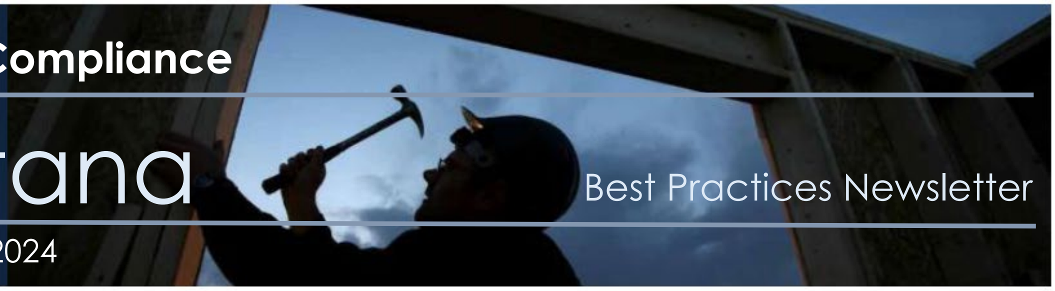
Energy Code Compliance

Montana

Best Practices Newsletter

Winter 2024



Published by MTDEQ and NCAT with funding from NEEA

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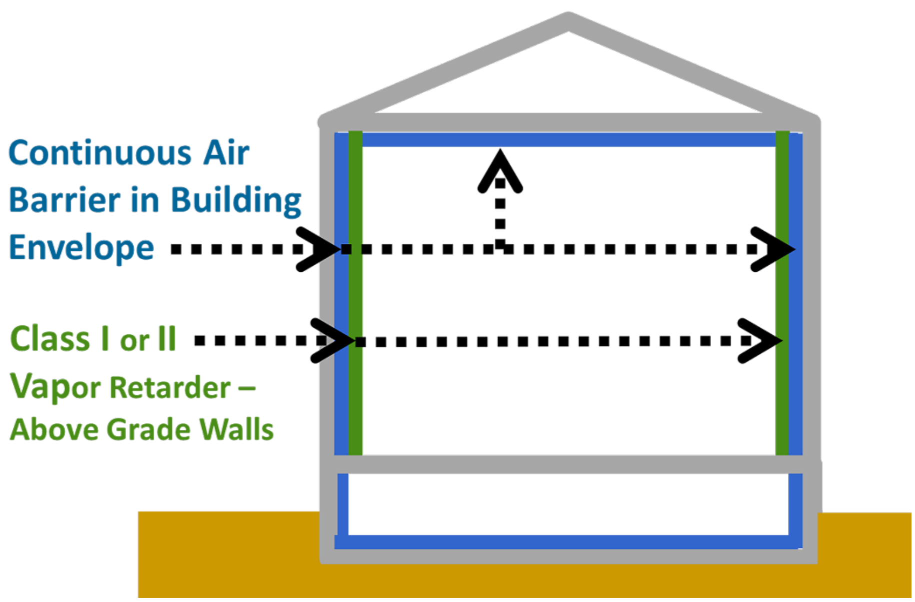
Weather-Resistant Barriers

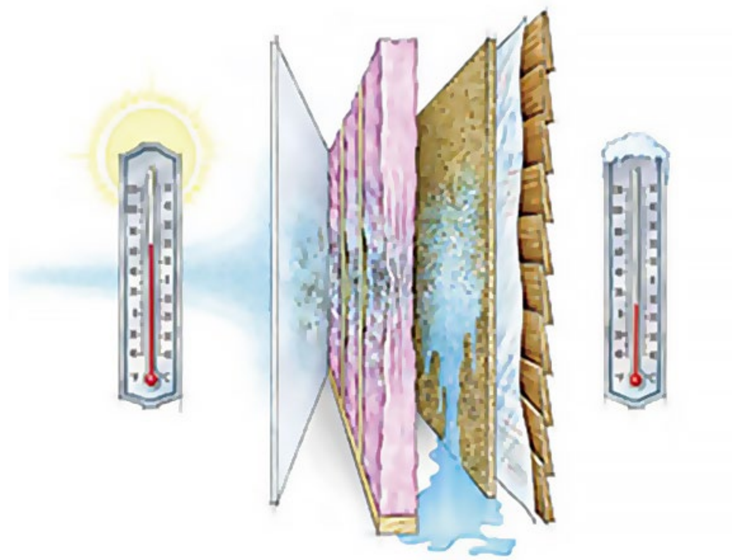
The purpose of a weather-resistant barrier (WRB) in buildings is simple: it helps prevent moisture issues by preventing outside water, and the movement of outside air, from entering the building envelope. However, if water does enter the building envelope, a WRB should also allow that moisture to drain away or escape by evaporation. This seems simple enough but, in practice, many misconceptions lead to confusion and misapplications, especially when it comes to understanding how water vapor moves through a wall.

Air, with its water vapor content, is driven from the inside of a wall assembly to the outside during the heating season in Montana's cold climate. This water will create condensate on the first cold surface it reaches, usually the inside of the exterior sheathing, leading to the interior of the wall assembly becoming wet. This is the reason that the Montana addition to the International Energy Conservation Code (IECC) R402.4.1.1 requirement for a continuous air barrier requires using a Class I or Class II vapor retarder on the *warm side* (usually defined as the interior) of the wall assembly. In theory, this requirement should block any moisture from the inside of the building from being driven into the wall assembly. We know, however, that construction is never perfect and there will be breaks in this air barrier that will allow moisture to enter the wall assembly. If an impermeable barrier is used for both the air barrier and the WRB, moisture can become trapped in the wall assembly, leading to degradation of building materials.



IECC requires a continuous air barrier at the building thermal envelope and a Class I or II vapor retarder on the *warm side* of above-grade walls. Image: NCAT

This often leads to confusion, especially when manufacturers provide different types of WRBs for different climate types. In climates dominated by interior air conditioning, you would want the continuous air barrier on the exterior of the building envelope to keep warm moist air from being driven into the wall assembly from the outside, often an air impermeable WRB is used to create this air barrier. In climates dominated by interior heating, there would be an interior air barrier that would allow drying to the inside, while also providing for adequate air sealing, and a WRB that would allow drying to the outside.



Warm, moist air passes through a wall and condenses on the cold exterior sheathing. Image: NCAT

Types of Weather-Resistant Barriers

Asphalt Impregnated Felt: This material is a traditional WRB made from asphalt-impregnated kraft paper. It provides moderate protection against water and is commonly used in residential construction. It is a vapor-permeable material having a rating of 30 perms. It is water- and air-resistant and is an excellent material for assemblies that require drying to the outside. It should be installed in a shingle-like overlap to ensure no water can get behind the WRB.

House Wrap: House wrap is a synthetic WRB made from materials like polyethylene or polypropylene. It is most often a woven material that offers excellent water resistance and breathability, allowing moisture vapor to escape while preventing water from entering the building. It is rated between 5 perms and 50 perms and is the most commonly used material for a WRB in Montana. All seams should be overlapped and taped.

Liquid-Applied Membranes: Liquid-applied membranes are sprayed or rolled onto the building's exterior surfaces. They form a seamless and flexible barrier that adheres to the substrate, providing excellent water resistance. These WRBs are expensive and not normally used in this climate due to their semi-impermeable nature. Perm ratings vary by manufacturer.

Rigid Foam Insulation: Rigid foam insulation boards, such as extruded polystyrene (XPS) or expanded polystyrene (EPS) polyisocyanurate (ISO), can act as both insulation and weather-resistant barrier. They provide thermal insulation, as well as protection against air and water infiltration when insulated properly with the seams sealed and taped. These are rated as vapor semi-permeable depending upon thickness and facings, unless faced with foil, which make them impermeable. This type of WRB is used in high-performance homes that utilize the foam as both insulation and WRB.

Self-Adhered Membranes: Self-adhered membranes are pre-formed sheets with an adhesive backing. They are easy to install and provide good water resistance when properly applied. These peel and stick WRBs require no taping, come in 100-foot rolls at different widths, and are rated at 33 perms, making them vapor-permeable. While these membranes could be a good solution for our cold climate, they are more expensive than house wraps and require more labor to install them properly.

As illustrated below, the best combination to ensure a dry wall assembly in our climate with conventionally built walls is to combine a semi-impermeable interior air barrier with a semi-permeable or permeable WRB. This will allow the assembly to dry to both sides of the assembly. Note that this illustration does not include the best practice of utilizing a draining plane gap between the cladding and the WRB, unless vinyl cladding is used. This draining plane will allow water that gets past the cladding to quickly drain away and air flow to dry any moist air. Draining planes can be created with a fiber mesh designed for the purpose, or vertical battens attached exterior to the WRB on which the cladding is installed.

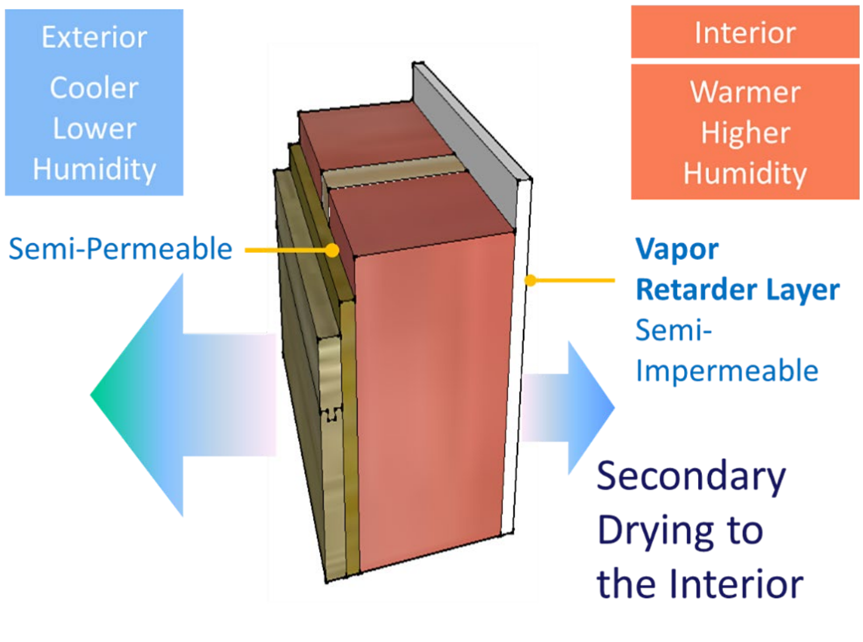


Image: NCAT

Conclusion

WRBs are a critical component of a wall assembly. While they will contribute to airtightness in a building, they are not the primary air-sealing component in this climate. This article attempts to clarify some of the misconceptions about WRBs and suggests what considerations should be taken into account for simple, conventionally built wall assemblies. Different considerations may be required for more complicated high-performance wall assemblies. The fundamental principles, however, should remain the same. Wall assemblies must be protected from both bulk water infiltration and water vapor. One should assume, however, that these systems will not be perfect, and walls will also need the ability to drain and dry. The choice of a WRB should be based on these fundamental principles.

DEQ Montana Department of Environmental Quality

For questions, suggestions, or to be removed from the newsletter distribution list, email: carl.little@littlewise.net

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