



# Calculating Moisture Risk in Roofs

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Glaser Method

v.

Hygrothermal Analysis

and

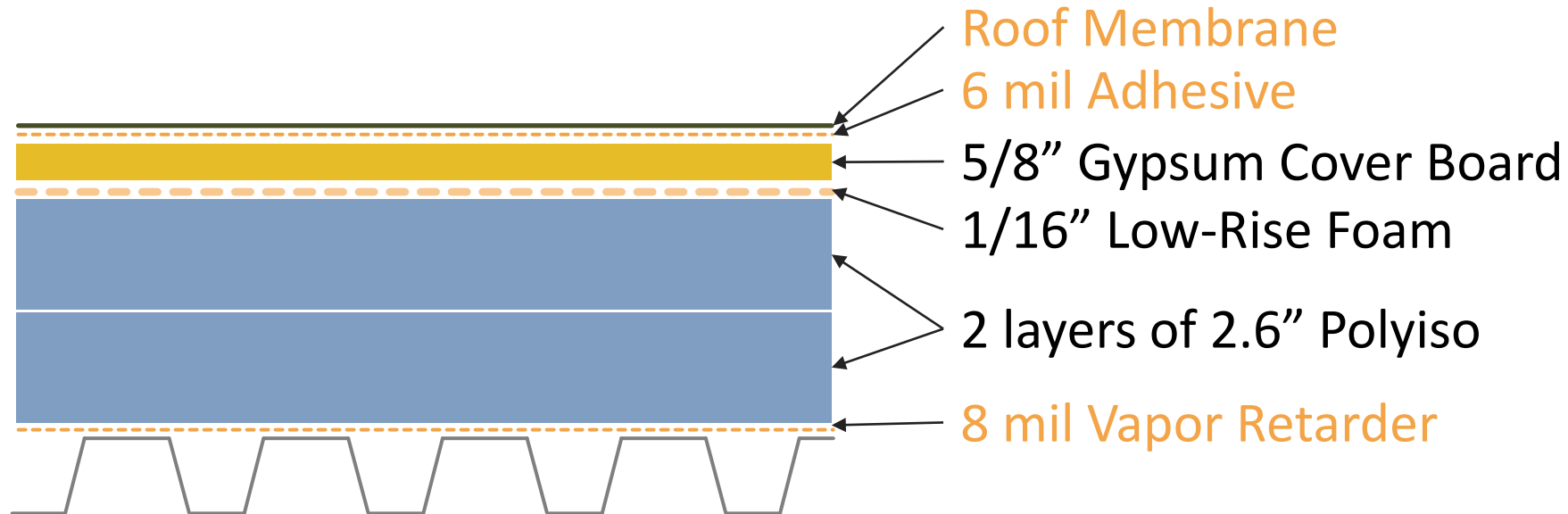
Other findings

# Current Status Quo



**EnergyWise** Roof Calculator

# Example Roof Assembly

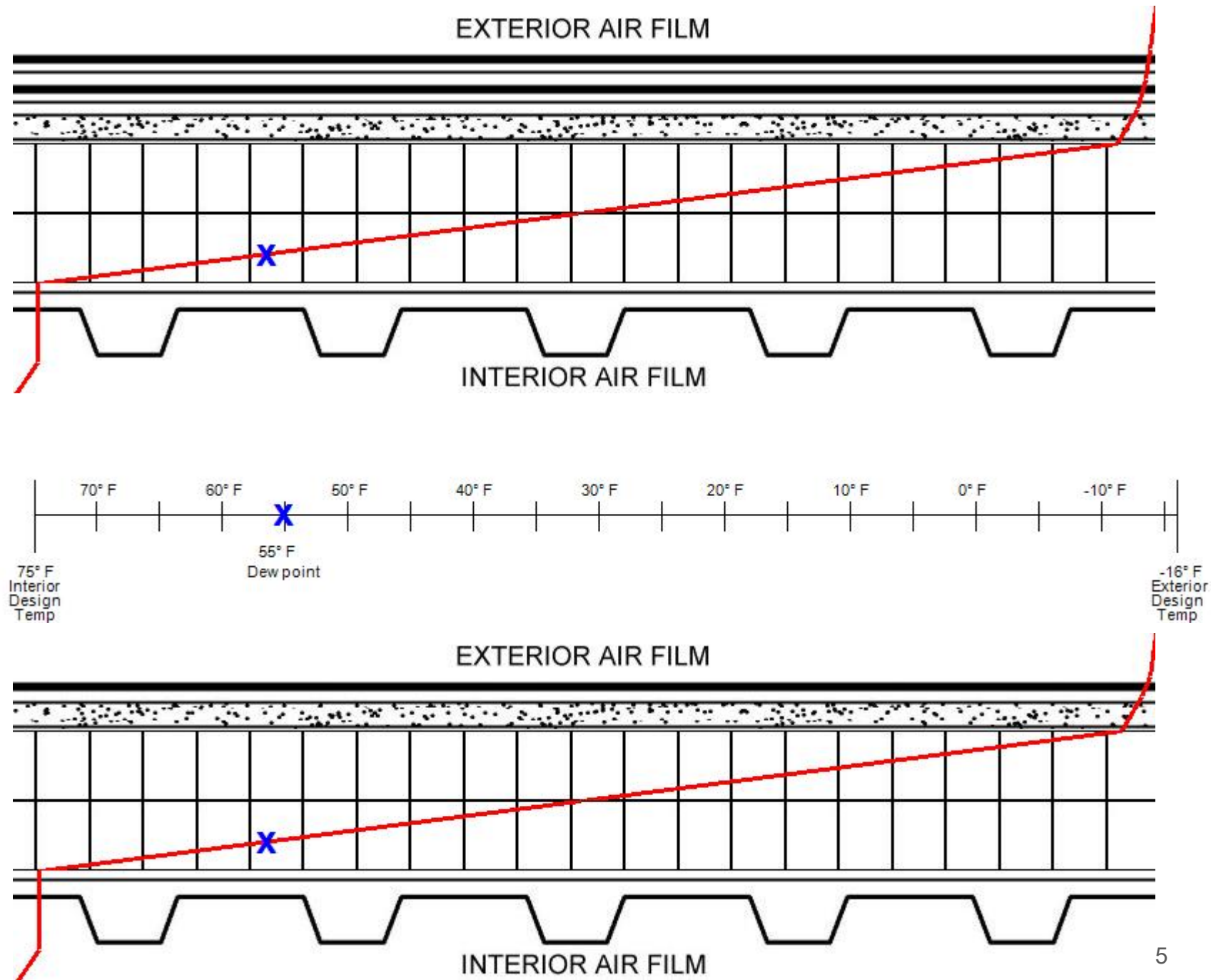


2-ply SBS Membrane

# Dew Point Analysis for MN

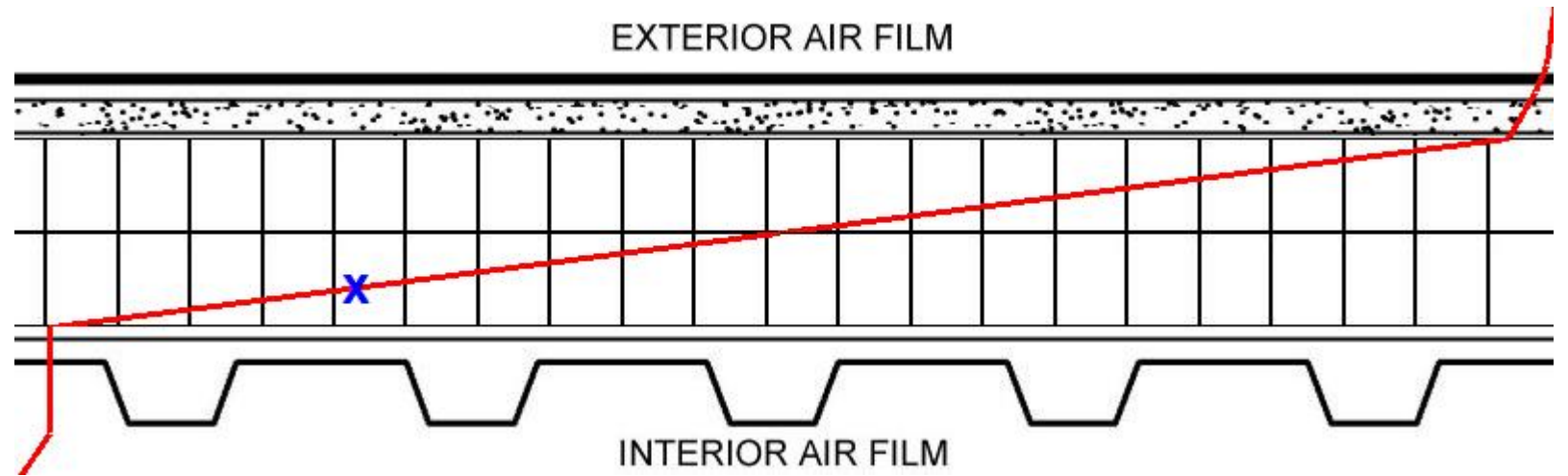
## Is there a problem?

TPO Membrane

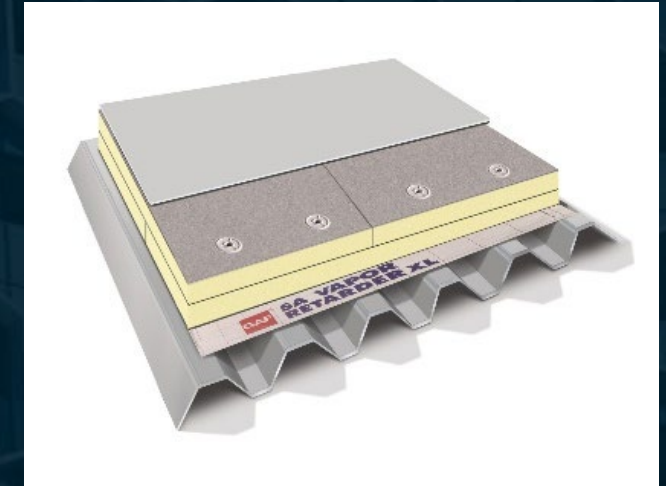
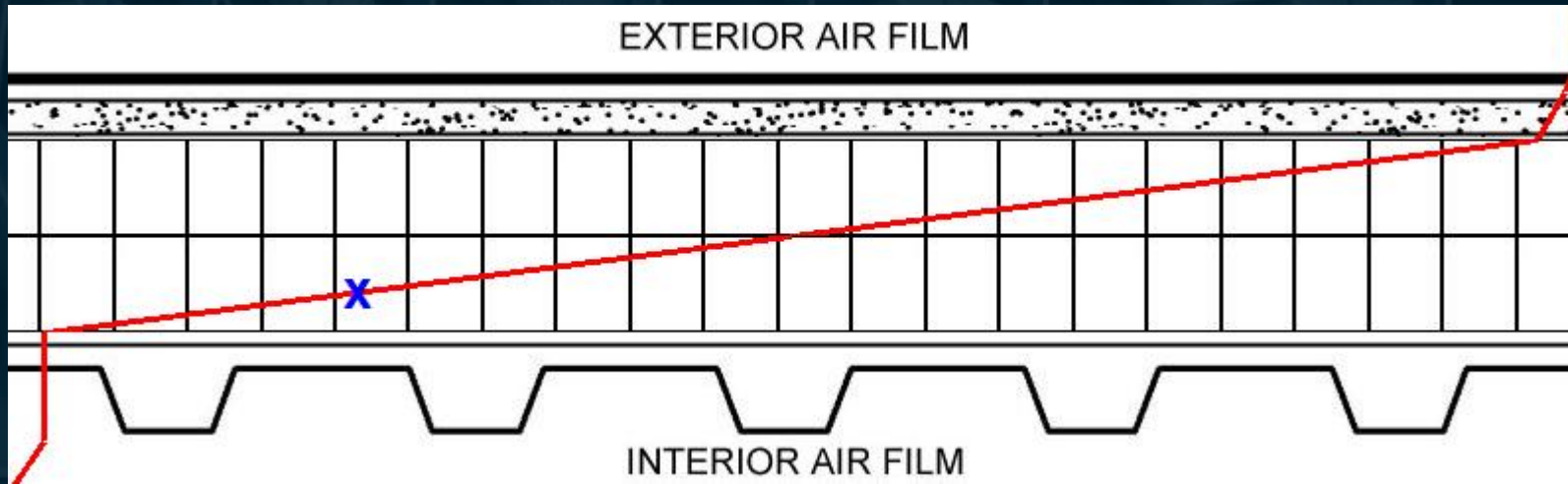


think

analyze



# TPO Membrane, Vapor Retarder



Air tightness

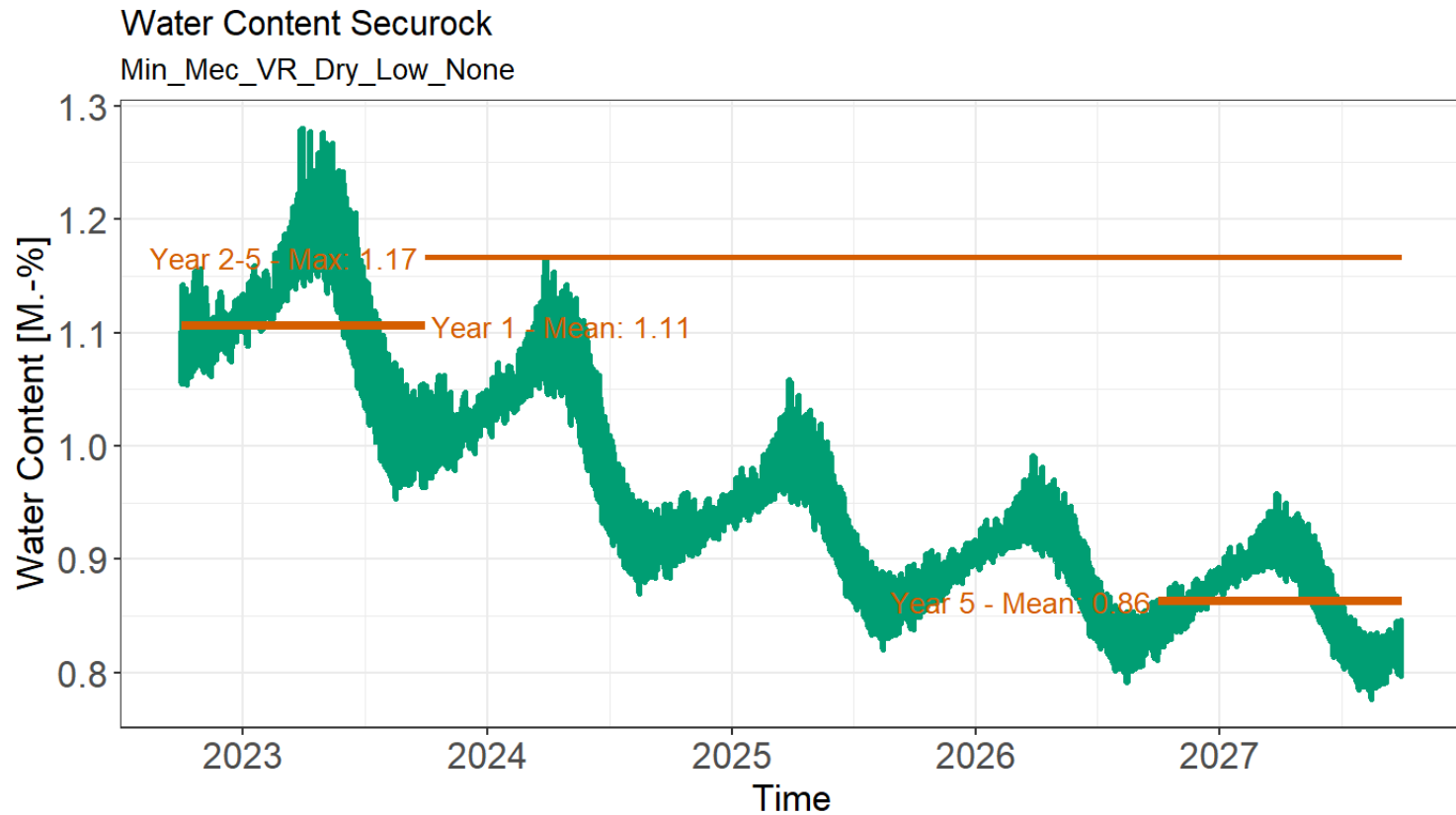
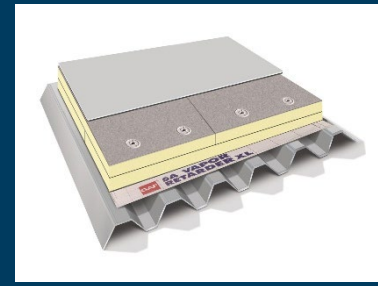


Moisture in the assembly



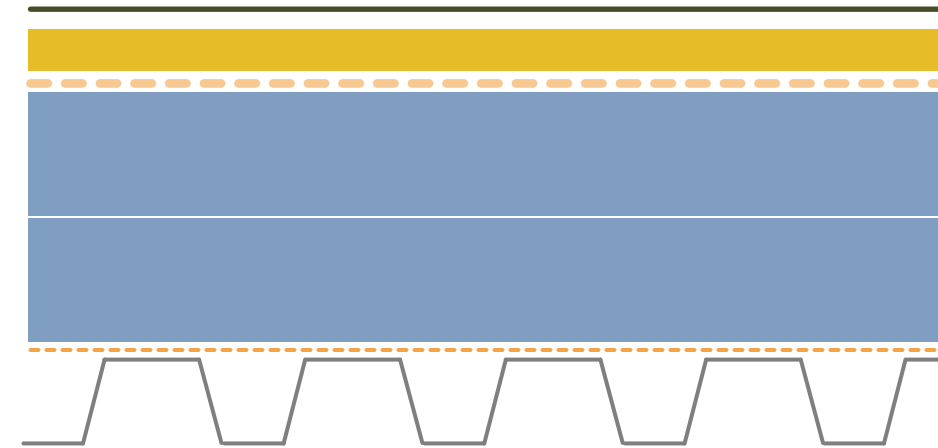
We need to dig further

# Same assumptions, same location



The Securock water content is never higher than 1.5 M.-% in any year after the initial year.  
The roof is rated **green**

Mechanically attached TPO  
Minneapolis, MN  
Dry initial conditions





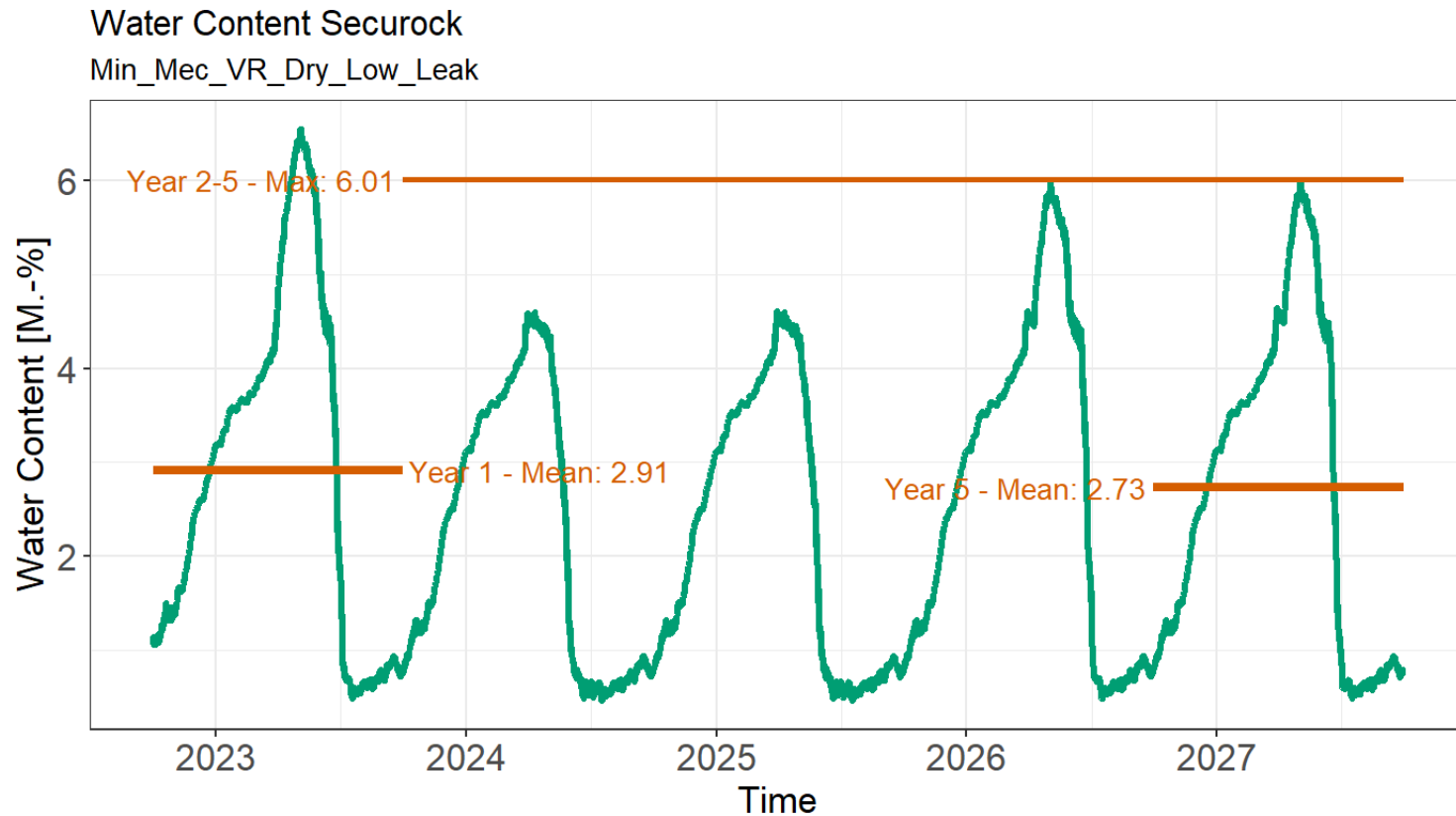
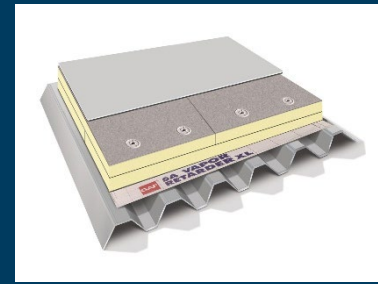
# ASSUME PERFECTION



# ASS U ME PERFECTION



# If we change the assumptions...

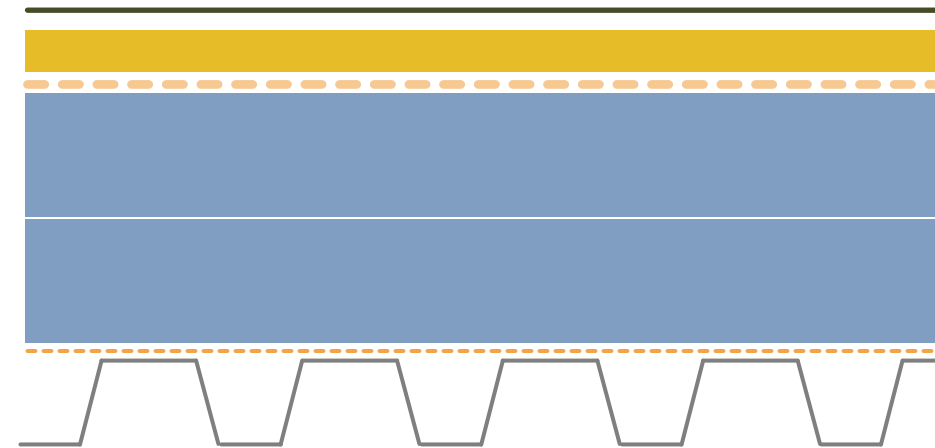


The Securock water content is higher than 1.5 M.-% in any year after the initial year.  
The roof is rated orange

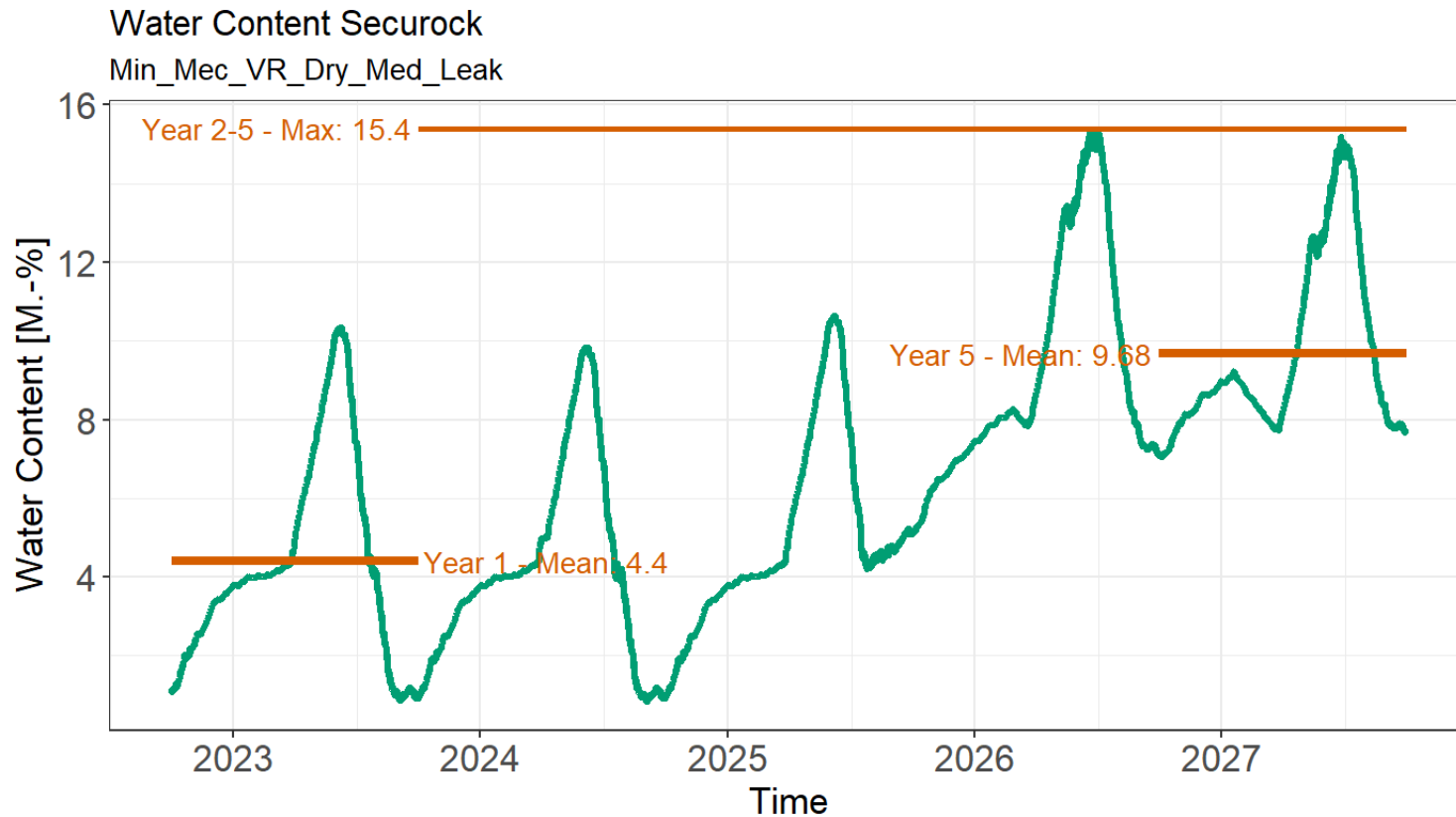
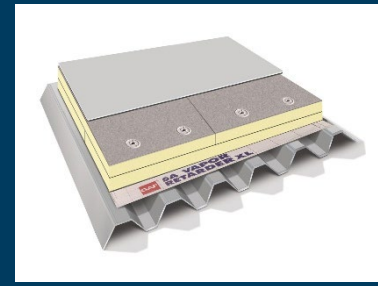
Mechanically attached TPO

Minneapolis, MN

Air leak introduced due to mechanically attached membrane



# If we change the assumptions...



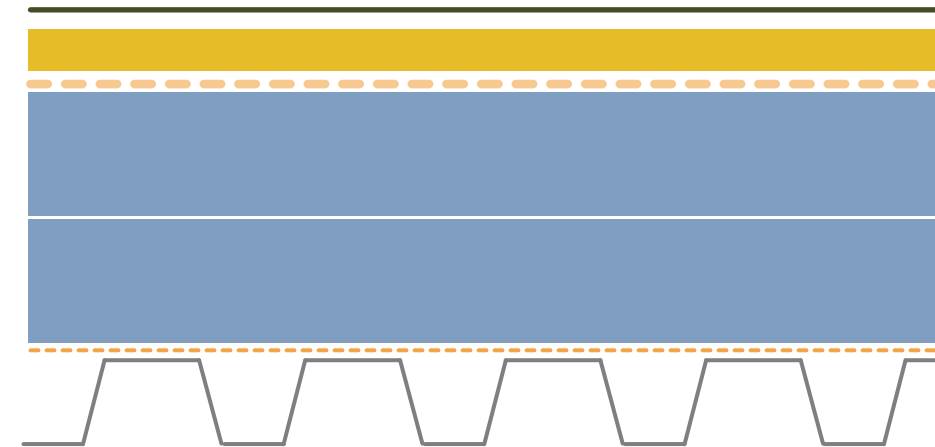
The Securock water content is higher in year 5 than in year 1 and above 1.0 M.-%.  
The roof is rated **red**

Mechanically attached TPO

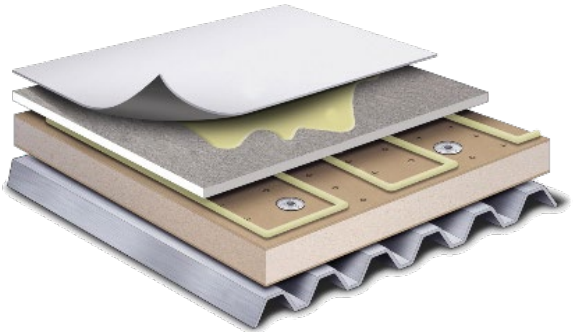
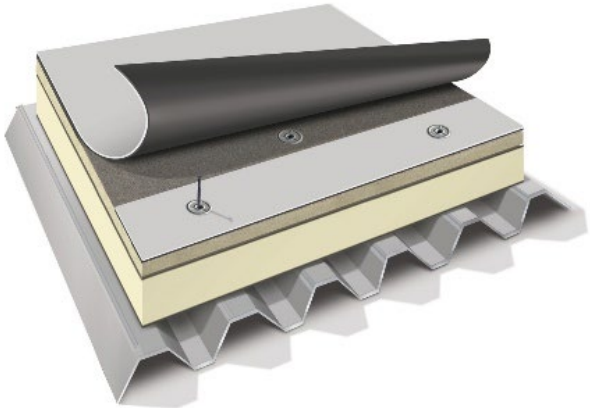
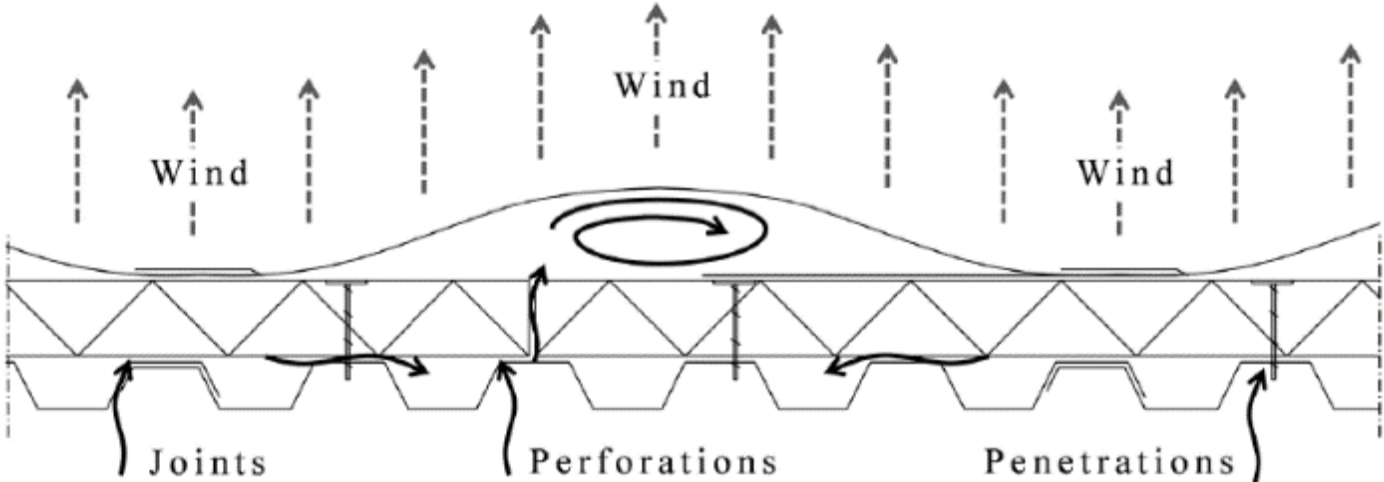
Minneapolis, MN

Air leak introduced due to mechanically attached membrane

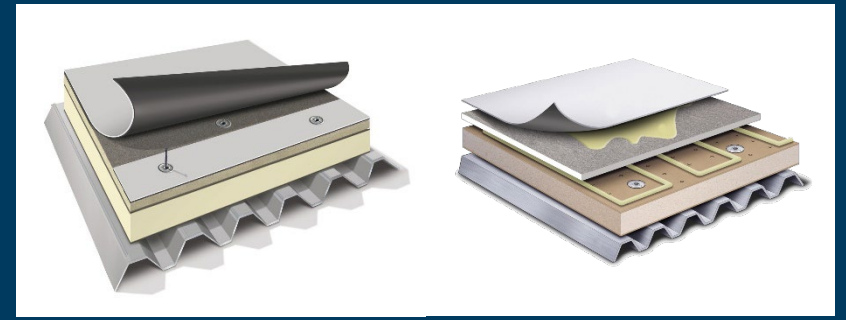
Medium interior moisture load



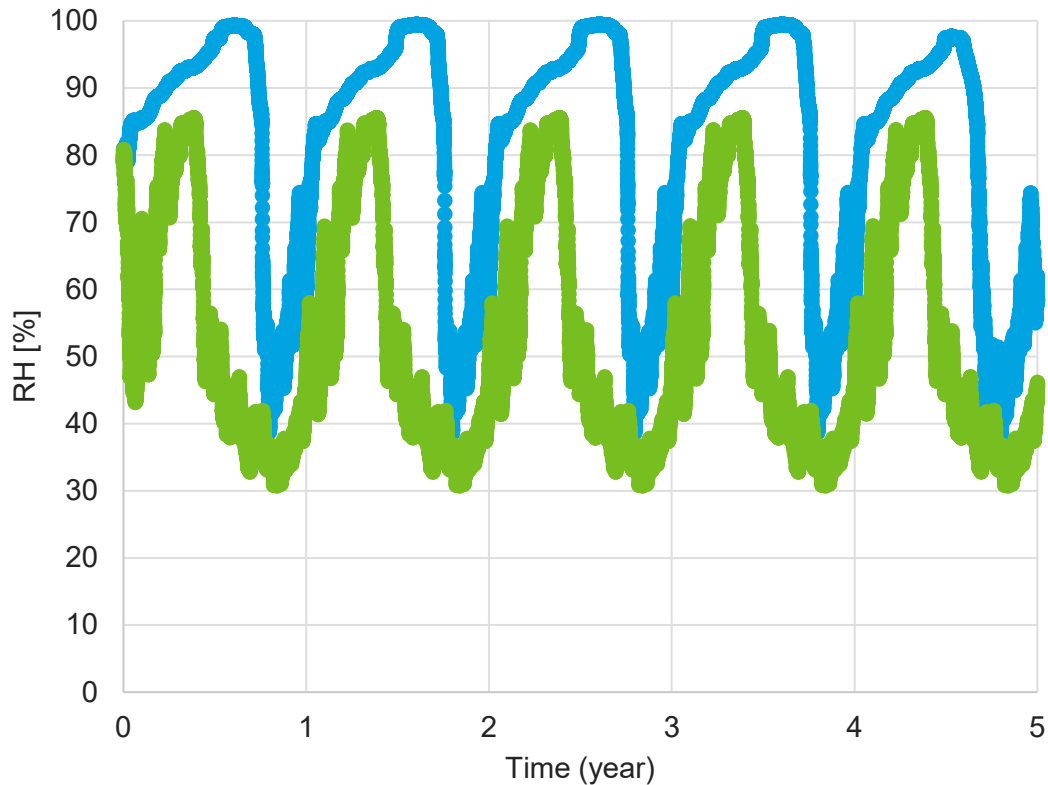
# What is realistic?



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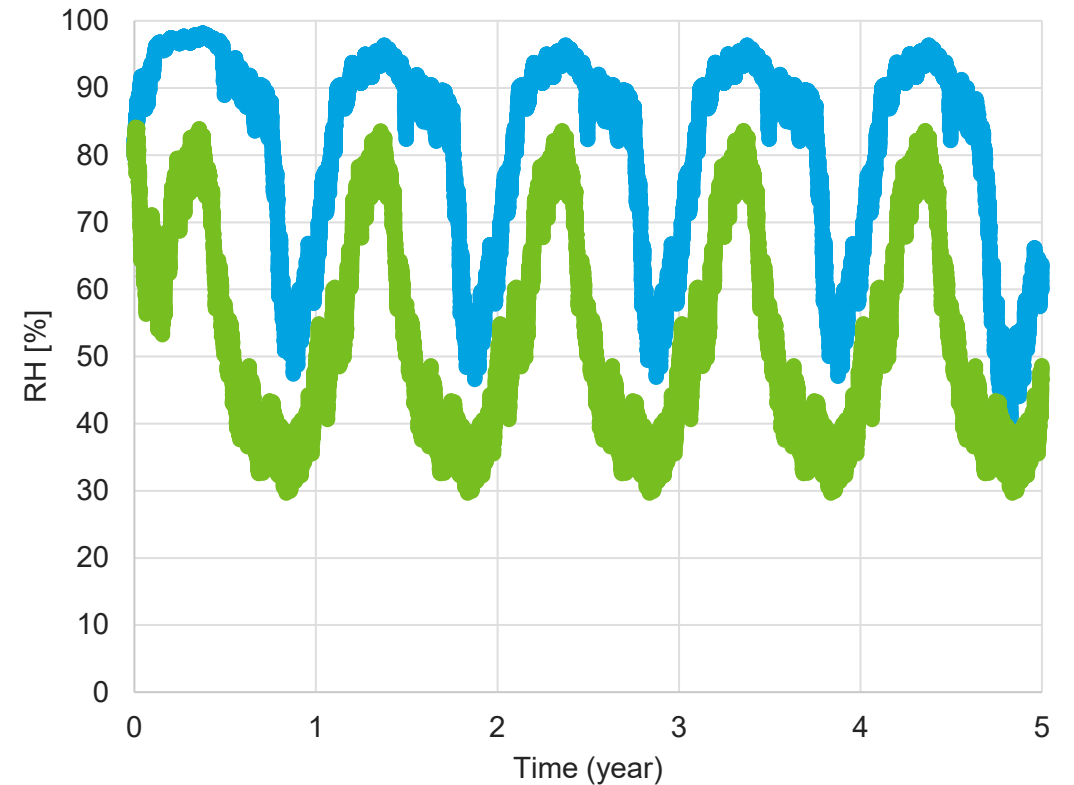


RH (Gypsum Coverboard) [%]



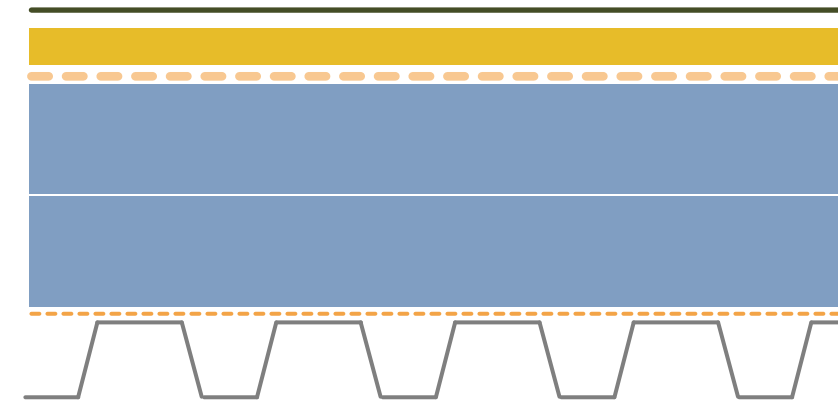
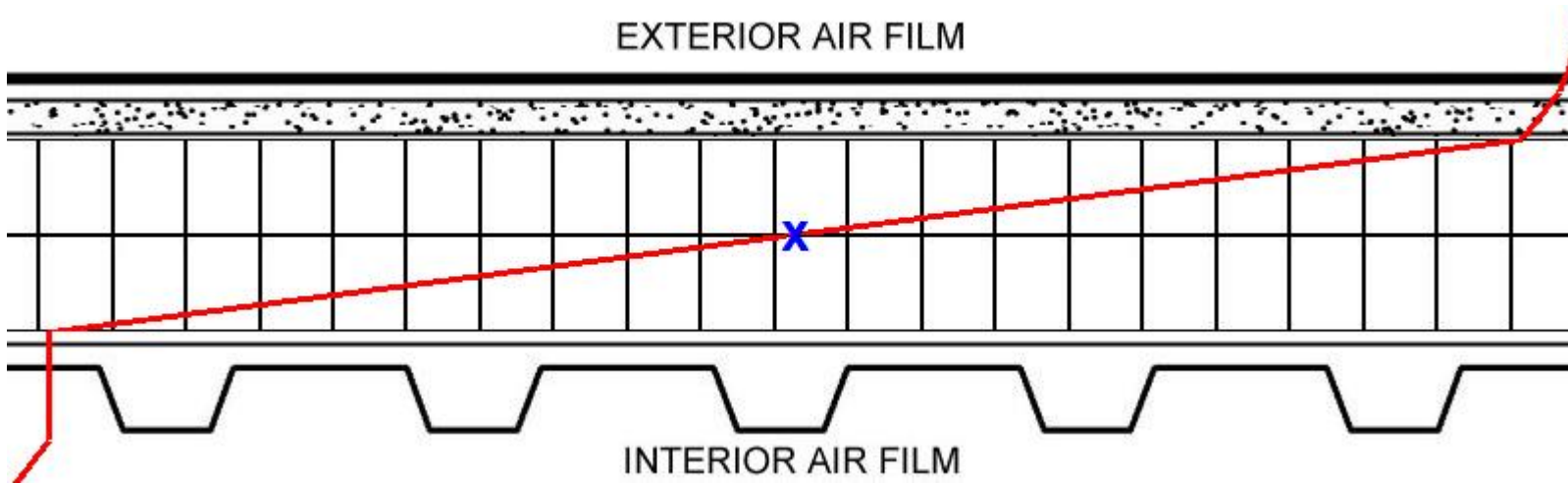
- TPO\_CB\_Min\_Mec\_No\_Dry\_Low\_Leak
- TPO\_CB\_Min\_Adh\_No\_Dry\_Low\_Real

RH (Top-ISO-Facer) [%]

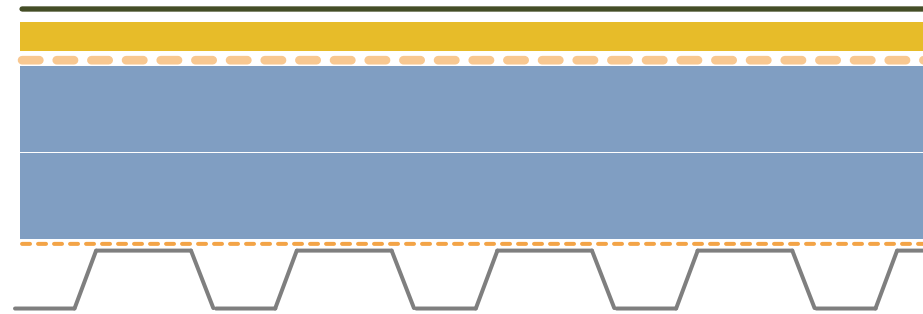


- TPO\_Top-ISO-Facer\_Min\_Mec\_No\_Dry\_Low\_Leak
- TPO\_Top-ISO-Facer\_Min\_Adh\_No\_Dry\_Low\_Real

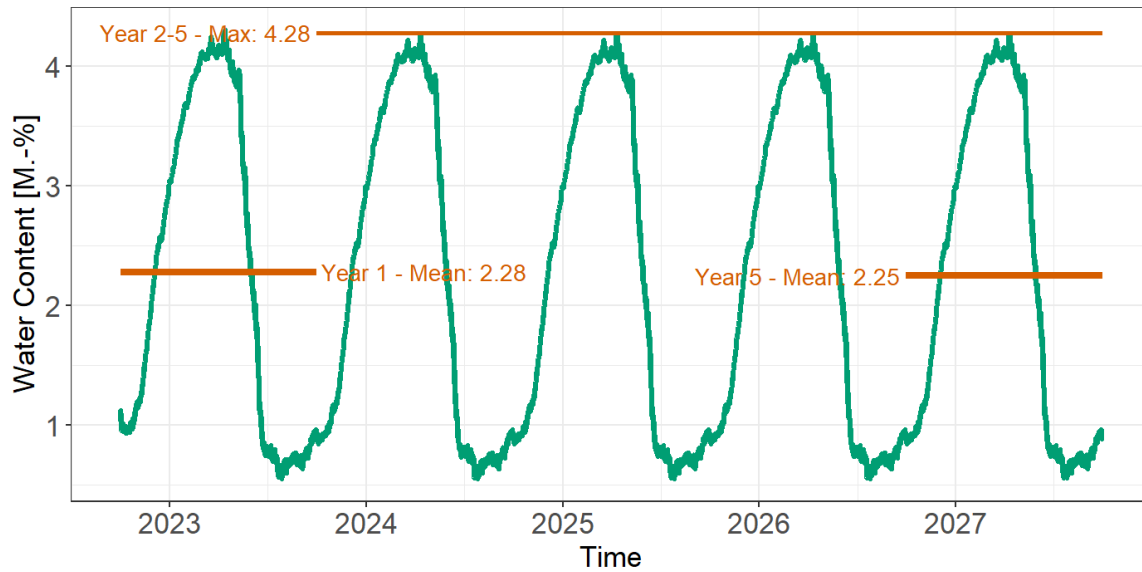
# Seattle, WA



# TPO vs. SBS (Reflectivity)

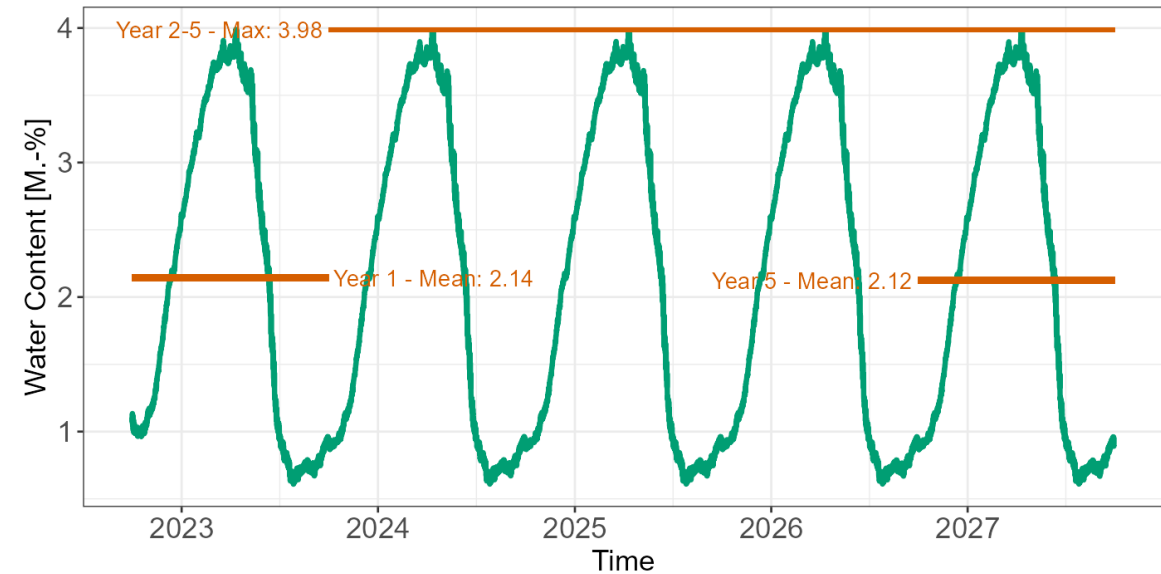


Water Content Securock  
Sea\_Mec\_VR\_Dry\_Low\_Leak



The Securock water content is higher than 1.5 M.-% in any year after the initial year.  
The roof us rated orange

Water Content Securock  
Sea\_Adh\_VR\_Pap\_Dry\_Low\_Real



The Securock water content is higher than 1.5 M.-% in any year after the initial year.  
The roof us rated orange

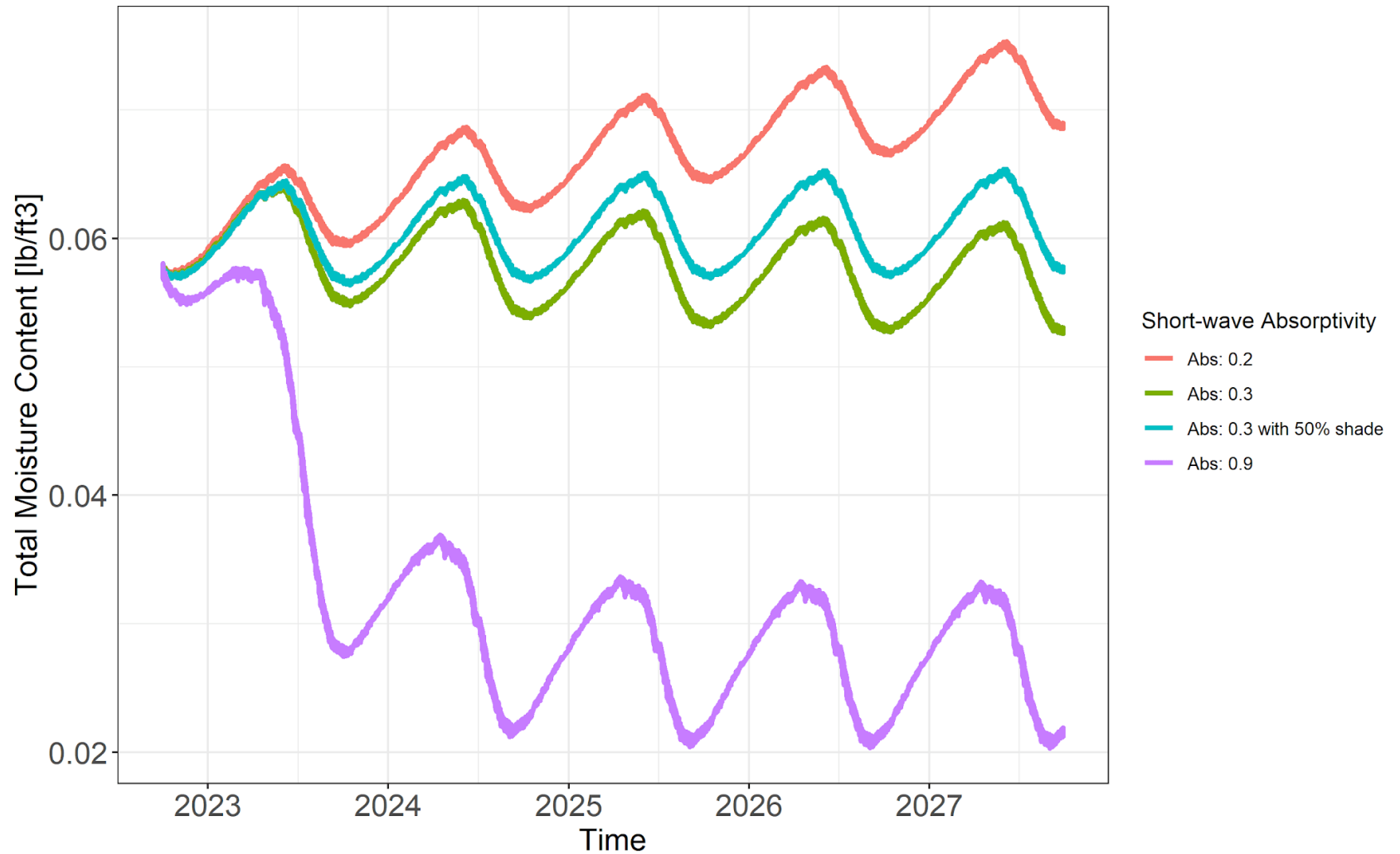


## Impact of the color of Roof Membrane

- High Interior moisture
- No vapor retarder

### Impact of TPO color on performance

Chicago, adhered, no air infiltration, high interior loads, no VR



# Desjarlais, Hardy Pierce, & Pallin. STP 1599, 2017

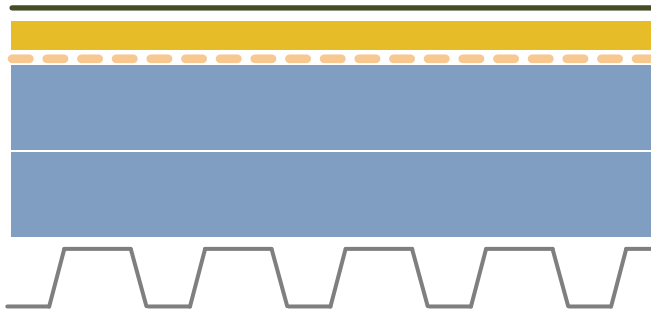
**TABLE 2** Summary of the evaluation of all the roof assemblies simulated with an excess of indoor moisture according to ASHRAE 160-2011.

Indoor Humidity—ASHRAE 160

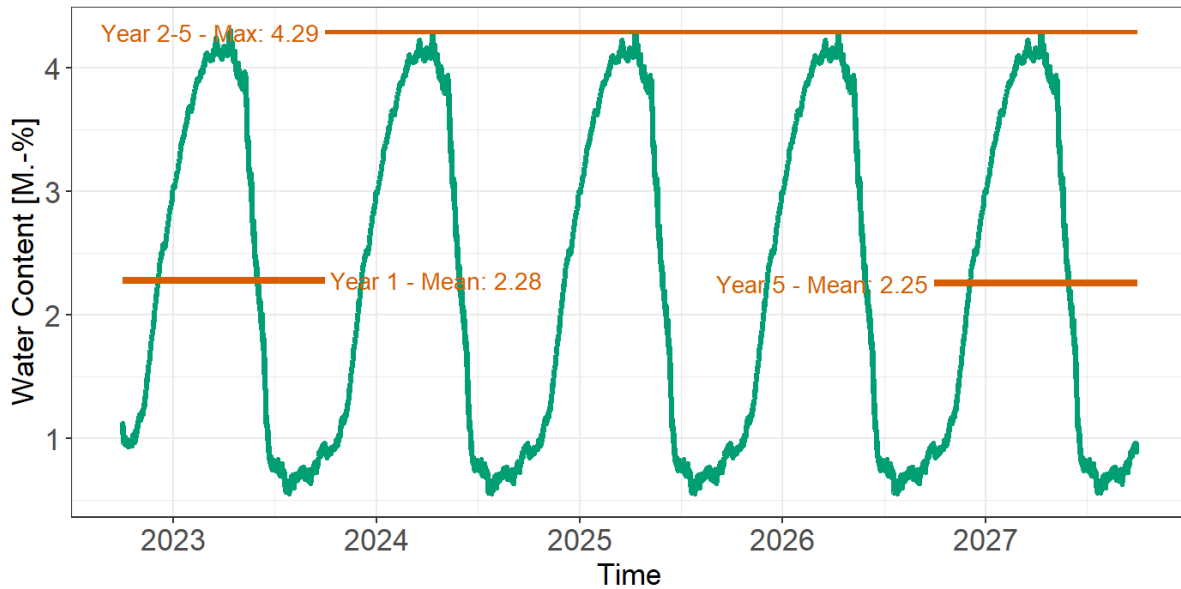
Climate	OSB						Plywood					
	2 × 8		2 × 10		2 × 10		2 × 8		2 × 10		2 × 10	
	R-19 (R-11) <sup>a</sup>		R-19 (R-11) <sup>a</sup> (R-25) <sup>b</sup>		R-30 (R-19) <sup>a</sup>		R-19 (R-11) <sup>a</sup>		R-19 (R-11) <sup>a</sup> (R-25) <sup>b</sup>		R-30 (R-19) <sup>a</sup>	
	Black	White	Black	White	Black	White	Black	White	Black	White	Black	White
San Diego	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Los Angeles	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
San Francisco	OK	FAIL	OK	FAIL	OK	FAIL	OK	FAIL	OK	FAIL	OK	FAIL
Sacramento	OK	FAIL	OK	FAIL	OK	FAIL	RISK	FAIL	OK	FAIL	OK	FAIL
Portland	RISK	FAIL	RISK	FAIL	RISK	FAIL	RISK	FAIL	RISK	FAIL	RISK	FAIL
Seattle	RISK	FAIL	FAIL	FAIL	FAIL	FAIL	RISK	FAIL	FAIL	FAIL	FAIL	FAIL
Atlanta			OK	OK					OK	OK		
Chicago					FAIL	FAIL					FAIL	FAIL

Note: <sup>a</sup>R-values for San Diego and Los Angeles; <sup>b</sup>R-values for Atlanta.

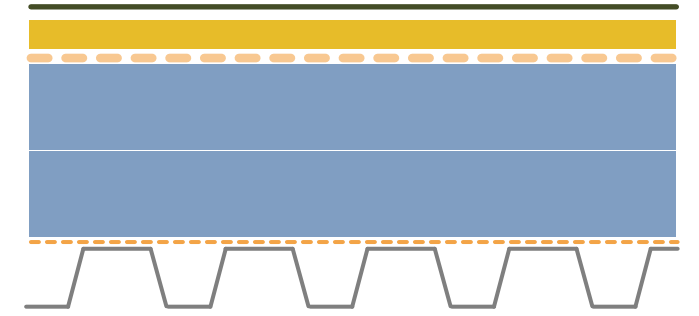
# With and without a vapor retarder



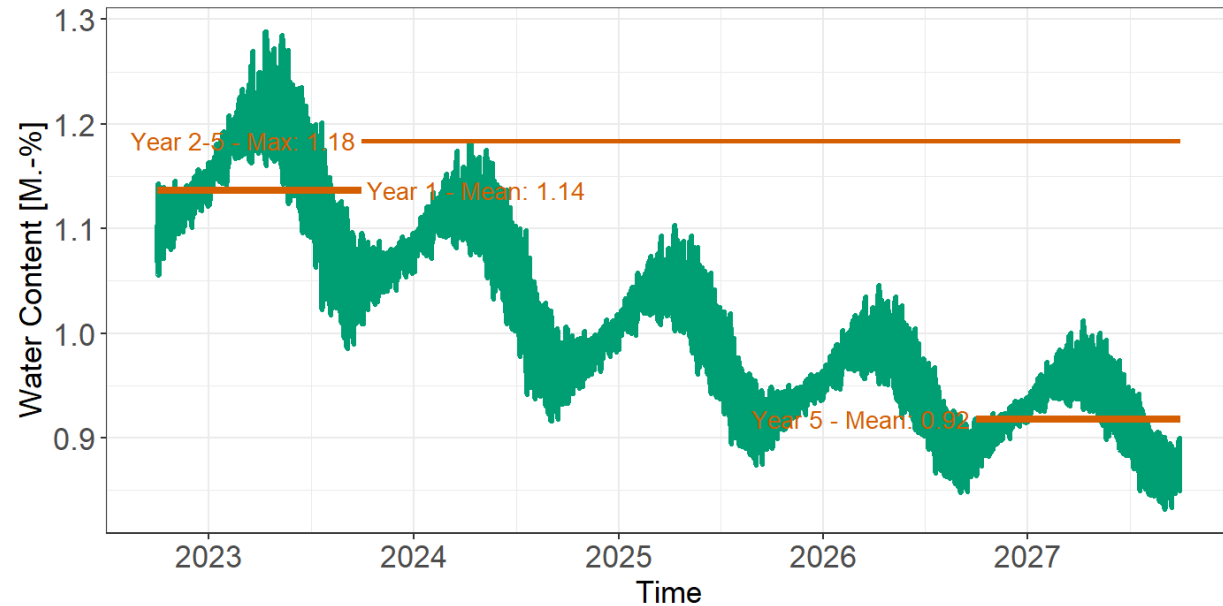
Water Content Securock  
Sea\_Mec\_No\_Dry\_Low\_Leak



The Securock water content is higher than 1.5 M.-% in any year after the initial year.  
The roof us rated **orange**



Water Content Securock  
Sea\_Mec\_VR\_Dry\_Low\_None



The Securock water content is never higher than 1.5 M.-% in any year after the initial year.  
The roof us rated **green**

**The conversation is still  
starting in roofing analysis.**



Let's continue the conversation.

Thank you.



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