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**Evaluation of Semi-Transparent Stains after Six Months'  
Exposure in Coastal British Columbia**

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## Abstract

More stringent regulations on volatile organic compounds in exterior wood coatings in Canada have prompted many companies to reformulate their products so there is little impartial data available on their medium to long term field performance. Selected commercial semi-transparent penetrating stains were evaluated in a field test after six months of exposure in Maple Ridge, British Columbia. All coatings exhibited some colour change and degradation; however, additional exposure time is needed to differentiate product performance.

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# 1 Objective

- To evaluate the performance of commercial semi-transparent penetrating stains after six months' exposure in Maple Ridge, BC.

# 2 Introduction

Heightened recognition of the environmental benefits of wood, combined with legislation such as BC's *Wood First Act*, are leading to increased use of wood products in non-residential buildings. Not only do architects want to use wood, they also want to be seen to use wood, which means putting it on the outside of buildings or infrastructure, and using transparent or semi-transparent coatings. In these applications, maintenance may be expensive, and appearance matters. More stringent regulations limiting volatile organic compounds (VOCs) in exterior wood finishes in Canada took effect in 2012 (Environment Canada 2009). This has shifted the market to water-based formulations, and prompted many companies to reformulate their products. As a result there is very little available, impartial information on the performance of currently available commercial wood coatings upon which architects, developers, and building owners can make product selections. To address this gap a field performance test of commercially available penetrating stains was installed in March 2013 at test sites in Maple Ridge, BC and Saucier, MS (Stirling 2013). The present report summarizes six-month inspection data from the Maple Ridge test site. Subsequent evaluations will include data from both Maple Ridge and Saucier.

# 3 Staff

|              |  |
|--------------|--|
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# 4 Materials and Methods

Preparation of test samples was described by Stirling (2013).

Samples installed at FPInnovations' field test site in the UBC Malcolm Knapp Research Forest (Maple Ridge, BC) were evaluated on September 9, 2013. Colour ( $L^*a^*b^*$  coordinates) was measured from one point on the exposed face of each sample using a Konica Minolta CM-700d spectrophotometer. In addition, all samples were visually rated for mould/stain (ASTM D 3274), flaking (ASTM D 772), erosion (ASTM D 662), cracking (ASTM D 661), and substrate condition (subjective visual assessment, Feist 1988). These ratings all use a scale of 1 to 10, where 1 is complete failure and 10 is no change from the unweathered condition.

## 5 Results and Discussion

Average colour coordinates from all coatings groups were darker (lower L\*), less red (lower a\*), and less yellow (lower b\*) than they were at the time of installation (Table 1). This was consistent with visual observations (Figure 1). Overall colour change ( $\Delta E^*$ ) was lowest for Coating 2 (Benjamin Moore – Arborcoat) and Coating 6 (Ilva – Klima).

**Table 1** Sample Colour and Change in Colour after Six Months' Exposure in Maple Ridge, BC

| Coating | Product                             | L*                         | a*            | b*            | $\Delta L^*$   | $\Delta a^*$   | $\Delta b^*$   | $\Delta E^*$  |
|---------|-------------------------------------|----------------------------|---------------|---------------|----------------|----------------|----------------|---------------|
| 1       | Forest Products Lab. Natural Finish | 41.3<br>(2.2) <sup>1</sup> | 6.9<br>(0.8)  | 13.7<br>(1.4) | -12.6<br>(3.0) | -10.2<br>(0.7) | -17.9<br>(1.3) | 24.2<br>(2.0) |
| 2       | Benjamin Moore – Arborcoat          | 48.8<br>(1.0)              | 9.7<br>(1.0)  | 21.9<br>(1.5) | -9.2<br>(1.9)  | -2.2<br>(0.8)  | -9.8<br>(2.0)  | 13.7<br>(2.7) |
| 3       | Sikkens SRD                         | 46.0<br>(2.0)              | 8.4<br>(0.8)  | 21.0<br>(1.2) | -13.5<br>(2.7) | -8.2<br>(1.1)  | -15.7<br>(0.9) | 22.4<br>(2.1) |
| 4       | Olympic Maximum                     | 45.2<br>(1.3)              | 10.5<br>(0.7) | 23.4<br>(1.2) | -11.3<br>(2.6) | -11.9<br>(0.6) | -16.8<br>(1.7) | 23.5<br>(2.5) |
| 5       | Broda - Pro-Tek-Tor                 | 45.7<br>(2.1)              | 7.4<br>(0.7)  | 14.6<br>(1.1) | -12.6<br>(2.9) | -10.0<br>(0.8) | -17.1<br>(1.1) | 23.5<br>(2.3) |
| 6       | Ilva – Klima                        | 50.1<br>(2.1)              | 9.3<br>(1.0)  | 20.6<br>(1.9) | -3.6<br>(1.7)  | -7.5<br>(1.2)  | -7.9<br>(1.8)  | 11.5<br>(2.1) |

<sup>1</sup> Standard deviations appear in parentheses,  $n = 6$



**Figure 1** Photograph of Samples after Six Months' Exposure in Maple Ridge, BC

After six months of exposure there was little degradation of the underlying wood substrate (Table 2). With two exceptions, all samples were rated 9 or 10. A moderate amount of coating discoloration was observed, with all groups having mean ratings greater than 8 except Coating 1, FPL Natural Finish with 7.7. All coatings groups exhibited a small amount of mould or biological staining, with mean ratings greater than 8. Only one sample was given a 9 for flaking; all others were rated 10. Similarly, only minor cracking was observed. Erosion was greatest for the reference (Coating 1, FPL Natural Finish), Coating 3 (Sikkens SRD), and Coating 4 (Olympic Maximum). Mean general ratings were greater than 7 for all products, indicating that they have not yet reached a level of degradation where they would be likely to be refinished (Morris and McFarling 2006).

**Table 2 Performance Ratings after Six Months' Exposure in Maple Ridge, BC**

| Coating | Product                             | Substrate                 | Discoloration | Mould/<br>Stain | Flaking       | Erosion      | Cracking     | General      |
|---------|-------------------------------------|---------------------------|---------------|-----------------|---------------|--------------|--------------|--------------|
| 1       | Forest Products Lab. Natural Finish | 9.8<br>(0.4) <sup>1</sup> | 7.7<br>(0.5)  | 8.8<br>(0.4)    | 10.0<br>(0.0) | 8.2<br>(0.8) | 9.8<br>(0.4) | 7.7<br>(0.5) |
| 2       | Benjamin Moore – Arborcoat          | 10.0<br>(0.0)             | 8.8<br>(0.8)  | 8.0<br>(0.0)    | 10.0<br>(0.0) | 9.7<br>(0.5) | 9.7<br>(0.5) | 8.0<br>(0.0) |
| 3       | Sikkens SRD                         | 9.2<br>(1.2)              | 8.2<br>(1.0)  | 9.0<br>(0.0)    | 10.0<br>(0.0) | 8.8<br>(1.0) | 9.5<br>(0.5) | 8.0<br>(1.1) |
| 4       | Olympic Maximum                     | 9.7<br>(0.5)              | 8.2<br>(0.8)  | 9.2<br>(0.4)    | 10.0<br>(0.0) | 8.2<br>(0.4) | 9.7<br>(0.5) | 7.8<br>(0.4) |
| 5       | Broda - Pro-Tek-Tor                 | 9.3<br>(1.2)              | 9.3<br>(1.2)  | 9.5<br>(0.5)    | 10.0<br>(0.0) | 9.8<br>(0.4) | 9.2<br>(1.2) | 8.5<br>(1.2) |
| 6       | Ilva – Klima                        | 9.8<br>(0.4)              | 8.7<br>(1.0)  | 8.8<br>(0.8)    | 9.8<br>(0.4)  | 9.8<br>(0.4) | 9.8<br>(0.4) | 8.5<br>(0.8) |

<sup>1</sup> Standard deviations appear in parentheses,  $n = 6$

## 6 Conclusions

All coatings exhibited some colour change and degradation after six months exposure. Additional exposure time is needed to differentiate product performance.

## 7 Recommendations

Evaluate coatings performance after twelve months of field exposure.

## 8 References

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