

Moisture in the Building Envelope

Moisture in the building envelope can cause the following problems:

- Mold & mildew
- Corrosion
- Rot
- Insects
- Staining
- Freeze-thaw damage
- Delamination & adhesion loss
- Loss of thermal resistance

The most common sources of moisture are:

- Water leaks
- Air leaks
- Vapor diffusion (and condensation)

Leaks in the Building Envelope

Leaks (for example, around a window frame) can introduce water into the building envelope assembly every time it rains. Construction and design techniques which minimize the effect of leakage include redundant water exclusionary details, drainage planes, through-wall flashing, and weep holes. Avoid moisture trapping assemblies and double vapor retarder construction.

Air Infiltration

Air contains water vapor. If air is cooled to its dew point, water vapor will condense into liquid water. Within a building envelope assembly, there is usually a temperature gradient; that is, the temperature varies within the assembly. If air infiltration allows humid air to enter the building envelope assembly and the air is cooled to its dew point, condensation will occur and liquid water will accumulate within the assembly.

Example 1: During winter, a wall assembly in Maine (Cold Climate Zone) separates interior air at 70F and 40 % relative humidity from exterior air at 20 F and 50 % relative humidity. The inside air has a dew point of 45 F. Where air leaking from the interior toward the exterior contacts surfaces colder than 45 F, water vapor will condense and wet the wall assembly.

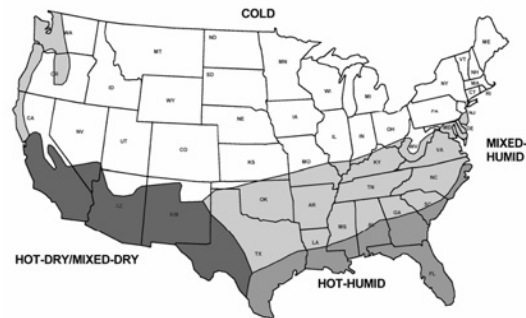
Properly installed and positioned air barriers will

Prevent air infiltration.

Water Vapor Diffusion

Water vapor diffusion is the movement of water vapor molecules from regions of higher absolute humidity to regions of lower absolute humidity. Water vapor can and does diffuse through solid materials.

Unlike air infiltration, diffusion can occur without any air leaks whatsoever. Like air infiltration, water vapor diffusing into a building envelope assembly will condense into liquid water if dew point conditions are encountered.



It is often said that water vapor moves from warm to cool. Actually, water vapor moves from high absolute humidity to lower absolute humidity. Because warm air usually holds more water vapor than cooler air, water vapor often moves from warm to cool.

Advantages of Spray Foam Insulation

Spray foam insulation forms an excellent air barrier, eliminating problems related to air infiltration. Spray foam is sprayed on as a liquid, expands in place, and fully adheres to its substrate. In doing so, it fills in small gaps between construction materials and conforms to odd shapes and spaces. House wraps, required with fiber insulations, can be eliminated. Furthermore, spray foam is moisture tolerant (i.e. spray foam will not rot, corrode, or degrade). If unforeseen leakage or other source of moisture ever occurs to wet the foam, the foam will perform just as well, once the wetting conditions have been eliminated and the foam has dried out.