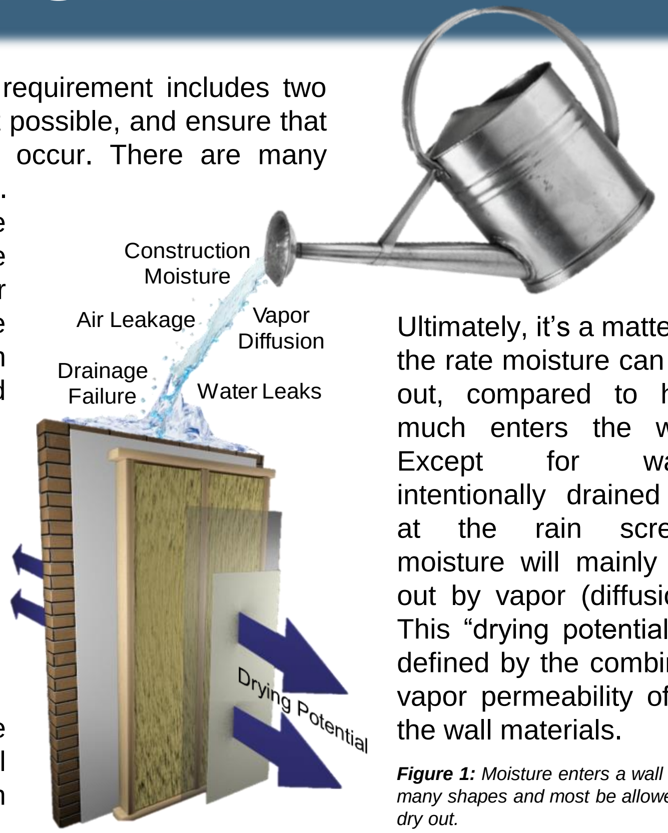
Building America Building Science Advisor

TRAPPED MOISTURE

A wall should be designed to handle moisture. This requirement includes two things; prevent moisture from entering the wall, as best possible, and ensure that moisture can dry out before critical moisture levels occur. There are many potential moisture sources that should be accounted for.

As seen in Figure 1, the most common moisture sources are construction moisture (built-in), air leakage (both indoor/outdoor), vapor diffusion (regular vapor transportation), water leaks and rain water drainage failure. The last two can be a result of bad installation quality upon construction, or insufficient seal around penetrations (electrical, plumbing, fasteners, etc.).



Ultimately, it's a matter of the rate moisture can dry out, compared to how much enters the wall. Except for water intentionally drained off at the rain screen, moisture will mainly dry out by vapor (diffusion). This "drying potential" is defined by the combined vapor permeability of all the wall materials.

Figure 1: *Moisture enters a wall in many shapes and most be allowed to dry out.*

Cause and Effect

A double vapor retarder is a way of referring to a building component (wall/roof) constructed with two relatively vapor impermeable materials, enclosing other building materials. If moisture ends up in-between the two vapor retarders (see Vapor Open Walls), the drying process will be very slow and the interior materials may see moisture levels that will result in mold growth and/or structural decay.

The EIFS (Exterior Insulation Finishing System) is a perfect example of a wall constructed with a double vapor retarder. For this system, there was no drainage plane behind the stucco and the exterior insulation. In combination with windows and attachments being face-sealed, this resulted in rain water uptake.

Figure 2: *The EIFS wall became popular in the 90s and resulted in many moisture problems. Due to improper handling of rain water, moisture penetrated the wall and ended up trapped behind the exterior insulation.*

Preventive Actions

In theory, a double vapor retarder is not necessarily a problem. However, it requires that the wall is constructed as designed. A good design involves controlling the wetting of building assemblies from both the exterior and interior, and different climates obviously require different approaches. Ideally, building assemblies would always be built with dry materials under dry conditions, and would never get wet from imperfect design, poor workmanship or occupants. Unfortunately, these conditions don't exist, which is why precautions must be taken.

Table 1 provides guidelines on how vapor retarders can be combined while ensuring good moisture management. In general, a class I vapor retarder shall not be used for cold climates. However, such can be allowed if the interior surface of exterior sheathing temperature can be maintained above dew point (see table).

Table 1: *Recommendations for double vapor retarders*

Maximum Interior Vapor Retarder Class			
Climate Zone	Exterior Sheathing		
	Class III	Class II	Class I
4	III	III	III
4 (marine)	III	II	III(a)
5	III	II	II(a)
6	II	II	II(a)
7	II	II	II(a)

(a) The interior surface of the exterior sheathing shall be maintained above the dew point temperature of the interior air, see table in Vapor Open Walls.

References and Further Reading

Building Science Corporation

BSI-092: Doubling Down—How Come…
BSI-026: They All Laughed....
RR-0410: Vapor Barriers and Wall Design
BSD-106: Understanding Vapor Barriers
BSD-146: EIFS - Problems and Solutions
Continuous Rigid Insulation Sheathing/Siding

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