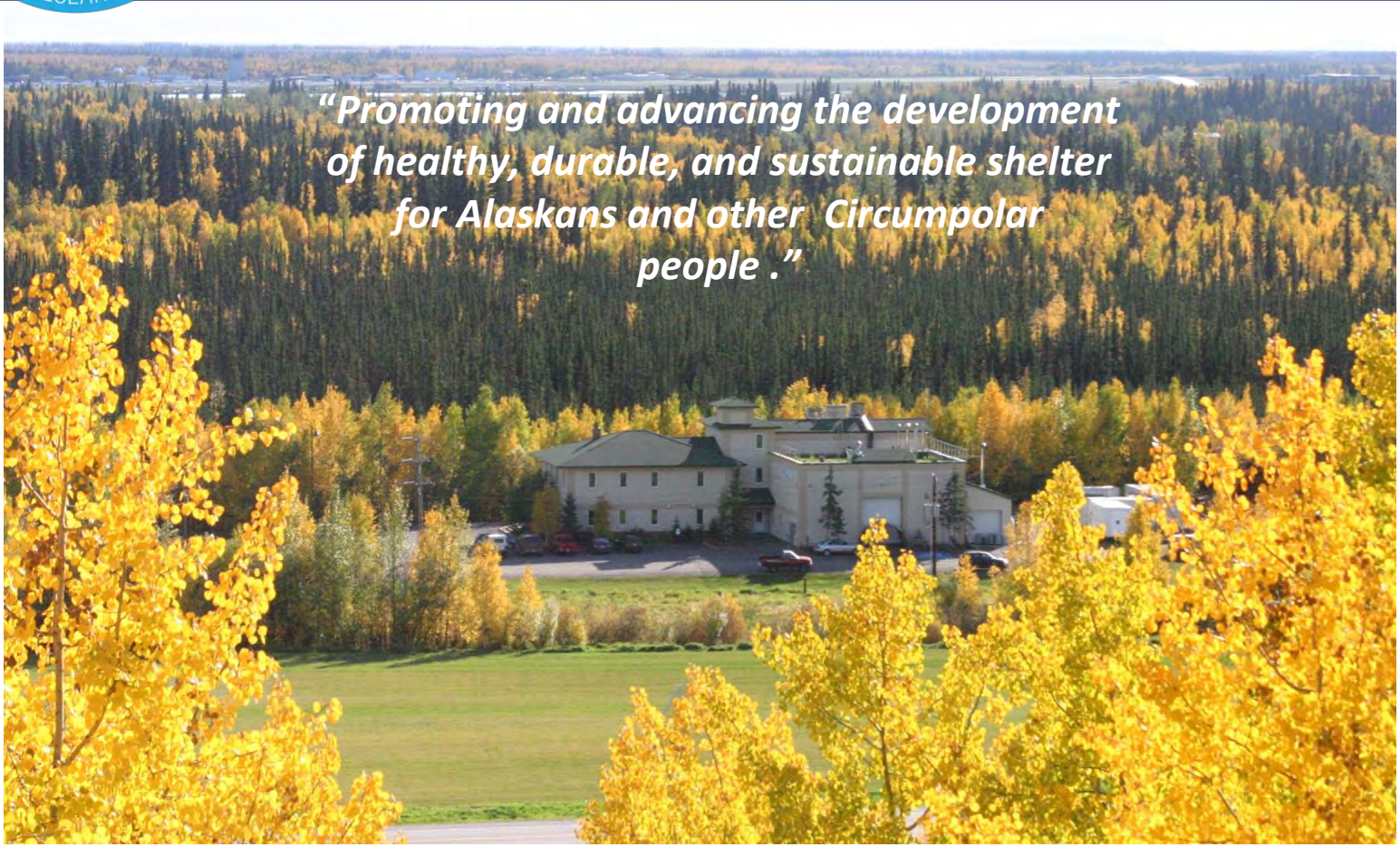
Safe, Effective & Affordable Retrofits for Cold Climates



Robbin Garber-Slaght, PE
Cold Climate Housing Research Center

Exterior Insulation Retrofits for Fairbanks, Alaska

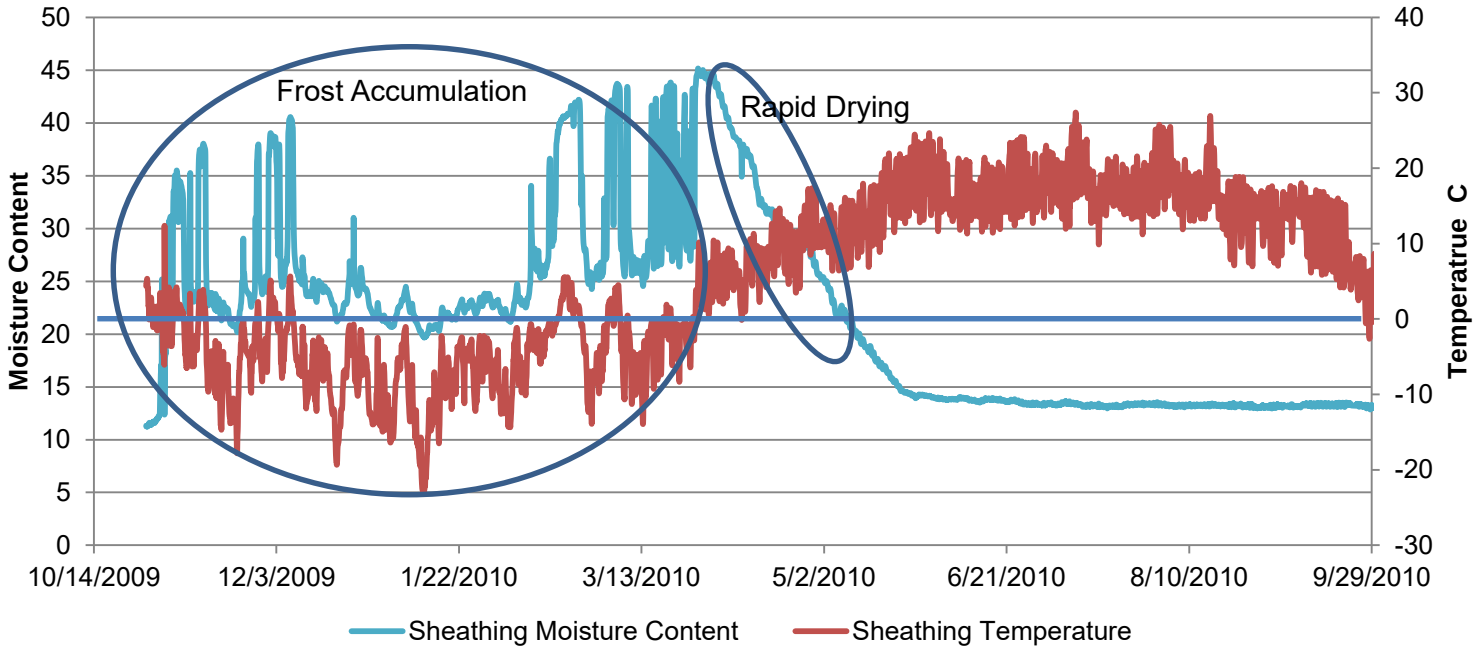
Most local Fairbanks construction is 2x6 frame with RSI 3.7 (R-21) fiberglass batts

Almost all walls have a 6 mil vapor retarder behind the gypsum board (usually poorly sealed)

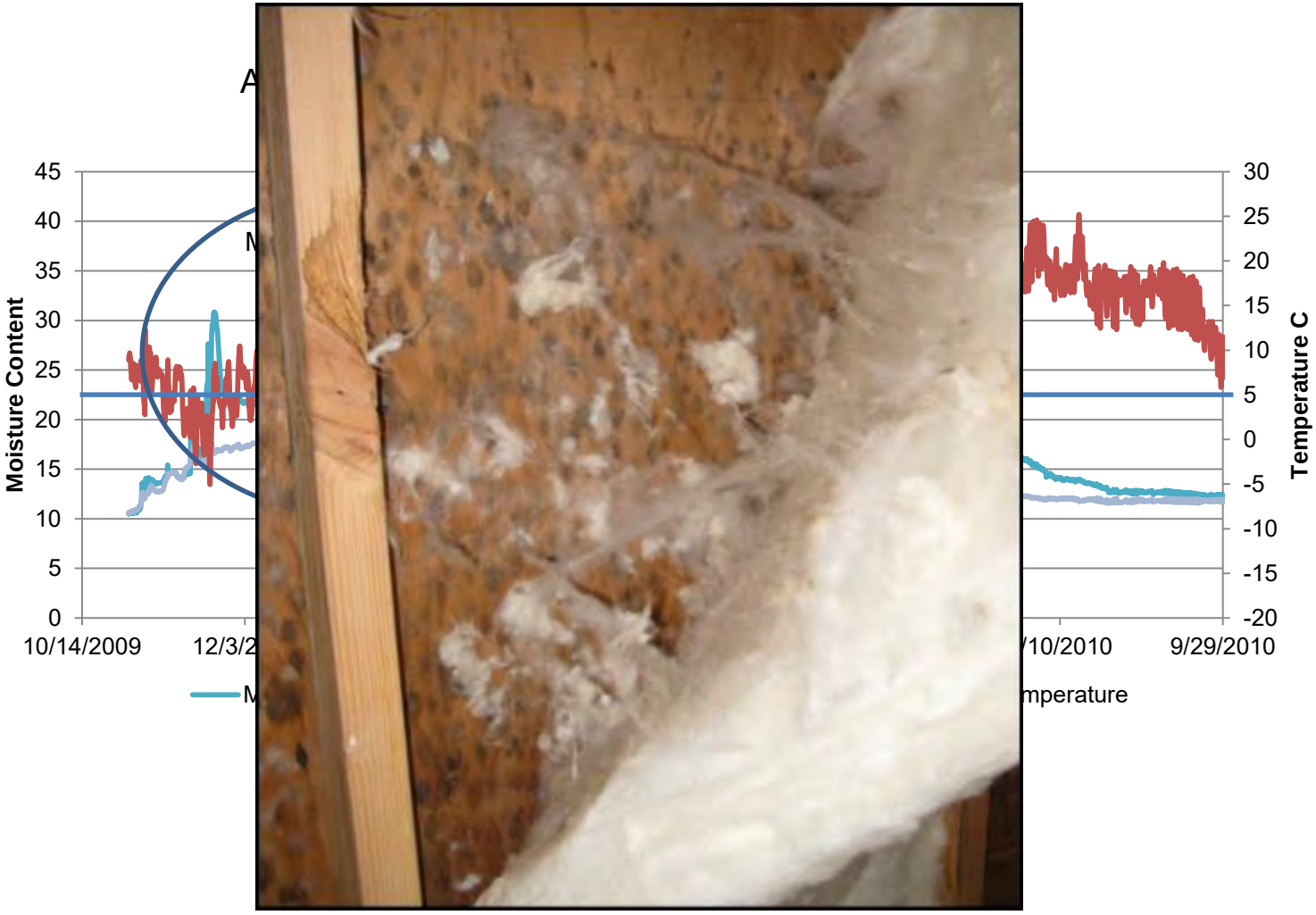
Frost buildup inside the sheathing is pretty common

Exterior Insulation Retrofits for Fairbanks, Alaska

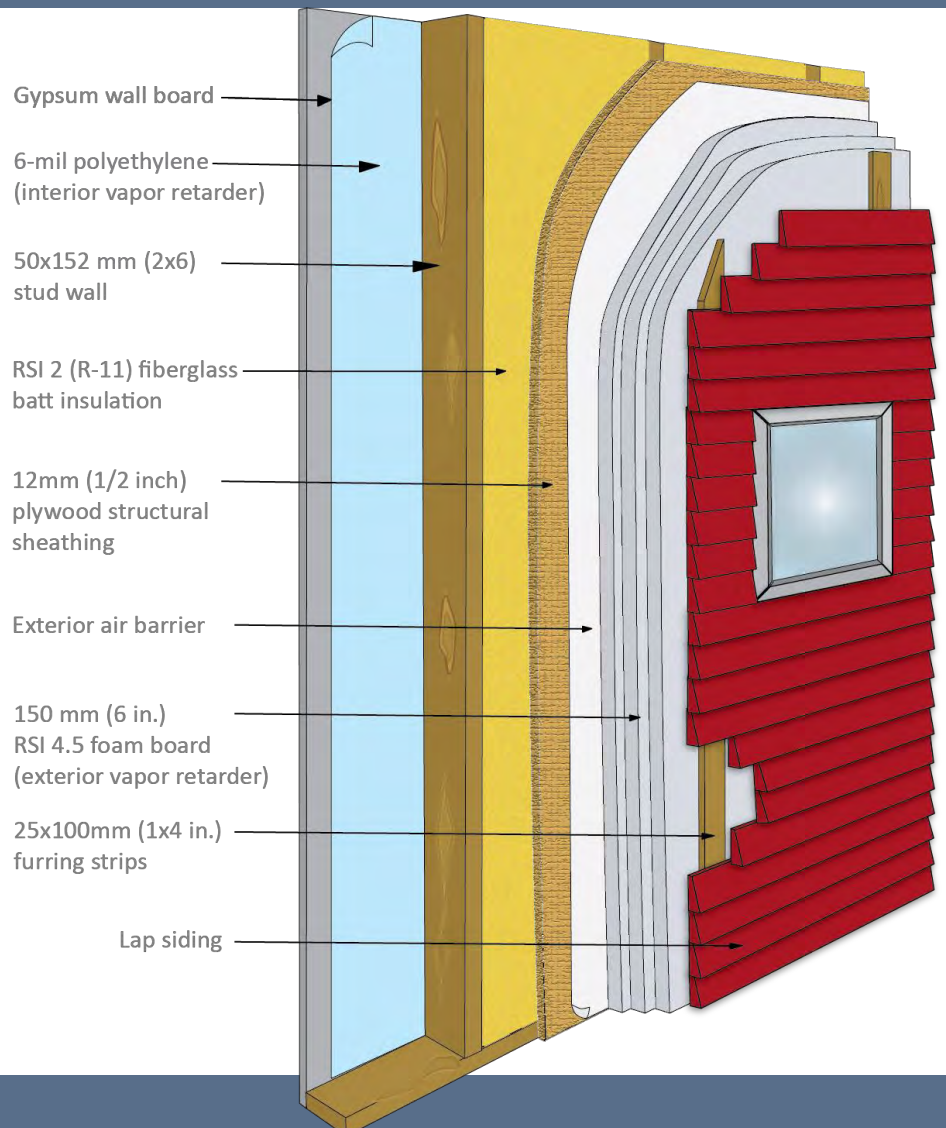
With all the frost build up, how do typical walls survive in Fairbanks?



Exterior Insulation Retrofits for Fairbanks, Alaska



Exterior Insulation Retrofits for Fairbanks, Alaska



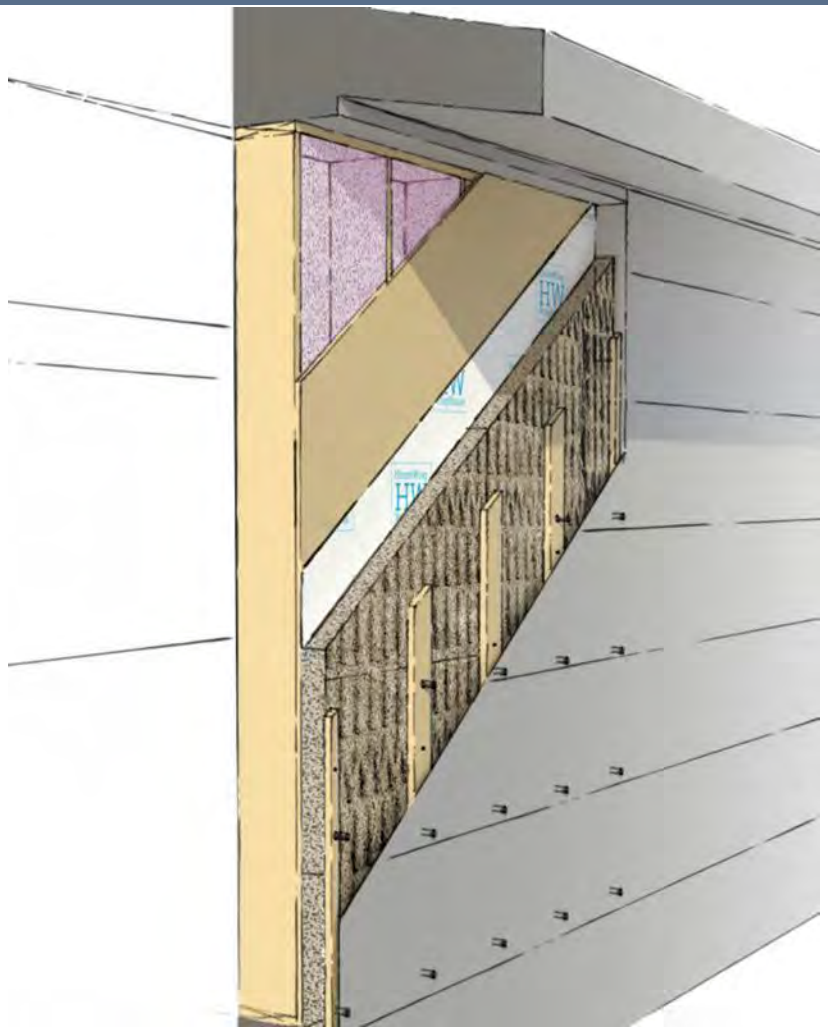
In the Fairbanks climate 2/3 of the R-value of the wall needs to be outside of the exterior sheathing.

RSI-2 (R-11) fiberglass batts inside then RSI-4 (R-24) insulation outside – that is 152 mm (6 inches) of EPS foam

The higher the R value inside the frame cavity the more outside insulation is necessary

This is not cost effective

Safe, Affordable, and Effective Retrofits



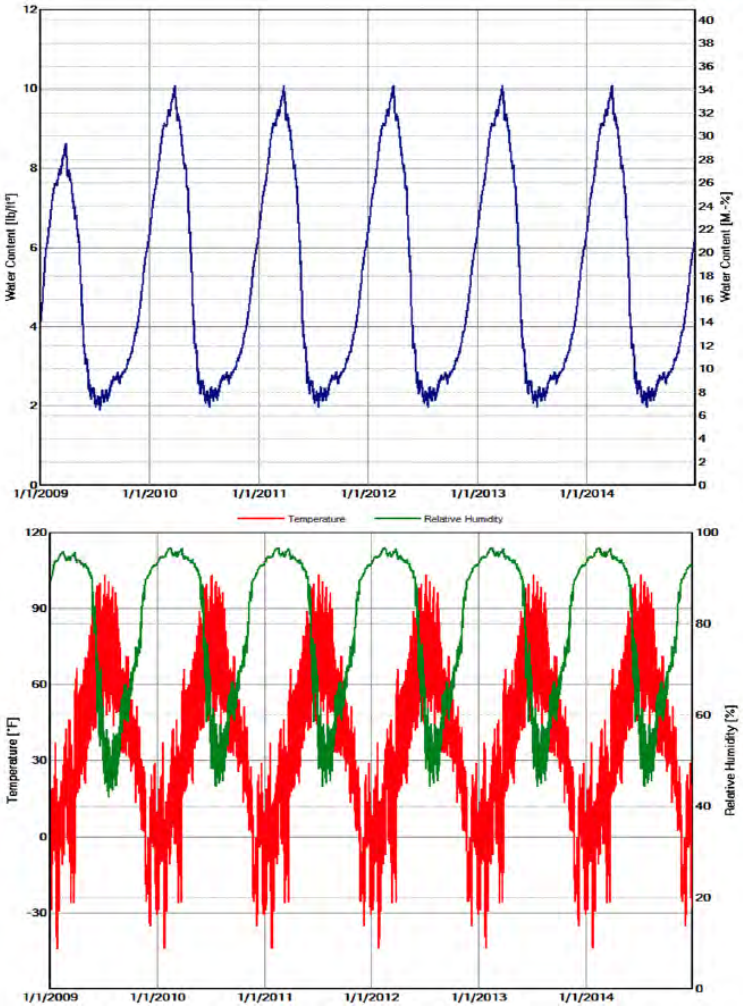
Is there a way to use vapor open insulation exterior to the sheathing?

Condensation will still form, but there is drying potential

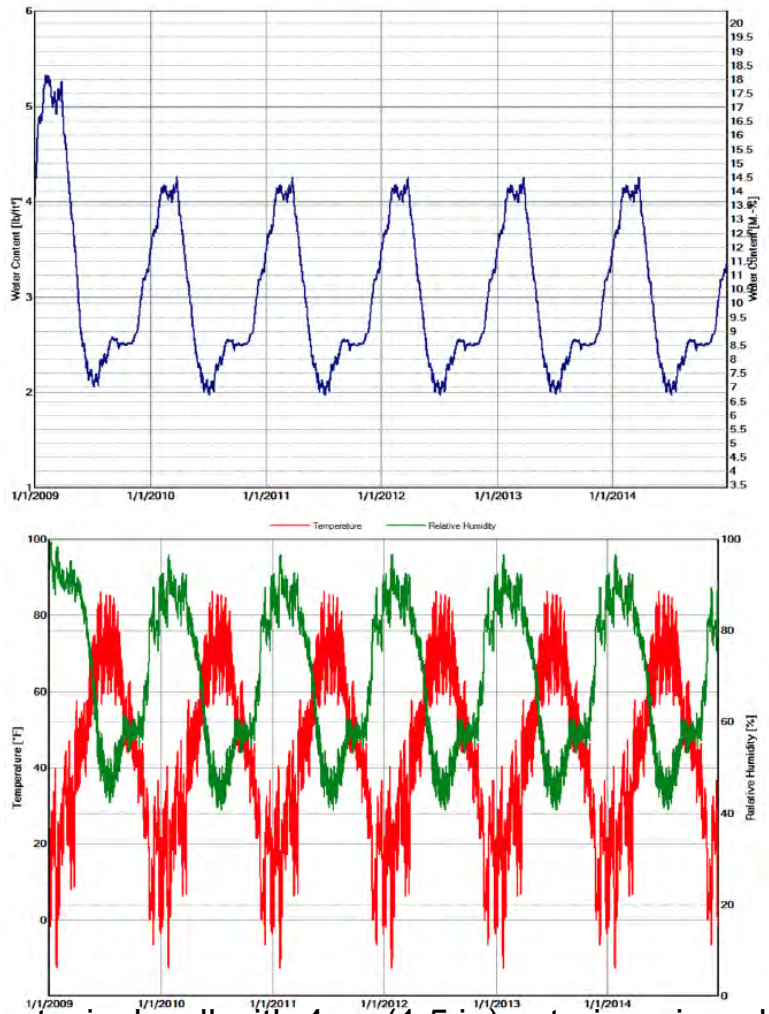
21 wall retrofit ideas were modeled and evaluated for installation and energy savings costs

The most cost effective and moisture safe 8 were chosen for further moisture study

Moisture Models



A typical Fairbanks wall



The typical wall with 4cm (1.5 in) exterior mineral wool

Moisture Models

	Air Barrier	Exterior Insulation	Siding Ventilation*	Mold Danger at the Plywood
Air Barrier Only Retrofit	Housewrap	None	19 mm (.75 in) ventilated rain screen	Yellow
EPS Foam Retrofit	Housewrap	7 inches EPS	19 mm (.75 in) unvented rain screen	Yellow to Green
EPS Unfaced Foam Retrofit	None	2 inches unfaced EPS	None	Red
EPS Unfaced Foam Retrofit	Housewrap	2 inches unfaced EPS	19 mm (.75 in) ventilated rain screen	Yellow
EPS Unfaced Foam Retrofit	Housewrap	4 inches unfaced EPS	19 mm (.75 in) ventilated rain screen	Yellow to Green
Mineral Wool Panel Retrofit	Housewrap	2 inches mineral wool panels	19 mm (.75 in) ventilated rain screen	Green
Mineral Wool Panel Retrofit	Housewrap	4 inches mineral wool panels	19 mm (.75 in) ventilated rain screen	Green
Mineral Wool Panel Retrofit	Housewrap	6 inches mineral wool panels	19 mm (.75 in) ventilated rain screen	Green
Mineral Wool Panel Retrofit	Housewrap	1.5 inches mineral wool panels	19 mm (.75 in) ventilated rain screen	Yellow to Green
Cellulose Retrofit	Housewrap	5.5 inches dense pack cellulose	19 mm (.75 in) ventilated rain screen	Green
Cellulose Retrofit	Housewrap	3.5 inches dense pack cellulose	19 mm (.75 in) ventilated rain screen	Green
Blown Fiberglass Retrofit	Housewrap	5.5 inches dense pack fiberglass	19 mm (.75 in) ventilated rain screen	Green
Blown Fiberglass Retrofit	Housewrap	3 inches dense pack fiberglass	19 mm (.75 in) unvented rain screen	Green

Lab Testing – Test Walls

Wall Number	Exterior Insulation
1	3.8 cm (1.5 in) Mineral wool
2	5 cm (2 in) Unfaced EPS
3	5 cm (2 in) Biomaterial
4	7.6 (3 in) cm Mineral Wool
5	none
6	8.9 cm (3.5 in) Cellulose
7	8.9 cm (3.5 in) Fiberglass
8	10 cm (4 in) Unfaced EPS
9	10 cm (4 in) Biomaterial

Lab Testing-Conditions

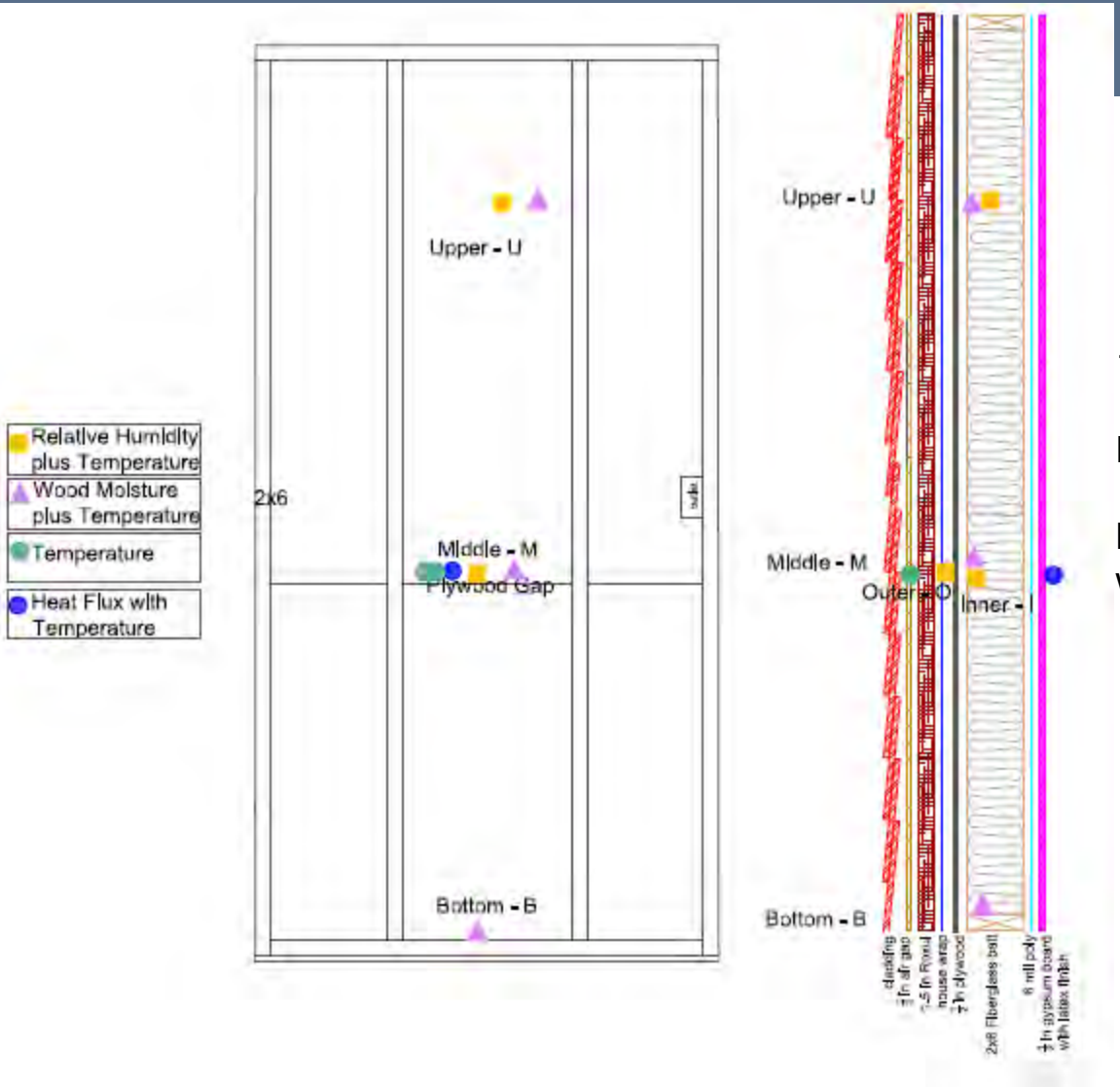
40% Relative Humidity

21°C (70°F)

Controlled air leakage approximating 5 ACH50 per wall

Fairbanks winter exterior conditions

Lab Testing – Data Collection



15 data points per wall

Focused around the sheathing

Mostly relative humidity and wood moisture content

Biomaterial

An organic medium held together with a grown-in-place fungus

The R-value is roughly equivalent to fiberglass

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Next Steps:

The walls will be stressed and monitored over the winter

They will be disassembled and inspected in June 2018

A final report will be available next year

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Thank you to our project sponsors:
Alaska Housing Finance Corporation, University of Alaska Anchorage, Rasmuson Foundation, Insulfoam, and Panasonic