

# **Moisture in Buildings**

## **A Practical Guide to Avoiding Moisture & Mold**



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The National Academy of Sciences recently released a report, "Damp Indoor Spaces and Health," examining the link between dampness, health problems and their causes. While the jury on mold is still out, clinical evidence has drawn a link between damp buildings and the appearance of irritation and respiratory symptoms. The precise types and levels of biological agents that cause these symptoms are still unknown, since damp buildings can result in the prevalence of a number of potential culprits including mold, bacteria, allergens, and chemical emissions due to disintegrating building materials. It is difficult to separate the effects of different factors since occupants in damp buildings are exposed to several biological agents at the same time.

In any case, it is clear that buildings with excessive moisture pose health risks to occupants. In addition, water can threaten the structural integrity of a building, and disintegrate materials within, leaving building owners in financial ruin and facility managers subject to potential lawsuits.

Avoiding moisture in buildings is not as simple as it may seem, as evidenced by the large number of commercial and residential buildings with moisture problems. Experts agree that by far the most effective manner of avoiding problems associated with moisture such as mold, bacteria, and allergens, is to prevent the unplanned wetness in the first place.

Understanding that maintaining a dry building is the best method for ensuring healthy people, safe buildings and maximum asset value, AQS has compiled this practical guide to best practices and common pitfalls associated with managing moisture in buildings. The measures outlined here are findings based on more than 15 years of experience tracing water problems to their sources in buildings and overseeing the restoration of the building after the fact. With a little research, some communication and a small investment of time and money, builders, building owners, facility managers and occupants can avoid finding out the effects of mold growth and dampness on occupants: information we are sure you are more than happy to live without!

### **Not just liquid**

When most people think about water problems in buildings, images of floodwater and leaky sinks immediately come to mind. While liquid water intrusion is the most obvious, easily recognizable problem, it is not the only culprit causing elevated moisture in buildings. Water vapor and humidity, which are more difficult to detect, can also create problems. The more subtle moisture issues are by far the most challenging to manage and the most difficult to monitor. While water has always been an issue in buildings, there are many more contributing elements today than there were fifty years ago. After World War II, new elements, all contributing to moisture, were introduced into buildings and have consistently gained increasing prevalence. Dishwashers release steam as they dry dishes, clothes dryers release warm, moist air indoors if not properly vented, and cooking equipment and showers release significant amounts of water vapor into buildings on a daily basis.

The complexity of modern building systems further complicates matters. Modern day buildings are made up of innumerable mechanical, electrical, operational, and building components that can all contribute, either positively or negatively, to moisture in buildings. While it is impossible to have complete oversight of every component and area of a building at all times, by identifying common problem areas and instituting frequent review and quick resolution procedures, it is possible to significantly increase the probability of catching moisture early before it becomes a major problem.

### ***Review specs for potential issues***

Of the many sources of water problems in buildings, improper design and construction are the most common. With so many functional, aesthetic, and financial criteria being placed on materials and systems in a building, it can be difficult for design and construction professionals to consider the impact that every single material or design choice will have on moisture control. For this reason, it is wise to bring in a moisture control expert to review plans and to collaborate with

the project team. A building consultant with expertise in this area can identify potential problems with construction and material selection early so that modifications can be made on paper, where they are much less expensive than those made after construction has begun. It is well worth the modest investment of time and money, as poor decisions made during construction can lead to chronic moisture issues in a building.

### ***Select an appropriate location***

The site of a building may predetermine its susceptibility to water damage. In some cases, buildings are placed in valleys or flood plains, directly in the path of water flows when it rains. These waters can flood the building or keep construction materials soaked for extended periods of time. For this reason, buildings should be located so that ground and surface water is directed away from the building. If the landscape naturally pushes water toward the building, then trenches should be dug and drainage pipes installed to direct water away from the structure. Any portion of a building that is underground should be protected with sufficient high grade, waterproofing materials and should be designed to allow for periodic inspections.

### ***Select appropriate materials for use***

The selection of appropriate materials for particular uses in buildings is important to avoiding moisture and mold problems. For example, materials lining exhaust chases from bathrooms, kitchens and dryers should be evaluated for their ability to resist mold, since these areas are subject to continual dampness. ASTM 6329 is a test designed to evaluate resistance of material to mold growth. While not the only protocol used for evaluating microbial resistance of products, this particular method is designed to simulate indoor conditions and provides the ability to quantify mold growth objectively. For this reason, architects, specifiers and other construction professionals may wish to have products they select evaluated according to the 6329 standard.

### ***Insulate HVAC pipes completely***

Chilled water lines, supply ducts, and water pipes offer a cool surface on which warm air condenses, dripping water onto underlying surfaces. For this reason, it is important to insulate pipes to prevent condensation. In many cases, even if the proper kind of insulation is used, it may not be properly installed. With cool pipes, even a small area left uninsulated can create a constant source of water droplets, wetting the wall, ceiling, or material below and initiating mold growth. It is important to ensure that pipes are completely and properly insulated to avoid moisture from condensation on water and air lines, and that any condensate has a way to drain away.

Materials should be completely insulated, including the areas around joints. In some cases, insulation will have to be cut and specially fitted to lines. This is critical to preventing what could become a major moisture problem.

### ***Select the proper HVAC system***

HVAC systems are critical for moisture management in buildings, as they are responsible for regulating temperature and humidity. HVAC systems need to be the appropriate size for the heat load of the building. Oversized systems can release too much cool air, too quickly, “short-cycling” or cutting off the unit when the desired temperature has been reached, but not giving the system enough time to dehumidify the air, resulting in high relative humidity indoors. This humidity is absorbed by porous, cellulose-based materials. Undersized units may not be able to adequately cool or heat the building, leaving warm, moist air, which can promote mold growth. Undersized units may also be unable to release the proper volume of air into the space to properly balance air pressure. Negatively pressurized buildings allow for unplanned, unfiltered airflows to enter the building from outdoors through cracks and crevices.

### ***Take care of issues when spotted***

Once a building is completed and occupied, it is much more difficult to make substantial changes to the structure and materials that can support or prevent water problems. However, there are still many things that can be done to control moisture. One of the most critical steps is to catch problems early. Most major mold problems stem from water issues that people have noticed, but not reported, or that were simply not addressed in a timely manner. A slow leak in the restroom can turn into major mold contamination issue if left unaddressed. Facility managers should put systems in place to encourage occupants to report problems early and then grant authority to maintenance staff to address these issues immediately. Communication is a key element in successfully establishing such a system. Facility managers or building owners must ensure that occupants understand the urgency of reporting problems and they need to know exactly to whom they should report them.

### ***Consider climate***

The outdoor climate plays an enormous and dynamic role on moisture in buildings and should be considered when designing the building and performing maintenance. A seaside location may be much more humid than a location just a few miles inland. Ocean breezes can bring moist air against and ultimately through the building, creating moisture in the building if indoor environmental conditions are not properly managed.

Different measures should be taken in cool climates than in warm climates. For example, vapor retarders are often used in areas that experience extreme temperatures. The location of the vapor retarders in wall construction should be toward the warmer side of the building: it would be toward the outside of the wall in warm climates, and toward the inside of the wall in cooler climates. Contractors should consult an architect on the proper configuration of a wall system to ensure that the insulation is properly installed for that particular climatic region in order to avoid problems.

By understanding the temperature and humidity conditions indigenous to the area, building owners, facility managers, and design and construction professionals can gain insight into the types of moisture problems that they need to be wary of and the seasons in which they are most likely to occur.

### ***Manage exhaust systems***

Exhaust can simultaneously work for and against moisture management in a building. By carrying warm, moist air directly out of the building, exhaust fans prevent moisture from settling in the building and being absorbed by the walls or condensing on cool surfaces. At the same time, fans can also create negative pressure in the building, pulling air in from outdoors through cracks, crevices, and other paths. If the air outdoors is warm and humid, this can create a moisture control problem indoors. Proper exhaust management means creating planned outdoor airflows and selecting appropriate exhaust. Unplanned air flows can offset proper functionality of the HVAC system and can bring moist air into the building in an unplanned manner.

Proper use of exhaust fans means ensuring that they carry the moist air directly outside of the building, away from windows or other air intakes to prevent reentry of exhausted air. Exhaust chases should be sufficiently sized and should be lined with water and mold resistant materials to prevent mold growth. Sufficient exhaust systems should carry warm, moist air from kitchens, bathrooms, laboratories and dryers out of the building.

### **Conduct preventive screenings**

Periodic preventive screenings are an excellent means of identifying potential problems. Experienced building investigators have many tools at their disposal to identify moisture problems before they are detectable by occupants and to reveal hidden mold growth that is not evident, but which can cause tremendous damage. An experienced building investigator can visit the site and conduct a periodic assessment including dust, air, and other samples to ensure that moisture in the building is at acceptable levels.

### **Managing water and moisture problems**

If a moisture problem should occur, it is important to address the issue immediately and thoroughly to protect occupants and to restore the building to its original, dry state. Depending on the circumstances surrounding the moisture problem, the complete clean-up may be easier or more difficult to manage. Distinct approaches to managing remediation may be required.

Catastrophic water damage resulting from a natural or manmade event may seem overwhelming to manage. However, in many cases, it is easier to complete thorough cleaning and restoration of the property after a major disaster than when less obvious water damage is identified. In such situations, the damage is obvious to everyone and there is little hesitation to allow workers to rip out saturated carpeting and upholstery, to tear down soaking wet wallboard, or to proceed with any activity associated with clean up of the area. Occupants are removed from the building and the space is left open to allow for restoration. In the case of chronic or hidden mold problems, it may be much more difficult for occupants, building owners, and other players to understand that the water damage should be dealt with in a similar manner.

Insurance companies may contest the fact that occupants should be removed from certain areas of the building in order to complete clean up, or that walls should be torn down to remove the mold colonization. In these cases, project managers must communicate the importance of complete remediation and correction of the underlying moisture problem to avoid resurgence. Because people can't see the problem as easily, they may require more "justification" for fixing it. In either case, once water and moisture damage has occurred, it is important to eliminate the source of the moisture, to dry the building, and to restore it to normal, dry conditions as quickly as possible.

The following steps provide high level guidelines for drying out a building with moisture problems:

- Secure the safety of occupants and workers by getting people out of the building and cutting off all power in the affected areas of the building
- Remove standing water
- Identify items that are salvageable and those that are not
- Place salvageable items in a cool, dry space with plenty of ventilation and circulation
- Begin drying the building ASAP, but be sure you have a drying expert on-hand to prevent warping of materials
- Call in experts to oversee remediation to ensure it is done completely and properly
- Select an experienced remediation firm with experience managing clean-up in the type and size of building in question
- Follow-up with testing to make sure that the building was completely remediated

As always, be sure to select qualified experts during this process.

### **Our Services**

Air Quality Sciences has more than 15 years of experience resolving complex moisture and mold problems in buildings of all kinds. We offer comprehensive indoor air quality and moisture control solutions. We have developed cutting-edge moisture detection and prevention methods. With a

particular focus on moisture prevention, our building investigations and proactive indoor air quality services are designed to help building owners, facility managers, maintenance staff and others to evaluate a building's risk of moisture problems, resolve any issues that may be present, and incorporate best practices to avoid moisture issues.

Some of our moisture prevention services include:

**MoldMAP™** - This new method for Mold Measurement And Prevention combines visual inspections, moisture readings, temperature and relative humidity monitoring, and use of mold detectors to determine if conditions in a building will support mold growth. These mold sensors, the newest tool in building investigations available exclusively from AQS, are tiny detectors that use viable mold spores to determine whether or not mold will grow in the surrounding environment. When placed strategically throughout a building, the sensors will grow mold if moisture and temperature conditions are right, providing building owners and managers with early warning of potential problems.

**Baseline investigations** – Our building consultants can conduct on-site investigations to identify past problems in the building. During this process, we collect air, dust and bulk samples to establish a “baseline” of types and levels of mold found in the building under normal, dry conditions. Then, if and when problems do occur, it is simple to identify increases in levels or changes in the types of mold present, which could indicate a moisture problem before it becomes a major contamination problem.

**Mold resistance testing** – For key products that are used in high moisture areas, AQS offers mold resistance testing to determine which of a selection of alternative products best resists mold growth. This may help in the selection of products that are appropriate for their particular usage in a building.

**Operations & Maintenance Planning** – During the O&M development process, AQS consultants work with building engineers, managers and owners to identify their special needs or circumstances. Once needs are assessed, our consultants work to develop a comprehensive, yet straightforward manual to serve as a blueprint for action and a reference tool over the long-term. We also provide complete implementation support, which includes training to prepare all players for their responsibilities. Training is available on-site or online. We also offer full call center support, a resource for managers of the IAQ plan when they need answers or advice.

**Due Diligence** - AQS will visit the building and spend the day conducting a thorough inspection to identify and assess potential IAQ and moisture issues. Using our proprietary mold detection methodology, MoldMAP, AQS experts employ unique technologies to determine if there is an impending mold problem in the building. Our experts have developed an extremely thorough investigation process designed to reveal critical information about the building's history, past problems, and potential issues that may require attention in the future.

**Resolution Services** – If a water intrusion event ever does occur, AQS offers comprehensive building investigation and resolution services. Our building investigation services identify and define the problem, oversee remediation to ensure the problem is taken care of thoroughly and adequately, and provide litigation support if needed.

## **About AQS**

AQS has been involved in some of the most complex water damage problems in large, commercial buildings around the world. Our building consulting experts provide comprehensive moisture prevention, operations & maintenance, mold investigation and remediation oversight services. Our services can resolve even the most elusive water and mold problems. For more information about how we can protect your building, please contact the Customer Care Group at 1-800 789-0419.