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### **Selected findings of an IRC study of the wetting and drying potentials of wood-frame walls exposed to different climates**

Rousseau, M. Z.; Dalglish, W. A.

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**ORAL-598**

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## Selected Findings of an IRC Study of the Wetting and Drying Potentials of Wood-Frame Walls Exposed to Different Climates

by Madeleine Z Rousseau and W. Alan Dalglish

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National Research Council Canada Conseil national de recherches Canada

Canada

## Damage due to Rain Penetration



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## What is Too Wet for Too Long?

**Minimize** moisture entry into the wall system, and  
**Maximize** the exit of moisture which does enter so that:

No component stays 'too wet' for 'too long'

Systematic approach  
to quantify **too wet, too long for wood in stud space** and **relative risk of its deterioration**  
associated with climate and wall assemblies characteristics

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## IRC Study - "MEWS"

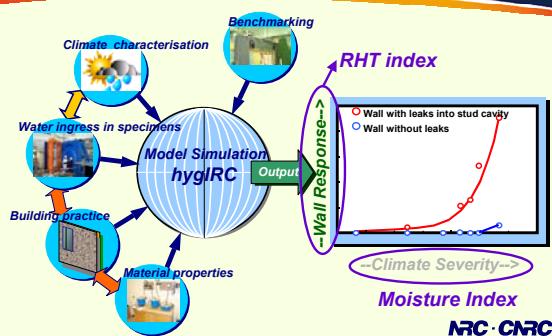
### Wood-frame wall assemblies

- Cladding system (masonry, stucco, EIFS, siding)
  - With/without an air space
- Sheathing board
- Insulation layer and location
- Water resistive membrane
- Vapour barrier
- Air leakage



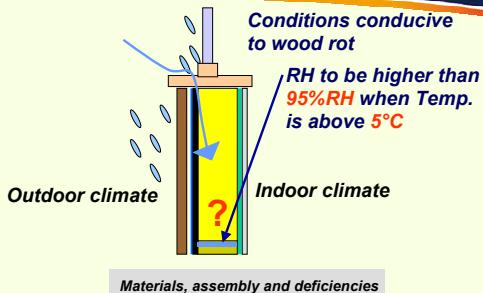
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## Method in a nutshell



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## MEWS Study: excessive RH and T



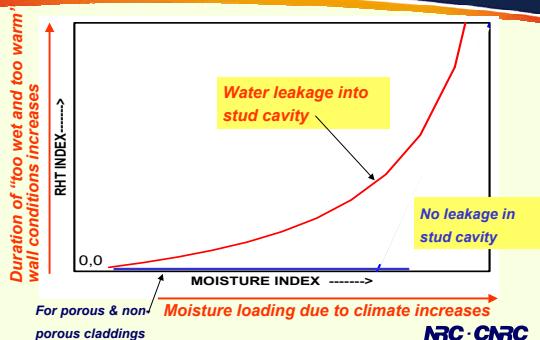
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## Modelling Studies using hygIRC 2D

- Exterior climate severity
- Deficiencies allowing water leakage in stud cavity
- Properties of materials on the exterior
  - Cladding and installation on an open air space
  - Exterior insulation
  - Sheathing board
  - Water resistive barrier
- Properties of materials on the interior
- Indoor climate
- Air leakage

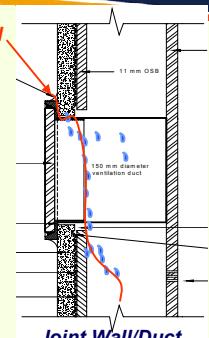
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## Effect of Climate Severity



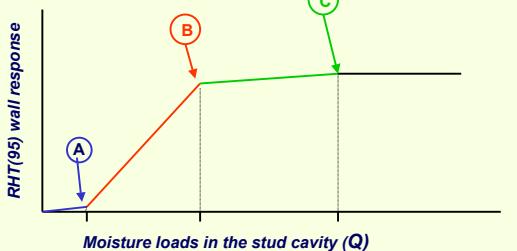
## Effect of Water Leakage in Stud cavity

- Deficiency: missing seal
- Magnitude of the moisture loads in the stud space depended on:
- Severity of the climate
  - Type and size of deficiencies in the wall system, providing a path for water entry to the stud space

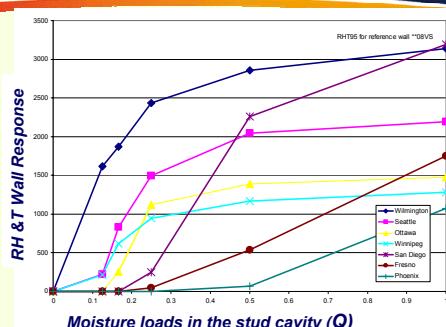


## Pattern of Wall Response to Water Leakage in Stud Cavity

Will vary with the wall assembly and the climate



## Effect of Water Leakage in Stud Space

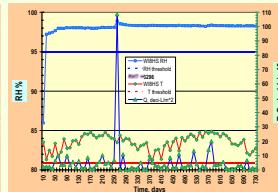


## Effect of Water Leakage Loads into Stud Space

**SMALL** moisture loads  
in stud space - Wall A



**LARGE** moisture loads  
in stud space - Wall A

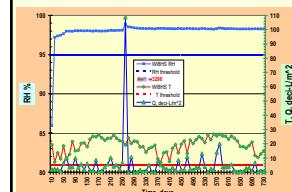


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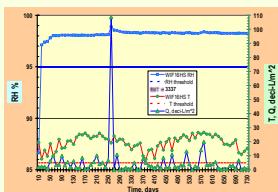
## Effect of Sheathing Property on RH & T Response

**LARGE** moisture loading in stud cavity

**Sheathing board A**

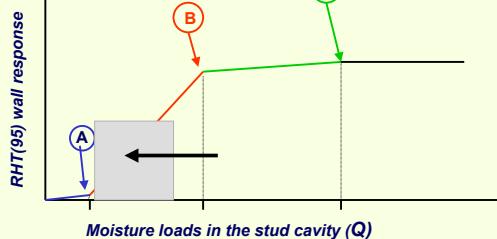


**Sheathing board B**



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## Drying to outside helped when leakage was small

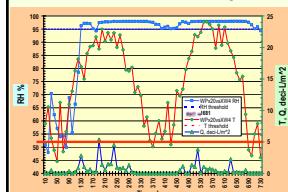


Moisture loads in the stud cavity ( $Q$ )

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## Effect of Thermal Properties Outboard

Higher thermal resistance outboard increased the duration of Temp. above 5°C in all climates



With insulating layer outside



Without insulating layer outside

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## Effect of Cladding Properties

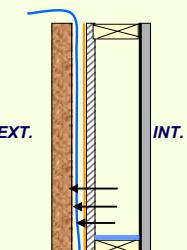
- No effect on excessive RH (at or higher than 95%) prevailing in stud space
- One case of a stucco cladding wall exposed to severe climatic loads resulted in a small excessive RH load in stud space

STUCCO	Masonry
EPS Lathing	Siding Hardboard/vinyl

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## Effect of Open Cavity Behind Cladding

- Large positive effect observed when air space was coupled with a more vapour permeable sheathing board
- When moisture loads in stud space were high, the drying potential of the vented cavity was not observed.



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## Summing Up

- ✓ Wetting of the stud cavity must be minimized, before benefits from drying strategies can kick in.
  - Wetting from rain
  - Condensation
  - Water built-up during construction process
- ✓ To reduce wetting from exterior sources:
  - ✓ ACCEPT
  - ✓ DEFLECT
  - ✓ COLLECT
  - ✓ DIRECT and
  - ✓ DON'T NEGLECT!

PRACTICE "SAFE" WALL!

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## To find out more ...

Visit NRC website <http://irc.nrc-cnrc.gc.ca/bes/mews/>

Research reports and papers on the MEWS project :

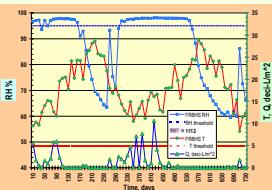
- ✓ Methodology
- ✓ N. A. climate characterization
- ✓ Hygrothermal properties of building materials
- ✓ Laboratory evaluation of wall systems exposed to simulated wind-driven rain
- ✓ Modelling results and benchmarking
- ✓ Research team and industrial partners

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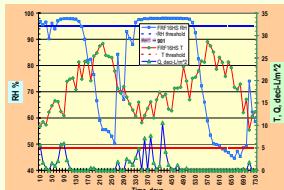
## Effect of Sheathing Property on RH & T Response

SMALL moisture loading in stud cavity

Sheathing board A



Sheathing board B



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