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Making Buildings Better™

TO **Mr. John Volk**
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Elastochem Wrapsulate Hygrothermal (WUFI) Simulation

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REGARDING **Preliminary Hygrothermal (WUFI) Simulations of Elastochem Wrapsulate (Drying of a Wet Residential Wall Assembly)**

Dear Mr. Volk,

This letter report summarizes a series of preliminary hygrothermal (WUFI) simulations that RDH Building Science Inc. (RDH) prepared to predict the response of three different exterior-insulated, wood-framed residential wall assemblies in the event that they are constructed with built-in moisture.

Background

A common problem faced by the construction industry is the rainwater wetting of exposed materials including wood sheathing and framing during construction. If these construction materials are not dried out before they are covered-up, closed-in or insulated over, then trapped (built-in) moisture may lead to fungal growth and/or degradation.

In the climate of Toronto ON it is not uncommon for new houses to be closed-in during rainy fall weather, as winter is approaching. Wetted walls will dry to the outside provided the materials on the exterior of the assembly have sufficient vapour permeance. Elastochem's Wrapsulate is proposed as a highly (vapour) permeable, moisture resistant spray foam insulation that can be used in exterior insulation applications.

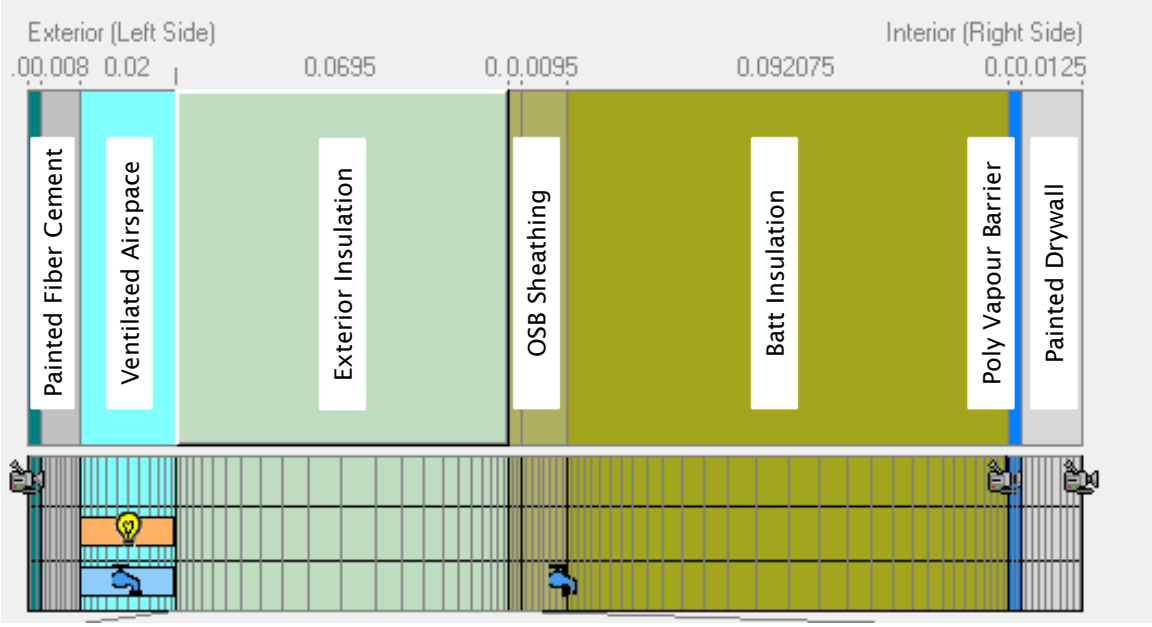
Hygrothermal Simulations

To illustrate the role that exterior insulation plays in the drying of wood sheathing wetted during construction, a series of three hygrothermal (WUFI) models are analyzed for a typical residential wall assembly in the climate of Toronto, ON. The three wall assembly models are constructed using different types of exterior insulation (Elastochem Wrapsulate, Rigid Mineral Wool, or XPS), each installed at sufficient thickness to provide an equivalent thermal resistance (of RSI 2 or R-11.3). The materials within the base wall assembly consists of:

- Painted fibre cement cladding
- ¾" air space (drained and ventilated)
- (RSI 2) R-11.3 Exterior insulation, varying thickness
  (either, Elastochem Wrapsulate, Rigid Mineral Wool, or XPS)
- Synthetic house-wrap WRB (for mineral wool and XPS cases)
- ½" OSB sheathing
- 2x4 Stud cavity filled with batt insulation

- Interior 6 mil polyethylene vapour barrier
- Interior gypsum (½") with latex paint

The wall assembly in the model is shown below.

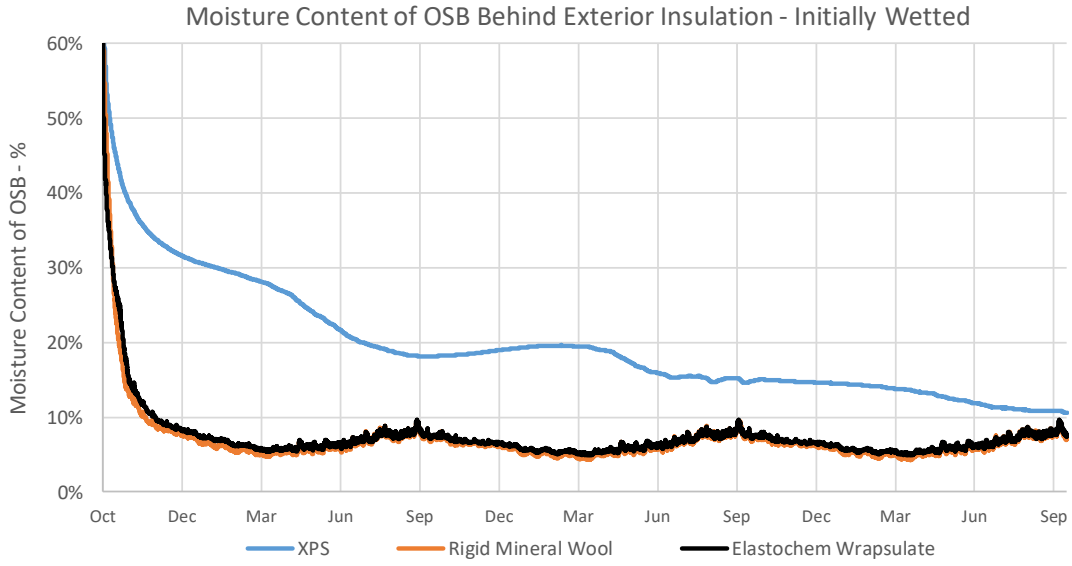


To simulate the drying potential, the initial moisture content of the OSB sheathing was saturated for a thin 3 mm layer near the exterior surface while the remainder of the sheathing was in equilibrium with 80% RH.

The simulation was performed using the WUFI cold year weather file for Toronto, ON for a total simulation period of 3 years, to observe the initial drying and long term performance of the OSB sheathing. To further test the performance of the wall assembly, a small leak was introduced to the sheathing at a rate of 0.01% of driving rain that hit the cladding. This represents a scenario where a rainwater leak, say below a window corner or at a penetration is able to bypass the WRB and wet the back (indoor side) of the sheathing. The wall is oriented SE to maximize its exposure to the predominant driving rain direction for Toronto.

Simulation Results

The results of the hygrothermal simulation show that the Wrapsulate insulation is as effective as rigid mineral wool insulation in allowing the OSB sheathing to dry out quickly. Where the Wrapsulate is used, drying occurs within one month whereas, where the XPS foam insulation is used, the OSB sheathing remains wet until the end of the following summer (over 8 months later). The results are shown below. The vapour permeance of foil-faced polyisocyanurate insulation is lower than XPS so a wall with that insulation can be expected to dry at a still slower rate.



We trust these simulations add to our discussion on the drying of built-in moisture in residential wall assemblies in Toronto. Should you have any questions, or require further information, please do not hesitate to contact us.

Regards,

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