Water Absorption by Wood Plastic Composites
Field and Laboratory Challenges

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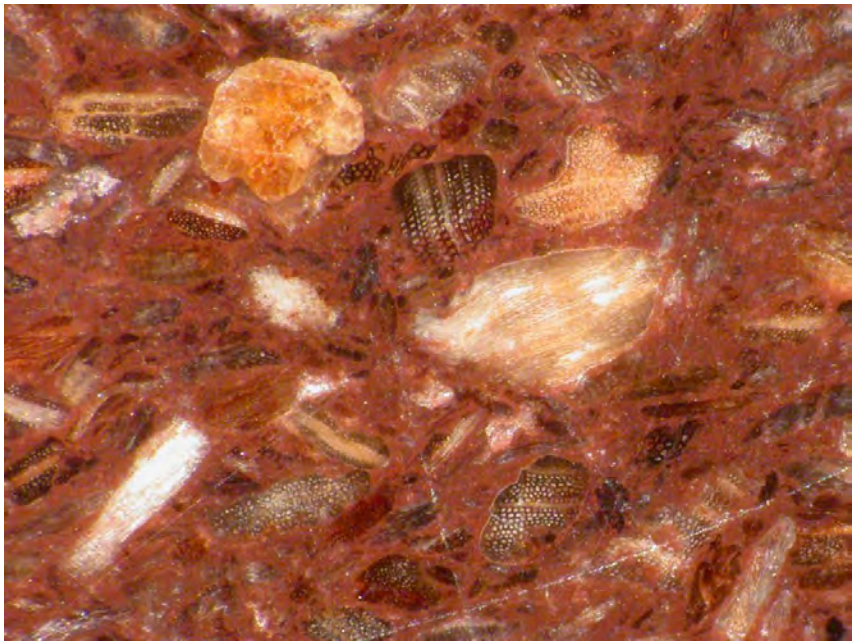
Wood Plastic Composites

Perception:
wood particles in WPC
are encapsulated in plastic

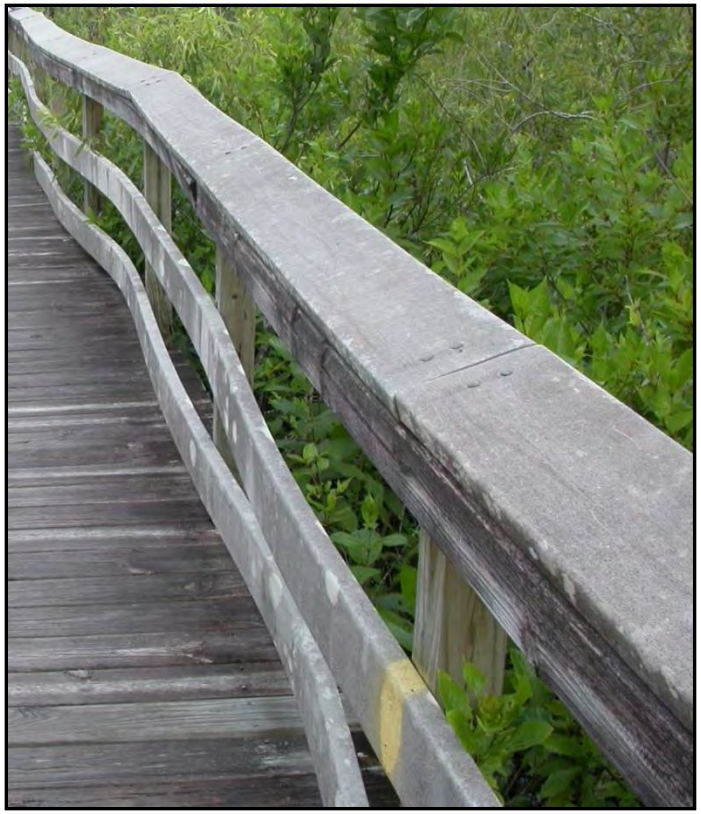


Optical microscopy of WPC cross-section

Visible wood particles encapsulated in resin

Wood Plastic Composites

WPC are designed to be continuously exposed to an exterior environment



Warping

Decay fungi growth

Dimensional changes

Water in Exterior Exposure

Water in Exterior Exposure



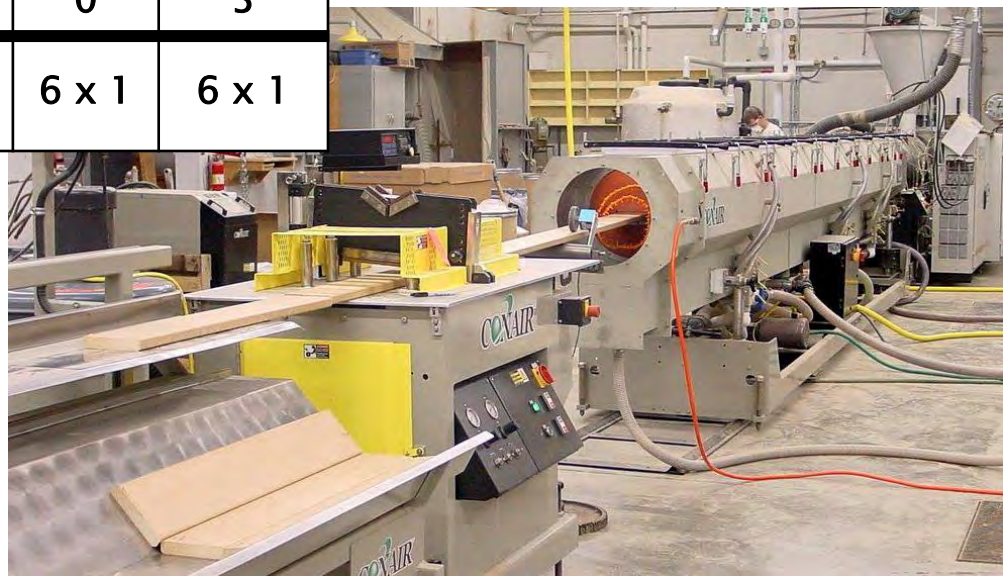



Objective

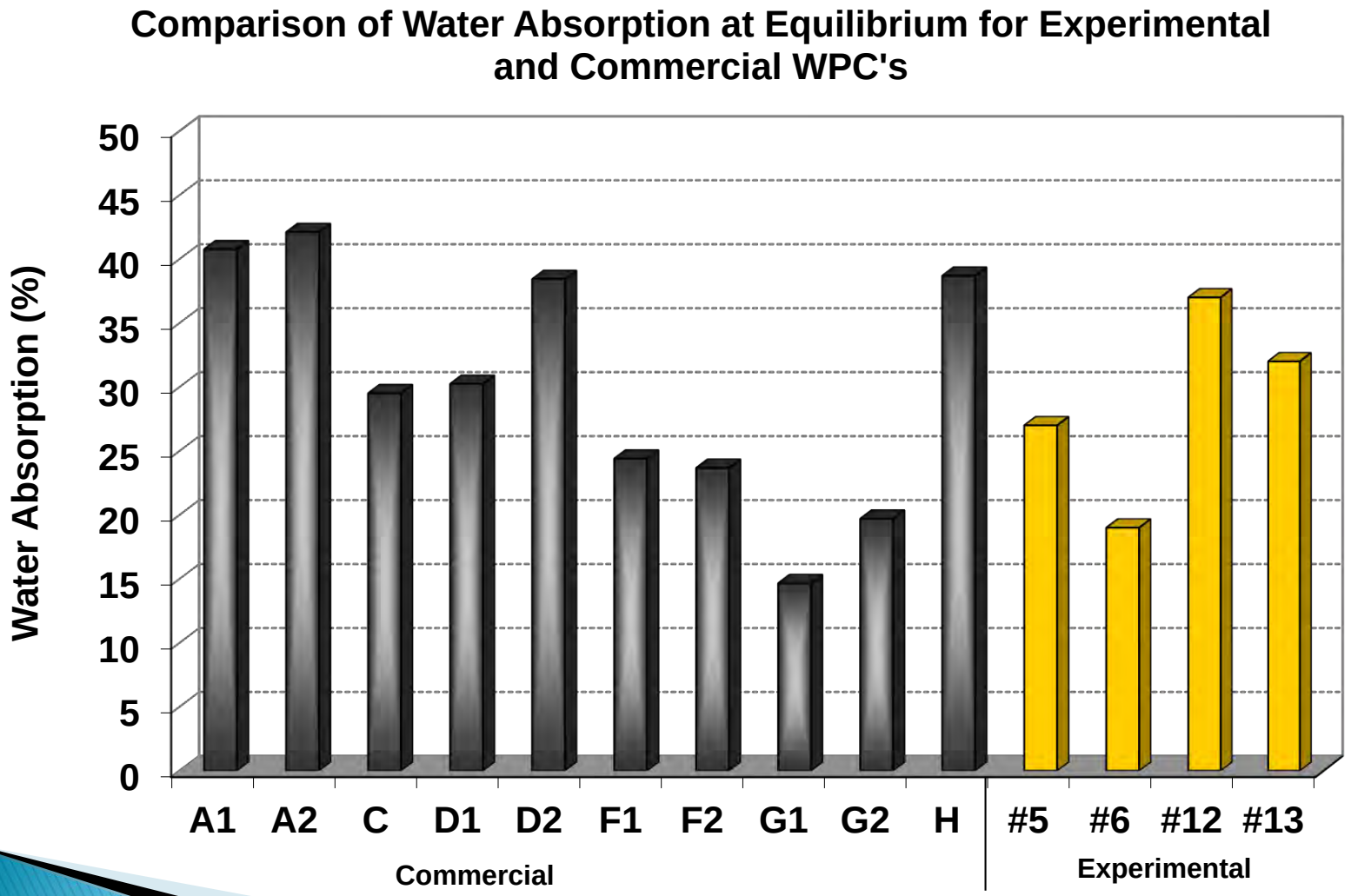
The objective of this work was to demonstrate the water absorption process in WPC exposed to exterior conditions and to laboratory testing

Experimental WPC

Ingredients	Formulation			
	#5	#6	#12	#13
Pine wood (20 mesh)	51	48	66	63
HDPE	45	45	30	30
Lubricants/Compatibilizers	3	3	3	3
Talc	1	1	1	1
Zinc Borate	0	3	0	3
Boards Cross-section (in)	6 x ½	6 x ½	6 x 1	6 x 1

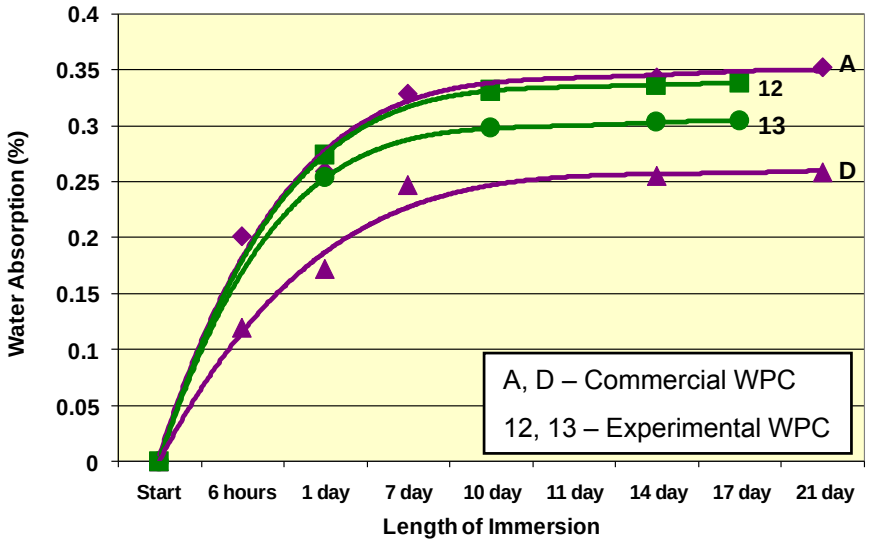


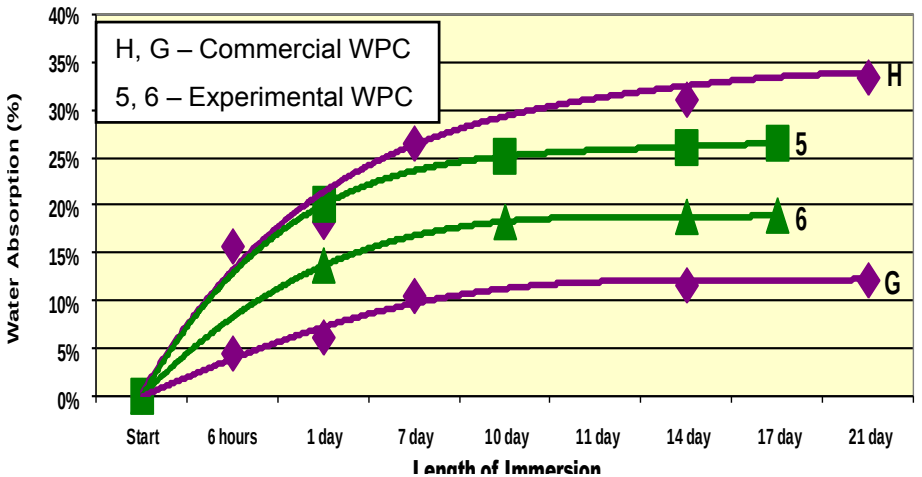
Experimental WPC



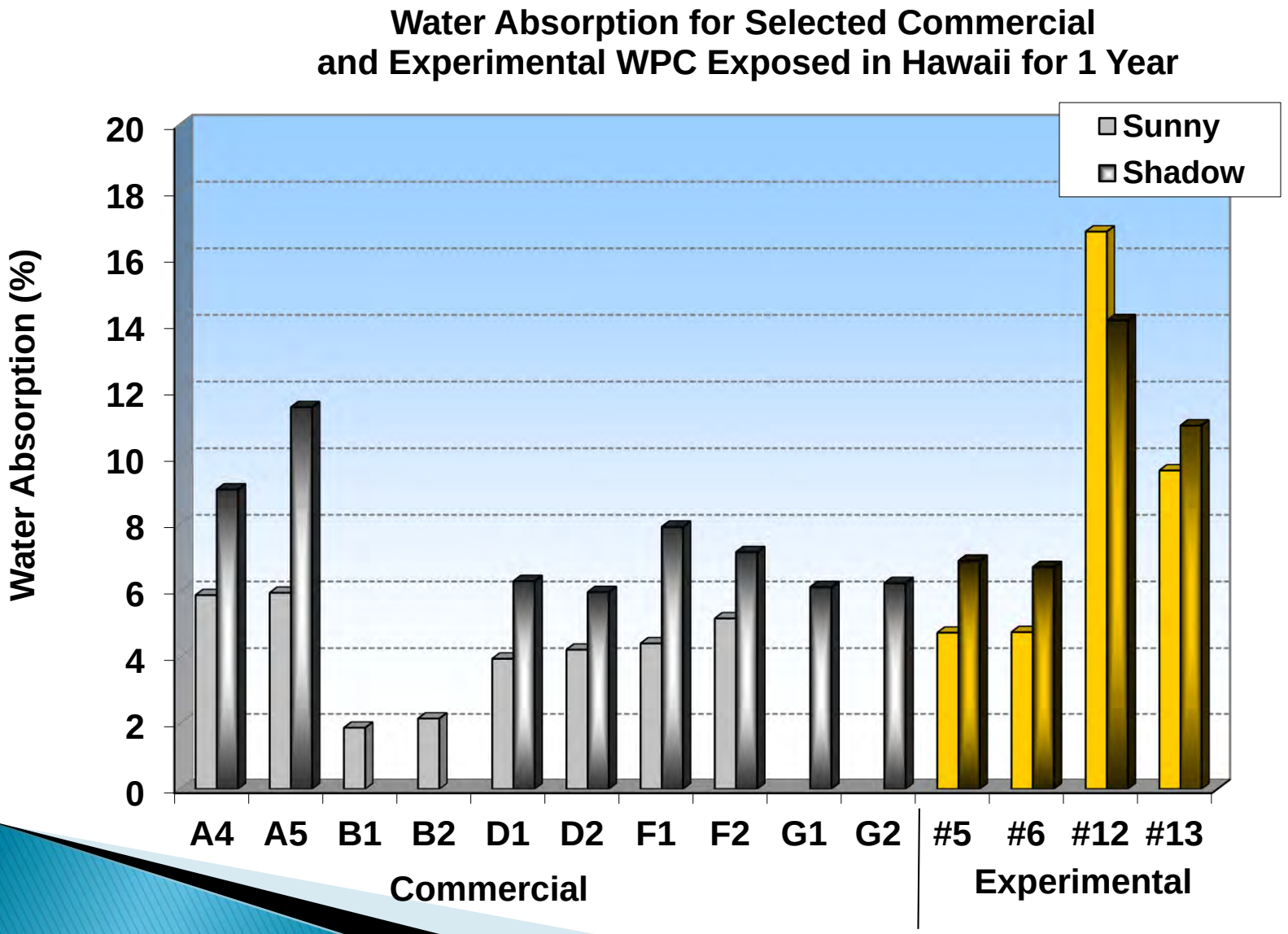
Experimental WPC

Comparison of kinetics of water absorption for experimental materials and commercial WPC's



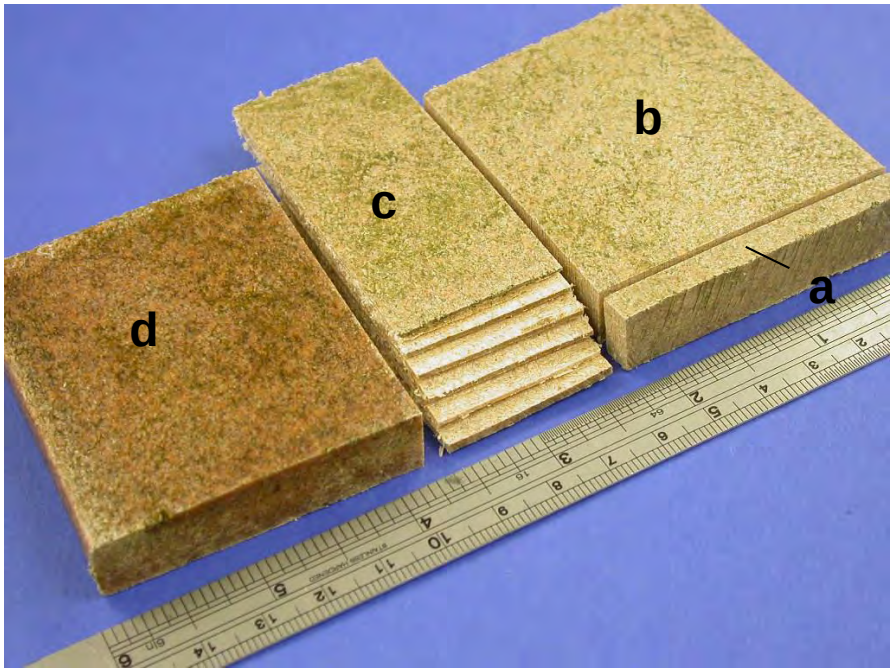


Experimental WPC

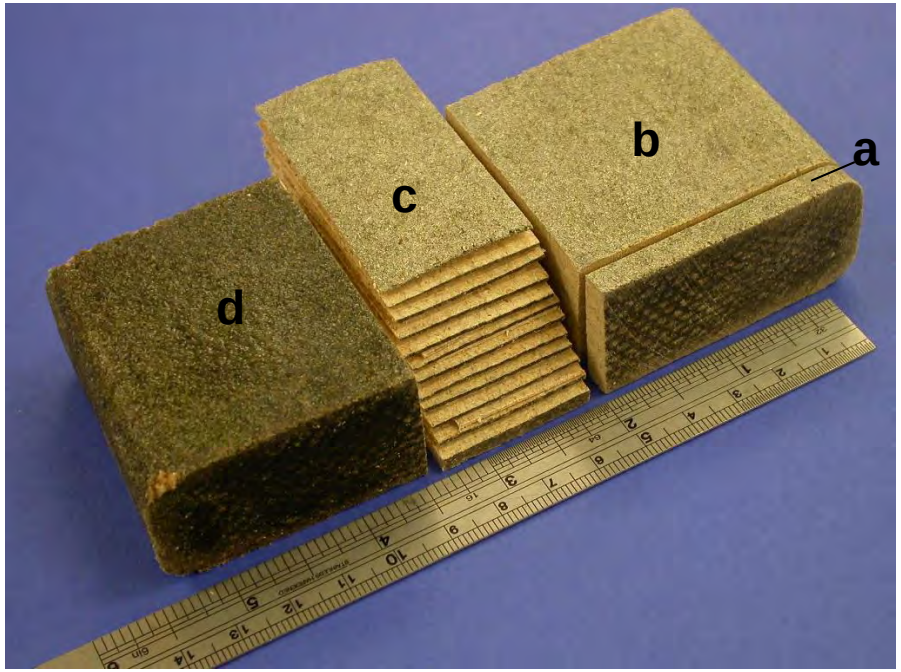


Exterior Exposure in Vancouver

Specimen preparation #5 and #6



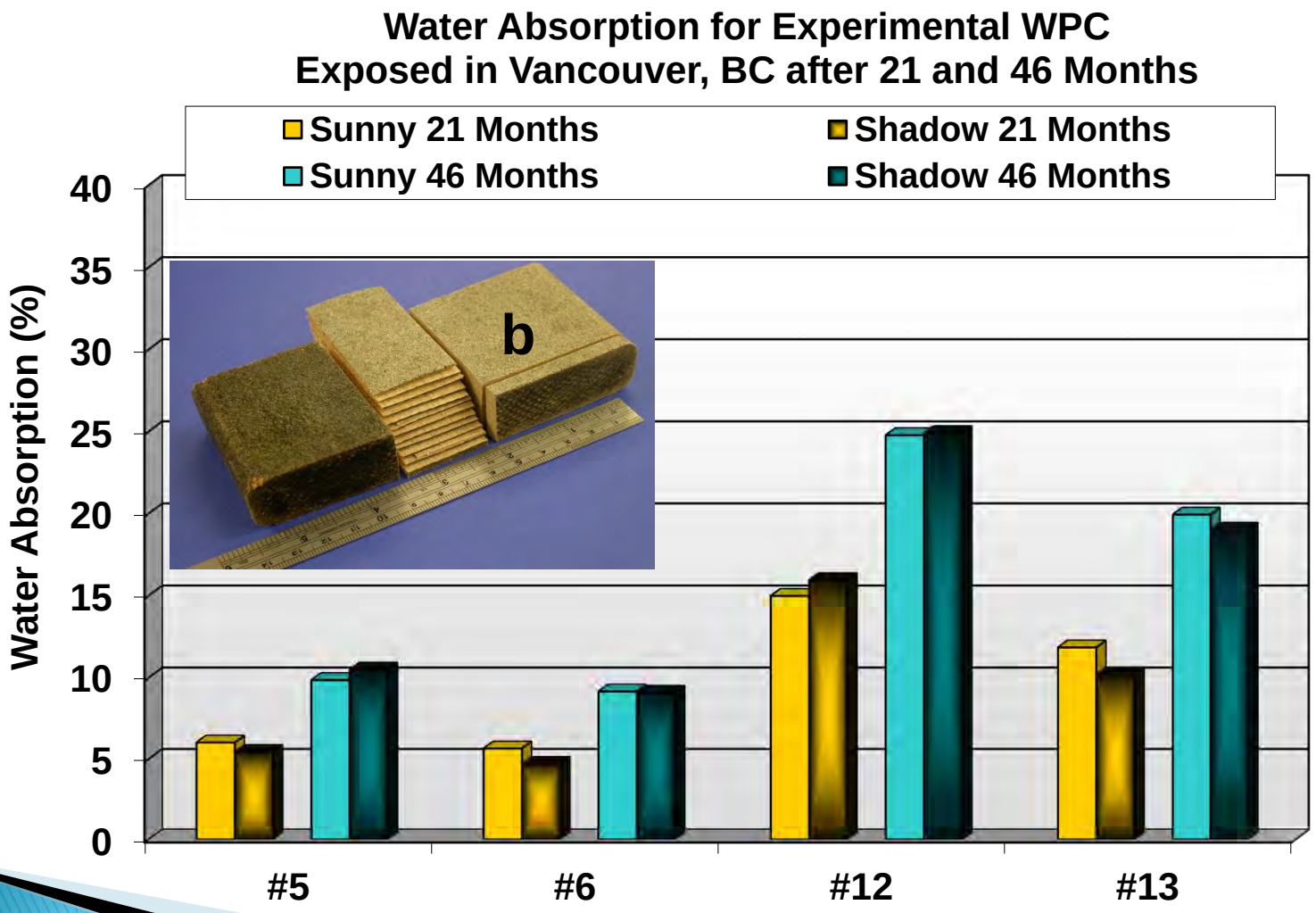
Specimen preparation #12 and #13



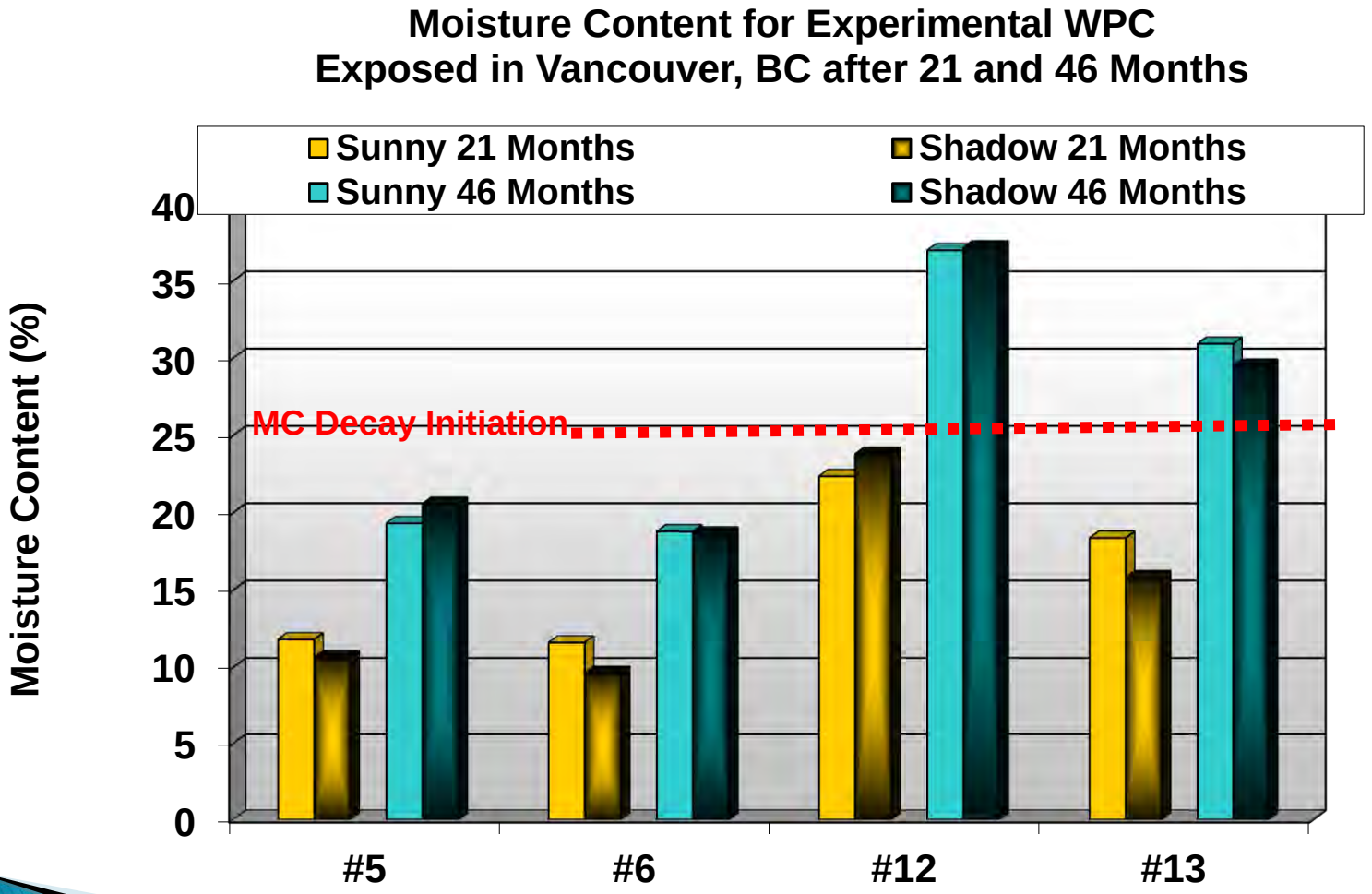
- 8th International Conference on Woodfiber-Plastic Composites, Madison, WI, May 23-25, 2005
- www.polymerengineering.ca

Author: M. Gnatowski "Water Absorption by Wood-Plastic Composites in Exterior Exposure"

Exterior Exposure in Vancouver



Exterior Exposure in Vancouver



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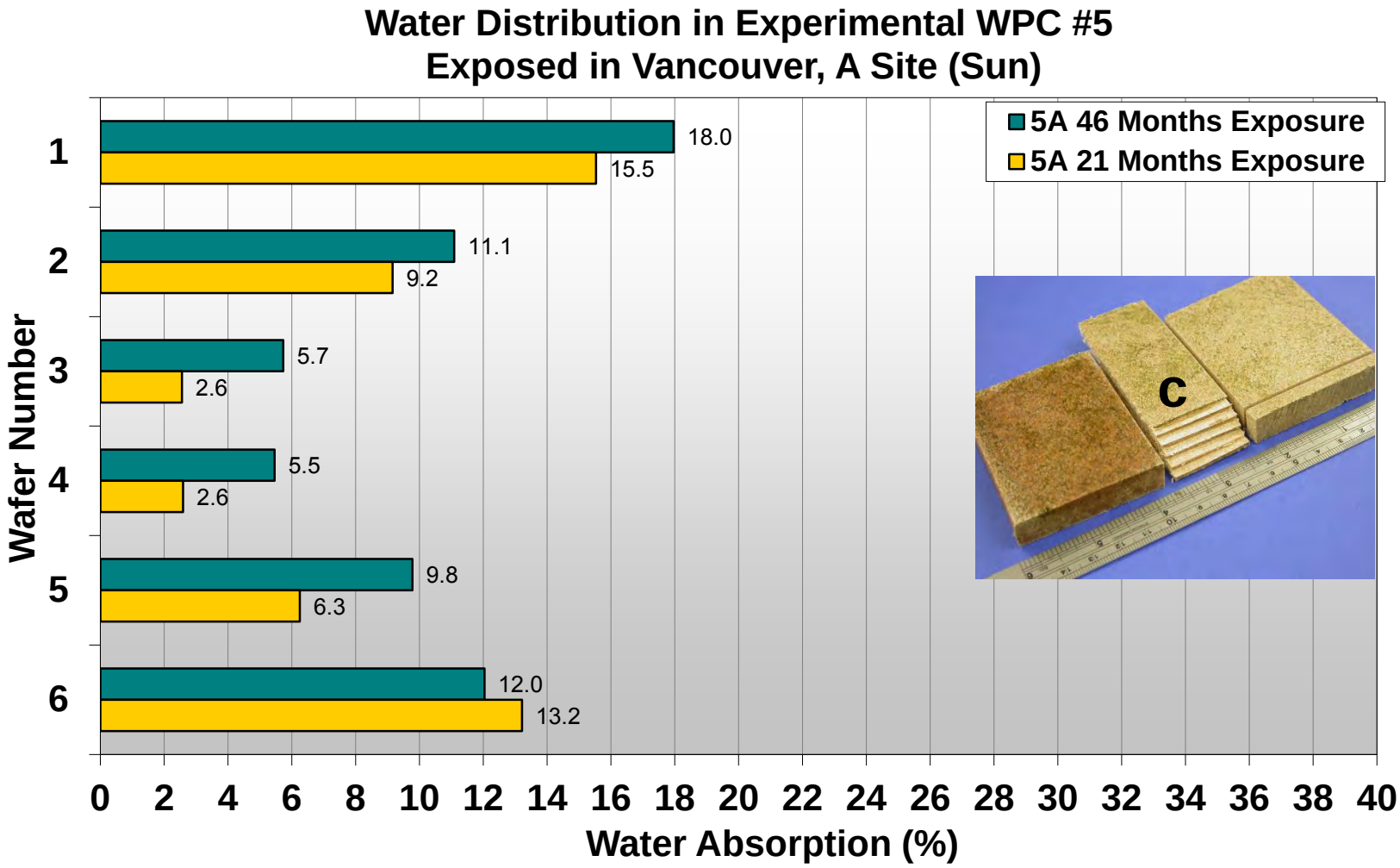

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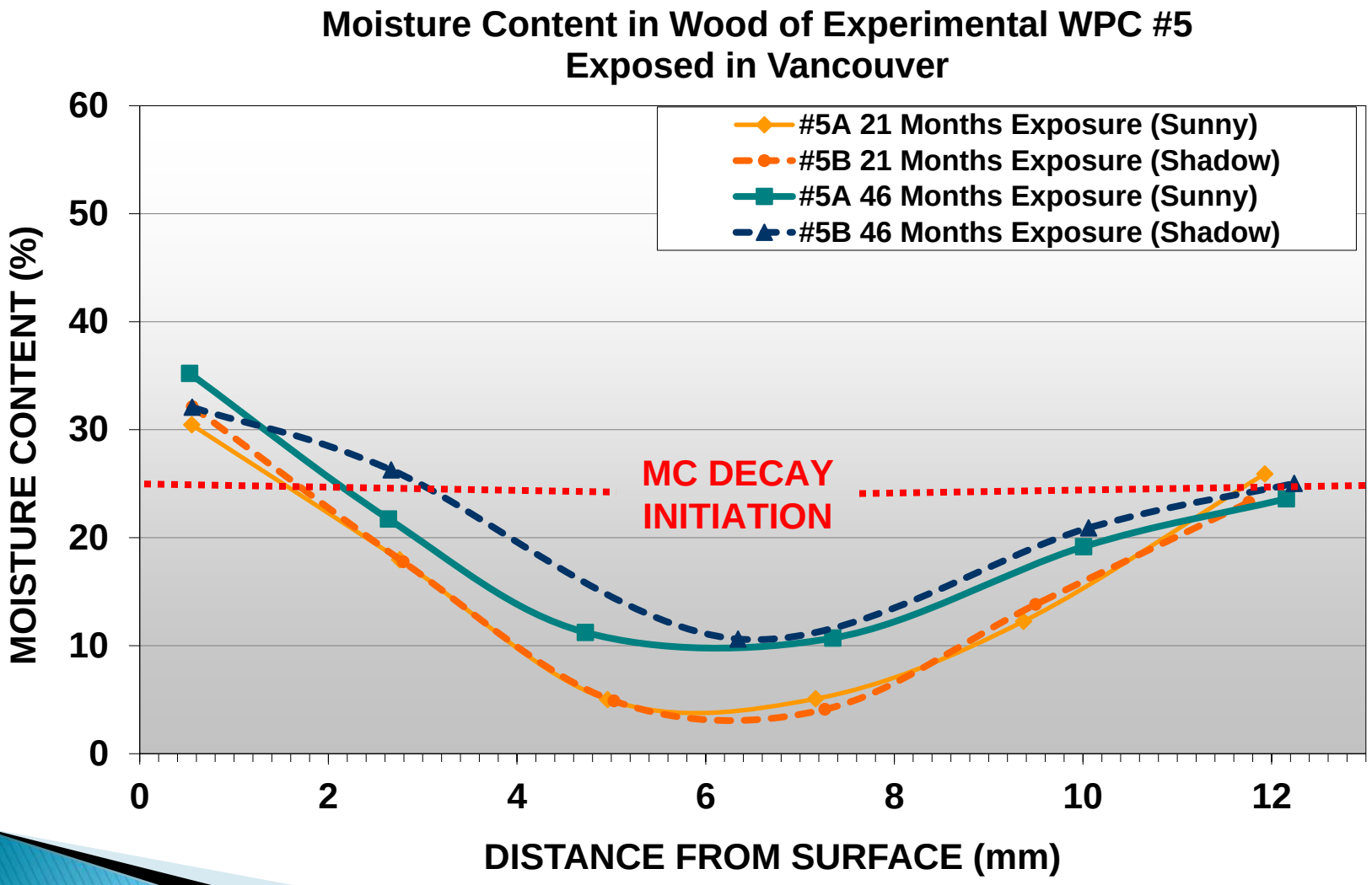

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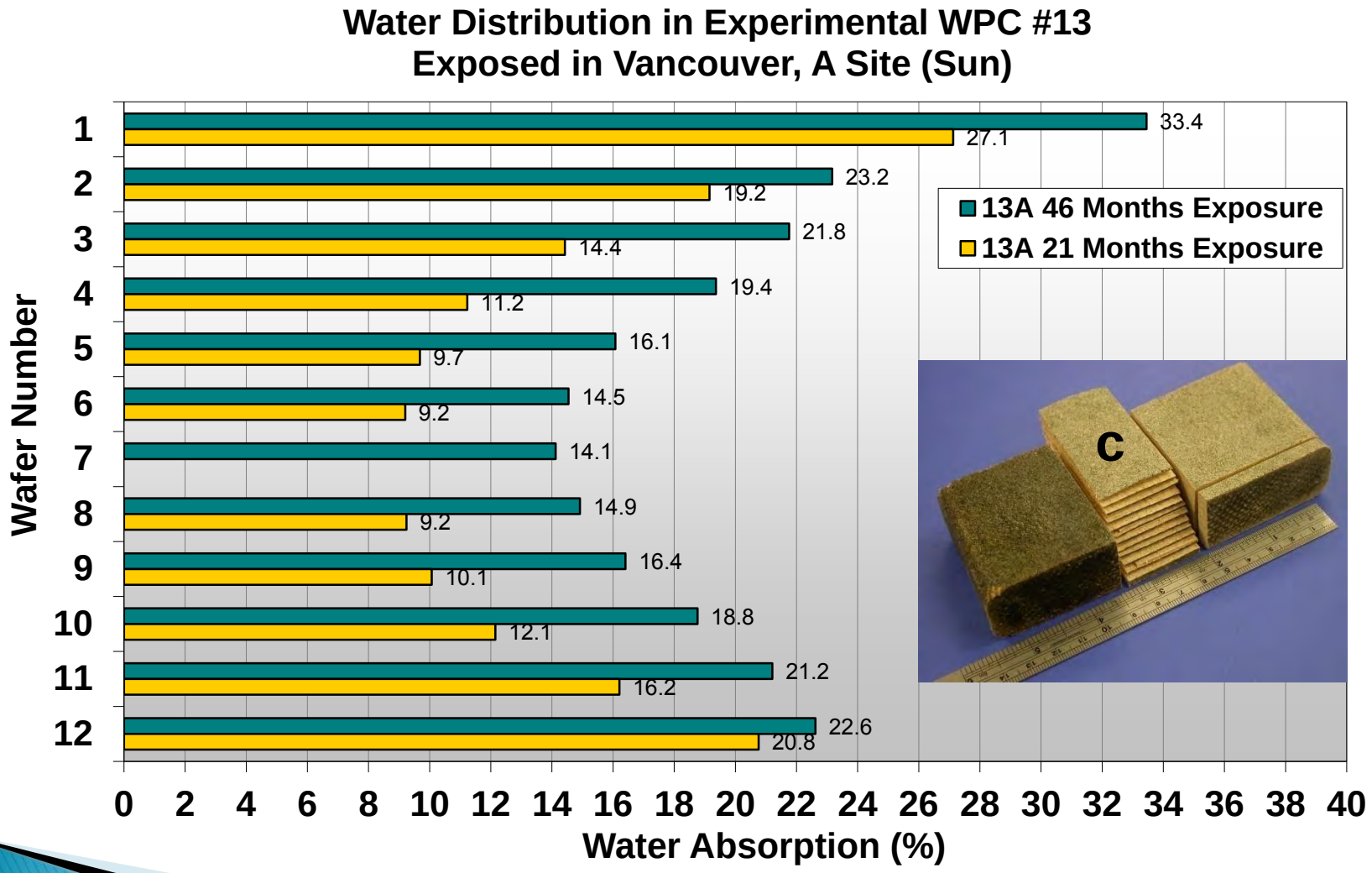

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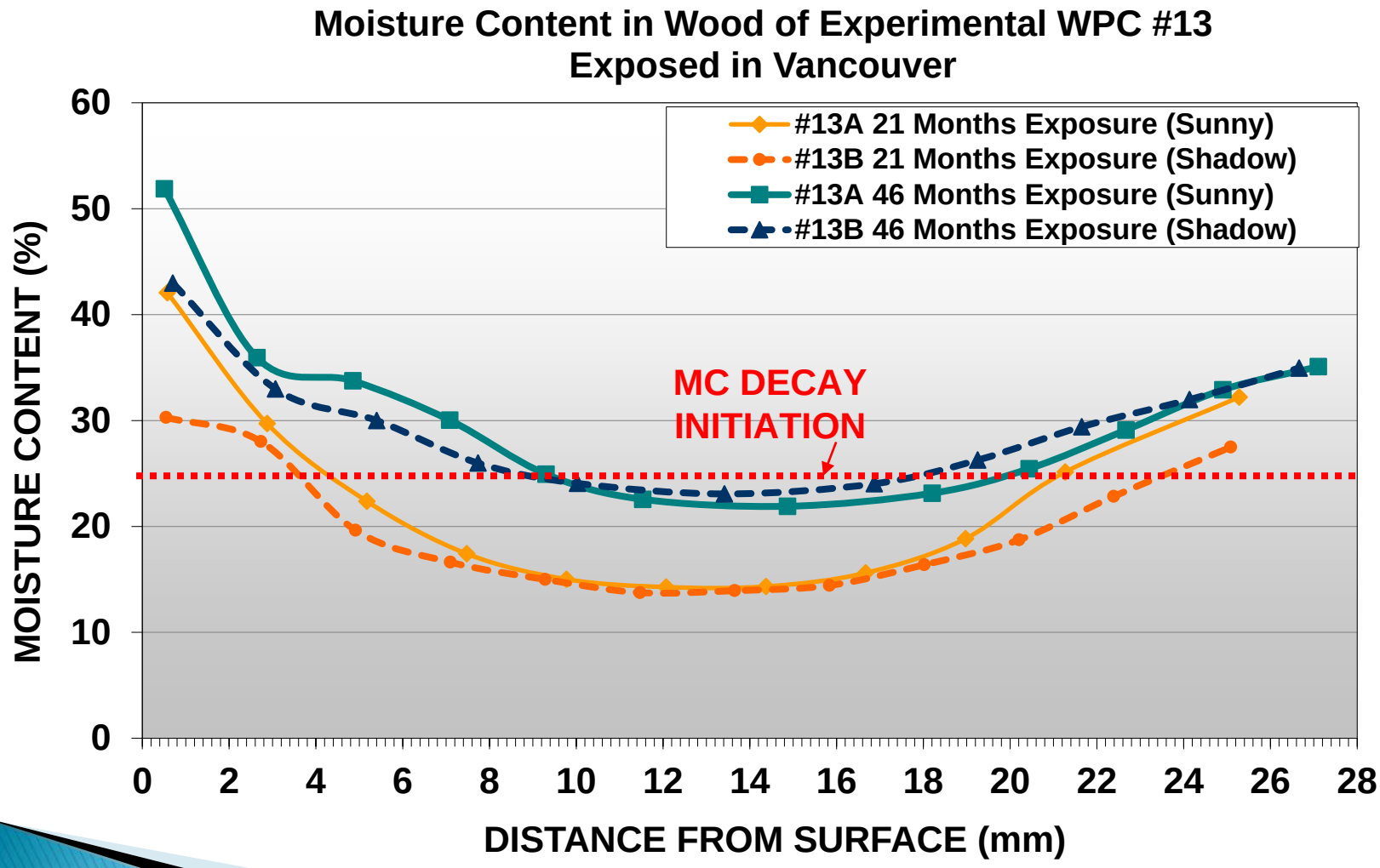
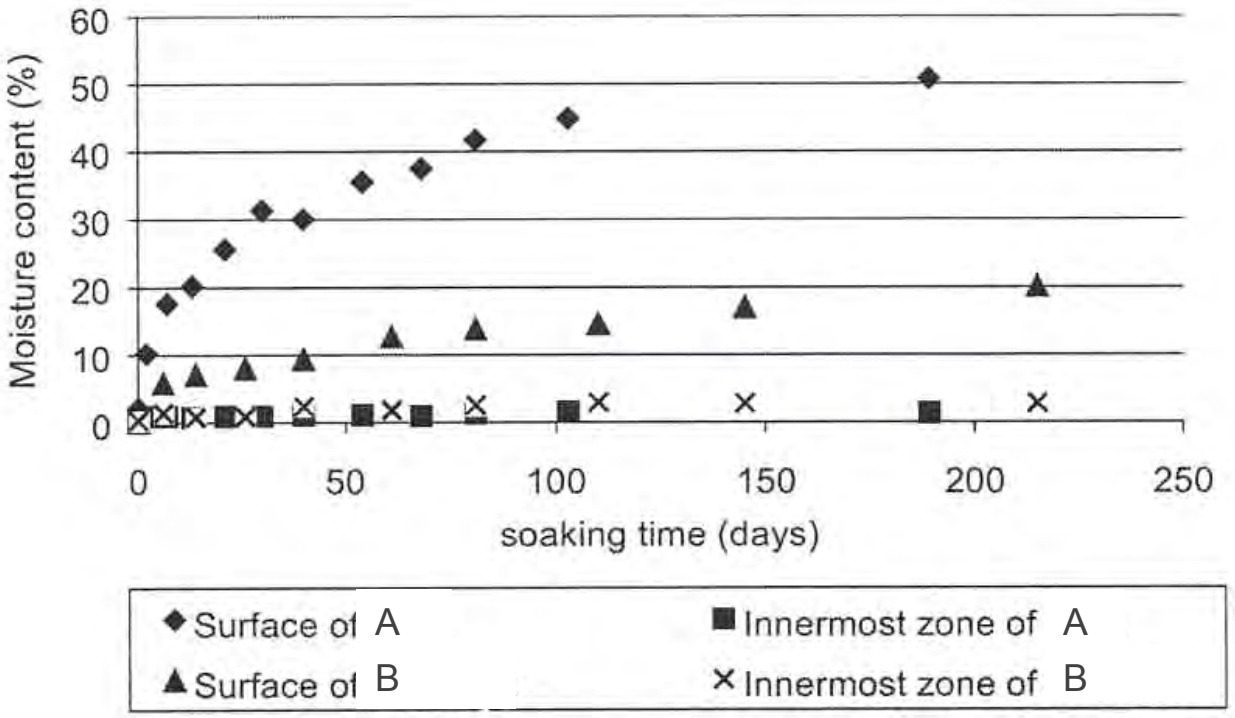


Laboratory Evaluation



Wood MC in surface (0 to 5mm) and inner zones (15 to 18 mm and 10 to 12 mm) of A and B commercial samples immersed in water for up to 215 days

Forest Products Journal, Vol 54, No. 12, December 2004
Weihong Wang and J.J. Morrell, Oregon State University

Laboratory Evaluation

Conditioning Methods

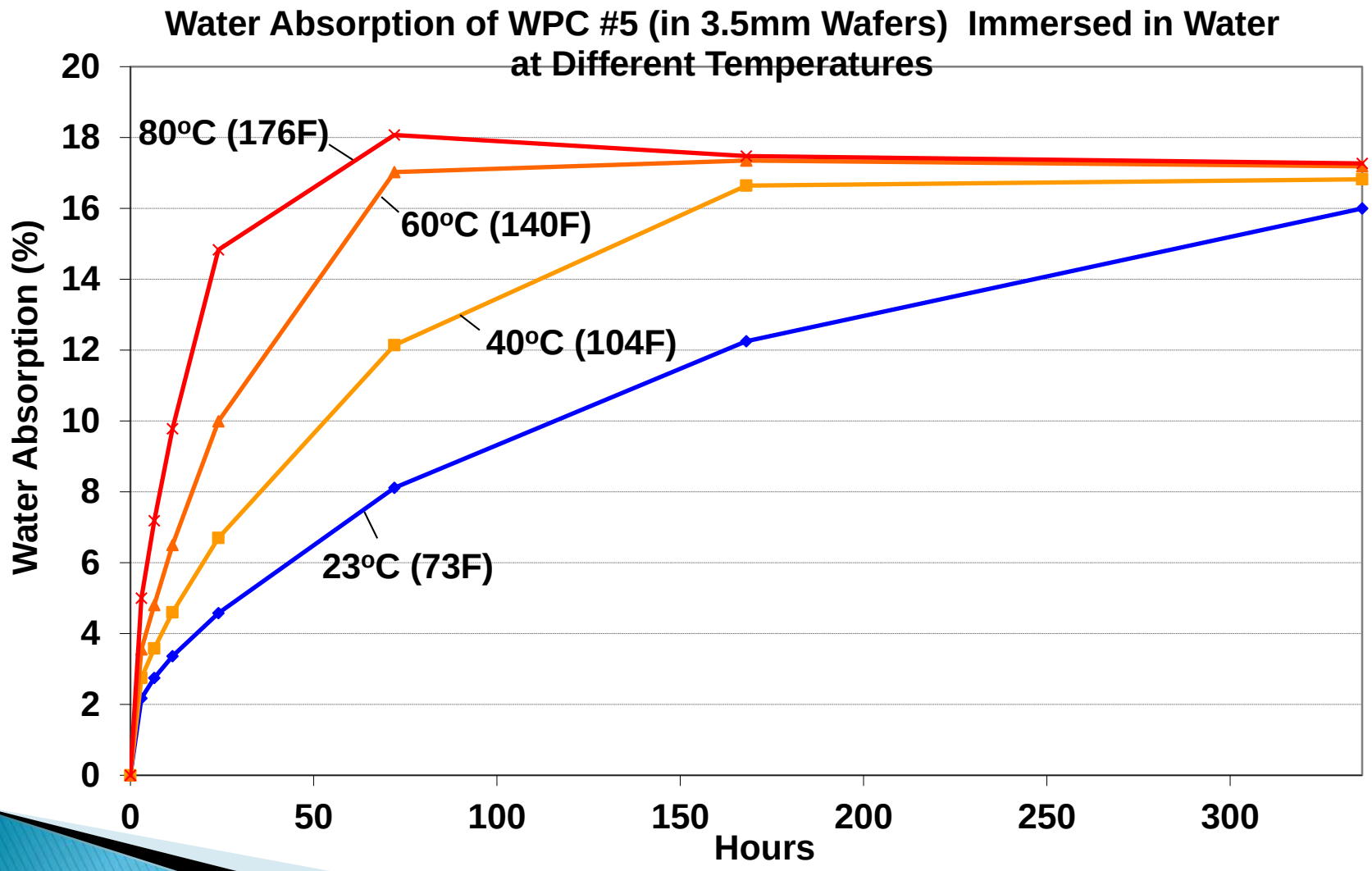
- Water soaking
- Boiling
- Steaming at a temperature over 100°C
- Exposure to elevated humidity at room or elevated temperature
- Pressure/vacuum treatment
- Cycling exposure with two or more of the methods described above

Laboratory Evaluation

Effective methods of acceleration of water absorption by wood plastic composites

- Size reduction
- Increase in temperature

Laboratory Evaluation



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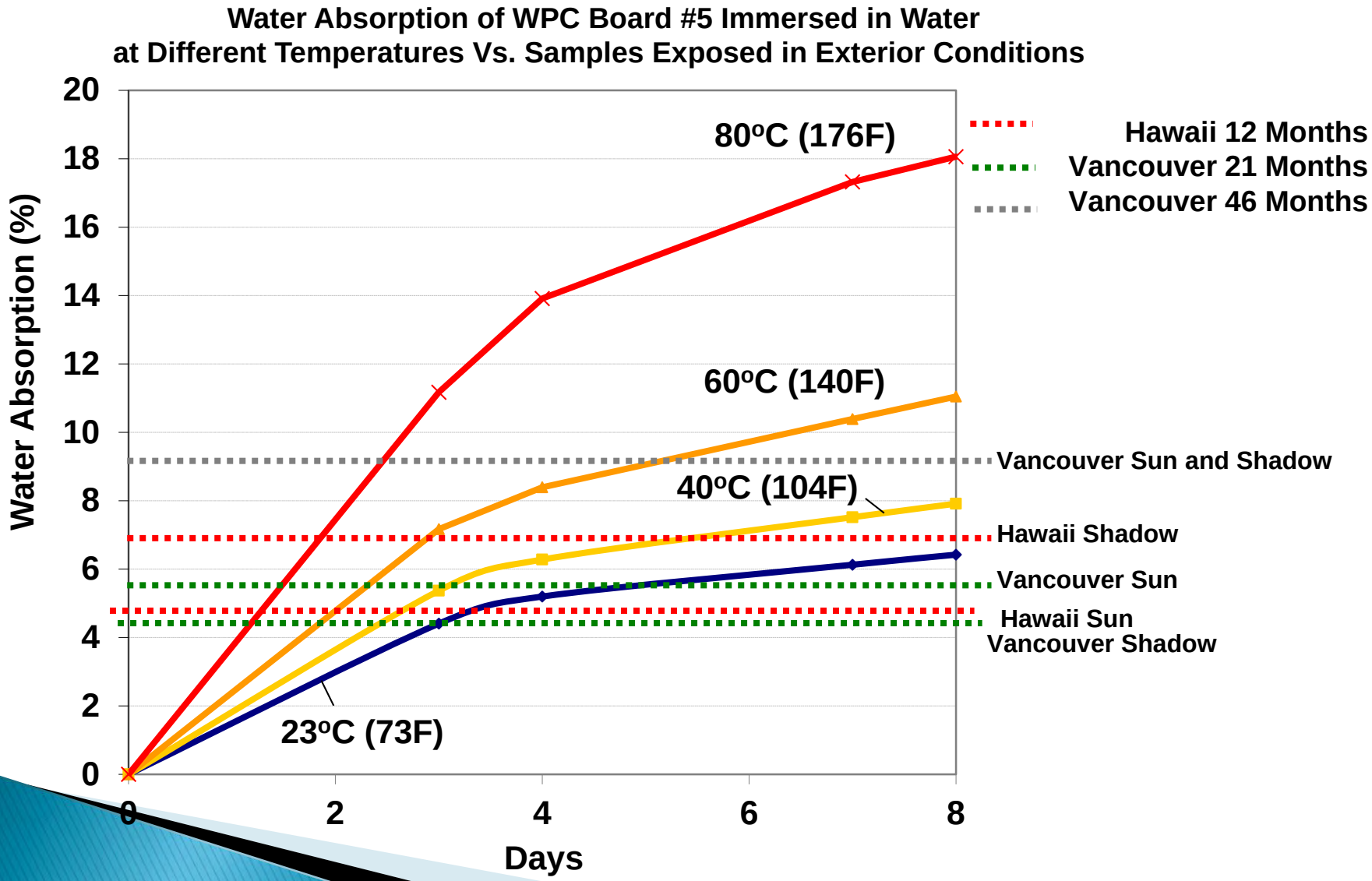

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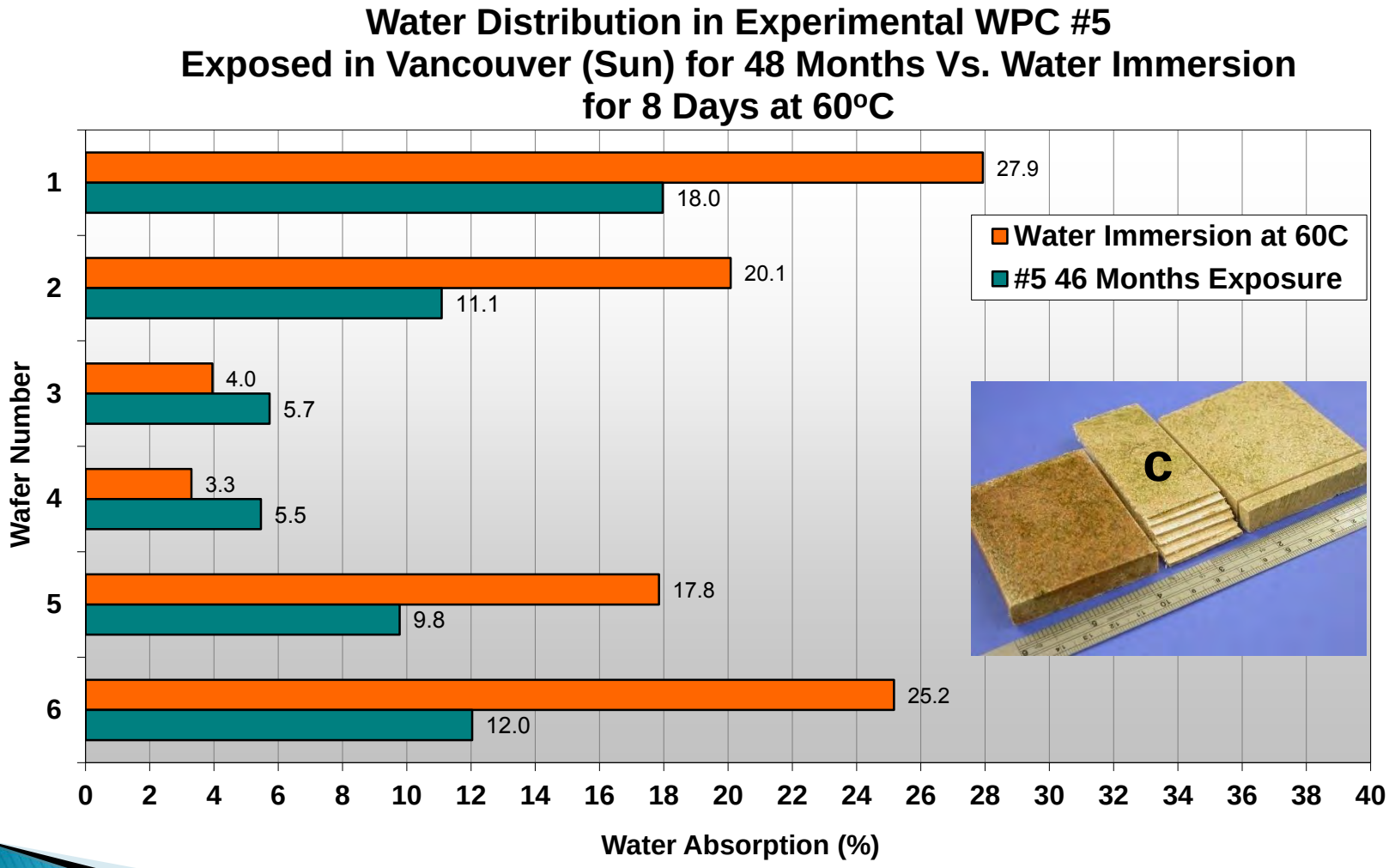

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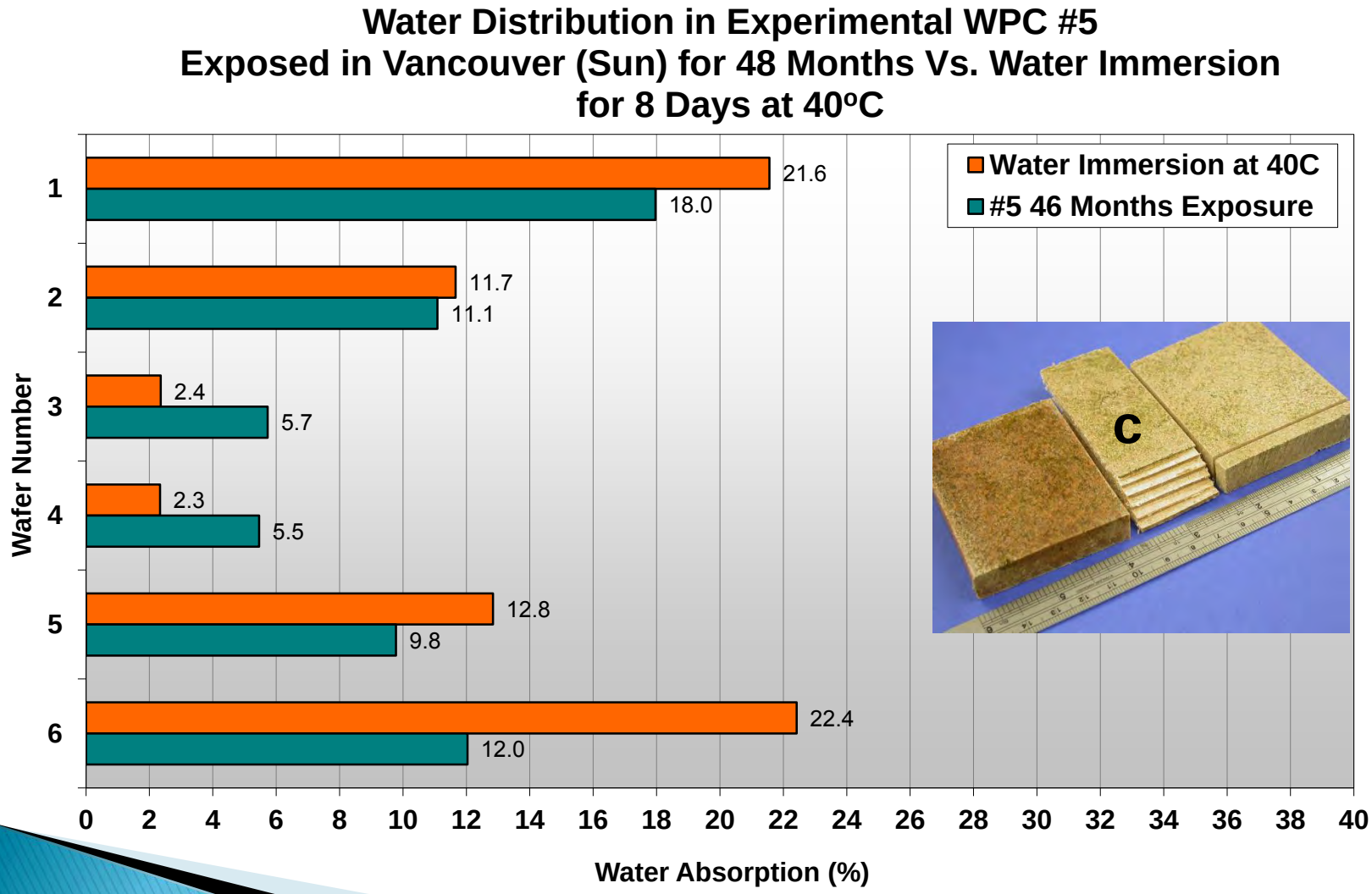

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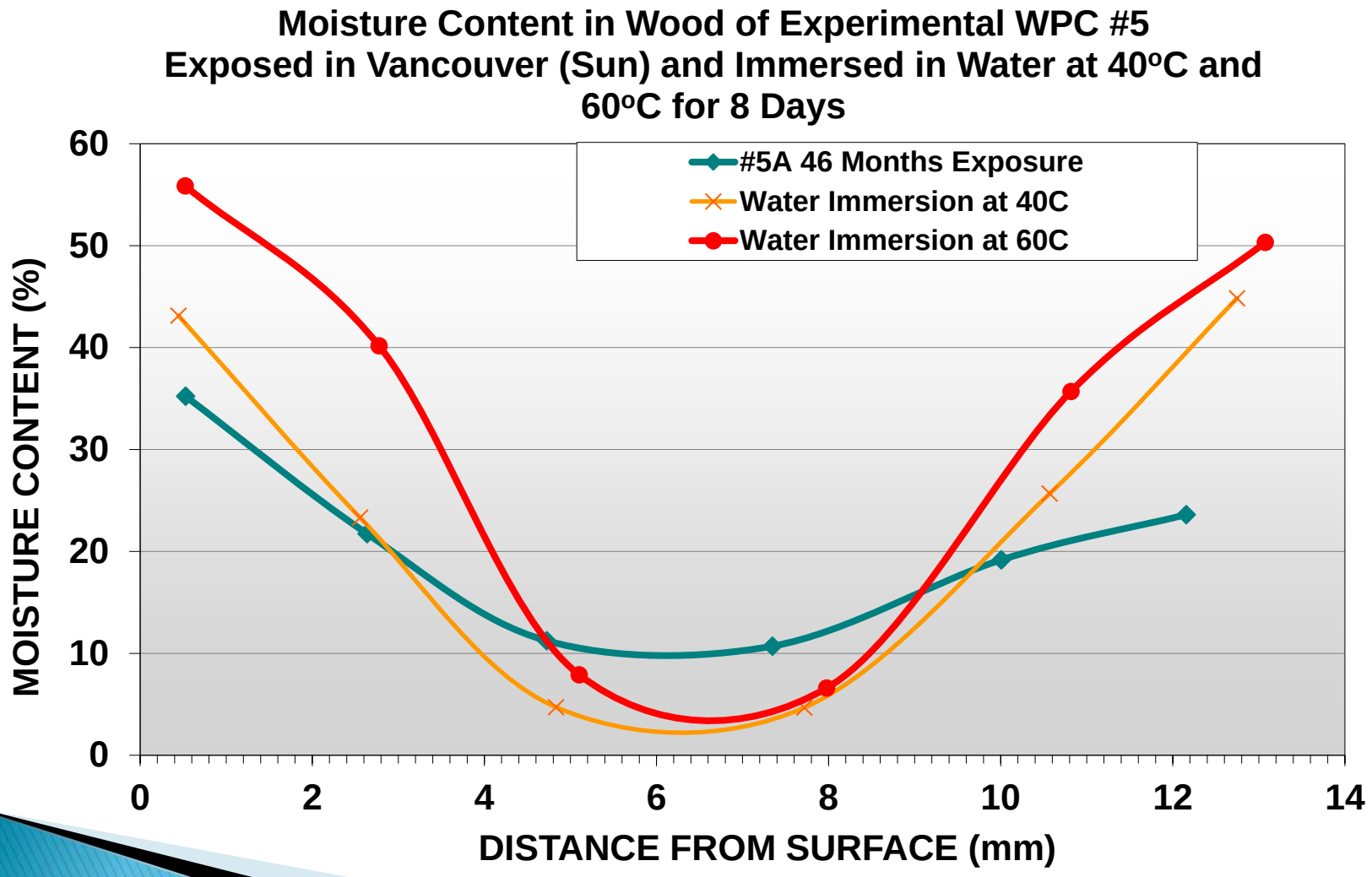

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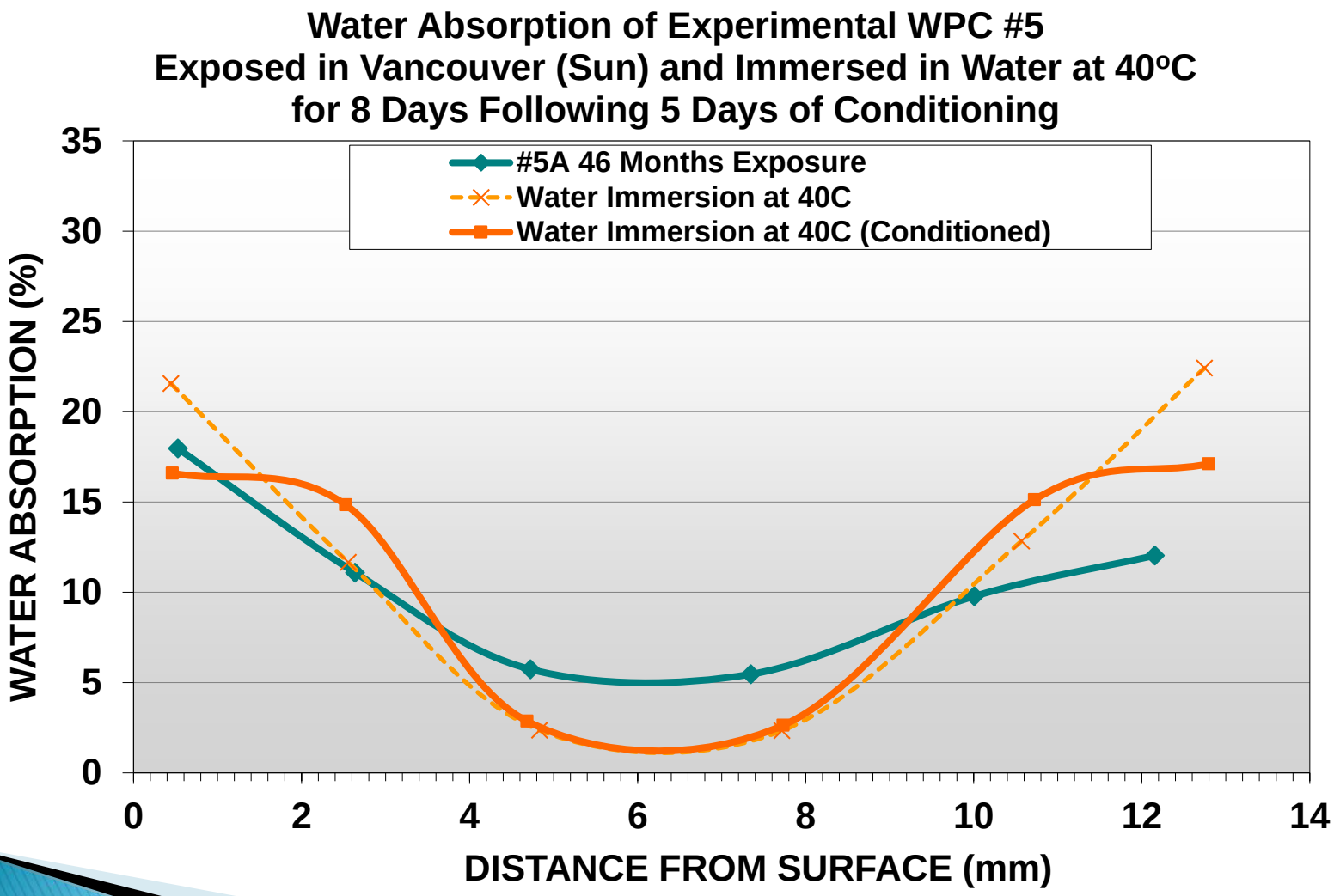

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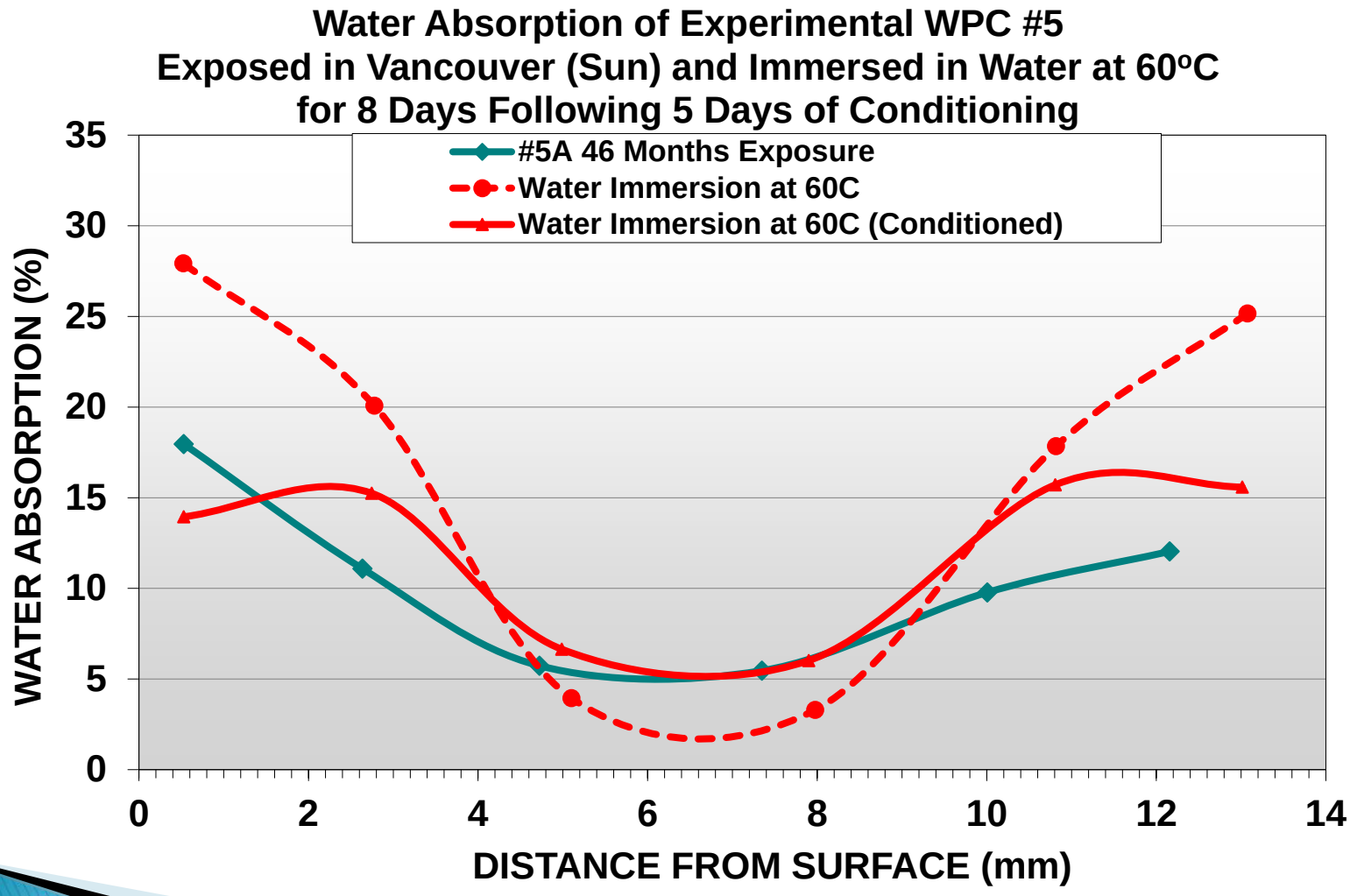

Conclusions

- Water will permanently accumulate in extruded Wood Plastic Composite boards exposed to exterior conditions.
- Water accumulation seems to increase with the increase of the exposure period.
- Moisture content in the wood of composites may reach and exceed the fiber saturation point at approximately 25% MC within the zone of a few to several millimeters from the board surface. The range of this zone seems to increase over exposure time and depends on composite composition.
- Laboratory simulation of water absorption by WPC in exterior exposure can be conducted by controlled immersion in warm water followed by conditioning at elevated temperature after sealing the specimen surface. Simulation conditions will depend on composite composition and simulated exterior exposure conditions.

Acknowledgements

PEC Staff

David Lesewick
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