Moisture Durability Assessment of Common Well-insulated Wall Assemblies

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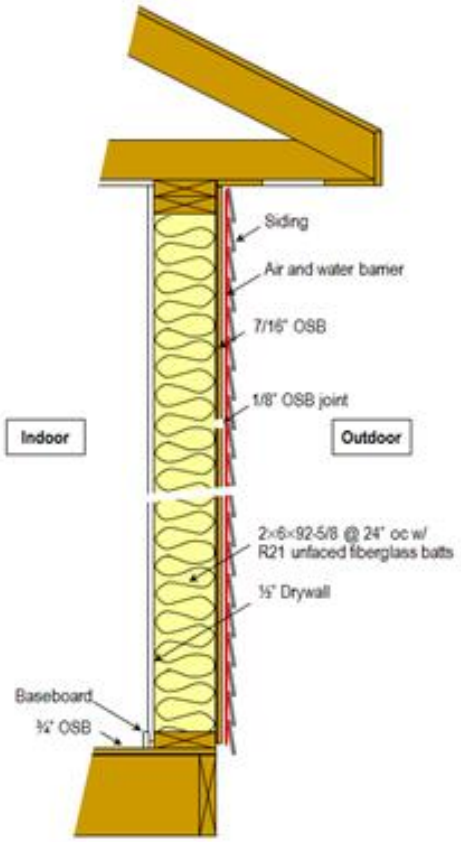
2 wall assemblies

- Vinyl siding
- XPS or spun-bonded polyolefin air barrier
- Oriented strand board
- Studs with R-19 fiberglass batt insulation
- Drywall

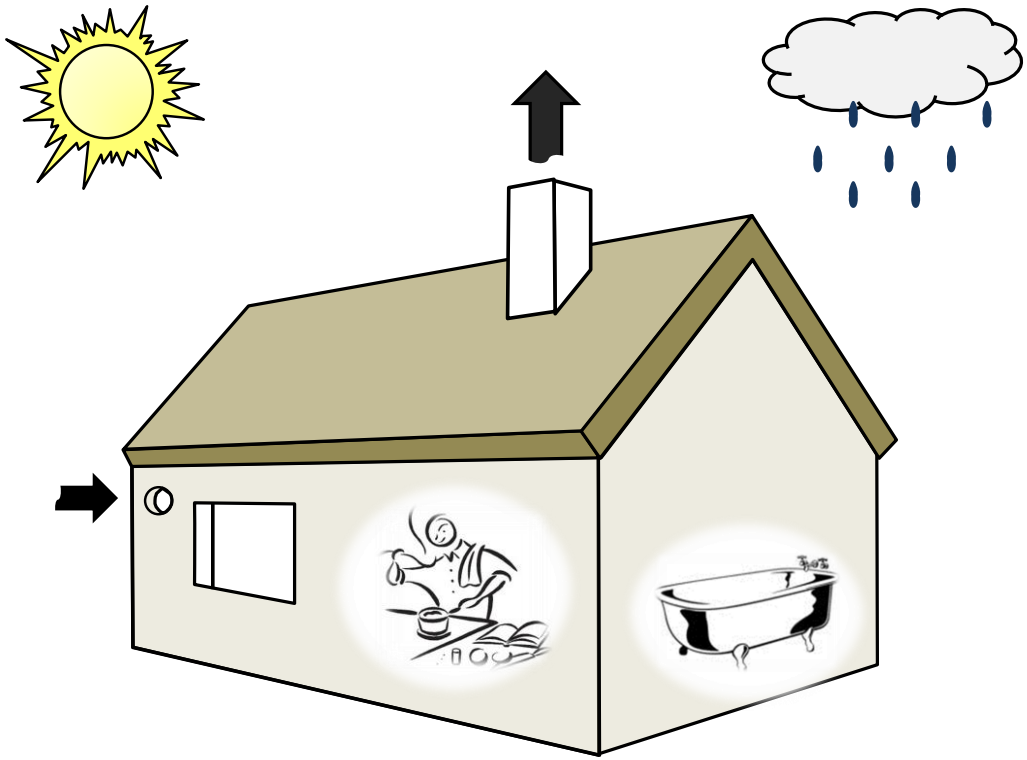


The main differences between the two assemblies are the R-values due to the requirements for the two vapor retarder classes. The first wall has a class III vapor retarder and the second wall has faced batt insulation to fulfill a class II vapor retarder.

	Houston, Texas	New York, New York	Chicago, Illinois	Minneapolis, Minnesota	Anchorage, Alaska
Wall assembly 1	**20**	**20 + 3.75**	**-**	**20 + 11.25**	**-**
Wall assembly 2	**-**	**-**	**20**	**20 + 5**	**20 + 5**

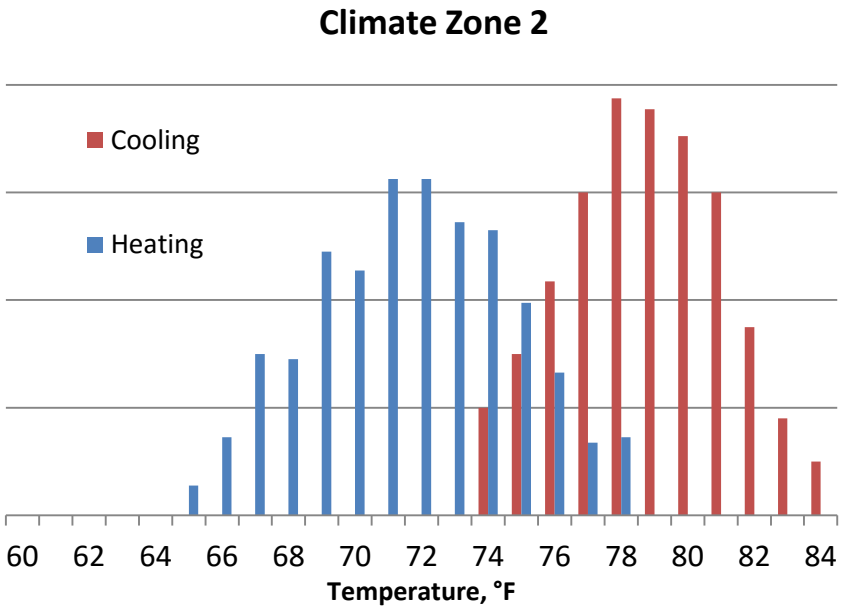
IRC 2015
IECC 2015

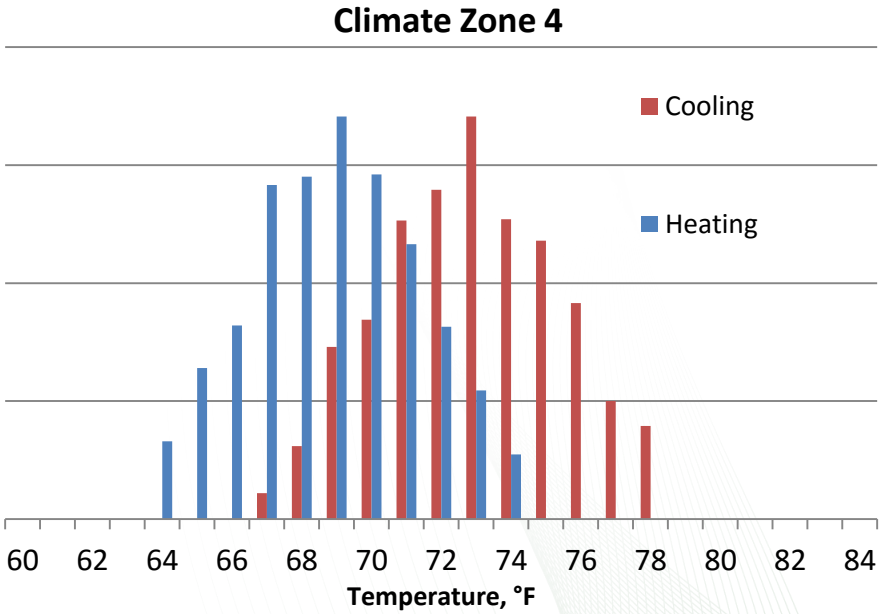
Varying Parameters



- Outdoor climate
- House characteristics
- Thermostat settings
- Indoor moisture generation
- Indoor heat generation
- Airtightness of the house

Thermostat settings





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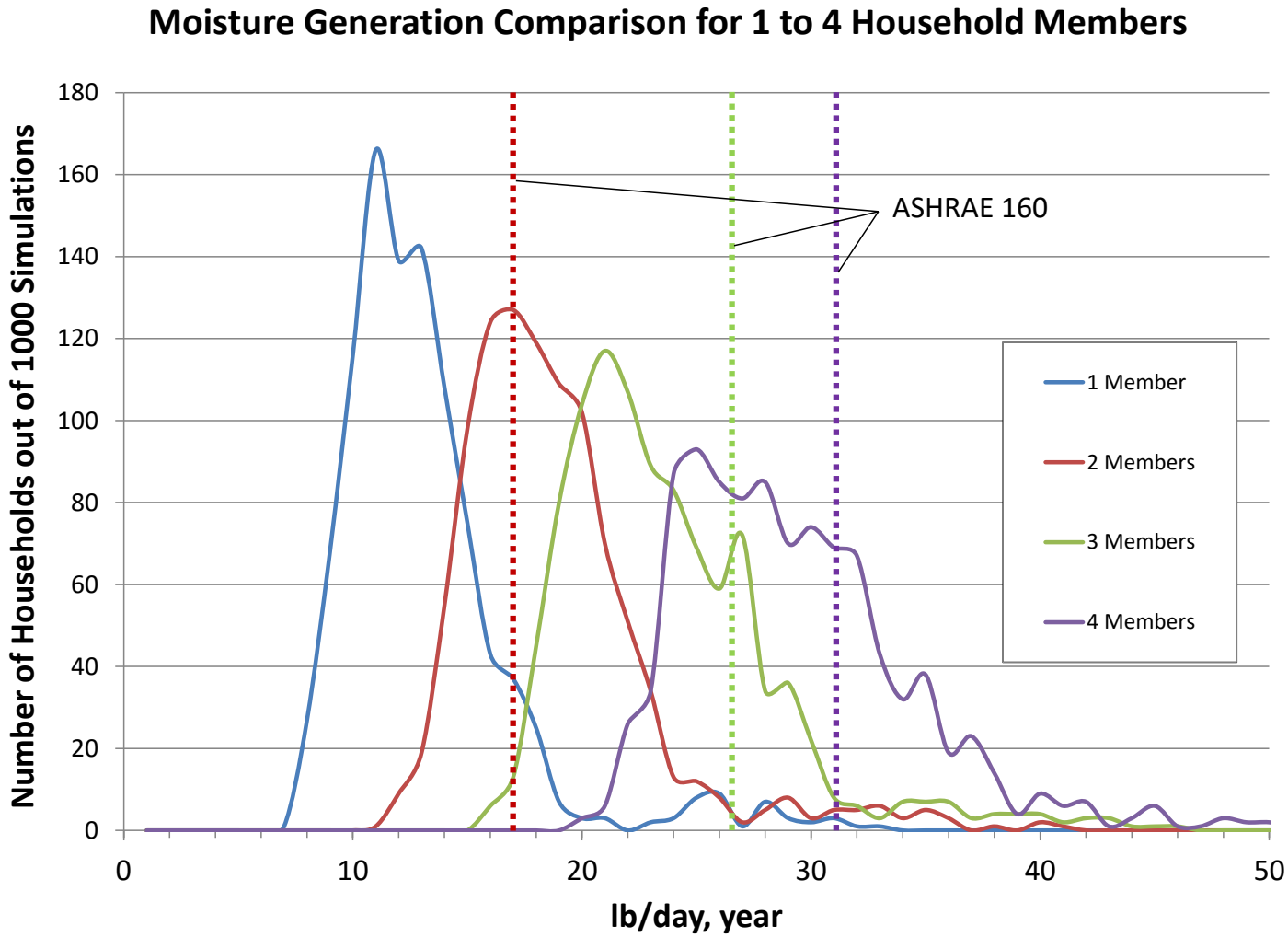
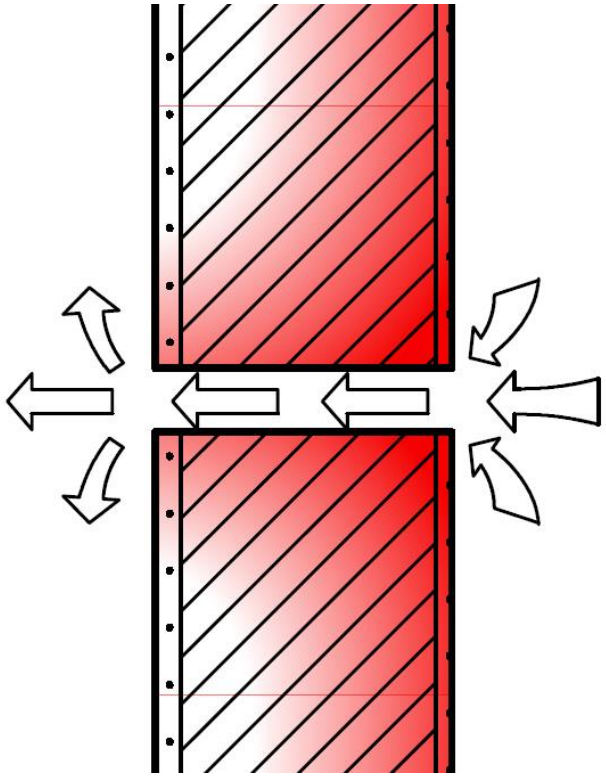
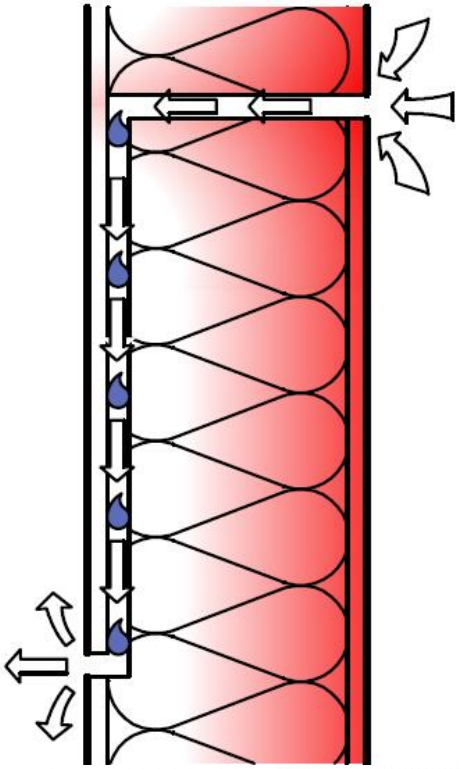
Indoor moisture generation



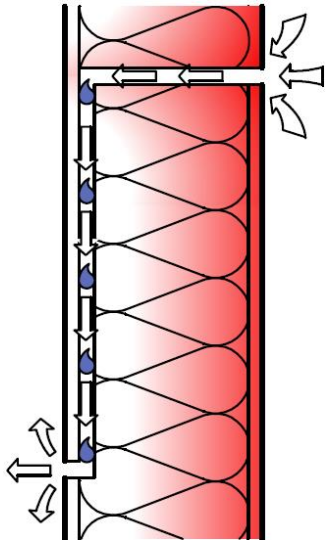
Energy leaks vs. moisture leaks





Fraunhofer IBP

Moisture leaks in a walls



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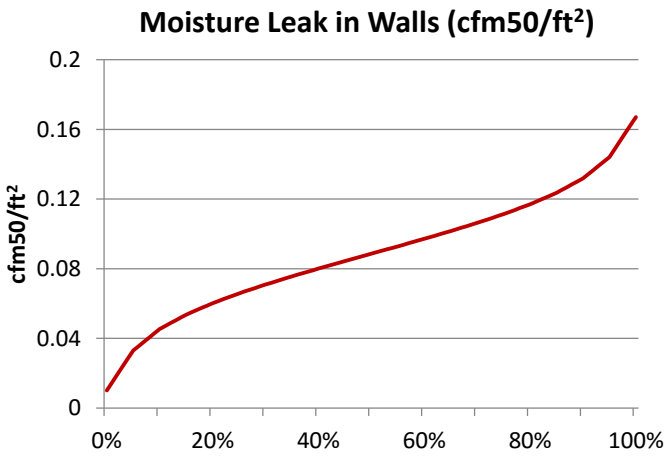

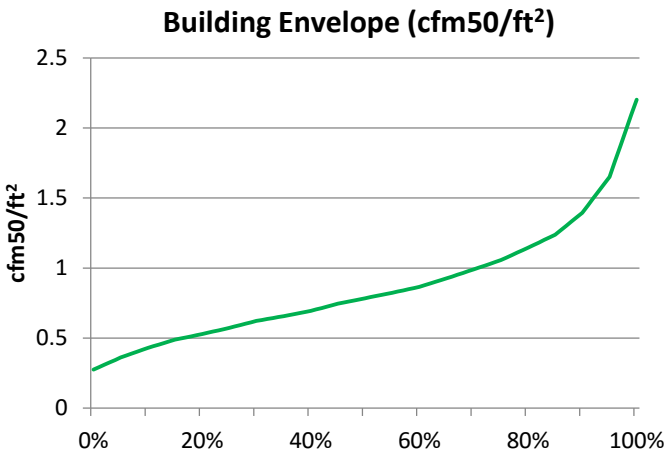

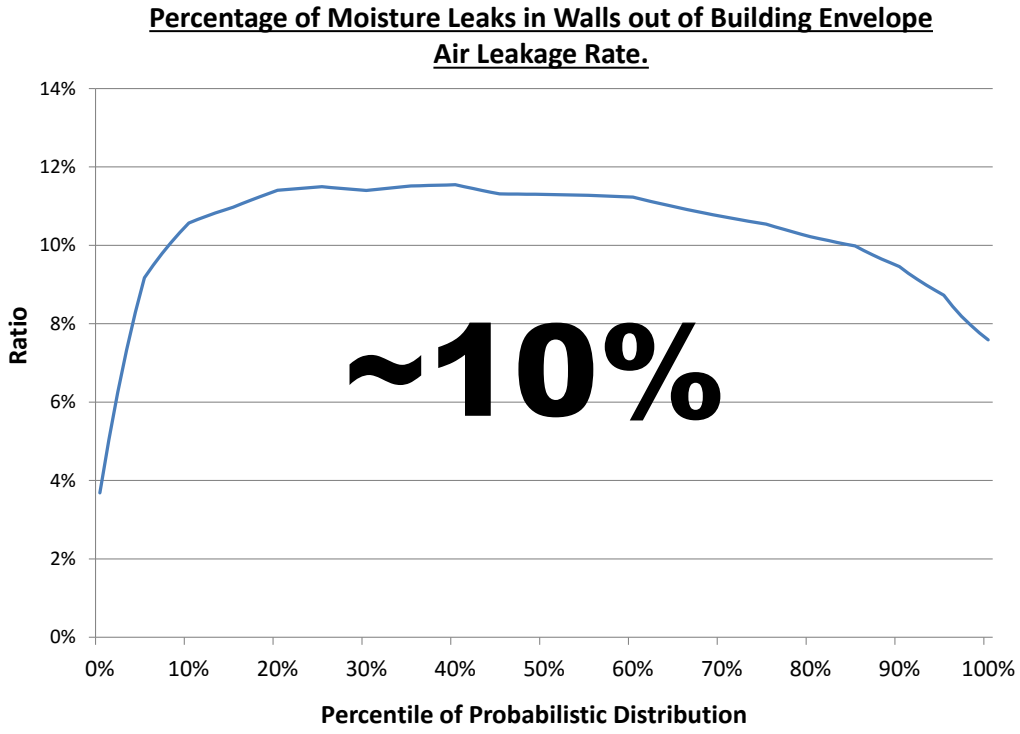

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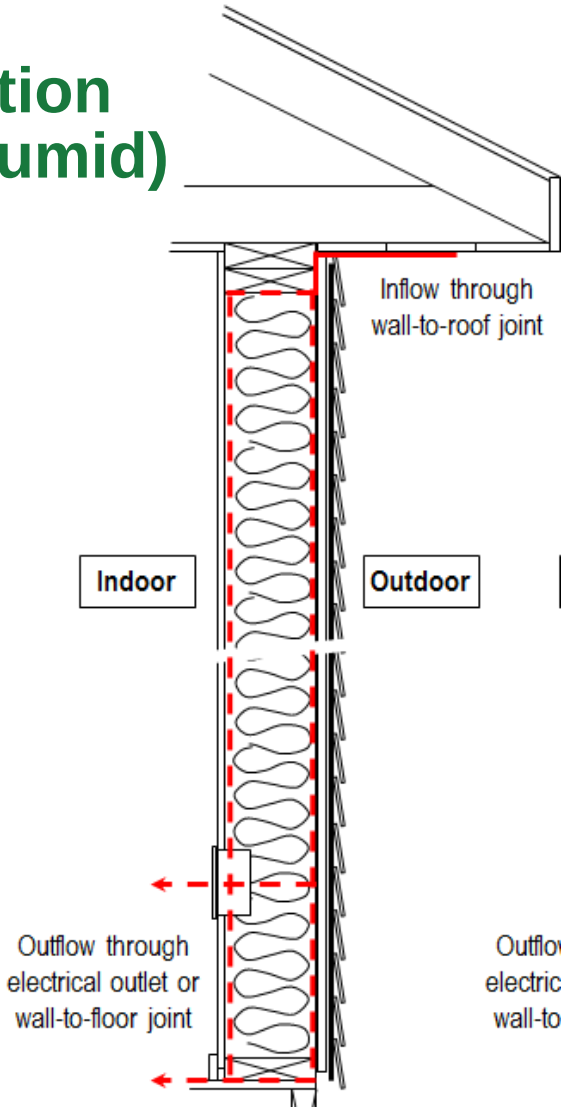
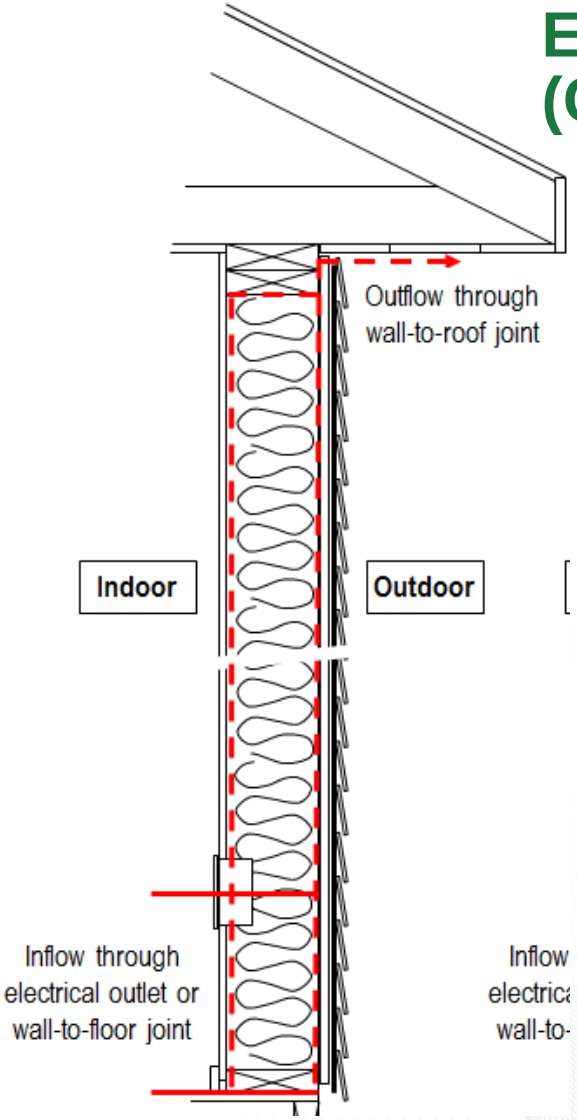
Moisture leaks in a walls

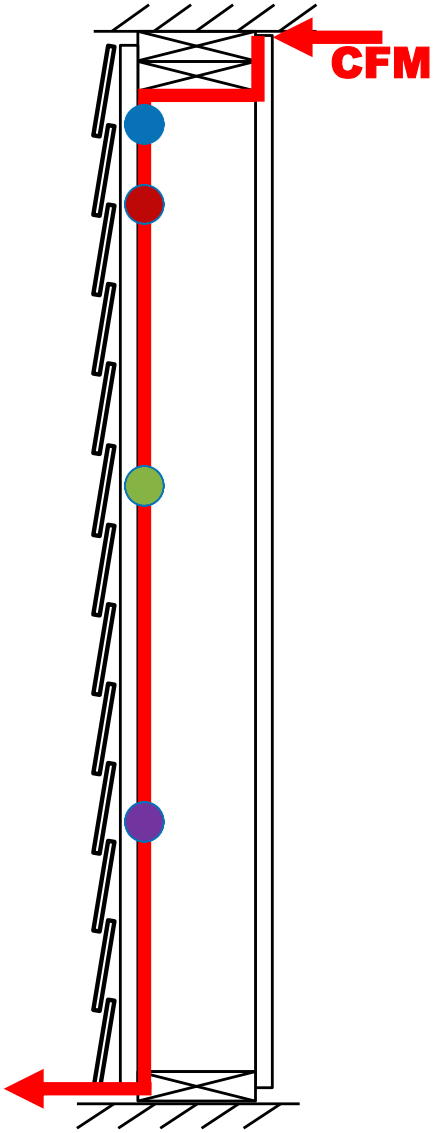
Infiltration (Hot-Humid)

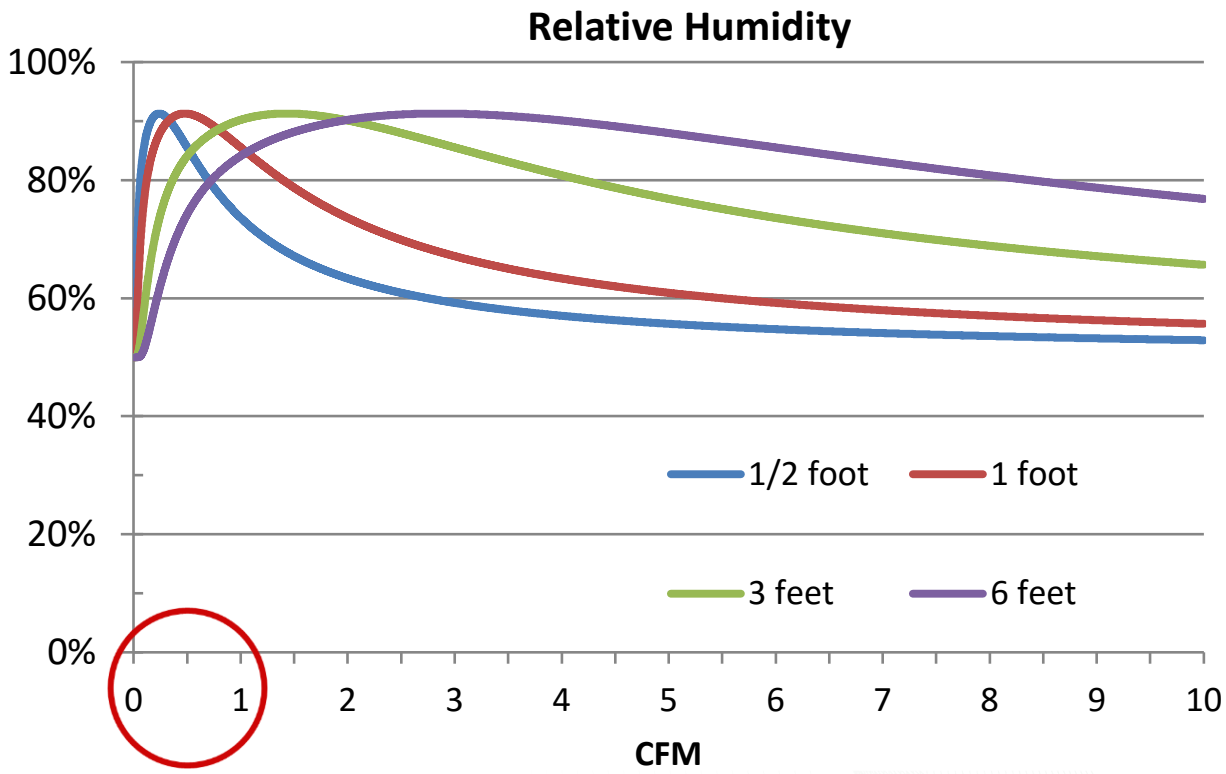


Exfiltration (Cold)



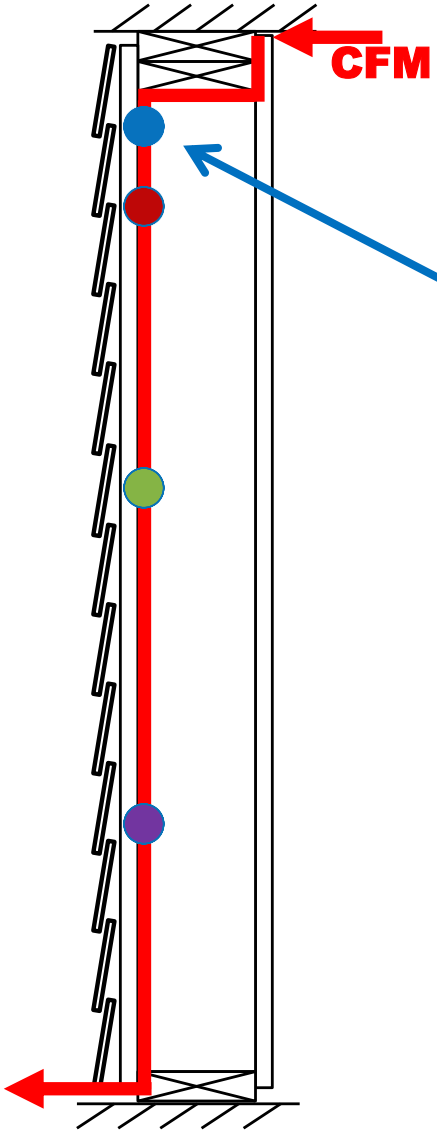
Is there a critical spot?

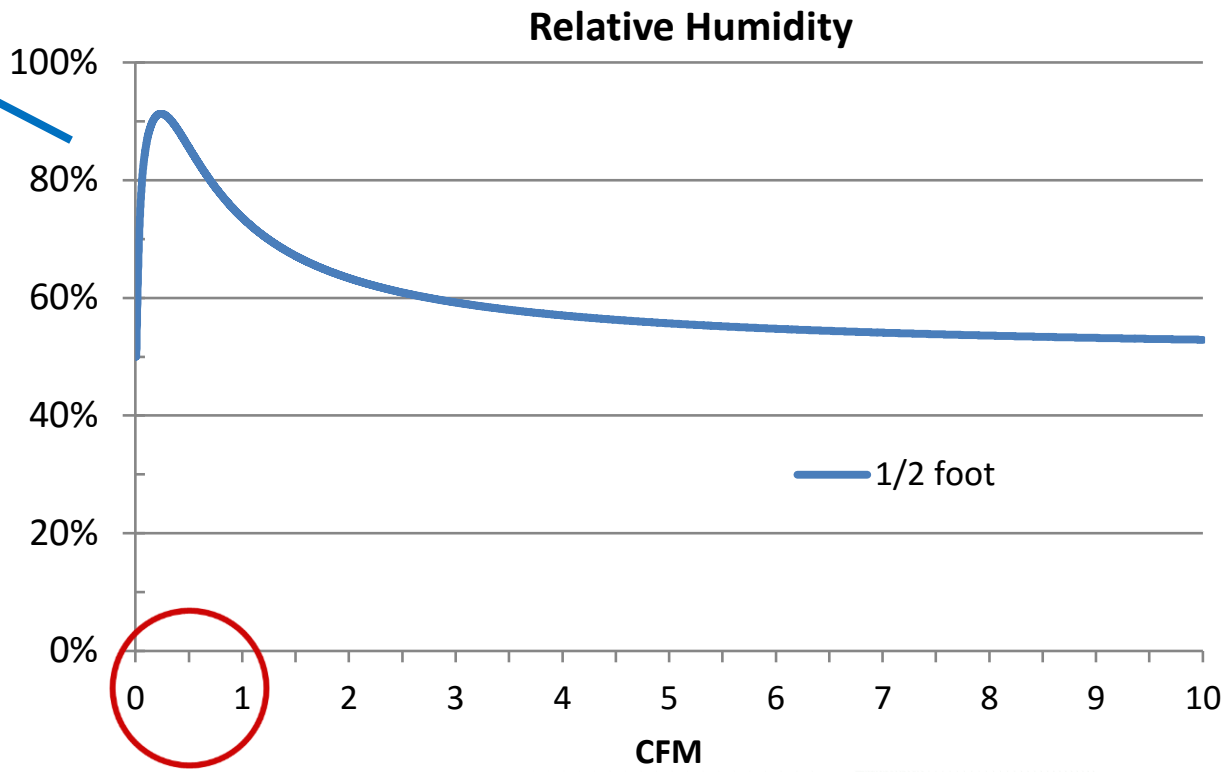




Air flow rates rarely exceed 1 cfm

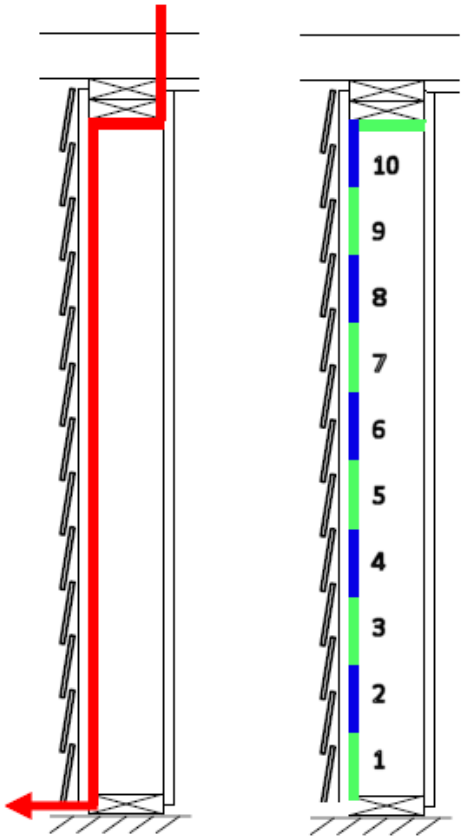
Is there a critical spot?

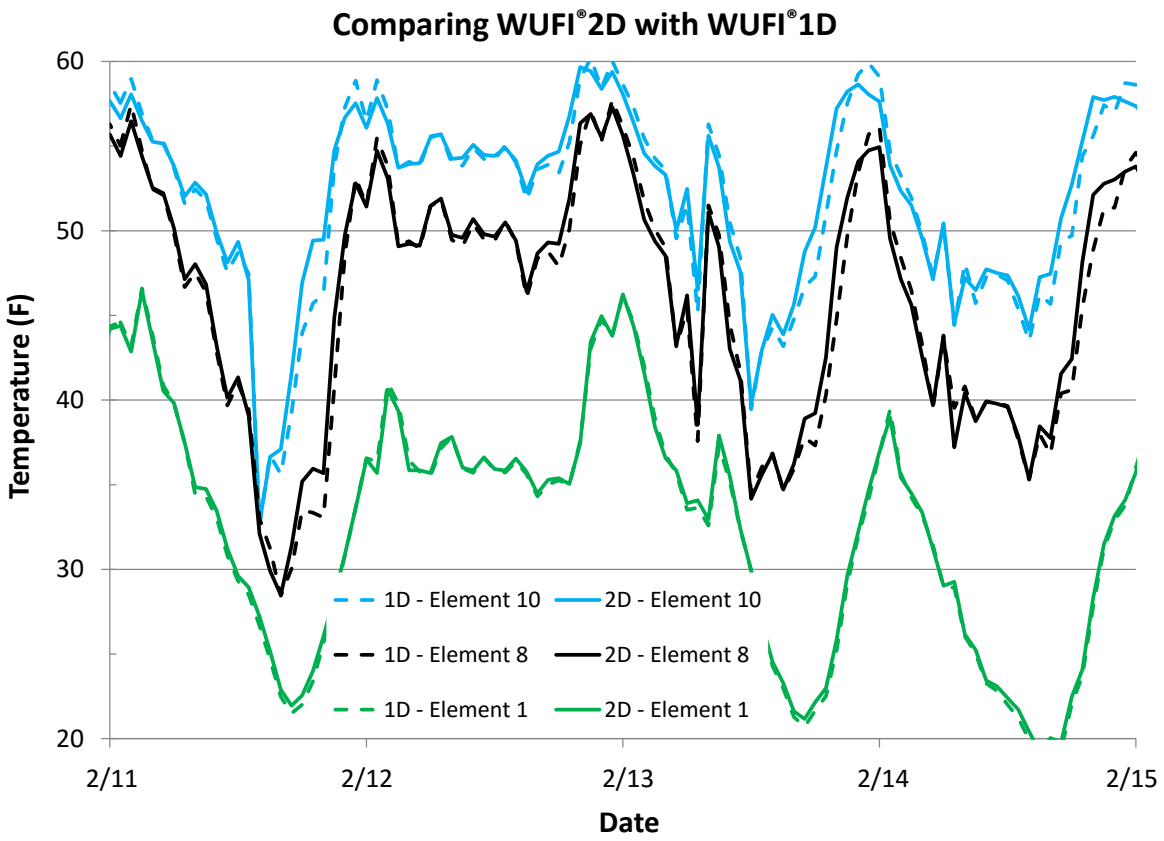




Air flow rates rarely exceed 1 cfm

Optimizing computational effort



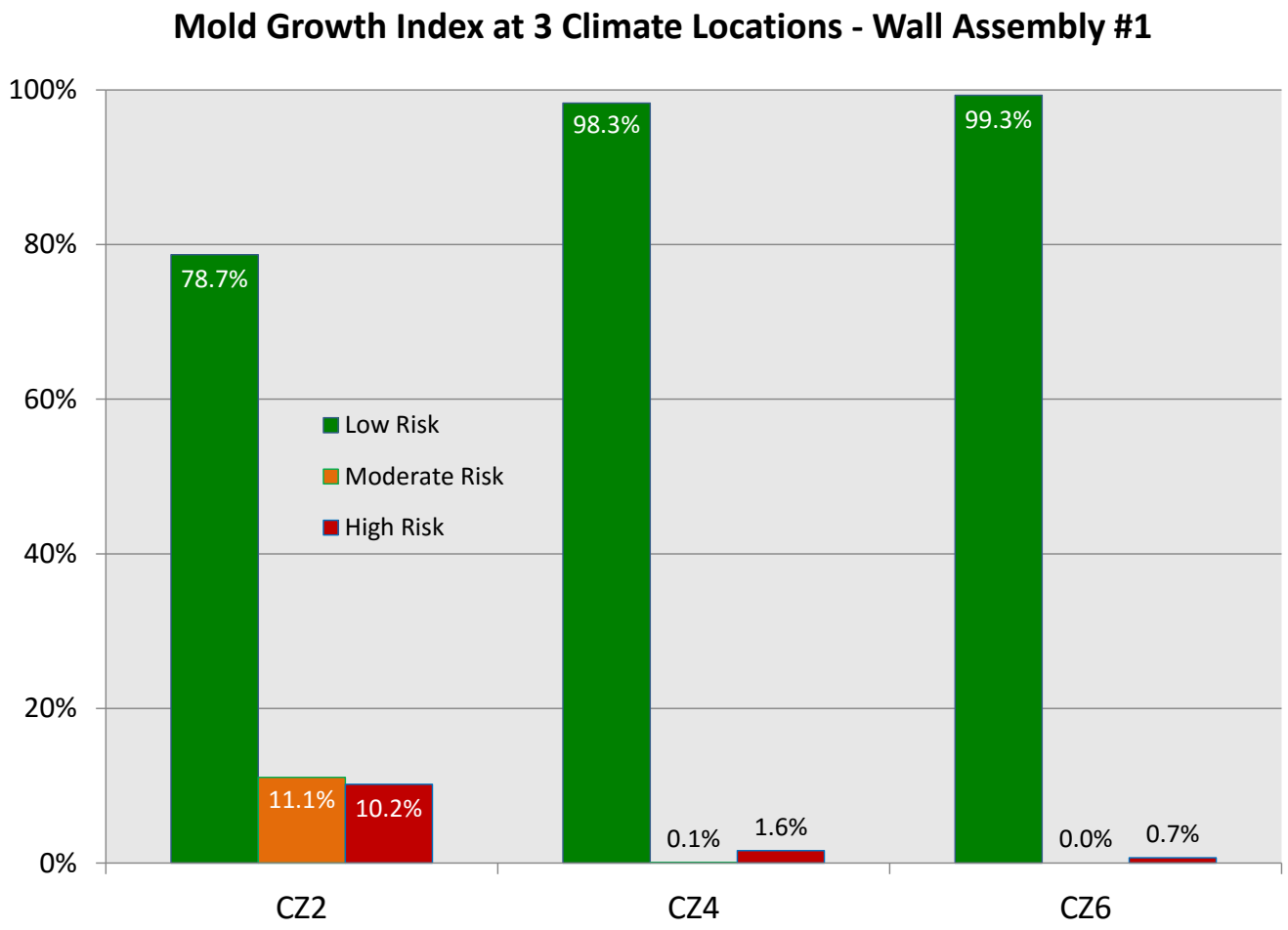


A comparison between WUFI 2D and WUFI 1D reveals that the 1D tool is capable of simulating air leakage at any location inside the air leakage path.

Performance Indicator – Mold Growth Index

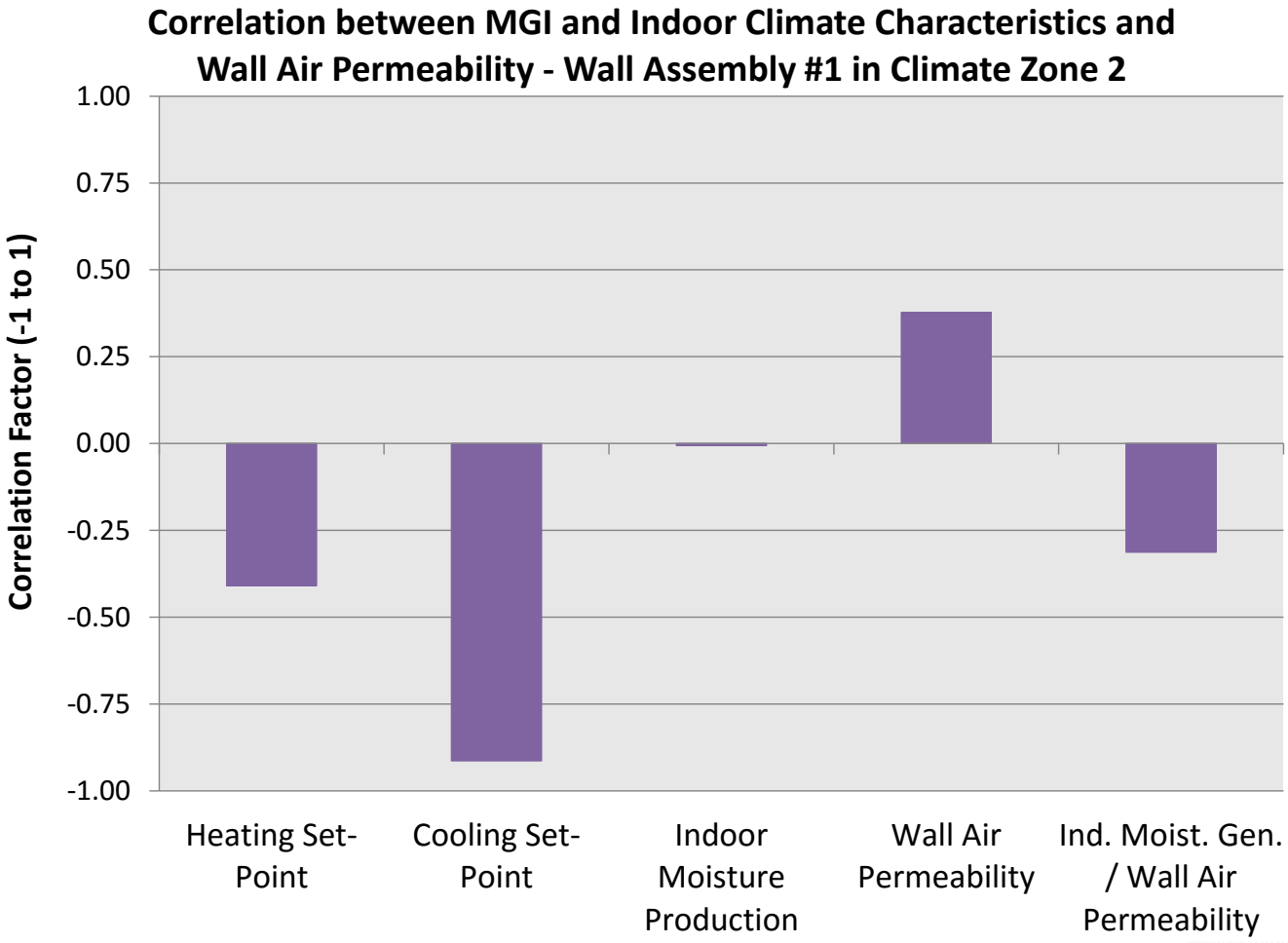
Index	Description of growth rate	Risk Level
0	No growth	Low
1	Small amounts of mold on surface (microscope), initial stages of local growth	Low
2	Several local mold growth colonies on surface (microscope)	Low
3	Visual findings of mold on surface, <10% coverage or <50% coverage of mold (microscope)	Moderate
4	Visual findings of mold on surface, 10–50% coverage or >50% coverage of mold (microscope)	High
5	Plenty of growth on surface, >50% coverage (visual)	High
6	Heavy and tight growth, coverage approximately 100%	High

Result – Wall assembly #1



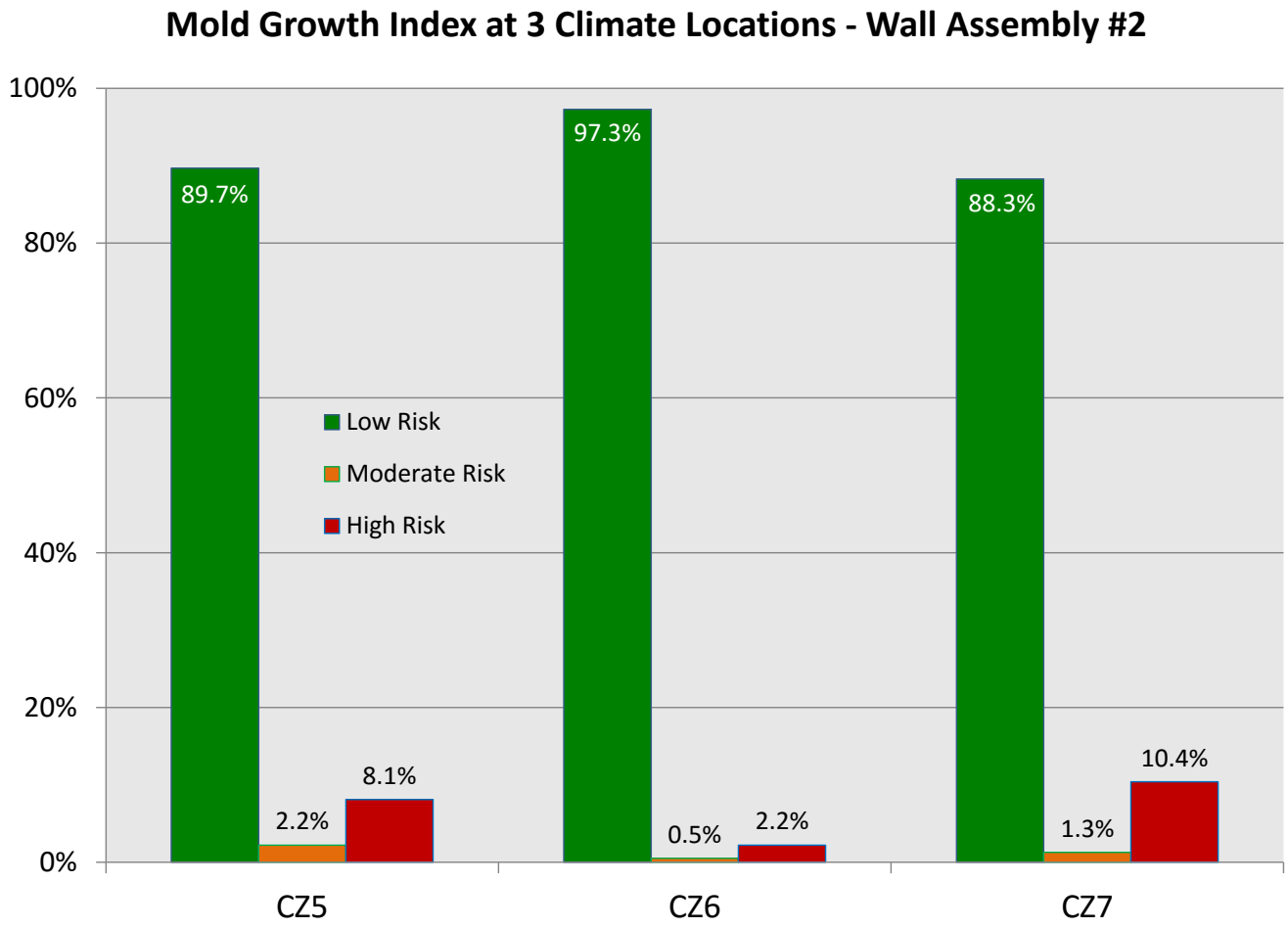
Hygrothermal performances for wall assembly 1, based on the mold growth index. Left, Houston; middle, New York; right, Minneapolis

Result – Wall assembly #1



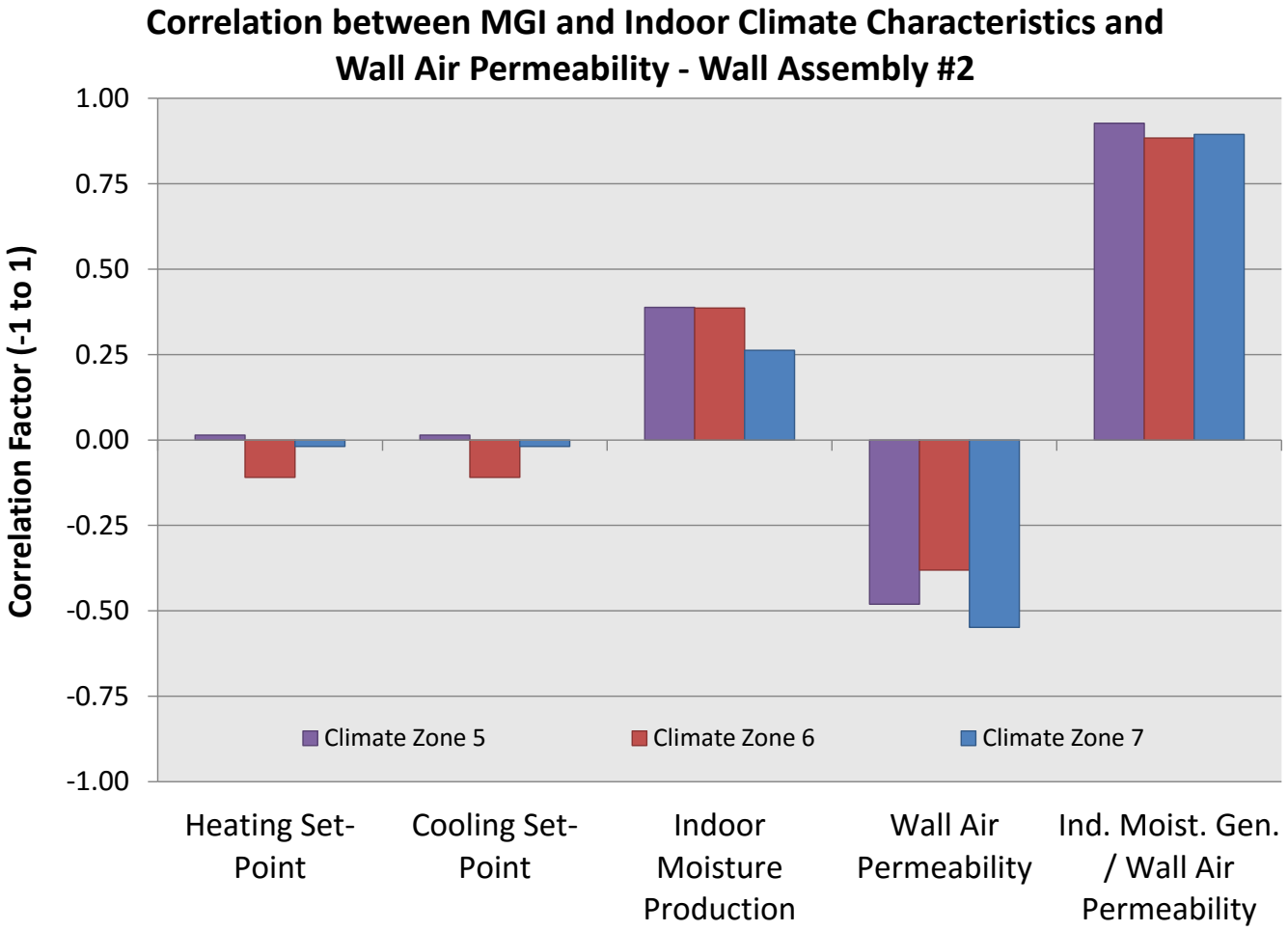
Correlation analysis for wall assembly 1 in the climate of Houston, TX.

Result – Wall assembly #2



Hygrothermal performances for wall assembly 2, based on a mold growth indicator (MGI). Left, Chicago; middle, Anchorage; right, Minneapolis.

Result – Wall assembly #2



Correlation analyses for wall assembly 2 in the climate of Chicago, Minneapolis, and Anchorage.

NOTICE: This document contains information of a preliminary nature and is not intended for release. It is subject to revision or correction and therefore does not represent a final report.

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Moisture Durability Assessment of Common Well-insulated Wall Assemblies

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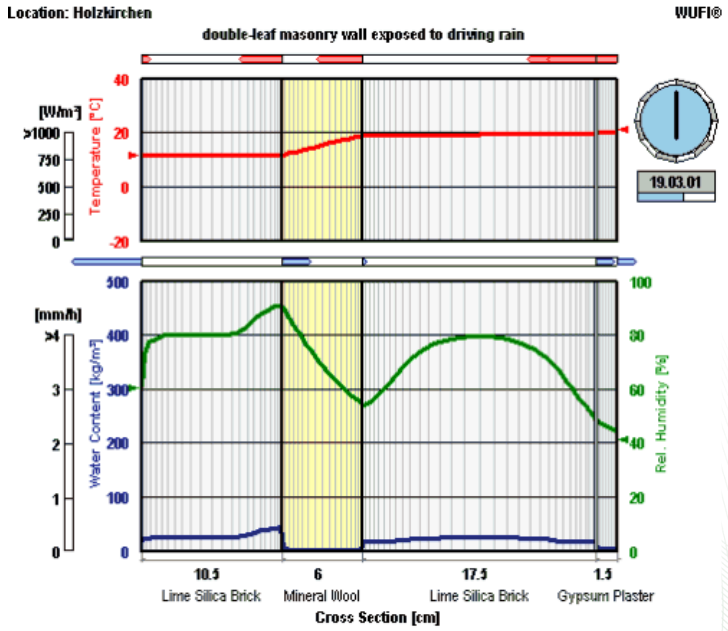

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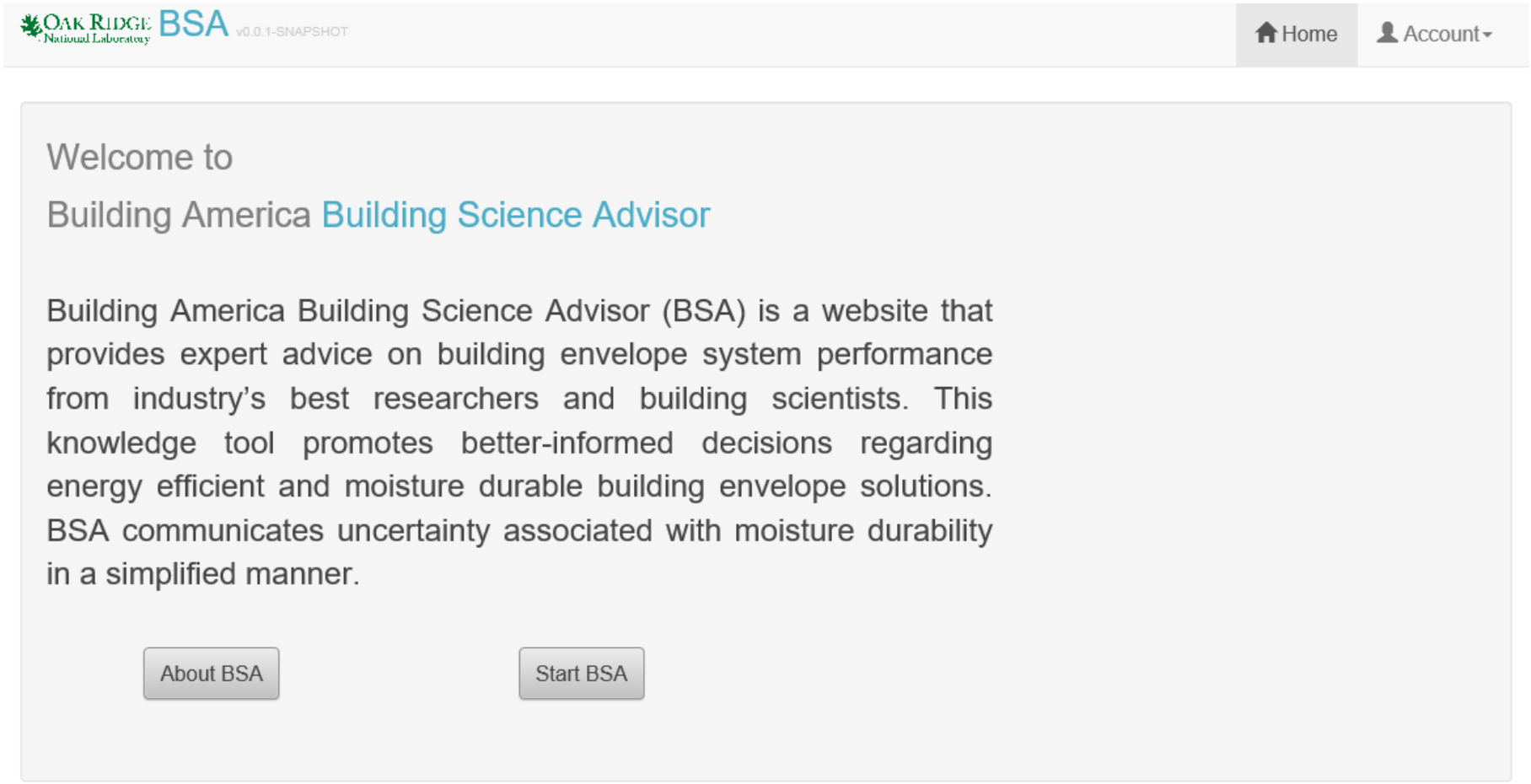
Conclusions

- In a hot-humid climate, a higher *R*-value increases the importance of the airtightness because interior wall materials are at lower temperatures.
- In a cold climate, indoor humidity levels increase with increased airtightness.
- The sensitivity analysis identifies mitigation strategies.

MGI is an indicator of mold, not an indicator of IAQ. Mold is the most conservative indicator for moisture durability issues.

Building Science Advisor



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