Crawl Space Science: Vital Principles

Basement Systems®

CleanSpace® Crawl Space Encapsulation System®

OLD: Vented Dirt Crawl Space Problems

Where is "IN"? Where is "OUT"? Upstairs is clearly inside the house. Outdoors is outside. But what is the crawl space? It's not inside, it's dirty and nasty and outside air is coming in. But you wouldn't put ducts "outside" the house—or pipes and exposed insulation. The crawl space is an in-between, ill-defined world of dysfunction.

Organic Materials ⊕ High Relative Humidity = Mold **Wood ⊕ 70% (or greater) RH = Mold** **Wood ⊕ 90% (or greater) RH = Rot**

If upstairs is "IN" and the crawl space is "OUT", it would require an intact air barrier and thermal barrier between them. The crawl space ceiling is neither. It has pipe, wire and duct holes, and the insulation is sagging out of open cavities.

Insulation is used between the heated and unheated spaces. The R-value of insulation is tested in a six-sided closed cavity. Installing insulation in an open cavity reduces its R-value by half or more. R-19 is reduced to R-9!

Gravity Causes insulation to sag away from the sub-floor. Outdoor air can get between the insulation and floor. This is a thermal bypass and short circuits insulation—making R-value zero!

Moisture is thermally conductive, and wet insulation loses up to half its R-value. Damp insulation is heavy & can fall to the floor.

Crawl space moisture getting up in the attic during winter is a roof rot risk.

Crawl space access doors aren't sealed and allow outside air in. Often they are rotted from the damp environment near the ground.

The soil is damp. Water vapor goes from more to less (higher concentration to less concentration).

The foundation, often porous hollow block, was not waterproofed. Rain saturates the soil and leaks in, and slowly evaporates upward into the house.

Vents were supposed to let moisture out. Instead, vents let the cold air enter during the winter, and warm humid air enter during the summer.

It's All About Psychrometrics

- Warm air can hold a LOT more water than cold air. Cold air can hold a lot less water than warm air. For every 1° we cool the air, we raise the relative humidity by about 2.2%
- The earth is cool. The below grade crawl space is too. Summer air is hot. By bringing summertime air into a cool crawl space, we make that air smaller without taking any water out of it—the relative humidity goes up!

Over ***70%*** *RH* **Mold** *Over* ***90%*** *RH* **Rot** ***100%*** *RH* **Condensation**

Pests!

- Termites love wet wood.
- Mice love crawl spaces and nest in insulation.
- Crawl spaces attract bugs. Bugs attract spiders.
- If raccoons and opossums can get in, they will.

The crawl space cools heating ducts, and heats cooling ducts—a big energy loser.

Ducts in a crawl space are outside conditioned space. Would you run ducts from the furnace, then outside, the to the room you want to heat?

Ducts leak, and when they leak into the vented crawl space, the air you paid to heat or cool is leaking outside the house.

Mold, rot, bugs, pests, energy penalties: A home with a vented crawl space is more expensive to own.

©2020 Basement Systems, Inc. PN 16134

New: CleanSpace® Transformative Solution

1. **Fix groundwater seepage:** SmartPipe, SmartSump, UltraSump back-up
2. **Isolate the house from the earth:** Drainage matting, CleanSpace
3. **Seal outside air out:** Seal vents, insulate walls, wall cap, seal rim joists, EverLast door
4. **Dehumidify:** SaniDry Sedona

Without touching the ducts, we have now moved them "Inside" to conditioned space. They don't cool in winter, or pick up heat in summer, and "accidental" duct leakage helps condition the crawl space and warms the floor above.

After CleanSpace, the crawl space is clearly "Inside"—it's conditioned space with an effective thermal and air boundary between it and unconditioned space (outside).

Remove old insulation—or leave it there. It's not doing anything in a conditioned crawl space.

Pipes are now "inside" the house.

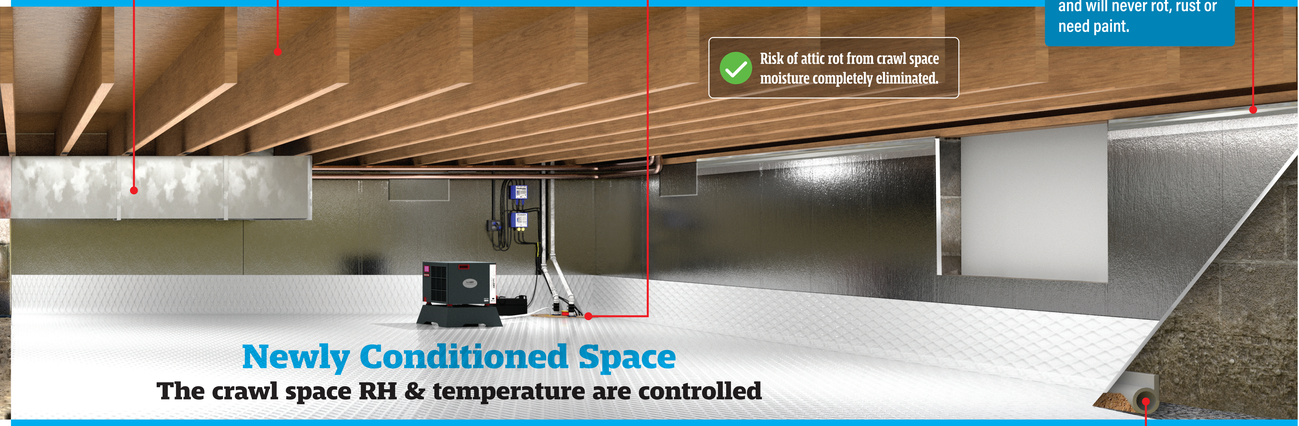
SmartSump: Designed just for crawl spaces. Airtight lid to prevent water evaporating into the crawl space. SmartSump is located in a low spot, just where plumbing leak water will run. SmartSump has an airtight floor drain, and alarm to alert the residents of the leak.

UltraSump battery back-up pumps water out of the crawl space in the event of a primary pump failure or power outage.

Foam insulation is on the walls where the thermal boundary should be—between conditioned and unconditioned space. **Foam does not have to be in a closed cavity to preserve its R value.**

L-shaped, transparent **WallCap** seals the top of block walls and allows termite activity to be seen.

EverLast doors provide an air seal around crawlspace entrances and will never rot, rust or need paint.



Newly Conditioned Space
The crawl space RH & temperature are controlled

Drainage Matting and CleanSpace—A Formidable Combination

Drainage matting prevents abrasion holes in the CleanSpace, provides a drainage space, and the airspace is a thermal break between the cold earth and the CleanSpace—raising the temperature of the CleanSpace more toward the indoor temperature, not the earth temperature.

Dry Air: The ultimate disinfectant. Air is tiny, it gets everywhere. Every nook and cranny, in between joints and cracks—everywhere. Dry air is the best way to prevent mold—even where you can't see it.

Air conditioning runs much more efficiently, using less energy, without the latent load of all that moisture from the crawl space.

Uncoupling the House from the earth. CleanSpace is a effective boundary. 20 mil thick, cord reinforced—it will last as long as the house.

Bugs don't prefer dry spaces.

DID YOU KNOW?
The term "crawl space encapsulation" was created by Larry Janesky in 1999.

SaniDry Sedona was engineered for crawl space environments. High performance in cool temperatures found in crawl spaces, and compact to fit in small spaces. The Sedona ensures the Relative Humidity stays below 65%, which prevents mold growth. 310 CFM blower circulates dry air everywhere.

SmartPipe around perimeter of crawl space requires no heavy crushed stone.

Mold Solutions

- **MoldX2:** Removes mold. Bleach odor for 1/2 day, full PPE and respirator required.
- **Shockwave:** kills mold but you can still see it. No odor.

Using these principles, Larry Janesky at Basement Systems invented CleanSpace in 1999 which created an industry, affected building codes and changed the fate of 28 million homes.

No mold, no rot, no energy penalties, less bugs/pests. A home with CleanSpace is less expen$ive to own!

Not shown: Turtl access door, SmartDrain

CONTRACTOR NATION

Concepts & educational poster by: Larry Janesky