

# Guiding Principles to Manage Moisture and Mold

An important part of creating sustainable buildings is ensuring that they are designed, built and maintained in a manner that keeps moisture and therefore mold at bay. It's a simple premise—keep a building dry and you'll likely keep it free of mold. Doing so is not complicated or costly — it's all about paying attention to details from design to maintenance. Our Guiding Principles provide a helpful checklist as you embark on any building project.

The Responsible Solutions to Mold Coalition (RSMC) was formed in 2006. Its premise was simple and straightforward—provide advice to everyone with an interest in constructing homes and commercial buildings on ways to keep moisture out of the structure. While building science can become quite complex at times, our goal is to help identify the clear-cut steps involved in creating dry, healthy environments. RSMC's membership includes a wide variety of building materials associations, building materials companies and academic and government organizations which share the common goal of communicating science-based information on controlling moisture and mold.

One of the principle ways of communicating this information was the development of the Guiding Principles to Manage Moisture and Mold. We have developed two versions of those Principles directed at the residential and commercial markets. The complete listing of these Principles is available on our website ([www.responsible moldsolutions.org](http://www.responsible moldsolutions.org)). This brochure will provide an overview. Our group, which comprises some of the nation's leading experts in building science, advises home and commercial building owners to treat water intrusion with the same urgency as they would a smoldering fire. Find out where the water is coming from—fix the problem—and replace damaged materials if necessary. A constantly wet environment not only encourages mold growth, it ultimately leads to the premature deterioration of a structure. Devising strategies to keep buildings dry is an important part of sustainable building practices.

## Residential Guiding Principles to Manage Moisture and Mold

- Building materials must be kept dry: Schedule delivery of building materials close to the time of their installation. Once they're on site, keep them off the ground, covered with tarps, or ideally, stored within the structure under construction.
- Better scheduling on the job site keeps moisture out: For example, roofers need to be coordinated with the cladding contractors so that proper flashing occurs where the two planes meet.
- Roofs must be designed in a manner that water has a clear path to the gutters: Elaborate roof designs may result in "dead valleys" where water can accumulate.
- Avoid condensation on windows: Generally, thermally insulated windows avoid this problem. But if it persists, check to see if the seal has been broken between the two layers of glass.

- Do not put pipes in exterior walls: Pipes placed in exterior walls may freeze. If they must be placed in exterior walls, the insulation should go on the outside of the wall cavity.
- Cover or seal crawl spaces: Exposed earth in basements is a constant source of moisture being released into a home—it should be covered with plastic, or ideally, with cement.
- Right-size air conditioners: Over-sized units may lead to higher humidity because of rapid cycle times that cool but do not dry the air.
- Keep AC condensate drains clear of debris: Blockage of air conditioning condensate lines can lead to water build-up at the base of the unit and ultimately to seepage of moisture into the building.
- Avoid installing water heaters or washing machines on second floors of buildings: If possible, water-handling appliances and equipment should be on the first floor or preferably in the basement.
- Use a water-resistive barrier behind shower and tub tile installations: Water will pass through tile grout, so a waterresistive barrier behind the tile will enable drainage of water back into the tub or shower pan.
- Ensure shower pans drain: All shower pans should be graded toward the drain. If not, water will pool in corners, leaving damp spots that will likely lead to mold growth.
- Bathroom and kitchen vents need to exhaust to the outdoors: Install timers on ventilation fans, particularly those located in bathrooms, that will run for ten minutes after the completion of a shower.
- Sprayed or wet insulation needs to dry: Allow three to seven days for wet insulation to dry before drywall is installed over it.
- Wallboard should only be installed during the controlled phase of construction: Because wallboard needs to stay dry, it should only be installed once the building has been closed in.
- Ventilate during construction: In warmer climates, keep doors and windows open during construction to allow joint compound, tile grout and eventually paint, to dry.
- Concrete floors need to dry before covering: Concrete introduces gallons of moisture into a new building after it's been poured. Concrete slabs should be poured over a vapor retarder.
- A weather-resistive barrier should be installed on the exterior of all buildings: This barrier prevents liquid water that has penetrated the cladding from passing into the building, but water vapor can escape.
- Windows, doors and chimneys must have flashings: Flashings collect water from window and door leaks and safely direct the water away from the wall assembly. Chimney flashing prevents water leakage where the chimney passes through the roof.
- Roof flashing is also critical: Faulty flashings are the cause of more leaks than failed roofing materials in residential applications. These include metal drip edges, valley flashings and flashings at the intersection of the roofs and vertical walls.
- Exterior cladding should never touch the soil: Cladding that touches the ground will provide for the transmission of moisture into the building.
- Walls need to drain: Exterior walls will get wet—but if they are designed and constructed in a manner that water can drain from the wall assembly, they can remain free of mold.

- Proper installation of siding and doors: Wind-driven rain poses special moisture intrusion problems. Careful attention to manufacturers' installation instructions is important during construction.
- Improper roof nailing leads to leaks: Avoid nailing shingles too high, using too few nails, or failing to drive nails flush with the shingle surface.
- The grade around a building should slope away: The first ten feet of soil extending outward from the house should be pitched away from the house at a five percent grade, or six inches of fall in the first ten feet.
- Near-foundation irrigation needs to be directed away from the house: Daily presence of water near the foundation increases the chances that some of the water will enter the building through cracks in the foundation.
- Vertical foundation walls should be coated on the outside with a vapor barrier: Concrete is porous and without the protection of this type of barrier, water moving down the side of the foundation may be absorbed.
- Install perimeter drains: By ringing the foundation both inside and out with perimeter drains, water will be taken away from the base of the foundation, thereby keeping the foundation and interior of the house dry.
- Mold Remediation: Like other organizations, the Responsible Solutions to Mold Coalition endorses a series of remediation steps developed by the New York City Department of Health and Mental Hygiene. The rule of thumb is that any mold outbreak greater than ten square feet should probably be dealt with by a professional mold remediator. Smaller outbreaks can be cleaned by scrubbing with hot water and detergent. Always use rubber gloves and discard your cleaning materials after use. For more information, please visit [www.nyc.gov/html/doh/html/epi/moldrpt1.shtml](http://www.nyc.gov/html/doh/html/epi/moldrpt1.shtml)

## **Commercial Guiding Principles to Manage Moisture and Mold**

The following Guiding Principles apply to commercial construction. There are some similarities between this section and the Residential version of the Principles because the basic concepts of keeping water out of a structure hold true, regardless of the design or function of the building.

- Keep building materials dry: All building materials should be kept dry once delivered to the job site - particularly drywall. If possible, drywall should be stored inside a commercial building that is already closed in.
- Schedule trades in a manner that minimizes water intrusion: All trades need to be aware of the role they may play in inadvertently introducing water into a structure. Each trade should take steps to ensure it seals any penetrations it introduces into the building floors, walls, or roof.
- Roofs need to provide a clear path for water to exit the building: Flat roofs must slope to a drain. Roof drains must be kept clear. Improper flashings around parapets and roof penetrations can lead to severe water intrusion.
- Avoid condensation that may be created by improper insulation within wall cavities: Cavity insulation should completely fill the cavity to prevent the formation of

convection cells within the wall that can negatively affect moisture and energy management.

- Keep wall cavities clear of dust and debris before sealing: Before drywall is installed, wall cavities should be vacuumed or blown clear of all debris that may have collected. Do not put pipes in exterior walls: Pipes placed in exterior walls may freeze. They may also generate condensation that can be trapped in insulated walls that cannot adequately drain.
- Install a water-resistive barrier behind shower installations: Water will pass through tile grout; therefore, a water-resistive barrier behind the tile that drains into the shower pan is an important feature.
- Ensure shower pans drain: Both the concrete base and ceramic tile surface of a shower pan must slope toward the drain; otherwise the surface is continually damp, leading to mold growth.
- Install drywall only after the building is closed in: Drywall should also be installed one-quarter of an inch off the floor so that minor spills don't come in contact with it. The resulting space should be sealed with silicone caulk.
- Allow time for sprayed insulation to dry: Wet-sprayed or foam insulation requires drying time before wallboard is installed over it
- Ventilate during construction: Avoid use of portable kerosene or propane-fired heaters in enclosed spaces. These heaters introduce large quantities of moisture into the building.
- Concrete floors need to dry before covering: Floor coverings should not be installed over a concrete slab until the floor has dried sufficiently.
- Interior conditioned spaces need to be balanced for temperature: HVAC systems must be balanced throughout the building in order to avoid overcooking interior rooms which leads to condensation and eventually mold.
- Lavatories and showers need special design details: To avoid mold growth, include extra ventilation to the outdoors and the use of approved tile-backerboard around tubs and showers.
- Walls need to drain: Exterior walls must be designed to incorporate a water-resistive barrier behind the cladding system as well as an air barrier and thermal insulation.
- Install roof, window and door flashings: Flashings should be installed around all rooflines, windows and doors, ensuring that water flows out of the building. All pipe penetrations through the roof should be properly flashed: All roof penetrations such as vent pipes and other HVAC related piping should be properly flashed and water should be directed toward roof drains.
- Grading around commercial construction should be away from the foundation: The slope should be checked every few years to make sure that the backfill has not settled, thereby reversing the grade back toward the foundation.
- Install perimeter drains: By ringing the foundation both inside and out with perimeter drains, water will be taken away from the base of the foundation, thereby keeping the foundation and basement dry.
- Near-foundation irrigation should be directed away from the building: Mis-directed or broken spray heads can pour thousands of gallons of water into the basement of a building.
- Vertical foundation walls should be coated on the outside with a vapor barrier: Left uncoated, concrete will absorb and transmit water into the basement of a building.

- Maintain HVAC drainage pans that may collect water: Drainage pans below HVAC units can become blocked resulting in standing water or overflow that may leak into the building. Keep roofs clear of debris: Make sure roof membranes are not punctured by loose debris that can be driven into it by maintenance people walking on the surface.
- Check windows to ensure caulking seals out moisture: Windows whose caulking and glazing have failed, provide entry points for water, leading to eventual water intrusion and eventually mold growth.
- Inspect plumbing fixtures for cracks: Twice-yearly inspections of all plumbing fixtures should uncover any cracks or leaks that may lead to unwanted water intrusion.
- Make sure all roof drains are clear: Clear drains, scuppers, gutters and downspouts to keep water moving off the roof and away from the building.
- Inspect attics for signs of water intrusion: Discoloration of sheathing, the presence of ice, or rusty nails or fasteners are all signs of water intrusion that must be corrected.
- Avoid excessive indoor humidity: All exhaust fans in lavatories should be vented to the outdoors. If possible, exhaust fans should run continuously during business hours, particularly in shower areas.
- Watch for water stains or puddles: Regular maintenance should include an ongoing inspection of basements and around all plumbing fixtures to make sure there are no signs of standing water.