

Unwanted Moisture in Buildings

Introduction

Unwanted moisture is a primary cause of deterioration of building components and systems. Over time, if not addressed, moisture can cause health issues and trigger building failures due to destruction of materials. It is in the best interest of building owners, operators and occupants to recognize moisture issues early and implement permanent corrective actions. There are many problems that are caused by unwanted moisture, both directly and indirectly, including:

- Electrochemical corrosion, including reinforcing bars, masonry anchors, HVAC equipment and other metal components.
- Discoloration and deterioration of finish materials, including gypsum board, ceiling tiles and wood products.
- Freeze-thaw cycle, which can cause cracks and failure in concrete and masonry.
- Health issues associated with the presence of mold, mildew and fungus.
- Slips and falls caused by wet or icy surfaces.
- Loss of thermal resistance value due to wet insulation.

Signs of Unwanted Moisture

Moisture will cause deterioration that will eventually be evident in surface finishes. Signs include:

- The presence of standing water or wet surfaces.
- Water stains, mold or mildew.
- Efflorescence (salt deposits), cracks or eroded mortar joints in masonry.
- Spalling or cracked concrete.
- Flaking, peeling or blistered finish surfaces.
- Musty or humid odors.
- Rust or corrosion.

When signs of moisture infiltration are observed the source should be investigated so that a comprehensive plan can be developed for mitigation and corrective actions. Destructive investigation or forensic testing may be required to determine the source.

Sources of Moisture

The primary sources of moisture in buildings include:

- Water from precipitation.
- Water from internal building systems.
- Water from the soil adjacent to the foundation walls.
- Water vapor from the exterior or from inside the building.

A properly designed and operating building will successfully manage moisture by draining it (water) or keeping it within acceptable limits (water vapor). If not managed moisture becomes unwanted. Unwanted moisture can come from both internal and external sources:

Internal Sources are from inside of the building, usually from system that are not operating properly.

- Leaks from plumbing systems that are damaged, corroded or with loose fittings or connections.
- Condensation from ducts, pipes or other improperly insulated items.
- Malfunctioning HVAC, humidification or dehumidification systems.
- Spills, overflows or other operational errors.
- Washing, rinsing or other maintenance activity using excessive water.

External Sources are from outside of the building through the envelope. Obvious locations are cracks, open joints, damaged doors and windows and other open breaches. Less obvious are conditions that are not visible but which compromise the envelope's integrity.

Walls, above and below grade:

- Below grade from saturated earth caused by a high watertable, improper runoff patterns, improperly functioning leaders, gutters or storm water conveyance systems.
- Improperly detailed, installed or maintained vapor or moisture barriers, drainage cavities, flashing or weeps.

Doors, Windows and Louvers:

- Inadequate flashing, sealant or weeps, inadequately sloped sills.
- Improperly designed louvers which are not adequately weather proof and self-draining.
- Operable units which do not close tightly, are not weather-stripped or which produce condensation.

Roofs and Plaza Decks:

- Damage, wear or puncture of the roof membrane.
- Loss of adherence of membrane to substrate.
- Failure of the seams in sheet waterproofing systems.
- Failure of roof penetration details.
- Failure of flashing and roof perimeter details.
- Lack of maintenance.

Conclusion

Unwanted moisture is a serious problem and can cause damage, deterioration and health issues. Building owners, operators and occupants should recognize unwanted moisture early, identify causes and implement permanent corrective actions.

Additional Reading

Straube, John F., *Moisture in Buildings*, ASHRAE Journal, January 2002,

Prowler, Don, *Mold and Moisture Dynamics*, Whole Building Design Guide, December 2016

