Moisture Flow and Vapor Retarders

The Second Law of Thermodynamics states: Moisture flows from warm to cold, and from more to less. (If "warm to cold" is in the opposite direction of "more to less", "more to less" prevails)

In the temperate zones of most of the United States, vapor retarders in a wall will be on the wrong side of the wall for half of the year. A vapor retarder on the inside of a wall in the summer, when hot, humid air wants to move toward the cooler, drier air inside, will trap moisture in the wall. Conversely, a vapor retarder on the outside of a wall in the winter, when warm air wants to move to the cold, dry air outside, will trap moisture in the wall. The relative humidity comfort range for most homes is about 60% in the summer and lower in the winter. Permeability increases as the relative humidity increases.

National Fiber advises contractors that, in houses insulated with cellulose insulation, vapor retarders are not necessary. Unlike fiberglass, cellulose insulation resists air movement, which is the primary mechanism for the transfer of moisture. Air movement accounts for 98% of vapor transmission in insulated cavities. ASHRAE standards warn against the use of vapor retarders in any structure in warm climates. There is also danger with moisture problems in cold climates caused by moisture being driven into the wall in the summer. Vapor retarders are installed on the interior in cold climates to control moisture movement from inside out during the heating season; however, those same vapor retarders trap the moisture contained in solar driven, warm summer air.

The installed density of cellulose insulation far exceeds the installed density of fiberglass. This increased mass does two things: it stops the flow of moisture into the insulated assembly, and it slows the transmission of heat or cold. Walls and ceilings insulated with cellulose insulation are effectively vapor retarders when used with ordinary paint. This has been demonstrated by extensive studies done at Portland University under Dr. George Tsongas, Professor of Mechanical Engineering. In his many studies on moisture problems in walls, he has found no evidence of moisture problems in homes without vapor retarders in cold climates, and he has concluded that there is no correlation between vapor retarder presence and moisture content in walls.

Research in Canada supports the position that vapor retarders can do more harm than good. They may work well in cold Canadian winters, but they can cause serious problems in humid periods during the summer. The Canadian research states that designers ignore the role of air conditioning in this problem. When air conditioning is running on a hot, humid day, even in Canada, the temperature of the poly vapor retarder on the inside of the wall reaches the dew point. Moisture driven into the wall condenses on the back of the poly material. The Canadian research says that a designer should rely on the painted surface of the drywall as an effective vapor retarder. Even ordinary latex paints perform adequately for stopping moisture. The bulk of the moisture that moves into an assembly is driven by air. Cellulose insulation is the means for controlling this part of the moisture movement. National Fiber does not recommend the use of vapor retarders, even in cold climates.