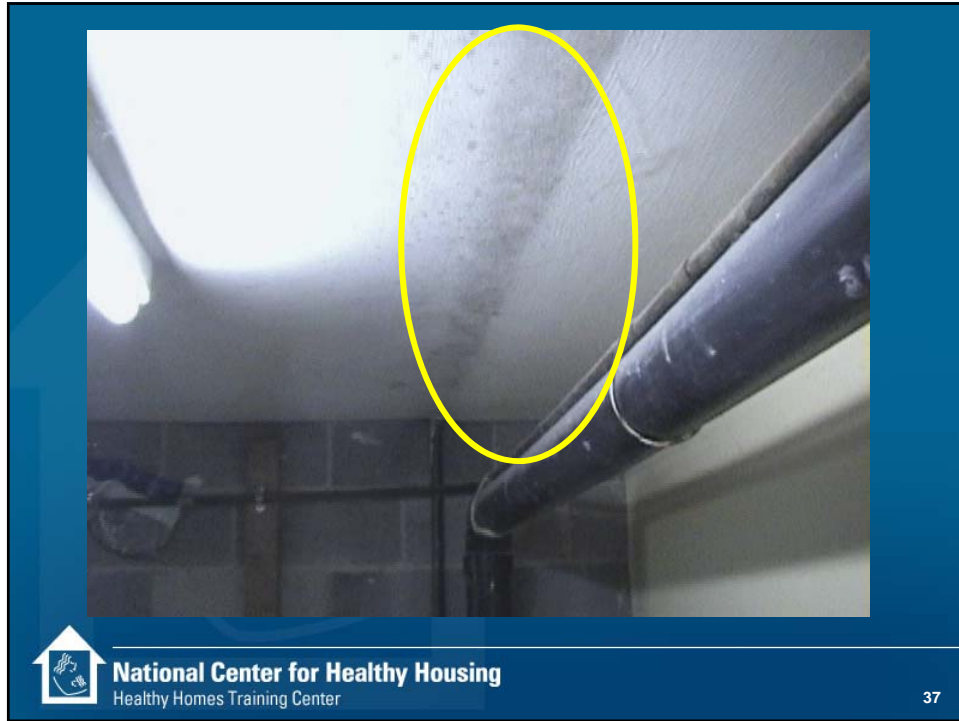


Mold around window where there is no insulation.

Mold due to poor insulation or wind blowing through insulation.

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DEHUMIDIFIERS

- Wattage (Energy Star rated)
- Water removal rate
- Noise
- Drainage
- Icing
- Filter



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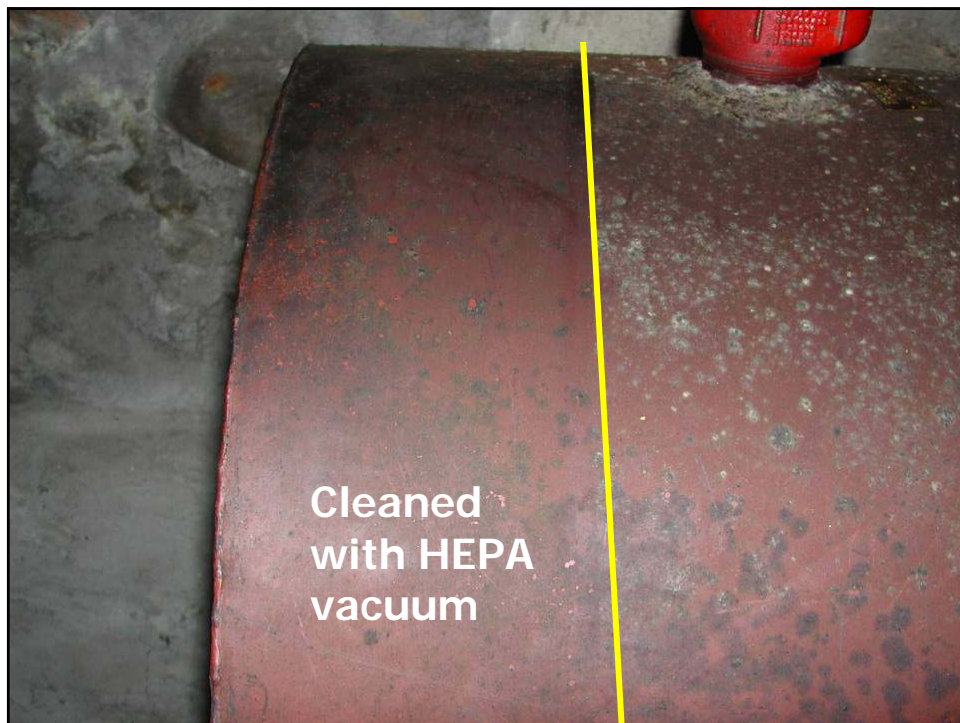
Response to Mold Problems

- **IDENTIFY**
 - extent of moisture damage and contamination
 - dynamics of moisture sources
 - appropriate containment and worker protection
- **DRY** the wet areas in the short term
- **DESIGN**
 - long term intervention in the moisture dynamics
 - fungal clean-up procedures and clearance criteria
- **DISCARD - DECONTAMINATE** contaminated material
- **IMPLEMENT** repairs and program changes to prevent future problems
- See EPA Guidance



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For areas less than 10 square feet - clean it up




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- ✓ **Cleaning Solution**
 - Detergent and hot water
- ✓ **Assorted brushes, rags, mist spray bottles**
- ✓ **Do not use high pressure sprayers**



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For Bigger Jobs

MUST HAVES:

- Respirator
 - P100 or P95 particulate filter
- Eye protection
- Rubber gloves
- Coveralls
 - remove/bag them before you leave the work area



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Containment may be needed for bigger jobs. See EPA Guidance.



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Code Requirements Related to Moisture

- **302.2 Grading and drainage.** All premises shall be graded and maintained to prevent the erosion of soil and to prevent the accumulation of stagnant water thereon, or within any structure located thereon.

- **304.7 Roofs and drainage.**
 - The roof and flashing shall be sound, tight and not have defects that admit rain.
 - Roof drainage shall be adequate to prevent dampness or deterioration in the walls or interior portion of the structure.
 - Roof drains, gutters and downspouts shall be maintained in good repair and free from obstructions.
 - Roofwater shall not be discharged in a manner that creates a public nuisance.



Code Requirements Related to Moisture

- **304.6 Exterior walls.** All exterior walls shall be free from holes, breaks, and loose or rotting materials; and maintained weatherproof and properly surface coated where required to prevent deterioration.

- **304.2 Protective treatment.**
 - All exterior surfaces, including but not limited to, doors, door and window frames, cornices, porches, trim, balconies, decks and fences shall be maintained in good condition.
 - Exterior wood surfaces, other than decay-resistant woods, shall be protected from the elements and decay by painting or other protective covering or treatment. . . .
 - All siding and masonry joints as well as those between the building envelope and the perimeter of windows, doors, and skylights shall be maintained weather resistant and water tight.



Key Messages

- Excess moisture creates conditions that can affect health.
- Moisture in the home comes from inside and outside.
- Excess moisture in the home should be prevented through appropriate construction methods and plumbing systems, temperature control, ventilation and proper maintenance.



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Learning Objectives

- Name three health hazards in the home that are related to excessive moisture.
- Identify four sources of moisture in the home.
- Describe five strategies for controlling moisture in the home.



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