Mold isn’t a bad thing. Without it, we wouldn’t have beer, blue cheese, or penicillin. When mold starts attacking the inside of your house, however, it is a bad thing. Even before the memorable onslaught of hurricanes in 2004 and 2005, we’d seen a lot more moldy buildings. Mold claims in Texas alone increased by five times a few years ago and cost home-owners’ insurers more than $1 billion in 2001. Why?

Mold is a water problem. Excluding the flooding in the Gulf states, though, there suddenly isn’t more water, so why is there more mold? The problem is that the water we’ve always had is hanging around in a new generation of building materials that can’t tolerate water as well as yesterday’s building materials could. Today’s building materials are also more palatable to mold because they’re more refined. Many of the wood products that make our lives convenient during the construction process can make our lives inconvenient later on. These deficiencies don’t show up, though, until something bad happens. It can be a single event like a hurricane, or an ongoing event like a roof valley that lets water into the house every time it rains.

While “toxic mold” makes headlines, news stories tend to offer more hype than hope. It’s really not difficult to avoid mold problems if you understand how mold works. Getting rid of mold isn’t so difficult, either.

Mold likes sugar, and trees are made with sugar. To engineers like me, trees are just big batteries. Let me explain: A tree stores the energy it converts from the sun (through photosynthesis) in the form of glucose, which is a hunk of sugar. When we burn the tree, we convert the energy in glucose into heat. Mold prefers the sugar found in dead plants, which is in the form of cellulose. Unfortunately, we build houses out of dead plants and

—Stephen L. Quarles, Ph.D., is a wood-durability adviser at the University of California Cooperative Extension and is based in Richmond, Calif.

Can moldy framing lumber cause rot?

Mold can grow on framing lumber as soon as it leaves the sawmill. You’ve probably seen the telltale black stains on bundles of 2x material at the lumberyard. But mold growth on studs is mostly a surface phenomenon; if it bothers you, you can wash off the spore-producing fruiting bodies of mold and sapstain fungi with soap, water, and an abrasive pad. Decay, or rot, is caused by different fungi, ones that can attack the cell walls of wood and eventually cause structural failure.

Because of the extractives in heartwood, both mold and decay fungi prefer sapwood. Framing and sheathing are made from tree species with lots of sapwood (southern yellow pine, Douglas fir, aspen, spruce); as a result, today’s houses have more potential mold and decay food than earlier houses built with lumber such as chestnut, oak, hickory, and other hardwoods as well as lumber cut predominantly from the heartwood of softwood species.

Wet framing lumber can support the growth of mold and decay fungi, but by itself, moldy lumber can’t cause rot. It takes a decay fungus to do that. Because the growth rate of decay fungi is relatively slow compared with mold, you are more likely to see mold growth. As long as wetted lumber isn’t wet too long and the dried lumber stays dry, you won’t see decay fungi.

Today’s houses make it easier for mold to find the food and water it needs to thrive. The cure is a quick cleanup and smarter choices in materials.

BY JOSEPH LSTIBUREK

The Mold Explosion: Why Now?


FINE HOMEBUILDING

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Solid lumber
Even young, violent mold with a bad attitude can’t get the sugar from the old-growth timber-frame structures. That’s because most of the lumber is heartwood cut from species like Douglas fir, white pine, and white oak. Mold can live on a sapwood surface, but it doesn’t mean the heartwood’s common in old buildings.

Sheathing
Rather than cutting the tree into 1/4-in.-thick boards for sheathing, we now peel the tree and smash the layers together under heat and pressure. This heat and pressure cause the wood sugars into mold candy, or plywood. We also flake the mold candy and put the flakes in a vat to make oriented strand board. OSB is the 5am of mold food. Because we peel and slit the tree, we can use smaller trees that are faster-growing and contain mostly sapwood. If you’re mold with the choice between 2x4s and OSB, which are you going to choose? OSB, every time.

Particleboard and MDF
We take those candy fibers, and we grind them down to make sawdust. Then we add nitrogen to make particleboard (the nitrogen is like Cajun seasoning for fungi). We make furniture, cabinets, floors, and sheathing from this. If you’re mold with the choice between OSB and MDF, which are you going to choose? MDF, every time.

Paper-faced drywall
Finally, we grind the sawdust and reconstitute it to make nature’s most perfect mold food: paper. Old mold with no teeth can eat paper. We glue the paper on both sides of drywall and wrap the inside of buildings with it. On commercial buildings, we wrap the outside, too. Even the dumbest of the three little pigs didn’t build his house with paper. Sometimes we color it green to fool the mold and put it in the shower. We glue tile to the paper, and we hose it down with hot water twice a day. Unless you’re mold repeat after me: paper, water, bad.

In a typical 2000-sq.-ft. house, the wood weighs 3000 lb. The buffer capacity is 10% of that, or 300 lb. So the house can hold 500 lb. of water before mold can cause a problem. A gallon of water weighs 8 lb., which is a lousy number to divide by, so for simplicity, let’s call it 10 lb.). So, 500 lb. divided by 10 lb. equals 50 gallons. This house can have 50 gallons of leaky plumbing, bad fishing, and poor drainage, and mold won’t be a problem.

Mold can’t survive and reproduce without water, so the ability of particular building materials to wick away, absorb, and store water (their buffer capacity) is related directly to whether mold can thrive in your house. Materials with higher buffer capacities produce fewer puddles, making it harder for mold to set up shop.

Let’s Compare the Buffer Capacity of Three 2000-Sq.-ft. Houses
Most wood-frame houses average 5% moisture content (MC). When solid lumber reaches MC of around 16%, mold is active. If the MC is under 15%, mold is dormant. Mold becomes a problem when we push the MC from 5% to above 15%. The difference between 5% and 15% is 10% of the typical moisture-storage capacity of a wood-frame house, or 10% by weight. In other words, you generally store 10% of its weight in moisture before mold can break out dormancy and reproduce.

In a 100-year-old masonry house with plaster walls and a rock foundation, the buffer capacity works out to be about 500 gallons.

Can mold make me sick?

Most molds reproduce by making spores, which are small enough to mix and move freely with air. When spores become airborne, you can be exposed three ways: You can inhale spores into your lungs, you can absorb them through your skin, or you can ingest them.

Mold’s musty odor is caused by volatile organic compounds (VOCs) that can create reactions including eye irritation, runny nose, cough, wheezing, laryngitis, headaches, and nausea. Some types of mold also produce mycotoxins that can be irritating to breathe, touch, and ingest.

Remediation workers handling mold-contaminated materials without skin protection have developed skin lesions, skin dryness, and rashes. Similarly, ingesting food contaminated with mycotoxins can cause digestive problems such as diarrhea.

In most cases, the symptoms disappear when exposure is curtailed or eliminated. That’s why it’s important to dispose of moldy materials, stop mold growth, and wear protective gear when doing mold cleanup. See “How do I clean up mold?” on p. 75.

After a flood or sewer backup, more than mold can make you sick. You also could be exposed to bacteria and human pathogens, which can cause sickness or death if you’re not properly prepared to handle them.

—Laura Oatman is a research scientist with the Minnesota Department of Health.

TodAy’s WooD PrOd UTC S are EA sy for MOld To eAT
Refining wood makes the mold nutrients more accessible to mold. As we go through this refining process, we also switch to tree species that are high in sapwood content and make them more susceptible to mold.

Living inside of mold food isn’t too much of a problem as long as we make it hard for mold to eat the food. Unfortunately, as wood is refined from a log to the paper facing on drywall, the cellulose is chopped, baked, ground, and seasoned to become easier for mold to eat.

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Drywall makes the mold nutrients more accessible to mold. As we go through this refining process, we also switch to tree species that are high in sapwood content and make them more susceptible to mold.

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Drying potential has shrunk because of thermal insulation and the lower permeability of roof and wall materials (plastic vapor barriers). The classic example is a commercial building where the dropped ceiling acts as the return plenum. The dropped-ceiling return plenum is connected to the exterior walls, and the interior walls are connected, with insulation in them can’t control airflow or moisture. We’re inadvertently building complex three-dimensional airflow networks.

The last big change in our buildings is that they now have hollow cavities. Walls, floors, and ceilings are hollow cavities. These hollow cavities with insulation in them can’t control airflow or moisture. We’re inadvertently building complex three-dimensional airflow networks.

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Photo: Courtesy of Huber Inc. Photo: Daniel S. Morrison

**WIN THE WAR ON MOLD BY CHOOSING MATERIALS WISELY**

Combined with good details such as flashing and a sloping grade away from the house, materials can have a big effect on a house’s mold tolerance. Smart decisions can be made everywhere between basement and roof sheathing.

**Material Types**

- **Framing**

- **Waterproofing**
  - AdvanTech (www.huberwood.com), Advantech is known as the best sheathing choices; regular OSB is second best. The worst choice is paper-faced drywall.

- **Treatments**
  - Borate-treated cellulose has big problems for you and your runoff, which can cause driveways or bricks set in gravel. Driveways effect on a house’s mold tolerance. Smart decisions can be made everywhere between basement and roof sheathing.

- **Loose-fill insulation**
  - Use cementboard or a fiberglass-faced drywall like DensShield (www.gp.com) for tile backing or paper-faced drywall.

- **Flexible membrane**
  - Use cementboard or a fiberglass-faced drywall like DensShield (www.gp.com) for tile backing or paper-faced drywall.

- **Spray foams**
  - Spray foam insulations are breathable and water-tolerant (www.elevations100.com; www.icynene.com; www.biobased.net; www.lindal.com; www.corbond.com).

- **Weather and ground water**
  - Use Zip Roof panels (shown), which are AdvanTech sheathing with spray-on membranes and tape that actually sticks (www.huberwood.com). Or use AdvanTech or plywood covered entirely with a self-stick membrane: Ty-Flax 10 or I-Flex & Water Shield (www.greenfibre.com).

- **Roof sheathing**
  - Use cementboard or a fiberglass-faced drywall like DensShield (www.gp.com) for tile backing in a shower or other wet area.

- **Backerboard**
  - Backerboard is backed by paper or foil backing for wall applications and can be used as a Vapor and water barriers in an upstair floor, where they don’t belong.

- **Cement Siding**
  - Are more watertight than wood. If you use cement siding are more water-tolerant than wood. If you use cementboard or a fiberglass-Plus, Weathersmart, Housewraps (www.benjaminobdyke.com; www.stuccoflex.com).

- **Siding**
  - Aluminum, vinyl, and fiber-cement siding are more water-tolerant than wood. If you use wood siding, it needs a drain-slope design, and all the vents must be sealed with primer.

- **Spray foams**
  - Spray foam insulations are breathable and water-tolerant (www.elevations100.com; www.icynene.com; www.biobased.net; www.lindal.com; www.corbond.com).

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- **Surface and ground water**
  - Ground sloped toward the house
  - Gutter downsputs not directed away from the house
  - Bad footing/drain detail

- **Interior moisture**
  - Vapor barrier and vinyl wall coverings
  - No exhaust fan in kitchen and bathrooms
  - Poor interior ventilation
  - Oversize air-conditioning unit

- **Driveways**
  - Make pores driven with porosity, and there for a few. This type of driveway reduces runoff, which can cause problems for you and your neighbors.

- **Foam sheathing**
  - Use foam sheathing to insulate basements, and crawl spaces because it doesn’t absorb water. Using foam outside wall sheathing eliminates the condensing surface on the plywood’s inside face.

- **Exterior walls**
  - AdvanTech (www.huberwood.com) is known as the best sheathing choices; regular OSB is second best. The worst choice is paper-faced drywall.

- **Framing**

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**How do I clean up mold? Consider the size of the mold problem when deciding who should do the cleanup. You can tackle most small jobs (less than 10 sq. ft.) yourself. Big jobs require a professional. Small mold problems usually result from small water problems. If you don’t fix the water problem, the mold will grow again. And don’t put off the cleanup; do it within 48 hours. The longer you let it go, the more mold you’ll have. If the source of the water was clean, such as that from a pipe leak or from rain, mold can be cleaned by scrubbing hard surfaces with detergent and water. You don’t need bleach. Then dry everything thoroughly. Throw away most soft or porous items if they get moldy because they are difficult or impossible to clean. For mold caused by contaminated water (sewage), consider using a cleaner/sanitizer, which is widely available in grocery stores and hardware stores. It’s important to avoid exposing yourself to mold while cleaning it up because mold produces both allergens and irritants. Wear an N-95 respirator ($10 to $25), goggles (without ventilation holes, $5), and water-resistant gloves ($5). You can get this protective gear at most hardware stores.

—Laura Kish works with the U.S. Environmental Protection Agency’s Indoor Environments Division (www.epa.gov/mold).