








Cuyahoga County Urban Mold & Moisture Project



Housing Remediation

Environmental Health Watch
and
HouseMender, Inc.

What I will cover:

-  Mold & moisture problems in Cleveland housing
-  Remediation strategy
-  Mold & moisture specifications
-  Costs of remediation
-  Occupant behaviors
-  Follow-up observations

Mold and moisture problems



Pre-WWII two-family homes:

- Large leaky basements and/or crawl spaces
- Ductwork runs through crawl spaces
- Cleveland drop forced air heating
- Foundations extend under porches

Mold & moisture problems



Post-WWII bungalows with finished basements:

- Moisture entering foundation walls causes mold on basement finishing materials
- Moldy floor coverings on basement floors

Mold & moisture problems



Post-WWII bungalows and ranch homes on slab:

- Leaking sub-slab heating ducts
- Water vapor from ducts condenses on cold exterior walls causing mold growth

Mold generated by moisture from sub-slab heating ducts









Mold & moisture problems



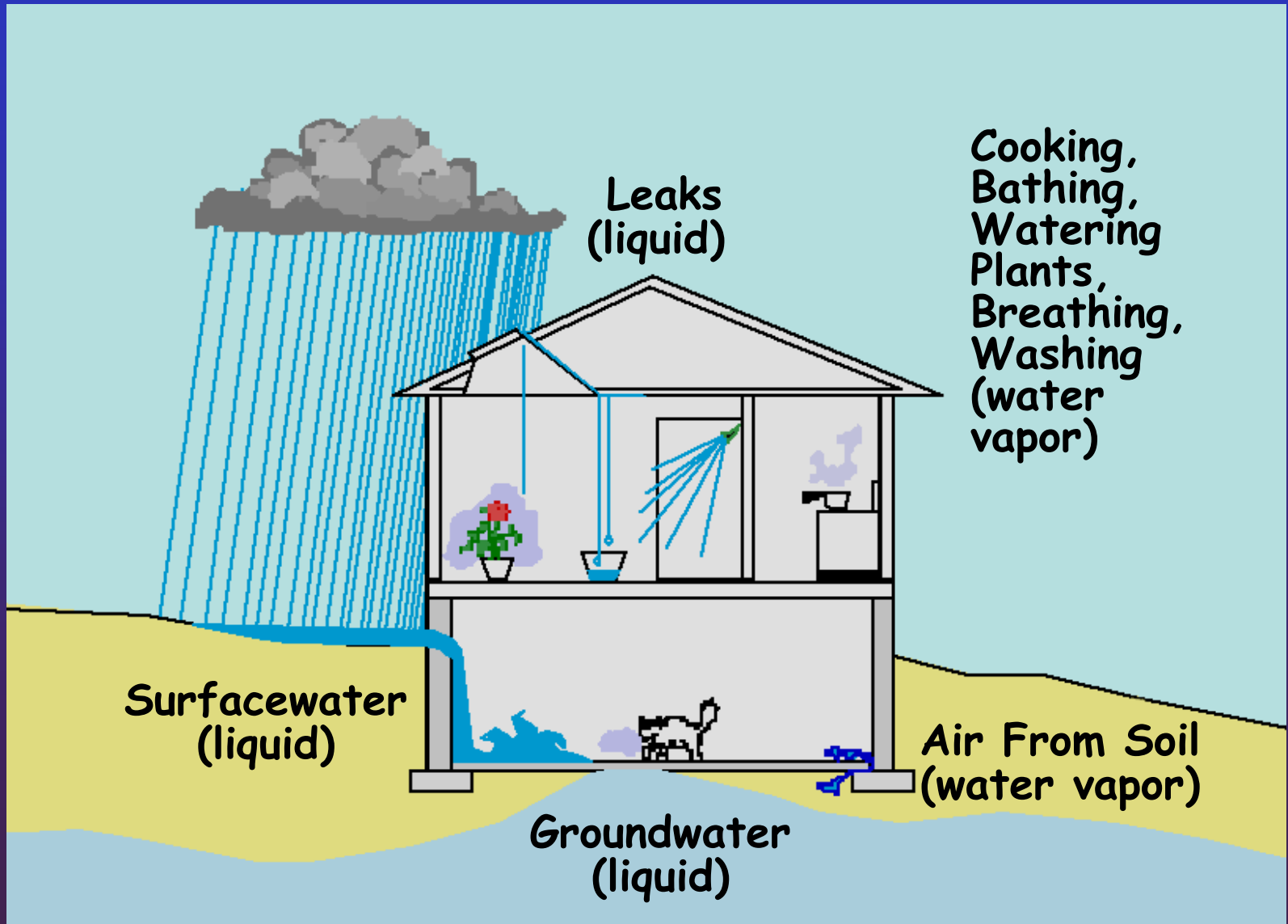
All housing types:

- No bath or kitchen ventilation
- Kitchen stoves used for heating
- Clothes dryers not vented to exterior
- Leaking toilet, tub and sink waste lines

Mold & moisture control strategy

-  Remove moisture damaged material
-  Remove mold exposure pathway
-  Clean mold from hard surfaces
-  Stop rain water intrusion
-  Exhaust water vapor
-  Repair plumbing leaks

How Water Enters a Building



Remediation Costs by Category

| Category | Mean | 25%tile | Median | 75%tile | Max |
|-----------------|-------|---------|--------|---------|--------|
| Lead | 2,324 | 955 | 1,755 | 2,925 | 13,990 |
| Moisture | 1,481 | 665 | 1,415 | 1,950 | 6,260 |
| Mold | 1,667 | 925 | 1,500 | 2,120 | 5,671 |
| Mold & Moisture | 3,148 | 1,630 | 2,965 | 4,335 | 9,464 |
| Other | 114 | - | - | 80 | 2,460 |
| Total | 5,635 | 3,235 | 4,470 | 7,020 | 22,320 |

Key mold & moisture specs

1. Repair the "Cleveland drop"
2. Flash the soil to the house
3. Treat the porch like a roof
4. Eliminate sub-slab duct and heating systems
5. Disconnect and redirect downspouts
6. Reduce moisture in crawlspaces

Repair the "Cleveland drop"



Cold air return not connected to forced air furnace



Furnace pulls air from across basement floor



Spec: Duct cold air return directly to furnace

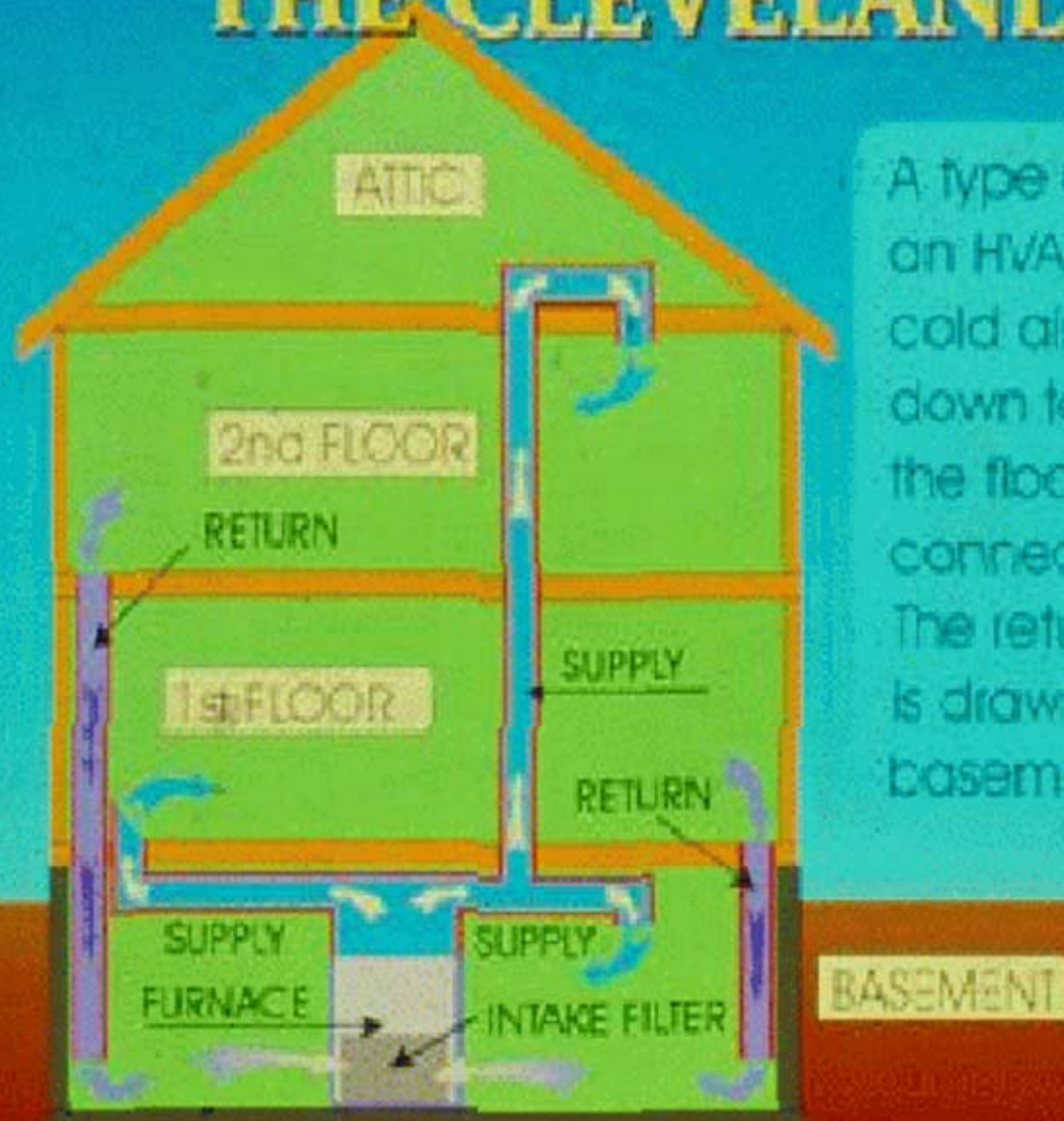
Repair the "Cleveland drop"



Spec execution:

- Done on a third of the houses; avg. cost = \$553; max \$1600
- Some contractors "panned" the floor joists with sheet metal instead of installing full duct

THE CLEVELAND DROP



A type of configuration for an HVAC system where the cold air return ducts drop down to the basement near the furnace, and are not connected to the furnace. The return air for the furnace is drawn directly from the basement via the filter intake.

Repair of "Cleveland drop" by ducting cold air return directly to furnace



Flash the soil to the house



To reduce surface water entering at house foundation



Spec: Trench 12-16" deep, 2-3' wide, sloped away from foundation



Spec: EDPM, rubber roofing material placed against wall and along trench

Flash the soil to the house



Spec execution:

- Avg. cost = \$860
- Some soils settled too much, leaving a depression
- Spec should have called for overfilling

Treat the porch like a roof



Foundations extend under porch, allowing water to enter basement when porch flooring deteriorates



Spec: Two layers of 6 mil plastic on old deck, sealed at perimeter. Indoor/outdoor carpet installed

Treat the porch like a roof



Spec execution:

- Avg. cost = \$312
- Covers the lead paint on deck
- Does the lead dust in the carpet get tracked into the house or is it trapped?

Indoor/outdoor carpeting on porch



Eliminate sub-slab duct and heating systems



Post WWII bungalows with slab-on-grade foundations, downdraft forced air furnace with ducts in slab



Water leaking into ducts creates whole-house humidification resulting in mold on walls and ceilings



Spec: Install updraft furnace with new duct system and fill old ducts with cement

Eliminate sub-slab duct and heating systems



Spec execution:

- New furnace and ductwork avg. cost = \$2,971
- Some sub-slab ducts were not sealed, allowing musty odor in living space

Disconnect and redirect downspouts



Downspouts, by code, enter sub-grade storm drain system



With deterioration, water leaks and spills at foundation walls



Spec: Downspouts disconnected and 5' elbows installed



Spec: Gutters resloped toward downspout closest to street

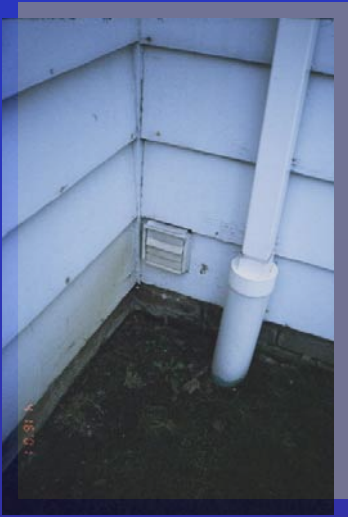
Disconnect and redirect downspouts



Spec execution:

- Downspout disconnect avg. cost = \$114
- Gutters repitched avg. cost = \$145
- Sometimes water flow not adequately diverted from foundation

Downspout disconnect



Reduce moisture in crawlspaces



Moisture from dirt floors enters living space



Spec: Remove debris



Spec: Cover floor with 6 mil plastic carried along walls to grade level

Reduce moisture in crawlspaces



Spec execution:

- Plastic sheeting avg. cost = \$270
- Debris removal avg. cost = \$305
- Would have been good to spec "rat slab" at the same time
- Some crawl spaces missed

Plastic covering crawl space dirt floor



Recommended occupant behavior



Repair/report plumbing leaks promptly



Keep mold host material off basement floors



Don't install vulnerable building/decorating materials on surfaces that get wet



Use ventilation fans

Observed occupant behavior



Positive behaviors observed



Occupants energized to do more



Other allergen controls utilized



Problems - basement shelves not used, debris on floors

One-year follow-up observations of remediation work







43 houses visited at least one-year
post-remediation:

- 347 mold & moisture spec executions assessed
- 285 (82%) - "OK"
- 28 (7%) - "poor work," "not done," or "did not follow spec"

One-year follow-up observations of remediation work

| Specification Rating | Number of specs | Percent of specs |
|-------------------------------|-----------------|------------------|
| Ok | 285 | 82% |
| Poor work | 12 | 3% |
| Not done | 8 | 2% |
| Did not follow spec | 8 | 2% |
| Material failure | 7 | 2% |
| Wrong treatment | 4 | 1% |
| Defeated by occupant behavior | 4 | 1% |
| Extreme event | 0 | 0% |
| Other | 19 | 5% |

Summary observations

-  Key specs generally performed well
-  Some aspects of overall strategy not adequately conveyed to spec writers and contractors through training and spec language
-  Moisture assessment and spec writing more complex than anticipated
-  Occupant behavior generally supportive