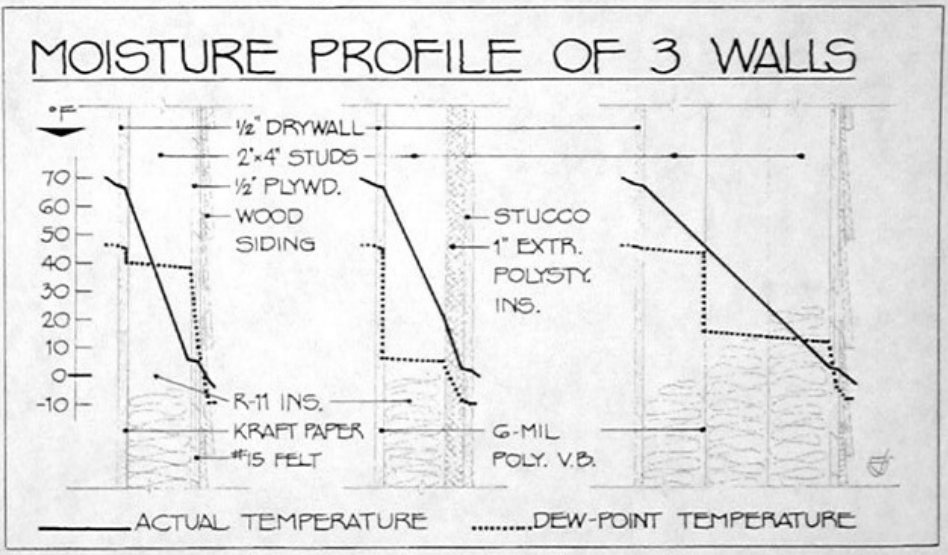

These diagrams compare the actual temperature drop through a wall with the corresponding dew point temperature, according to diffusion theory. Design conditions are 70°F with 40-percent relative humidity inside and 0°F with 60-percent relative humidity outside. Where the curves cross, the wall temperature is below the dew point and condensation may occur. The standard 2x4 wall (left) shows condensation at the sheathing line. Adding a poly vapor barrier and one inch of foam (center) reduces the condensation risk by both cutting the vapor drive and warming the wall cavity. The double wall (right) with th... ut a... ry p...

A: Wood and other porous building materials safely store a lot of the moisture at well below saturation levels till it re-evaporates from daily or seasonal warming.

Q: *Then what's all the fuss about?*

A: As houses get smaller and tighter, indoor humidity levels are rising, which increases the risk of condensation. Also, the more insulation in a wall cavity, the colder the exterior sheathing—another factor in condensation. Finally, the use of low-permeance sheathings has raised many questions. They go against the conventional wisdom of keeping the outside of a wall five to 10 times more permeable than the inside.

Q: *So what's the best approach?*

A: The safest approach is to install a lapped and sealed 6-mil poly vapor barrier —Saskatchewan style—on the winter warm side of the wall. So little moisture will diffuse or leak into the wall cavity that it doesn't much matter what insulation or sheathing is used.

Q: *How important is it not to puncture the vapor barrier?*

A: ASHRAE lists a typical foil vapor barrier at 0.02 perm if unperforated and 0.08 to 0.16 if it has a "few holes larger than pinholes" per square foot. After monitoring a number of test walls for two years, researcher Gerald Sherwood of the Forest Products Laboratory (FPL), in Madison, Wis., concluded: "Puncturing the vapor retarder, as with an electrical outlet, can completely change the moisture patterns in the wall," and that, once punctured, 6-mil poly performed no better than kraft paper.

Q: *Is it really necessary to make the vapor barrier continuous around band joists?*

A: This seems like the preferable way when feasible. Many builders, though, prefer to caulk pieces of foil-faced rigid insulation between the band joists and caulk or tape these to the wall vapor barrier. This seems adequate. Non-hardening acoustical sealant remains the best bet for polyethylene patchwork.

Q: *How about putting the vapor barrier a third of the way into the wall?*

A: This approach was developed by the National Research Council of Canada for use in 10,000-degree-day climates. So it should be all right in milder climates. If it's 70°F indoors and 0°F outdoors, the vapor barrier temperature will be $70 - (⅓ \times 70) = 46.7$°F. If the indoor RH is above 45 percent at 70°F this could be a problem. Consequently, I wouldn't recommend this approach if you're anticipating similar conditions for prolonged periods.

Q: *How about multiple vapor barriers?*

A: There is no theoretical reason why this should be a problem as long as neither of the vapor barriers falls below the dew point. For example, using foil-faced insulation plus poly on the inside should pose no problem.

Q: *Do you need a vapor barrier in the ceiling?*

A: In mild climates, some researchers claim you can safely omit the ceiling vapor barrier if you have good attic ventilation. Exactly how mild and how much ventilation is not clear. I wouldn't leave it out with a cathedral-type ceiling where there is little space for vapor to disperse.

Next month in Part II we'll look at some of the recent research findings on retrofits and insulating sheathings, and discuss vapor barrier and condensation issues that crop up below grade.