

## Cleveland-Cuyahoga County Healthy House Initiative

# Moisture Control Treatments in Older Housing

The Cleveland-Cuyahoga County Healthy House Initiative (2004-06), funded by a demonstration grant from the [HUD Office of Healthy Homes and Lead Hazard Control](#), developed these moisture control treatments. They were devised for generally older detached wood frame, single and two-family housing located in low-income communities in Cleveland and the inner-ring suburbs of Cuyahoga County.

The lead agency for the project was the [Cuyahoga County Board of Health](#). Other partners involved in the development of the moisture treatments were the [Cleveland Department of Public Health](#), the [Cleveland Housing Network](#), the [Cuyahoga County Department of Development](#), and [Environmental Health Watch](#). Jim LaRue, building science consultant for Environmental Health Watch, was the primary technical consultant and author of this report. [Ralph Solonitz](#) did the drawings.

The development of these treatments built upon the partners' experiences in the [Cuyahoga County Urban Mold & Moisture Project](#), funded by a HUD healthy house technical studies grant (1999-2003) and the [Cleveland Lead + Asthma Project](#), funded by a HUD lead hazard control grant and a [USEPA](#) whole house grant (1997-1998).

The building intervention strategy developed for the Cleveland-Cuyahoga County Healthy House Initiative was to integrate home weatherization with healthy house treatments, focusing on moisture control to reduce sources of inhalant allergens, such as mold, dust mites and roaches that can [trigger asthma exacerbations](#).



The home assessments were conducted by weatherization specification writers (Cleveland Housing Network and the Cuyahoga County Department of Development) and by public health sanitarians (Cuyahoga County Board of Health). The work was conducted by private contractors that were both certified weatherization and licensed lead abatement contractors that had received specialized training from project staff. The [healthy house approach](#), the [inspection process](#) and the general [interventions](#) are presented in the attached slide presentations.

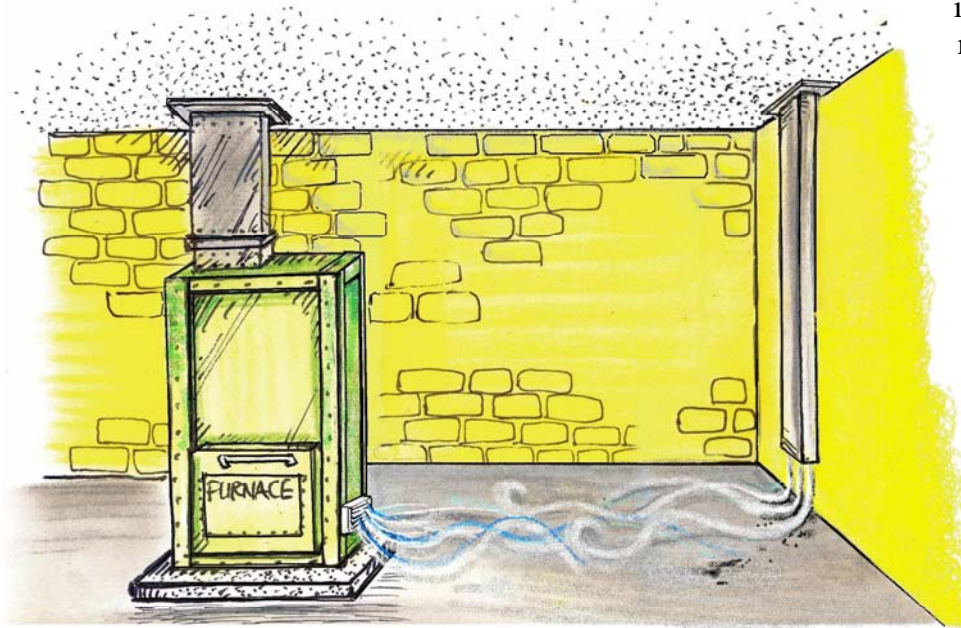
The key moisture control treatments discussed in detail in this report are:

- Duct cold air return directly to the furnace (repair the “Cleveland Drop”)
- Flash the soil to the house
- Treat the porch floor like a roof
- Eliminate sub-slab duct and heating systems
- Effectively run gutter systems and disconnect and redirect downspouts
- Reduce moisture in foundation crawlspaces

- **Duct cold air return directly to the furnace (repair the “Cleveland Drop”):**

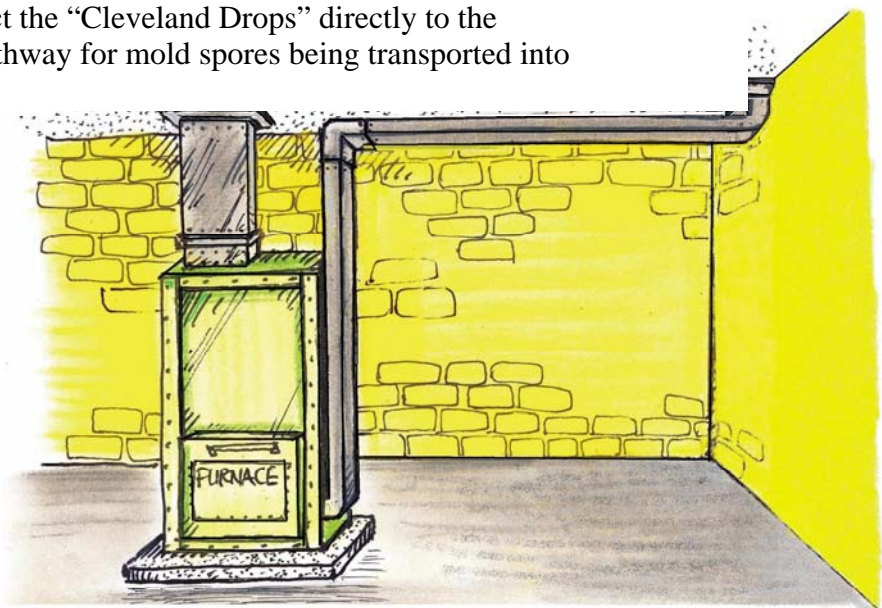
**Problem:** All forced air furnaces need a way to get heat to the rooms of the house and a way to have used air which is now colder return to the furnace to be reheated. In thousands of older Cleveland homes, there is ductwork

carrying heat from the furnace, but the cold air returns are large metal rectangular ducts that go directly from each floor to the basement and are not connected to the furnace. When these furnaces are operating they pull air from all over the basement including these cold air returns we started calling “Cleveland Drops.” Since many of the basements in homes we investigated had significant mold growth on all manner of materials, these furnaces would suck mold spores directly into the heat delivery ducts which would then carry it into the rooms of the house including the bedrooms of the children.



**General Approach:** Connect the “Cleveland Drops” directly to the furnaces to eliminate this pathway for mold spores being transported into the living spaces.

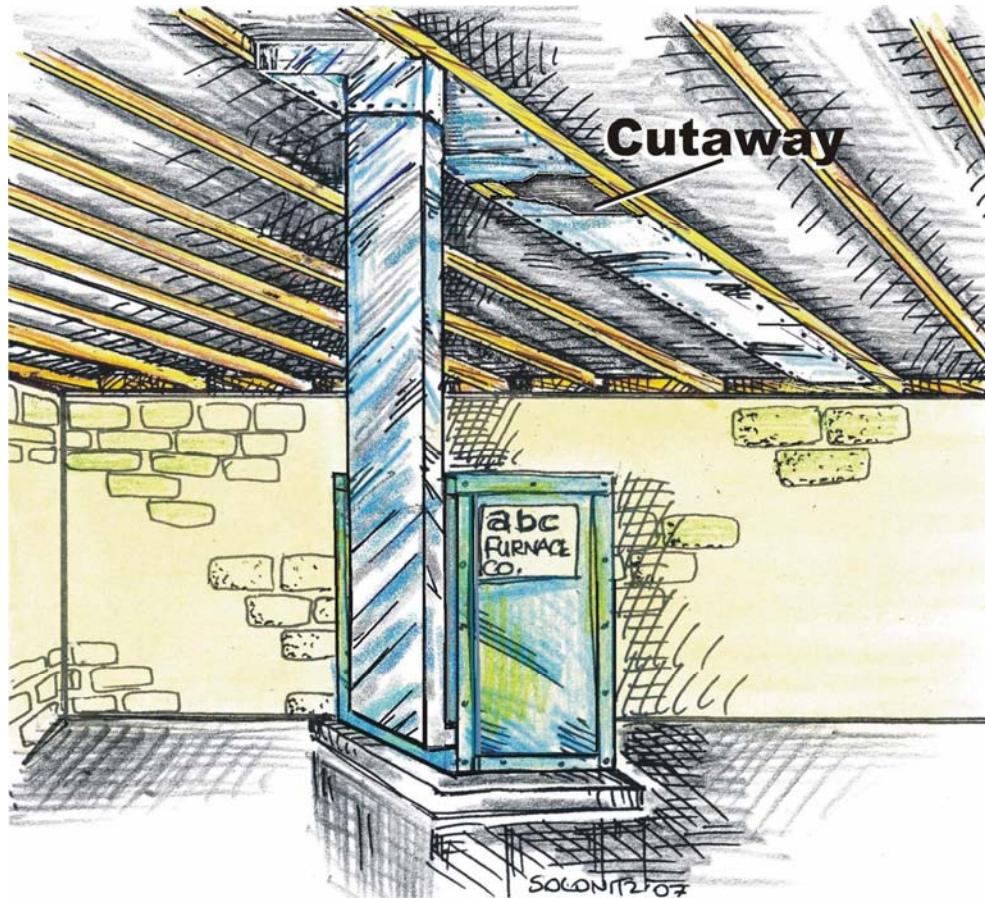
**Treatment:** Remove the “Cleveland Drops” and connect an appropriately sized duct to the cold air return register in the floor or wall of the living space and run that duct to the cold air return opening (where the filter is located).



**Potential Problems and Solutions:**

1. Sometimes when the Cleveland Drop is corrected, contractors use the space between the floor joists to carry the air toward the furnace. This is called “panning” the joists, affixing sheet metal across two joists to create an enclosed air space by sealing the sheet metal to the joists with caulk. There are two

problems with doing this: a) the joist cavity itself can be very dirty and/or moldy and b) if there is excess moisture in the house, it can be pulled into the joist cavity where it can contribute to mold growth. Similar practices should be discouraged in any forced-air installation.



2. Since this treatment will reduce make-up air entering the basement for combustion purposes (if furnace is not a 90+ efficient furnace that gets its combustion air from the

exterior), install a heat register in a heat run near the furnace that will deposit some air in the basement space for combustion air.

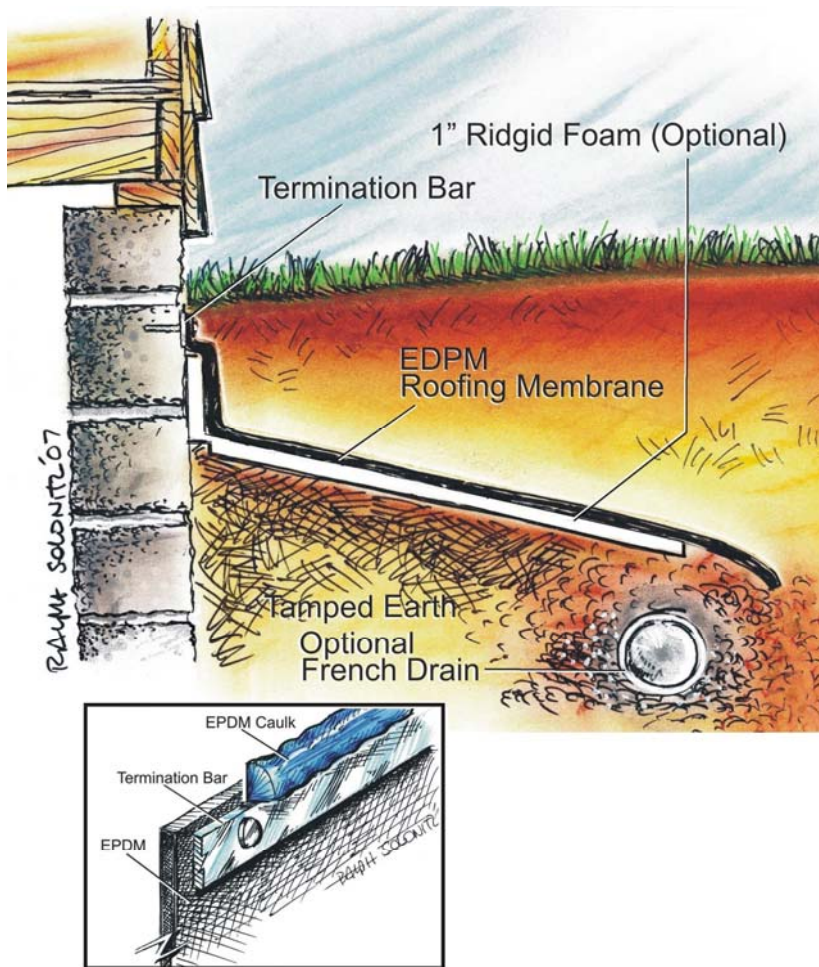
- **Flash the soil to the house:**

**Problem:** In many of the homes in this program there was evidence of basement wall damp from the soil level down. Any wood framing material secured to these surfaces would often show signs of mold. Also, paint on these walls would peel and some of this paint could include lead with the result being peeled paint on the floor where children could access it. Sometimes

simply sealing a crack between a sidewalk and the foundation walls could stop this damp. Sometimes some simple grading would do it. But in some cases, especially where a yard graded toward the foundation, a more effective treatment was required to stop surface water penetration of the foundation wall.

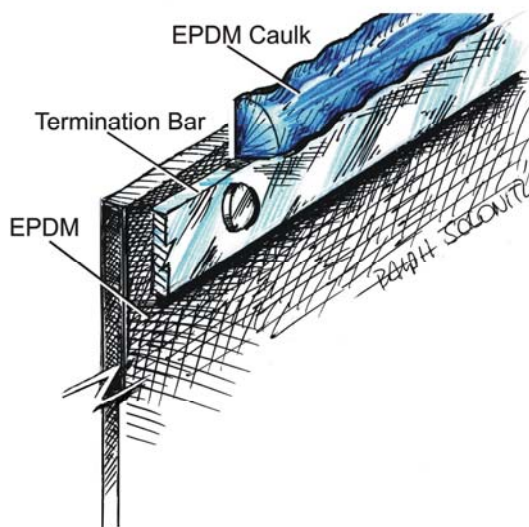
**General Approach:** Using a technique created and detailed by Bill Rose, a research scientist at the Univ. of Illinois School of Architecture, we created a “flashing” between the soils and the house at the surface.

**Treatment:** We would dig a shallow trench about 12” deep and 3’ wide along the foundation wall and slope the trench away from the house slightly. We would then install EPDM rubber roofing material against the foundation wall using a metal fastening bar that was secured into the cinder block or sandstone mortar joints with Tapcon screws. The fasteners can go directly into the cinder blocks. Then the EPDM was spread on to the flat surface of the trench. A caulk designed for use with EPDM was applied along the top edge to stop rain water penetration and then the excavation was backfilled with the soils removed.



**Potential Problems and Solutions:**

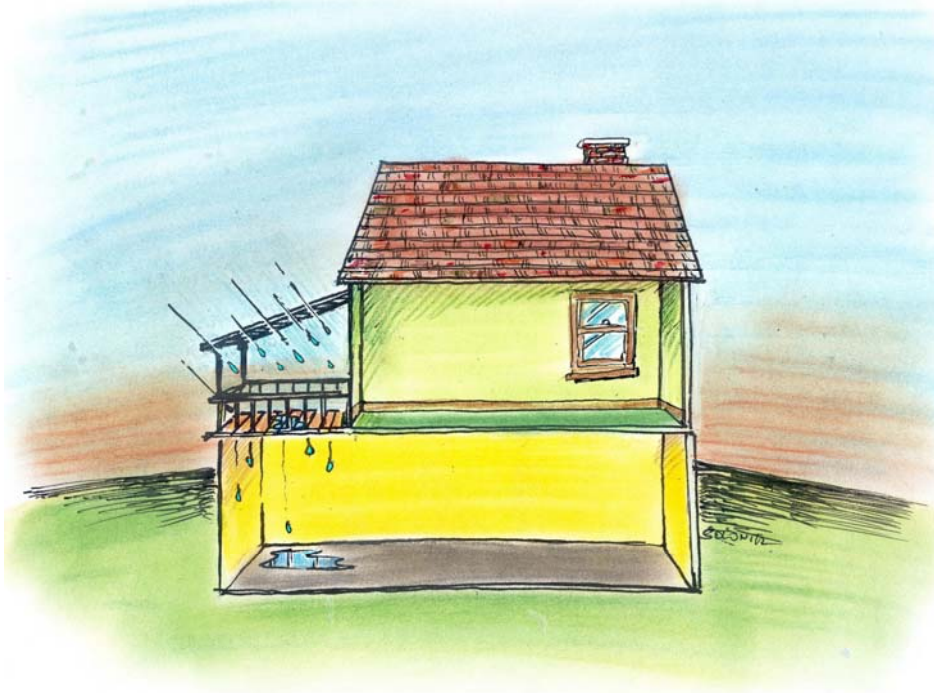
1. The top edge of the EPDM and metal flashing needs to be just above the soil level, so chances of water entering that edge are reduced.
2. Because downspout locations are often where worst surface water issues can occur due to overflow of clogged gutters/downspouts and often drop at a foundation corner, wrapping the EPDM around a corner for a couple of feet can help keep this type water problem from penetrating around a corner.
3. If the EPDM is applied between the foundation walls and a driveway, wrap the EPDM up along the soil under the driveway so water will not be carried along the EPDM and under the driveway where frost heaving might do damage to the driveway.
4. Where significant water accumulation might be anticipated (from a large sloping yard), a drain tile wrapped in geotextile could be installed at the end of the trench and then run a few feet beyond the end of the foundation wall into a gravel bed that could accumulate this water and permit time for it to evaporate.



• **Treat a porch floor like a roof:**

**Problem:** In Cleveland there are hundreds of homes which have the

foundation extending out under the front porch. Over time damage to the porch flooring leads to rain water and snow melt dripping into the basement resulting in moisture issues in the living space under the porch. It is not uncommon to find mold growing on the floor joists under this porch flooring and on all manner of materials stored there.

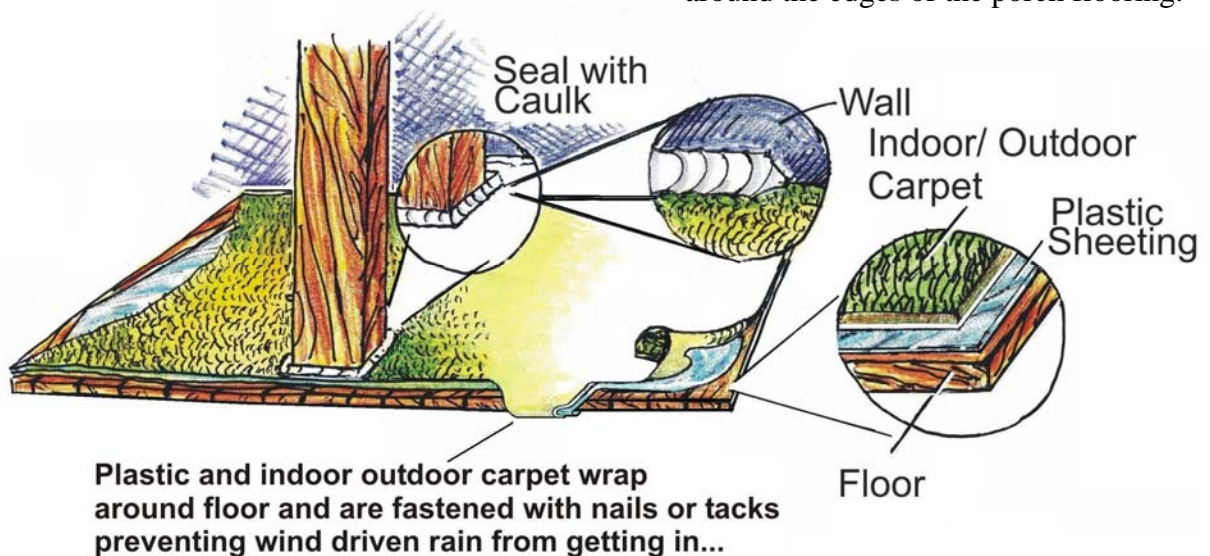


**General Approach:** Install a surface treatment on the porch floor that will keep the moisture from penetrating to the interior.

**Treatment:** An expensive solution, which this program could not afford, is to remove the existing porch flooring, install plywood or OSB underlayment, install felt roofing paper on the underlayment, and then install new tongue and groove flooring. In other

words, treat the surface as you would a roof.

Our low-cost treatment was to install two layers of 6 mil plastic over the existing flooring, making sure it was effectively fastened and sealed against the house wall and any support posts that were set on the porch surface. We would then install indoor/outdoor carpeting on top of the plastic material, securing this flooring as it wrapped around the edges of the porch flooring.



**Potential Problems and Solutions:**

1. A worker safety issue involves having rubber sole shoes when installing the plastic because the plastic surface is so slippery a worker could fall and injure him/herself.
2. There is good news and not so good news with this technique as it relates to lead in the porch floor paint. Research shows that a lot of lead tracked into a house comes from chipped porch floor paint. By covering this flooring with the plastic, we eliminate this tracking problem and the cost of remediating it. But, indoor/outdoor carpeting

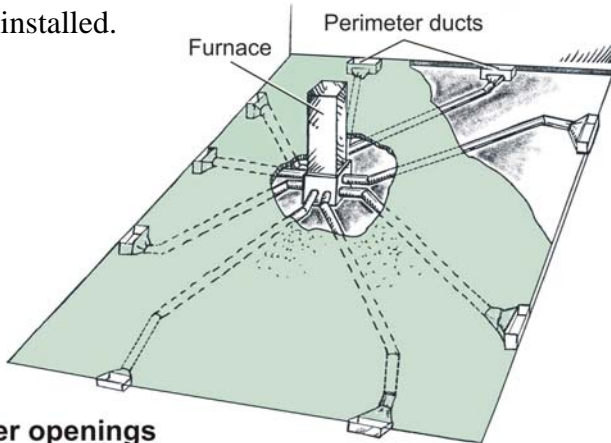
- can accumulate some lead dust tracked onto from soils around the house that have significant lead levels.
3. Because the porch flooring is exposed to the exterior, once the surface has been made moisture-proof, there is the potential for excessive interior moisture vapor condensing on this cold surface. Insulating the underside of the porch flooring could be considered, or the space could be opened to the heated basement space so dewpoint temperatures would be less likely to occur.

- **Eliminate sub-slab ductwork and heating systems:**

**Problem:** In the inner-ring suburbs of Cleveland there are a sizeable number of housing units built on concrete slabs that have their heat ducts running under the slabs. Over time, this ductwork develops holes which permits water to enter. When this occurs during the heating season, the combination of air movement and moisture presence results in the whole duct system becoming a giant humidifier dumping lots of moisture vapor into the living space where it condenses on all the coldest exterior wall surfaces it can find. The result can be rampant mold growth throughout the house on exterior walls and ceilings just under the attic area.

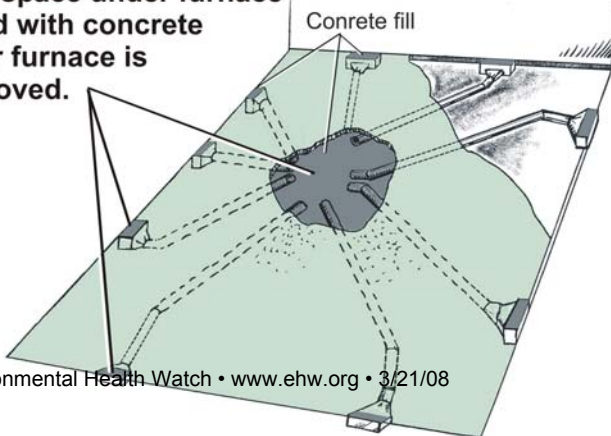
**General Approach:** There is no way to correct the situation and the entire subslab ductwork system must be abandoned, requiring a new updraft furnace and new ductwork be installed.

**Treatment:** Cement is poured into each hole in the concrete slab where a duct has been and it is leveled with the concrete floor surface. A new updraft furnace is installed where the old furnace was located. A new duct trunk line is installed along the ceiling of the first floor and ducts to each room are run from this main run, including to the second floor. A drop ceiling is then put in place to hide this ductwork.



New updraft furnace with new duct trunk line.

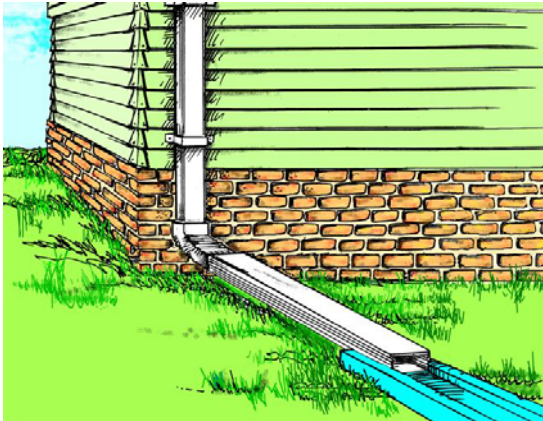
**Register openings and space under furnace filled with concrete after furnace is removed.**



**Potential Problems and Solutions:**

1. It is important to put cement in the old openings or mold spores and moisture vapor from the old ductwork can continue to enter the living space.
2. To avoid having to replace carpeting or patch other flooring after closing off the old system, the heat register covers can be put back on top of the closed off ductwork, so it still looks like it belongs there and fills the space in the flooring.

- **Effectively run gutter systems and disconnect and redirect downspouts:**



**Problem:** Gutter/downspout maintenance is generally very poor in most of the homes we treat. The result is water spilling out of them and eventually penetrating the soils around the house where it often passes on into the basement creating all manner of problems on the interior. In addition, downspouts that are connected to old storm drains underground that are deteriorated and leaking, means lots of water can enter basements through leaking storm drains, usually where the basement floor and walls meet.

**General Approach:** Finding ways to optimize storm water flow that will require minimal and manageable maintenance by the resident is our objective.

**Treatment:** There are four basic treatments for the gutter/downspout system:

1. When possible, we try to get all gutters to run all the way to the front of a residence so there is less chance of needing to use underground storm drains alongside the house to carry water to the street.
2. We make sure the gutters are effectively secured to the fascia

board that holds them and replace damaged fascia as required.

3. We make sure that the gutters are properly pitched so water flows effectively.
4. If the underground storm drains seem ineffective, we remove downspouts from these drains and install extensions and/or splash-blocks that carry water at least 5' from the foundation of this house or a neighbor's house. Rain barrels for garden watering can also be incorporated.

**Potential Problems and Solutions:**

The installation of hooded gutters that keep debris out of them would be very helpful in most of the homes we treat, but at nearly \$10 a foot installed, it is simply too expensive for our programs. The result is that gutters/downspouts are our most troublesome task and where, over time, we are the least successful. On return visits to sites, it is not uncommon to find the extensions we have installed either removed altogether or not facing properly.



- **Remove wood shelving from basements:**

**Problem:** In the basements of many older homes, there is wood shelving that is often secured to the exterior foundation walls where over the years it is subjected to moisture leakage through those walls. The result is mold growth on the framing and shelf surfaces.

**General Approach:** There is usually little or nothing that can be done to restore this shelving to a useful state, so we have generally removed any shelving that appears to be severely compromised by moisture.

**Treatment:** After removing the old wood shelving, we install plastic

shelving kits that include up to five shelves that are as much as 16” deep and 4’ wide. In addition, this shelving has holes in each shelf that allows air to flow through thus reducing the chance of mold growth in anything on the shelving.

**Potential Problems and Solutions:** There is usually no problem with this shelving itself, but getting residents to use it regularly and effectively can be a challenge. It is not uncommon on our return visits to these sites to find boxes and paper on the damp floors where mold can grow and there is nothing on the shelves.



- **Reduce moisture levels in foundation crawlspaces:**

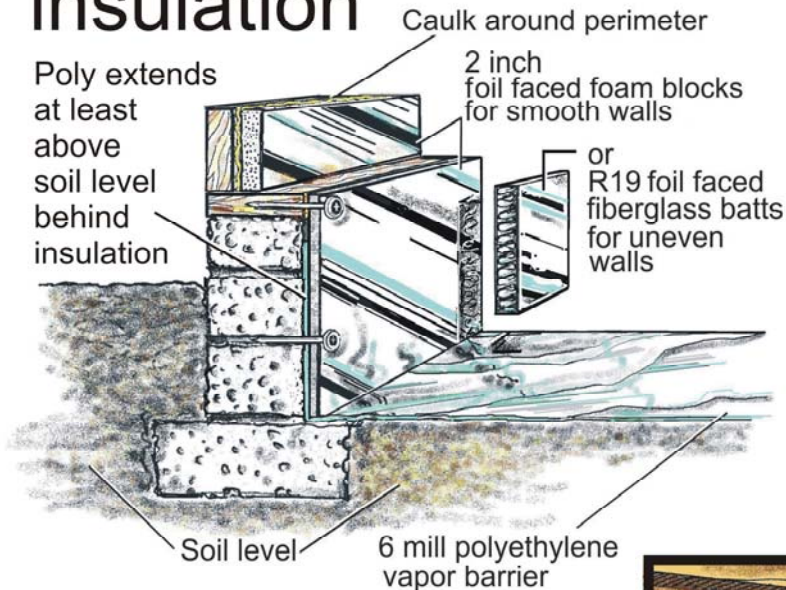
**Problem:** There are hundreds of homes in Cleveland that are built over crawlspaces with open soil floors. While it is not visible, this soil emits lots of moisture vapor which can result in mold growth in the floor system above the crawlspace as well as on any cellulose materials that have been stored in this area. It can also contribute to higher

moisture levels in the rest of the house that could result in additional mold problems. In addition, this kind of crawlspace often was vented directly to the exterior with several vents installed around its perimeter. In moist air months as much moist air could enter such a crawlspace as could be removed, thus creating a problem, not solving one.

**General Approach:** The basic tact with this problem is to use a method to seal the soil surface of the crawlspace so moisture vapor cannot escape and eliminate the need for the exterior vents.

**Treatment:** the basic treatment is to cover the soil surface with 6 mil polyethylene plastic sheeting, carrying it at least above soil level around the exterior walls and sealing all seams so moisture vapor is trapped beneath the plastic sheeting.

## Interior insulation

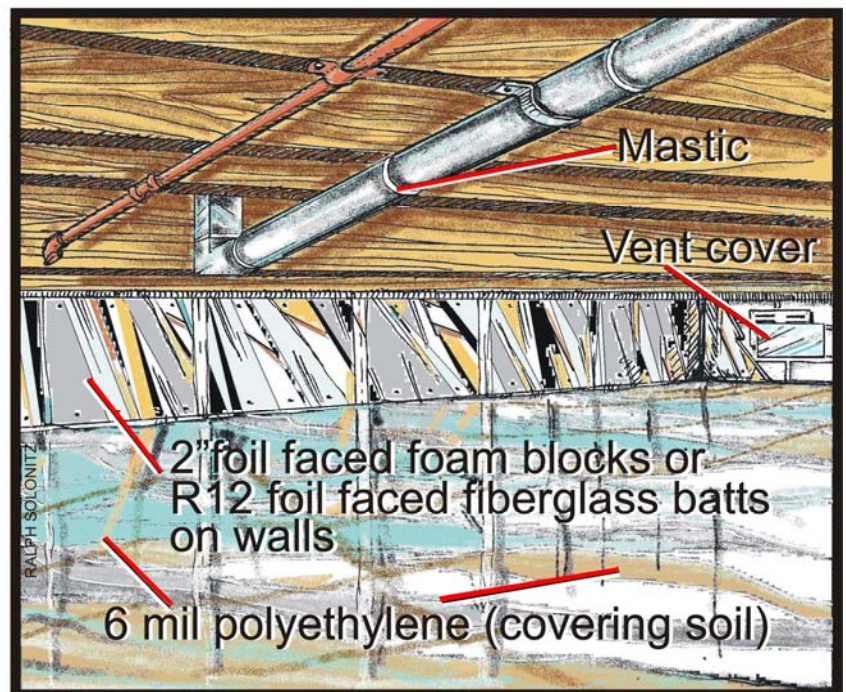


### Potential Problems and Solutions:

1. Sometimes when this treatment is used, there can be some minor cracking of plaster in the rooms above the crawlspace, because the wood framing there no longer experiences the high levels of moisture from the previous conditions and it can shrink a bit.
2. After this treatment, insulating the perimeter walls of the crawlspace can result in both

significant energy savings for the whole house and increase comfort in the living space above the crawlspace because the crawlspace is now left open to the rest of the basement and the heat that enters is not lost to the outside walls.

3. In many older homes with crawlspaces, ductwork would run through that space and it would lose heat to the crawlspace and pickup mold spores that could be deposited in the living spaces above. Sealing this ductwork can stop the mold spore pickup and leaving this ductwork uninsulated in a crawlspace that has been insulated means the floor above will be more comfortable.
4. It is not uncommon in crawlspaces to find evidence of rats burrowing under the walls and entering the space. When this occurs, and if funding permits, we would recommend what we call a "rat slab" or 2" of concrete slurry poured onto the plastic covering in the crawlspace which will keep the rats from being able to enter.



- **Repairing roof leaks and roof sheathing with mold growth:**

**Problem:** When roofs leak their damage is usually limited to a specific and hopefully small area, but sometimes the damage can be severe enough to cause major repair and even some mold growth when the repair is not done in a timely manner. Also, if interior moisture conditions are excessive and there are openings into the attic spaces for this moisture to enter, there can be mold growth on the rafters and sheathing of the roof after moisture condenses there.

**General Approach:** Find and seal all holes that could be allowing moisture to enter from the exterior and find and seal all holes that could be allowing interior moisture vapor to enter the attic space.

**Treatment:** Wet or damaged plaster seldom produces the mold issues we are

concerned about and while roof sheathing with mold on it can result in severe damage to the roof, it is not likely to be a major concern unless it were necessary to spend a lot of time taking things in and out of the attic crawlspace where the mold is located. One of the values of this program has been air sealing work being included as part of the weatherization work and this can dramatically reduce moisture vapor entry into attic spaces.

**Potential Problems and Solutions:**

There are few public dollars available to low/moderate income homeowners to make necessary roof repairs or replacement. Plaster/drywall damage is usually manageable within the parameters of programs such as this one.