

## Moisture Mitigation System Closed Crawl Space

### Getting Started

Many homes built on crawl space foundations suffer from poor moisture management. Some of the common symptoms of a crawl space moisture problem are:

- Mold or moisture damage in the crawl space or living area
- Musty odors in the living area
- Condensation ("sweating") on air conditioning ductwork or equipment
- Condensation on insulation, water pipes or truss plates in the crawl space
- Buckled hardwood floors
- High humidity in the living area
- Insect infestations
- Rot in wooden framing members

For many decades, building codes and conventional wisdom have prescribed ventilation with outside air as the primary method of moisture control in crawl spaces. However, ventilation with outside air only makes moisture problems worse, allowing outside humid air to enter into the cooler crawl space where it reaches it's dew point and condenses.

Through Building Science and research we understand why crawl space ventilation fails and why a closed crawl space system, with NO vents to the outside, can provide greatly improved moisture control and significant energy savings when properly installed.

## Designing Closed Crawl Spaces

The recommended components of a good design fall into six major categories:

### Moisture Management

- A roof runoff system to direct all water away from the house a minimum of ten feet
- Site grading and landscaping that directs ground surface water away from the house
- Foundation drains and foundation dampproofing or water-proofing to protect the structure from sub-surface water
- Air sealing of the access door, perimeter wall and perimeter framing to prevent the entry of moisture-laden outside air and to separate the crawl space from areas under porches or decks
- An access door that is protected from roof runoff, at least 4" higher than the exterior soil grade and made of a non-corroding material
- A fully sealed vapor retarder on the floor and perimeter walls to reduce evaporation of water into the crawl space
- Appliance discharge pipes and exhausts from kitchens, bathrooms and clothes dryers that terminate outside the crawl space
- A mechanical drying system to reduce humidity (for example, a supply of conditioned air or a dehumidifier)

### Pest Control

- A termite inspection gap at the top of the perimeter wall to facilitate detection
- Batt insulation in the band joist area of wall-insulated closed crawl spaces to facilitate inspection or treatment

### Combustion Safety

- Ensure adequate combustion air for fuel-fired appliances, if applicable.
- For homes on slabs, basements or crawl spaces, it is recommended to install carbon monoxide monitors or alarms if the structure has an attached garage or any combustion appliances
- For homes on basements or crawl spaces, it is recommended to install an appropriately placed raw-gas leak alarm if fuel-fired appliances or fuel lines are in the home

### Fire Safety

- Air sealing of all penetrations in the subfloor with non-porous materials
- For homes on slabs, basements or crawl spaces, it is recommended to install smoke detectors or alarms on each floor

### Thermal Insulation

- Insulation at the perimeter wall to provide the R-value required by the local residential code. Note that perimeter insulation may be located on the interior surface, exterior surface or inside the perimeter wall, or the perimeter wall itself may provide the required R-value
- Insulation at the sub-floor is not recommended
- Insulation on the crawl space access(es) of minimum R-2

### Radon Control

- In areas where radon is a risk or where the local residential code requires control of radon or other soil gases, houses with closed crawl space foundations can be tested, monitored and, if necessary, mitigated with the same techniques used for houses with a slab or basement foundation in the same region.
- The U.S. Environmental Protection Agency and the Surgeon General recommend testing all homes for radon



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1. Exterior water control must be maintained by the client. Keep gutters clean of debris, extend downspouts a minimum of ten feet from the foundation, and grade away a minimum of one-inch per foot for ten-feet.
2. A four-inch corrugated pipe with perforations is installed in a closed-loop around the crawl space perimeter. This pipe is installed under the vapor barrier and connected to a high efficiency fan.
3. The high efficiency fan pulls the ground moisture from beneath the vapor barrier and exhausts to the exterior.
4. A 6-mil poly vapor barrier or a 4-mil High Tensile Strength poly is installed over the entire floor and up the perimeter walls and piers. Seams are to be taped using manufacturers recommended materials.
5. Seal the top of the vapor barrier to the foundation wall and piers.
6. Leave a minimum of a three-inch termite inspection gap between the top of the vapor barrier and the top of the foundation wall.
7. Seal penetrations through the building envelope such as the mitigation fan, air conditioning plumbing, electrical wiring, and/or dryer vents.
8. All foundation vents in exterior walls are to be sealed and reasonably air tight.
9. Certain applications may require multiple supply vents from the living space to the crawl space in order to provide conditioned air.

\* After completion of converting the crawl space to a mini-basement, a dehumidifier may need to be installed into crawl space to achieve optimum humidity levels, the same as any basement.

