

F.L. Padian

**Densepack applications:
retrofitting vaults and flat roofs
in cold climates**

Episode 2

*“unaware of the enigma machine,
Rommel drives deeper into Africa”*

The problems so far...

- Un-insulated roof cavities work because the heat loss dries them out
- Insulated cavities fail because:
 - Membrane roofing on wooden deck is a nearly perfect vapor barrier on the outside of the assembly (asphalt shingles are near enough)
 - air leaks and stack effect indoor humidity carry water vapor through fiberglass and cellulose insulation to cold roof deck

Solutions

- If it ain't broke don't fix it
- Warm up the roof membrane and sheathing
- Air seal the ceiling and densepack it (or vent it)
- Lower the indoor humidity (at least in winter)
- Depressurize the top floor so air leaks from cold to warm
- the chief cause of problems is solutions— *Eric Sevareid*

If it ain't broke don't fix it

- Do nothing - We can't afford to not to insulate and air seal it, but it's better than rotting roofs
- fix the one in ten that fails
- Use the banking system approach:
 - Loan them the money to do it the way we've been doing it,
 - Bundle loans in a portfolio so no one can tell which one will fail,
 - Sell the portfolio to someone else and make money,
 - Take bets that they will all fail,
 - Sell the bets for more money,
 - Blame the people whose roofs failed,
 - Elect a congress that won't change this system
 - repeat

Warm up the roof membrane and sheathing

- Make the existing roof and cavity edge into a real air barrier
- Add four inches of foam board to the top of the roof, vertical strapping and a new roof and sheathing
- Dense pack the cavity



Thanks to VEIC, NYSERDA, Marc Rosenbaum, Greg Pedrick

Air seal the same hole out of it and dense pack the cavity

- If you can get a good air seal at the ceiling and edges of the cavity – go for it and be prepared to come back and fix some of them
- Seal the ceiling
 - Interior wall tops, exterior wall tops, lights, wires, chimneys, pipes, ducts, shafts and party walls
- Seal the edge of the cavities
 - From the outside or the inside?
 - Parapet walls

parapetitus





Lower the indoor humidity (at least in winter)

- How high should the humidity be in the coldest month?
 - % RH < average coldest month outdoor air temperature plus 5, but not less than 25%
- **NO HUMIDIFIERS!!** (except in climates where coldest month average temperature is less than 20 degrees F, then you have to add the foam board to the roof)
- Add, repair or modify fan powered ventilation
 - Kitchen range hood
 - Bath fans
 - Continuous low-switched high
- Don't use dehumidifier in cold weather
- Get rid of occupants!

Humidified Buildings Cold Climates



Safe humidification?

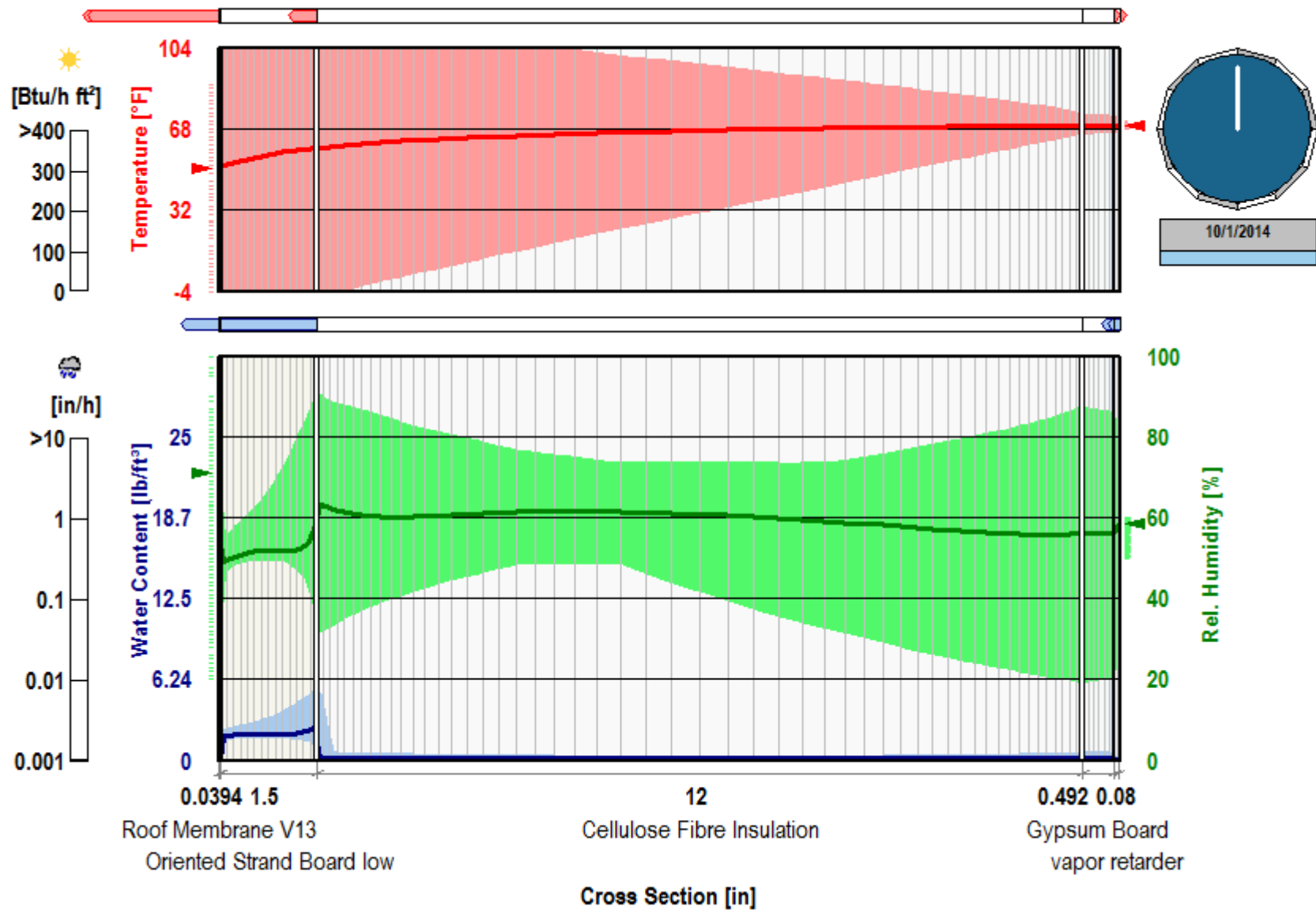


Depressurize the top floor

- Make the top floor tight enough to depressurize it using a small amount of exhaust ventilation (e.g. 50cfm@5 pascals)
- Install 50 - 80 cfm of exhaust with no off switch (NOTE: Fans should have a site switch; 20% of occupants will have the uncontrollable urge to figure out a way to turn the damn thing off, 3% will involve firearms)
- Leave note for owner to:
 - Clean fan every 5 years
 - Replace fan when it dies in 10 - 20 years (Hey, if the fan lasts longer than the shingle warranty you won!)

Location: Montreal; standard year;

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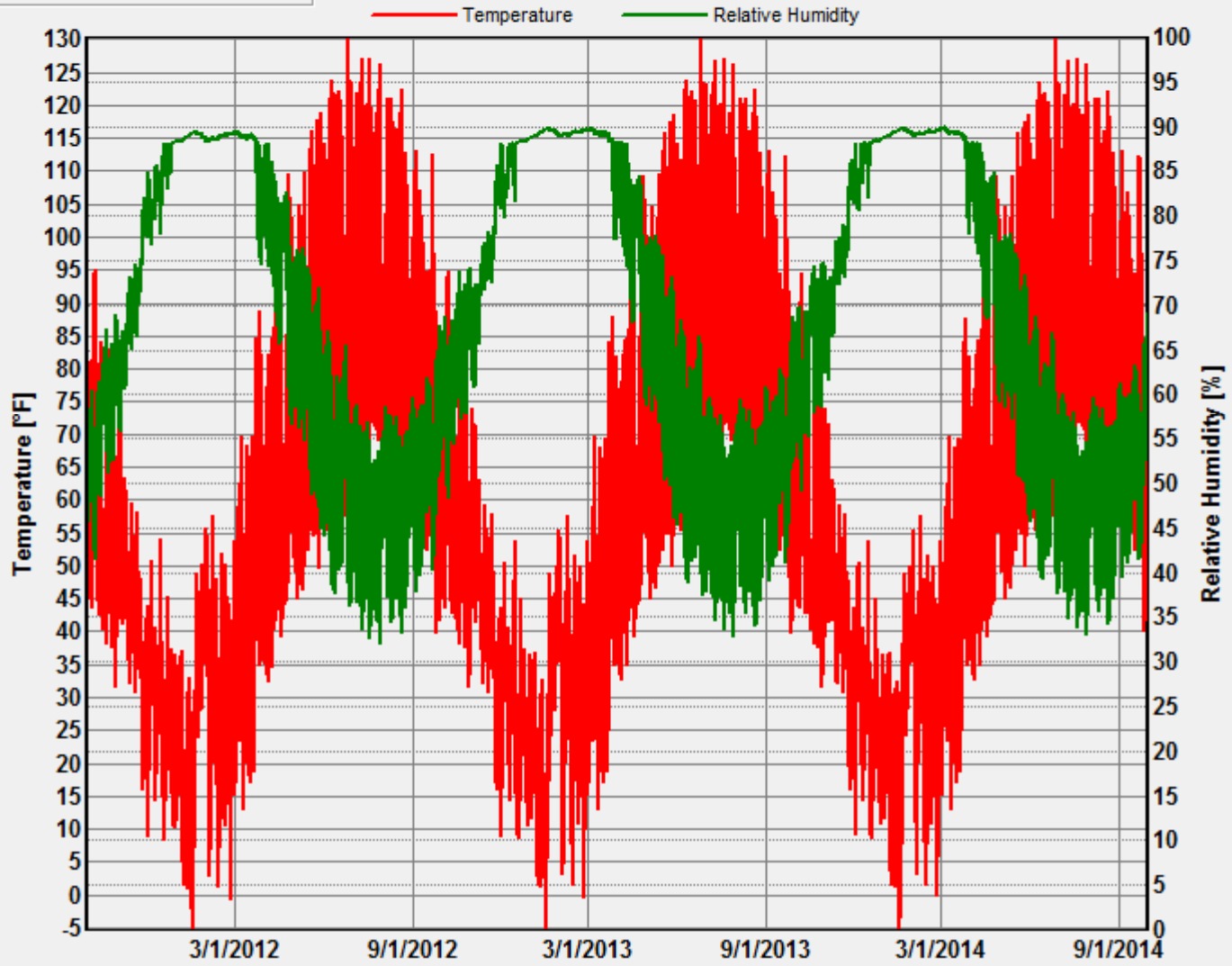


Project:

Sheathing – cellulose interface

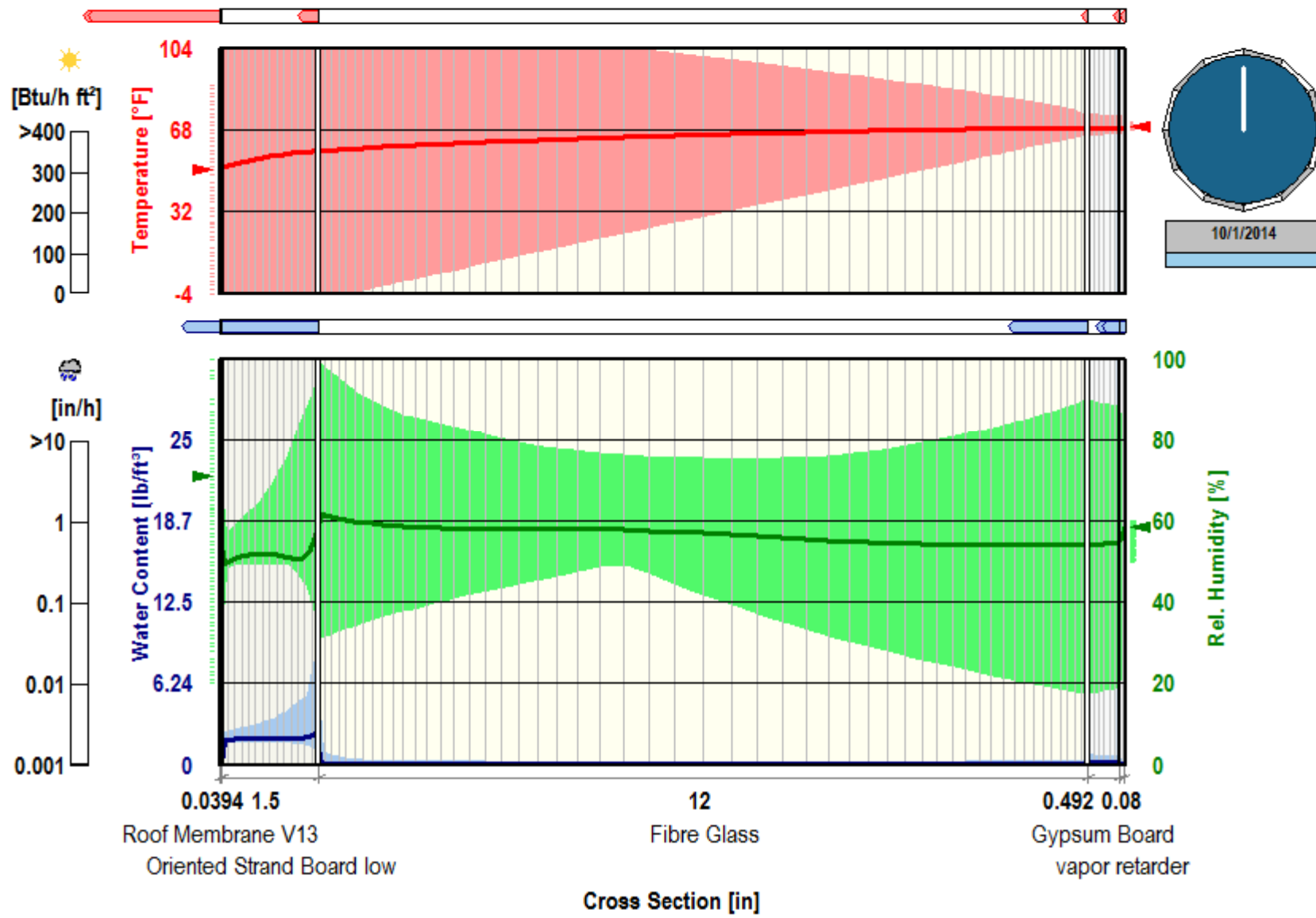
- Humidity
- Relative Humidity
 - Dewpoint

1.59 in



Location: Montreal; standard year;

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Project:

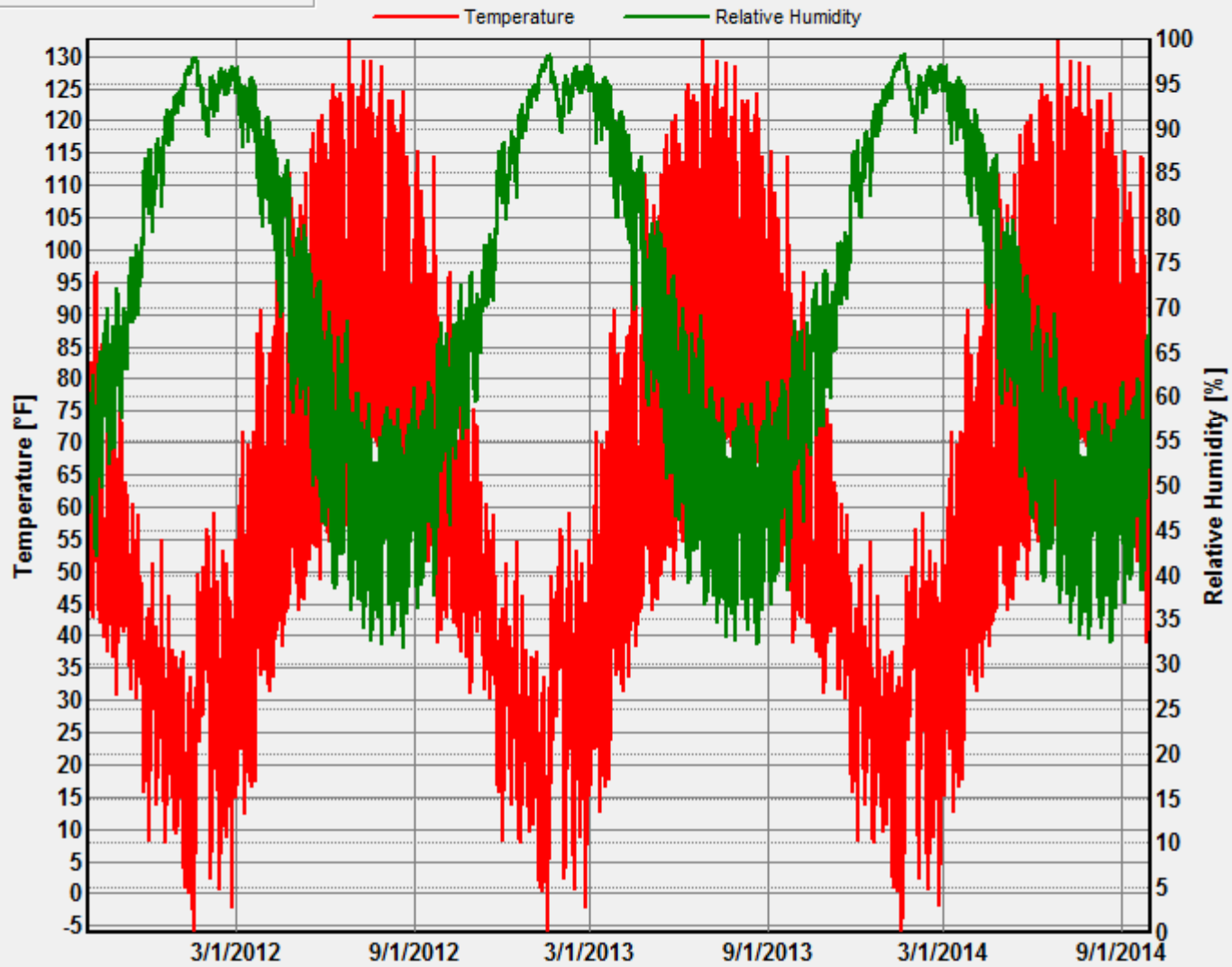
Sheathing – fiberglass interface

Humidity

Relative Humidity

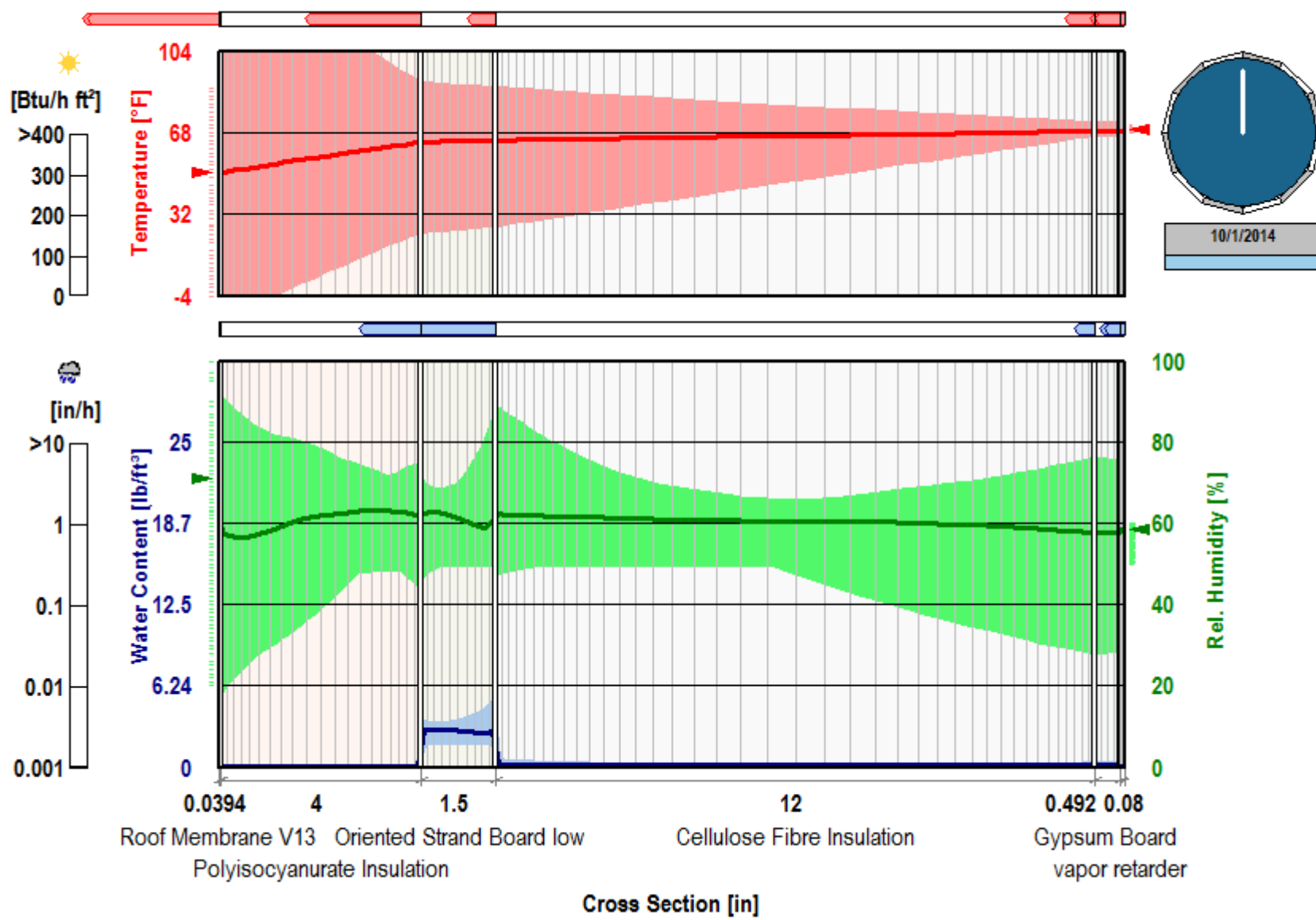
Dewpoint

1.59 in



Location: Montreal; standard year;

WUFI®



Project:

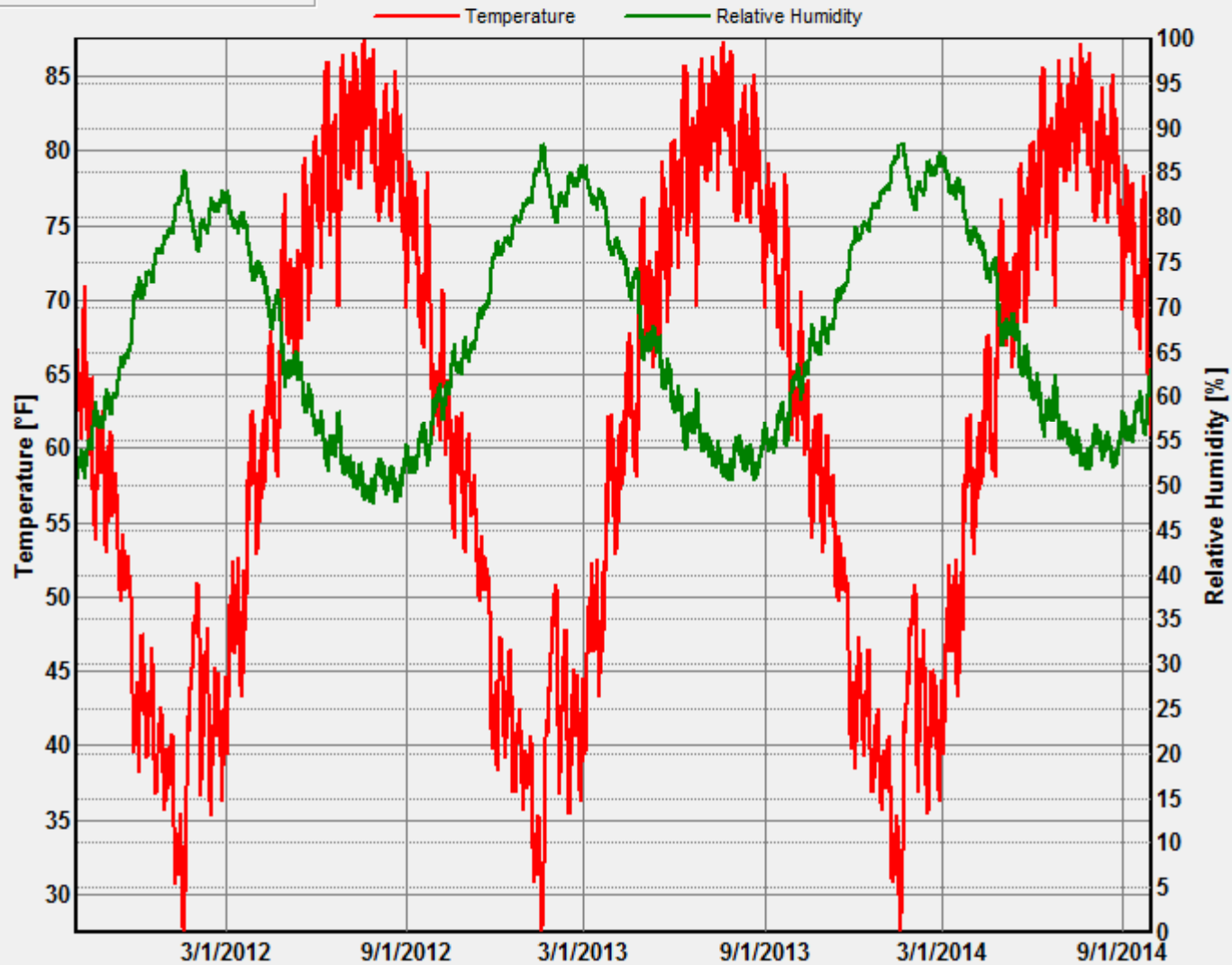
4 inches foam on top sheathing-cellulose interface

Humidity

Relative Humidity

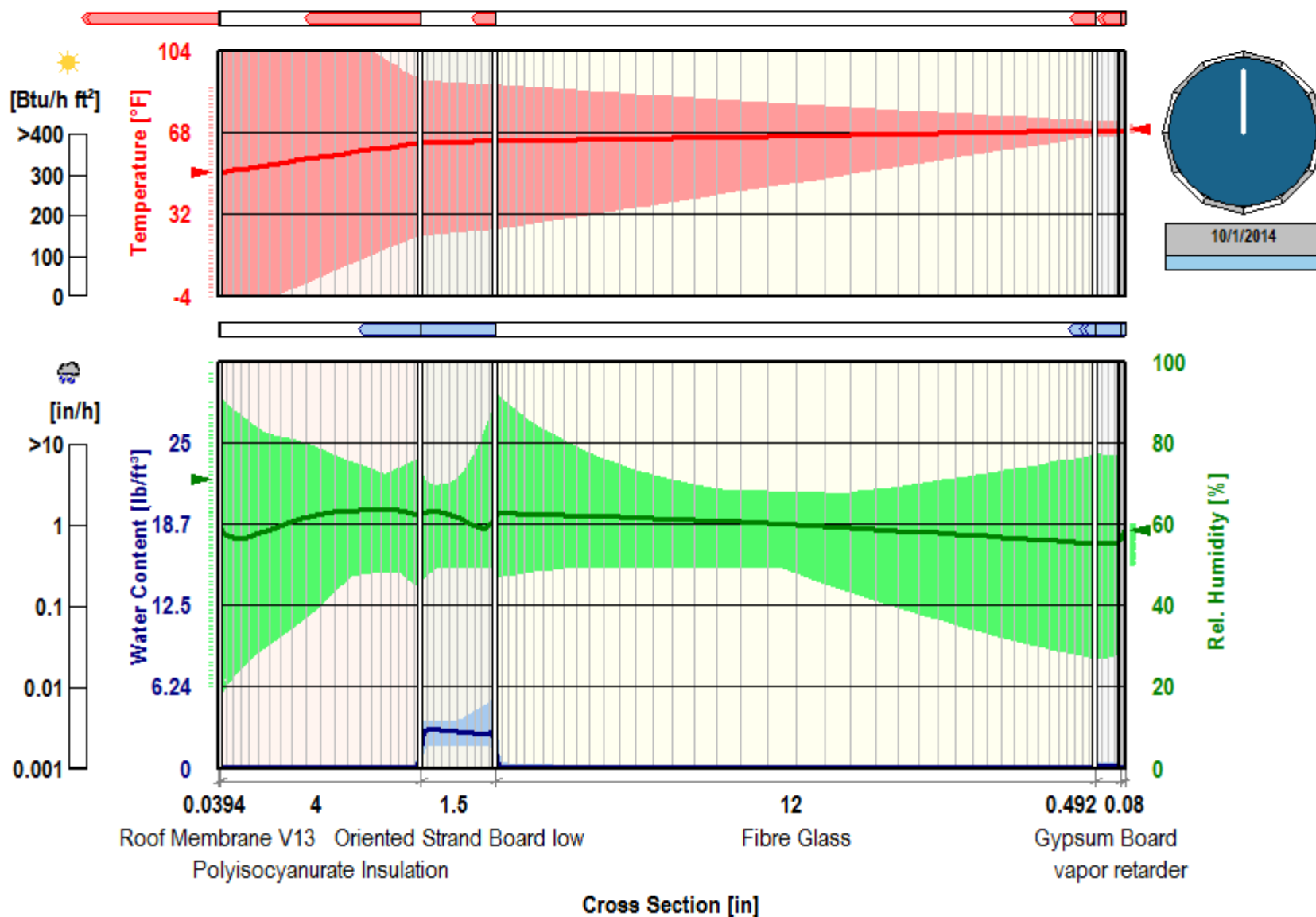
Dewpoint

5.60 in



Location: Montreal; standard year;

WUFI®

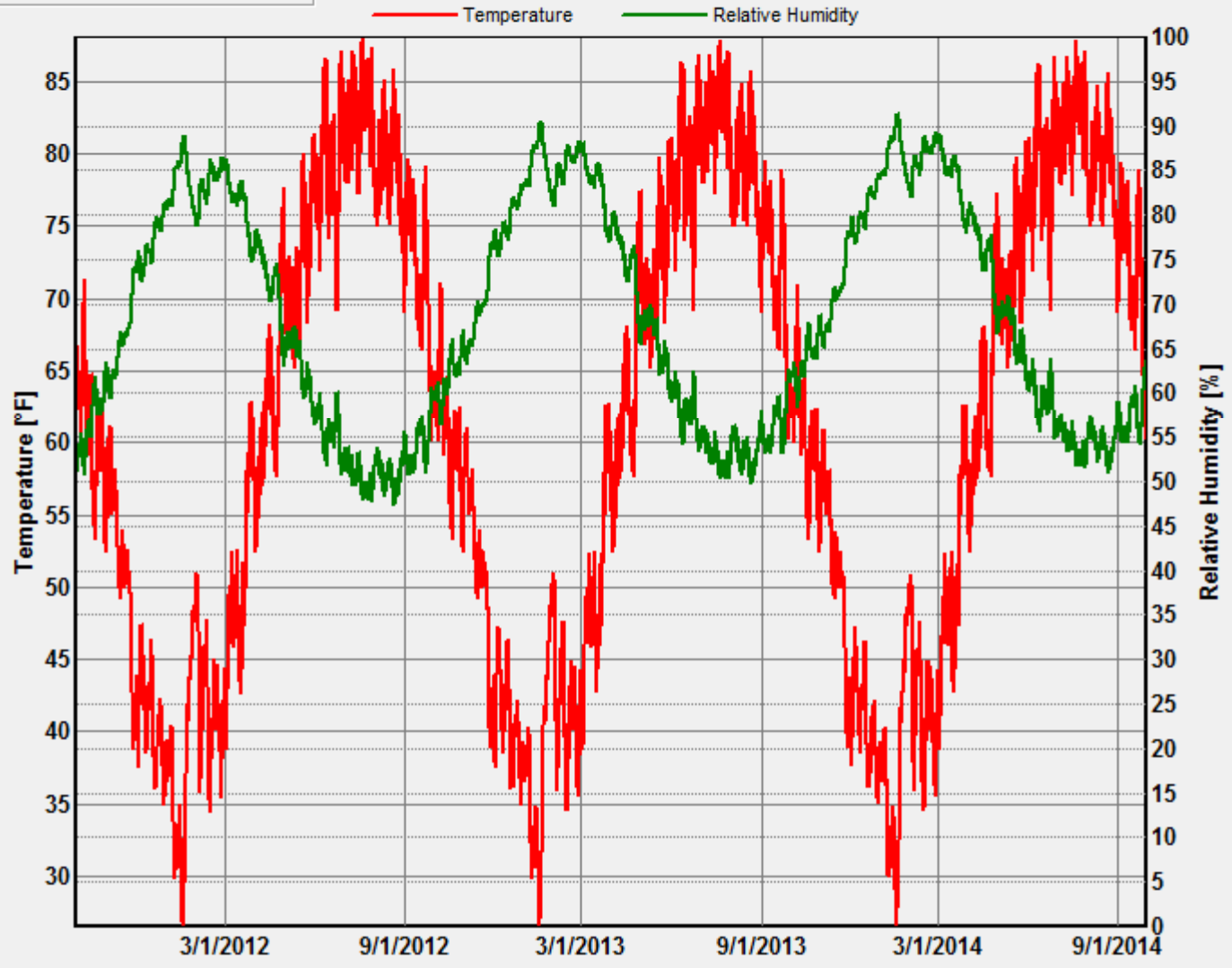


Project:

4 inches foam on top sheathing-fiberglass

- Humidity
- Relative Humidity
 - Dewpoint

5.60 in





Moisture problems weatherization fixes













Thanks to VEIC, NYSERDA, Marc Rosenbaum, Greg Pedrick, Blair Hamilton