

Cuyahoga County Urban Mold & Moisture Project

Housing Remediation

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What I will cover:

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

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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

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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

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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

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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

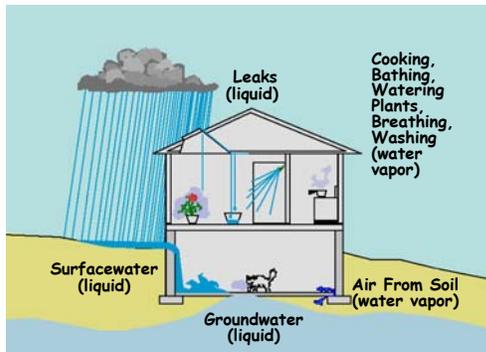
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Mold & moisture control strategy

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

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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

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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

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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

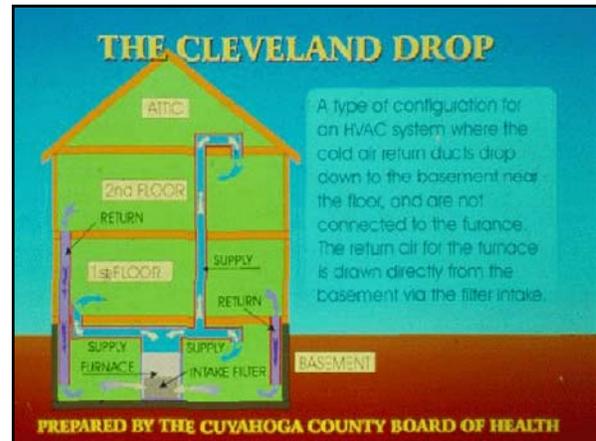
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Repair the "Cleveland drop"

Spec execution:

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

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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

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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

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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

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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?

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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

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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

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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 resploped toward downspout closest to street

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Disconnect and redirect downspouts

Spec execution:

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

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Downspout disconnected



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

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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

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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

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Observed occupant behavior

- 🏠 Positive behaviors observed
- 🏠 Occupants energized to do more
- 🏠 Other allergen controls utilized
- 🏠 Problems - basement shelves not used, debris on floors

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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"

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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**

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