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CRAWL SPACE SCIENCE

Crawl Space Mold: What Homeowners Need to Know

What causes mold under a house, when it matters, what removal actually involves, when testing is worth paying for, and how to verify that the problem is fixed.

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November 2026 · Version 1.0



A typical coastal Virginia finding. Fungal growth across the framing, with old fiberglass insulation falling out of the floor system.

Summary

Mold in a crawl space is a symptom. The cause is moisture: humid outdoor air, condensation on cool surfaces, water intrusion, or a combination. Remediation is not mysterious. Contaminated materials that cannot reasonably be cleaned are removed, the wood is physically cleaned, the moisture problem is corrected, and the crawl space is kept dry.

This paper explains each of those steps for homeowners and the contractors who serve them, with a focus on the older, low, vented crawl spaces common in the coastal Southeast.

Key points

- In a HUD-funded Duke University study, Advanced Energy inspected 45 vented crawl spaces in North Carolina and found visible mold in **62%** of them; **67%** had wood moisture readings at mold-supporting levels of 19% or greater [1].
- Mold color does not identify the species or its hazard, and it does not change how the wood should be cleaned.
- The EPA states that sampling is usually unnecessary when mold growth is visible [2]. Testing is useful in specific cases, not as a routine step.
- Spraying or fogging a chemical is not the same as removing contamination, and neither one corrects the moisture that caused it.
- Success is verified by clean wood, a working moisture-control system, and wood moisture content that stays below **16%** through the worst summer months.

1. What causes crawl space mold

Mold grows where there is enough moisture for long enough. In a vented crawl space in a humid climate, that condition is common, not exceptional. The Duke University study found visible mold in 28 of 45 wall-vented crawl spaces it examined in Durham, New Hanover, Wayne and Wilson counties [1]. The sample is small, and it does not mean that exactly 62% of all homes have mold. It does show how ordinary the problem is where summers are hot and humid.

Sixty-two percent of crawl spaces had visible mold
Twenty-eight (62 percent) of the crawl spaces were observed to have visible mold (fungi). Sixty-

Figure 1. "Twenty-eight (62 percent) of the crawl spaces were observed to have visible mold (fungi)." Advanced Energy, *Crawl Space Characterization*, prepared for the Duke University study funded by HUD, September 30, 2005, p. 44 [1].

Condensation and the dew point

A cold can of soda taken outside on a summer day collects water within minutes. The water comes out of the air: when warm, humid air touches a surface colder than its dew point, some of its water vapor condenses into liquid. The dew point is the temperature at which that happens.



Figure 2. The cold can. Humid outdoor air condenses on any surface below its dew point.

Under an air-conditioned house the same thing happens. Humid outdoor air enters through foundation vents and other openings and meets ductwork, plumbing and sometimes framing that the conditioned space above has cooled. When those surfaces are below the dew point, condensation forms. Even without visible water, sustained high humidity lets wood absorb moisture. Over weeks or months, that is enough for mold. No broken pipe or standing water is required.

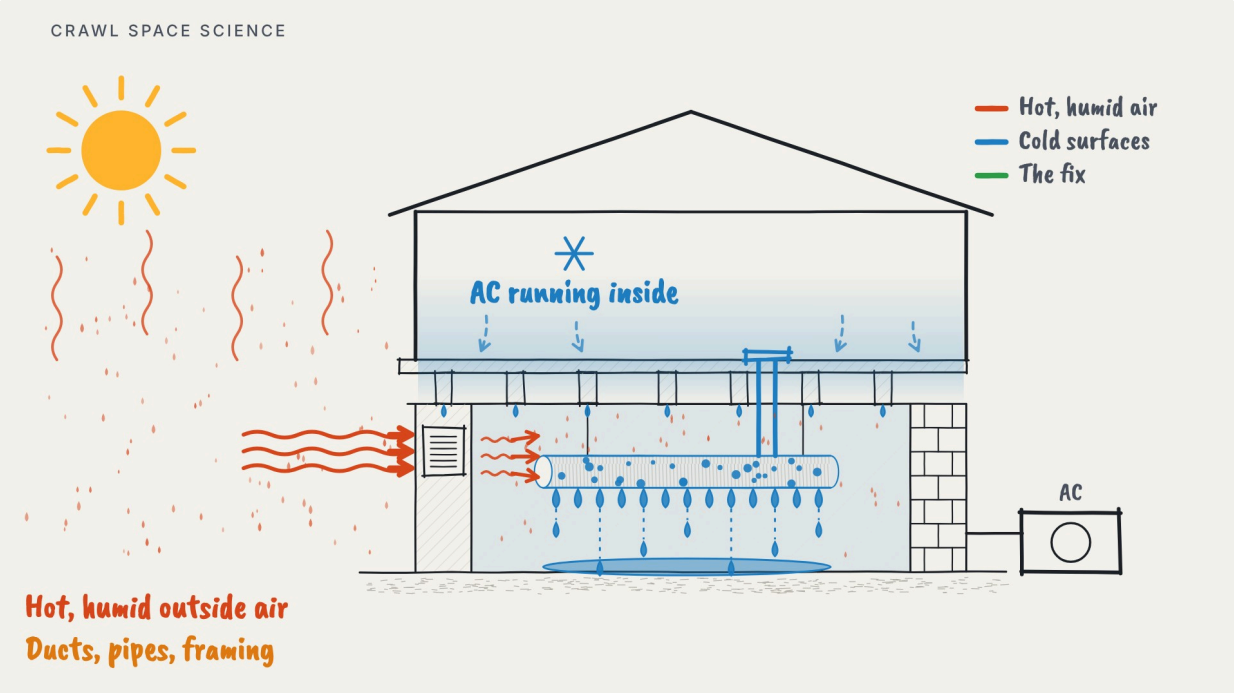

Figure 3. A vented crawl space in summer. Hot, humid air enters through the vent and condenses on cool ducts, pipes and framing.

2. Is it dangerous?

To the people in the house

Mold exposure can cause coughing, itching, irritated eyes and allergic reactions, and it can make asthma worse. Sensitivity varies widely from person to person. A crawl space is not sealed off from the living space: air moves up through openings around plumbing, gaps in the floor and leaks in ductwork. That does not mean everyone living over a moldy crawl space will get sick, but it is a real pathway and worth taking seriously.

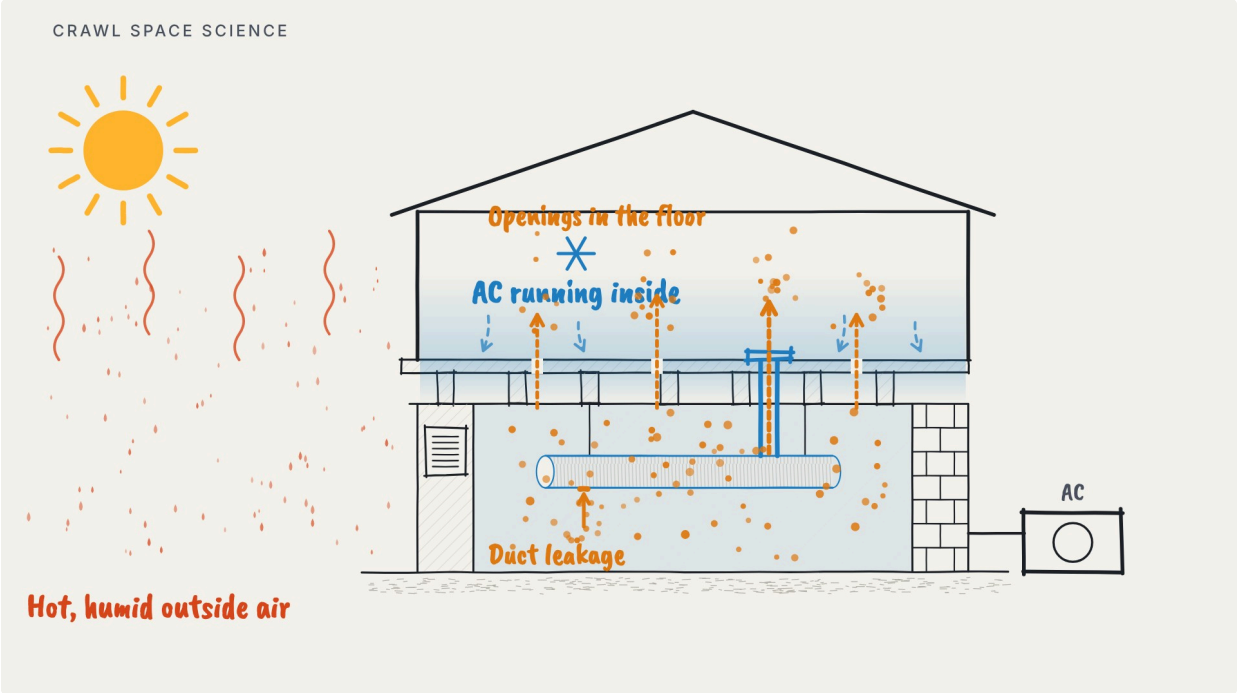

Figure 4. Crawl space air reaches the living space through floor openings and duct leakage.

To the house

Picture wet towels wrapped around the floor joists and air conditioning ducts. Every summer they get damp; every winter they dry out. Repeat for 25 years. That is a fair picture of what happens to the fiberglass insulation under many older homes: it gets damp, collects dirt, can become contaminated, and falls apart. Old duct insulation has the same problem.

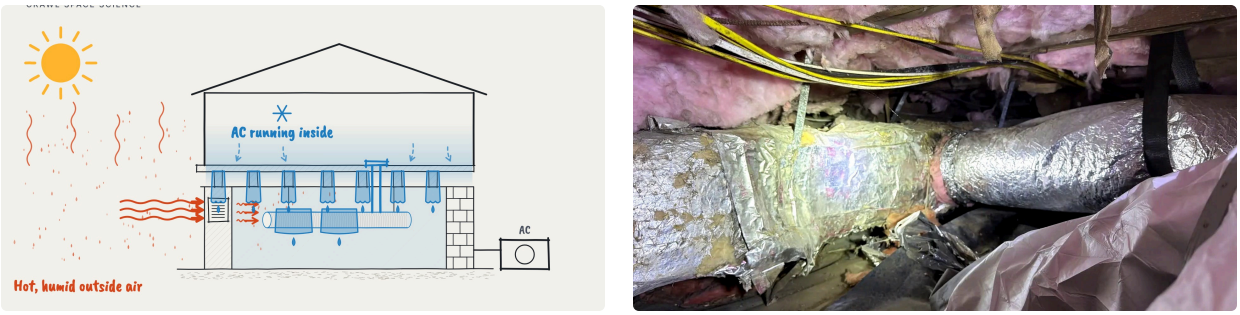

Figure 5. Left: the wet-towel picture, summer. Right: fiberglass and duct insulation after years of seasonal wetting.

Mold on wood is not the same as wood rot. But the moisture that supports mold can also support wood-destroying fungi, which over time damage floor framing and subfloor. Finding mold does not mean the house is ruined. It means the source of the moisture has to be found and corrected.

3. Is black mold worse?

Homeowners often assume black growth is more dangerous than white, green or brown. Color cannot reliably identify a species, and it does not indicate how hazardous a growth is. Different molds can cause different reactions, people differ in their sensitivities, and one color on the surface does not mean only one organism is present. Several molds and other fungi commonly grow in the same crawl space.

Color does not change the work. The amount of contamination, the materials involved and the moisture problem determine the scope. A more expensive cleaning process is not justified because the growth happens to be black.

4. Does every bit need to be removed?

Scope should match conditions. A few small spots of suspected growth on sound wood, with little visible contamination and no other major problems, can reasonably be left alone while the moisture is corrected and conditions are monitored. Obvious fungal growth across joists and subfloor should be cleaned. Fiberglass insulation that is old, dirty, falling down or contaminated should be removed. Ductwork that is old, leaking, or wrapped in mold-contaminated insulation that cannot reasonably be cleaned should be replaced; dirty ductwork alone is not a reason to replace it.

Staining is not active growth. Wood can stay discolored after it has been properly cleaned.



Figure 6. Cleaned framing. Discoloration can remain after the visible fungal growth has been removed.

5. Can a homeowner do it?

Cleaning mold is not proprietary. It means cleaning contaminated hard surfaces and removing contaminated materials that cannot reasonably be cleaned, the same principle as cleaning a dirty shower. The difference is scale and conditions. A shower might have 50 square feet of surface. A crawl space can have thousands of square feet of wood, worked from a two-foot space on your stomach, around ductwork and plumbing.

The work also requires proper protective equipment, a plan for removing materials without spreading contamination into the house, and the knowledge to deal with damaged wood, extensive contamination or groundwater intrusion. A small, accessible area may be a reasonable homeowner project. A large crawl space with insulation removal and moisture control is a different amount of work.

6. Is mold testing worth paying for?

Usually not. When mold is visibly growing on the wood, a test confirms what is already known. The EPA's homeowner guide states that in most cases, if visible mold growth is present, sampling is unnecessary [2]. Identifying the species rarely changes the work: the contamination still has to be cleaned and the moisture corrected.

Testing can help when it is unclear whether something is mold, when there is a dispute about conditions, or when there is a specific reason to identify the organism. The same logic applies after cleaning. A homeowner should be able to inspect the finished work; old staining may remain, but visible growth should be gone. Additional testing is optional, not automatically necessary.

7. Spraying and fogging versus cleaning

Spraying mold with a chemical is not the same as removing it. A product may kill some organisms or suppress growth for a while, but the contamination can remain on the wood, and dead mold can still cause allergic reactions [2]. If you hired someone to clean a moldy shower and came home to mold on the tile, "I treated it" would not be an acceptable answer. The same standard applies under the house.



Figure 7. Left: a moldy shower nobody would accept as "treated." Right: treated crawl space framing with the growth still on the wood.

Cleaning products are useful when they are used to remove growth. Neither spraying nor cleaning corrects humidity, condensation or water intrusion, so mold that was only treated, or cleaned without fixing the moisture, often returns within a year or two.

8. The proper removal process

1. **Remove what cannot be cleaned.** In older crawl spaces this usually means old fiberglass insulation, damaged vapor barriers and other contaminated materials.
2. **Physically clean the wood.** Patriot uses YCS Pro Cleaner, a hydrogen peroxide-based product (under 17% hydrogen peroxide per its safety data sheet), applied according to the label, given the required dwell time, then followed by wiping away remaining visible growth.
3. **Correct the moisture.** In a typical coastal Virginia crawl space: seal foundation vents and unwanted openings, install a ground vapor barrier, exclude rodents, and dry the air with conditioned supply air or a dedicated dehumidifier, depending on the layout. Groundwater or standing water needs its own drainage solution.



Figure 8. Physical removal: wiping the framing after the cleaner has had its dwell time.

Expensive coatings, special vacuuming and other add-on procedures sometimes have a legitimate purpose, but they are not automatically necessary for surface mold on sound framing. Procedures designed for occupied, finished interiors, where furniture and belongings must be protected, do not all transfer to exposed wood in a crawl space. Worker protection and keeping contamination out of the living space still apply.

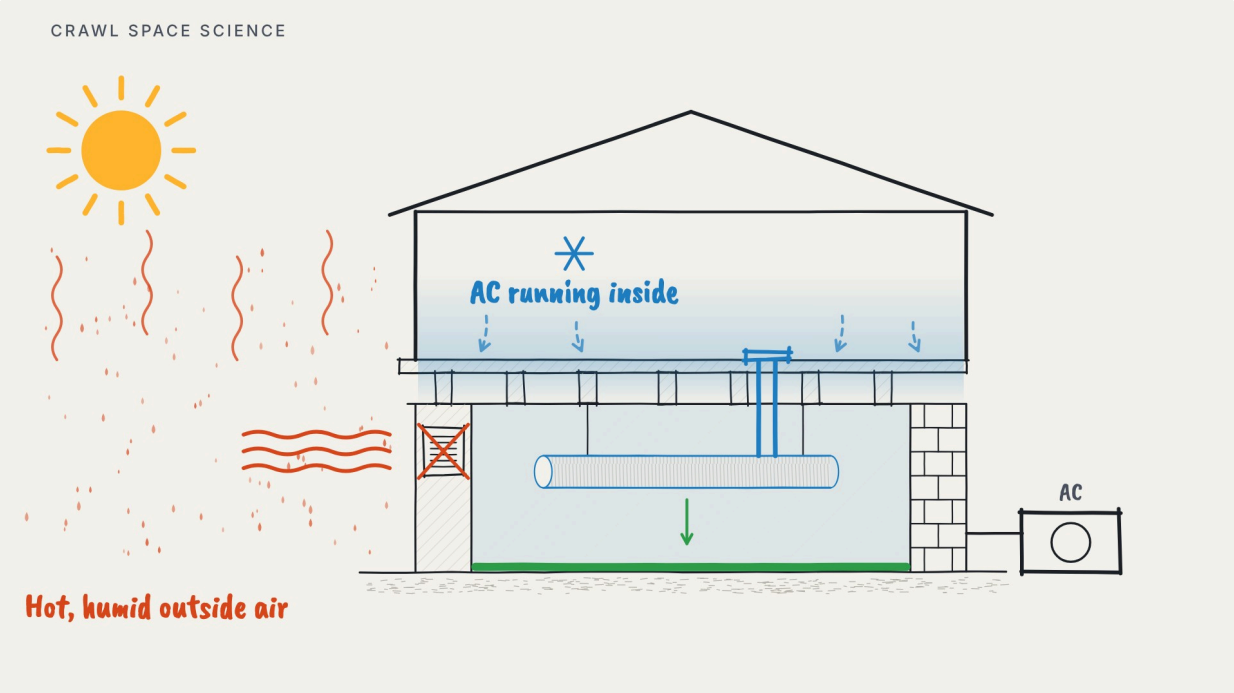

Figure 9. Moisture corrected: vents sealed, a ground vapor barrier only (not run up the walls), and conditioned supply air drying the space.

9. How to know it is fixed

Three checks: Is the wood clean, meaning visible growth removed rather than sprayed? Is the moisture-control system working? Is the wood staying dry?

Wood moisture content is the most direct measure. Patriot's target is below **16%** during the worst summer months, and around **11%** most of the year. For comparison, the Duke University study treated readings of 19% or greater as mold-supporting [1].



Figure 10. A wood moisture meter reading on crawl space framing.

Relative humidity versus dew point

Relative humidity depends on temperature, so it can mislead. A crawl space dried with conditioned supply air may run around 70% RH in peak summer, while one with a dehumidifier may run around 55%. The cooler supply-air crawl space can show the higher RH reading while holding about the same amount of water vapor. Dew point measures the moisture in the air in a way that compares fairly across temperatures.

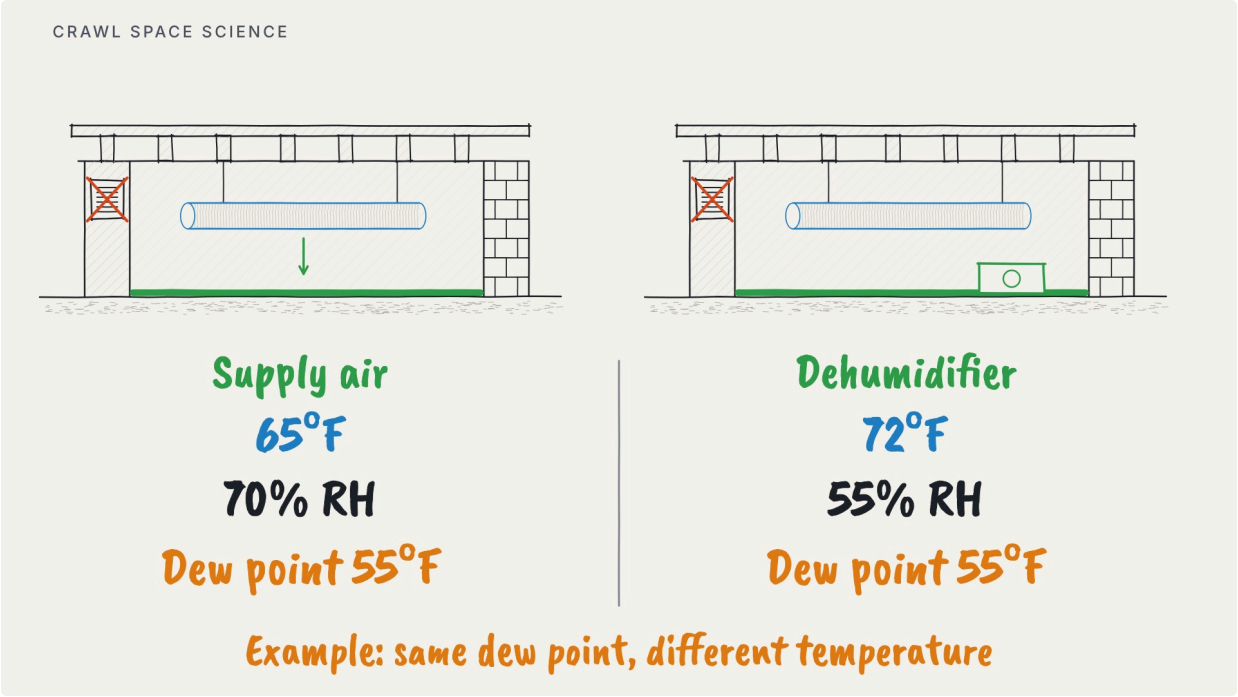

Figure 11. Example: at a 55°F dew point, air at about 65°F reads about 70% RH, and air at about 72°F reads about 55% RH. The temperatures are illustrative.

> **Monitoring still matters.** Dehumidifiers fail, new air openings develop, plumbing leaks and drainage changes. A simple temperature and humidity sensor lets a homeowner see changes without crawling under the house. Judge performance by temperature, dew point and, above all, wood moisture, not by a single RH number.

References

[1] Advanced Energy. 2005. *Crawl Space Characterization: Characterizing Crawl Spaces as Sources of Mold in the Home Environment.* Report submitted to Duke University (lead agency) and the U.S. Department of Housing and Urban Development (funding entity), September 30, 2005. p. 44. advancedenergy.org

[2] U.S. Environmental Protection Agency. A *Brief Guide to Mold, Moisture and Your Home.* epa.gov/mold

About the author



Robbie McCarty is the owner of Patriot Crawl Space Repairs in Hampton Roads, Virginia. He personally inspects more than 600 crawl spaces a year and has been involved in building, renovating, inspecting and selling homes across roughly three decades in Virginia construction and real estate. He holds a Virginia Class A contractor's license, a master plumber license, a licensed pest control operator credential and MICRO certification as a mold remediation contractor.

His company specializes in structural repair, mold remediation and moisture control in the hot, humid coastal Southeast. His Crawl Space Science video series and technical papers document what works, and what does not, in this climate.

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