INWARD VAPOR DRIVE

Being able to condition a home to a comfortable temperature is great, but it may have a drawback in terms of building moisture performance. It comes down to the physics of how an HVAC system works. When in operation, the HVAC uses air from the interior, cools it down to a temperature around 50°F, and then returns the conditioned air back to the interior. At the temperature of 50°F, air can hold much less vapor than at typical indoor temperature (see *Outward Vapor Drive*), causing some of the vapor in the air to condensate in the HVAC unit and drain off. In a hot/humid climate, this means that the HVAC system (in cooling mode) often creates a vapor differential between the indoor and outdoor air, resulting in a vapor to drive from the outside to the inside.

Cause and Effect

Inward vapor drive can cause condensation problems in walls when vapor retarders are installed on the interior side of air-permeable insulation (see Figure 1). A vapor retarder is a building material that can significantly reduce the vapor flow through a wall (see *Vapor Open Walls*), such as foil-faced insulation, a traditional vapor barrier such as polyethylene film, or a vinyl wallpaper installed on the interior surface of the wall. Actually, all materials provide some resistance to vapor flow, but those materials that provide most resistance (Class I and II vapor retarders) will determine how moisture is distributed inside a wall. The wall in Figure 1 has a vapor retarder installed on the interior side of the cavity insulation (mineral wool, fiberglass, or cellulose). When a vapor retarder is present inside a wall, the humidity conditions on its exterior side will be similar to that of the outside, and its interior side will have humidity conditions similar to that of the indoor space. An analogy can be made with thermal insulation and temperature, for which most of the drop in temperature occurs inside the insulation material. For the moisture distribution, an interior vapor retarder will "trap" outdoor vapor and thus allow for condensation on this relatively cooler, impermeable surface. Over time, this dampness can lead to ruined insulation, mold, and rot of framing members.

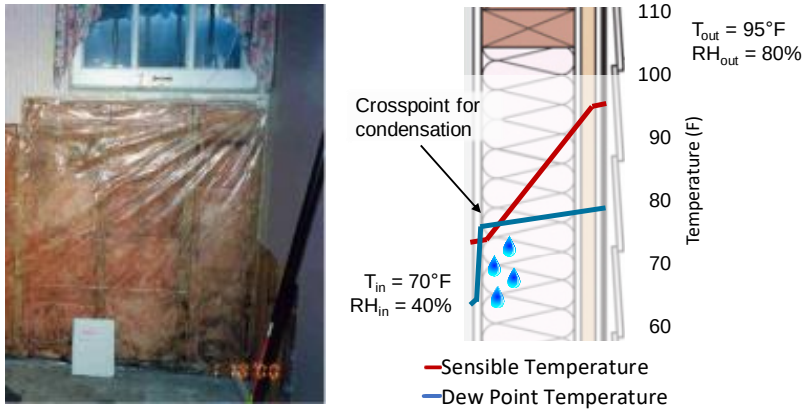

Figure 1: *In warm/humid climate, an interior vapor retarder can cause intermediate condensation.*

Figure 2: *Vinyl paper will perform as a vapor retarder in a warm/humid climate, resulting in mold growth.*

Preventive Actions

Vapor retarders can be a crucial part of the building envelope moisture management. However, in some instances, vapor retarders can cause condensation issues. As a rule of thumb, when a vapor retarder is installed (if at all, see *Vapor Open Walls*), it should be placed on the side from which vapor is moving. In a warm climate, that means on the exterior side (Figure 3).

Walls facing wet areas may create problems in warm/humid climates, since a vapor impermeable material is typically placed on the interior side. For tiles, such should be installed over a semi-vapor-permeable fluid applied coating on a cement board or paperless gypsum board. Inward drying will occur through grout joints. For other materials in wet areas, the backboard has to be vented.

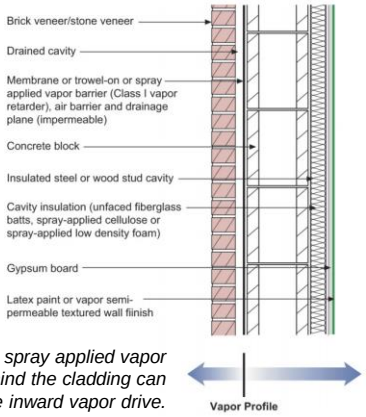

Figure 3: *A spray applied vapor barrier behind the cladding can reduce inward vapor drive.*

References and Further Reading

BSI-061: Inward Drive - Outward Drying
BSD-106: Understanding Vapor Barriers
BSI-039: Five Things
Info-015: Top Ten Dumb Things…
Class I Vapor Retarders Not Installed in Above-Grade Walls in Warm-Humid Climate