



Ventilation for SPF Contractors and other BS



April 14, 2015

Dear Allison,

On behalf of The International Women's Leadership Association, it is my distinct pleasure to notify you that, in consideration of your contribution to family career, and community, you have been selected as a woman of outstanding leadership.

Allison Bailes

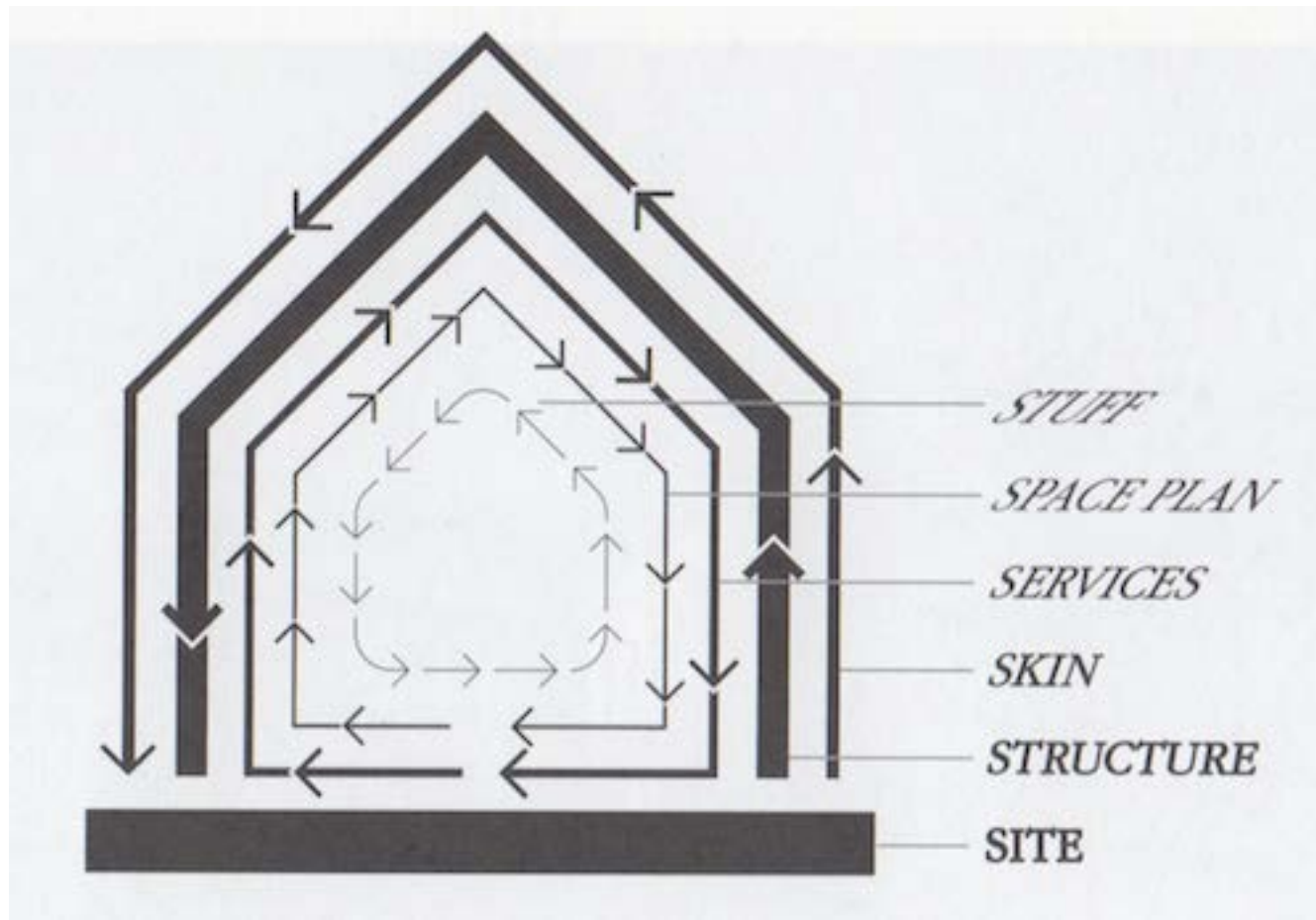


QUESTION

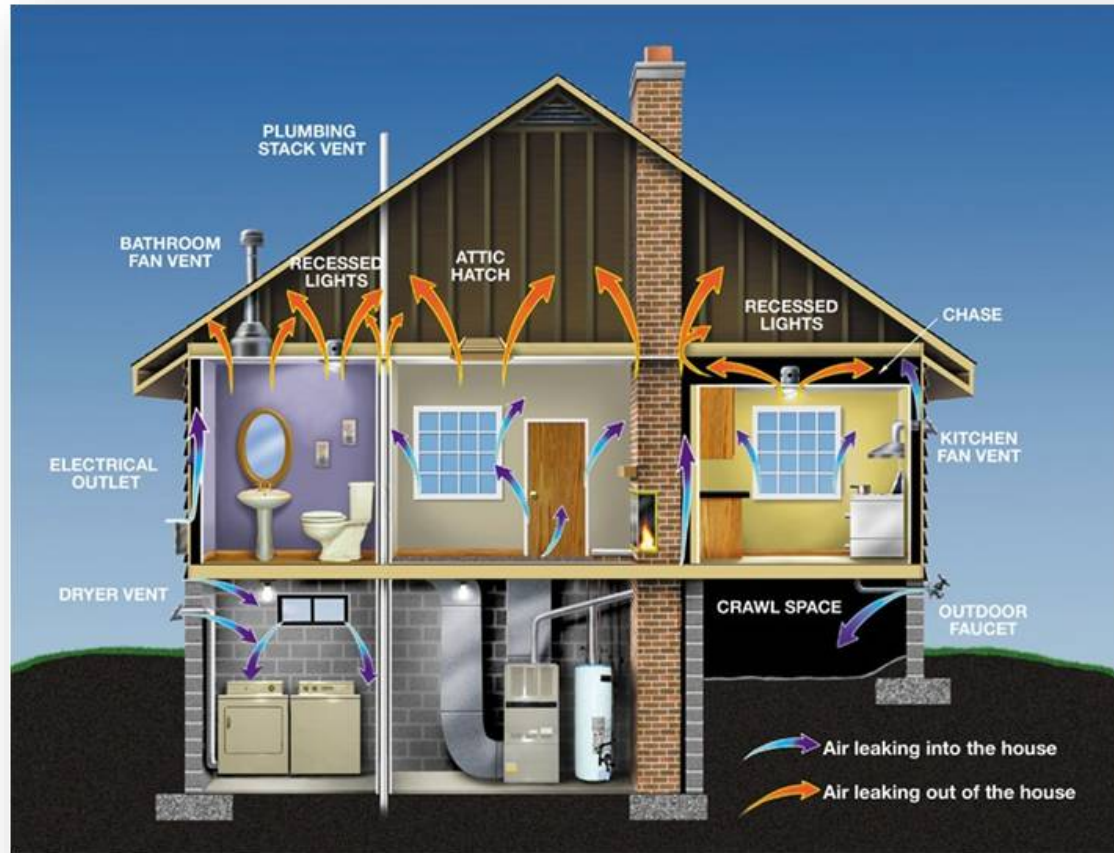
Why should a spray foam contractor know building science?



Stewart Brand's 6 Ss



A Building Is a System



*Everyone
wears
blinders.*



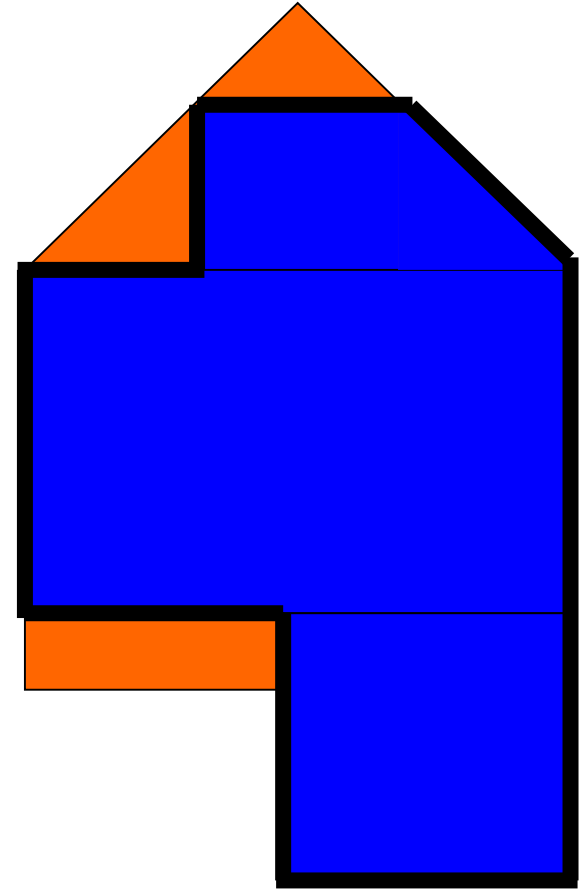
Building Enclosure

Boundary between conditioned
& unconditioned spaces with
two key components:

- Air Barrier
- Insulation



*Air barrier should be touching
insulation (in most cases).*







Going with the Flow



“In this house, we obey the laws of thermodynamics!”

~ Homer Simpson

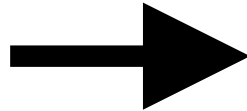
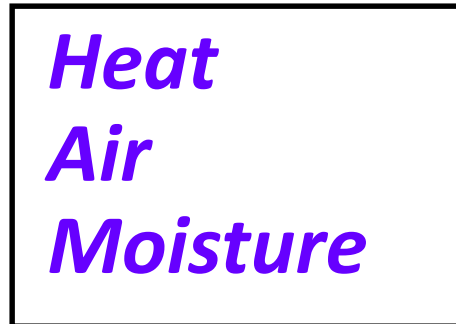
Heat, Air, & Moisture take the path of least resistance:

- Hot → Cold
- High → Low Pressure
- Wet → Dry

2nd Law of Thermodynamics

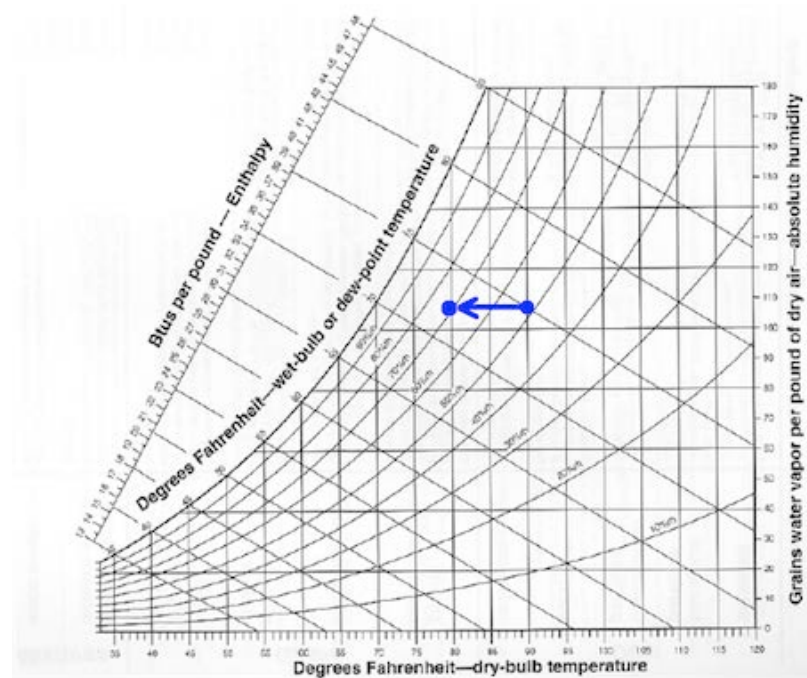
Going with the Flow

Controlling



Results in





The Physics of Water

The Two Kinds of...

People

Moisture

- Liquid
- Vapor
- *(Ignore solid)*



2nd Law of Thermodynamics for Moisture

Water moves from wet to dry areas.

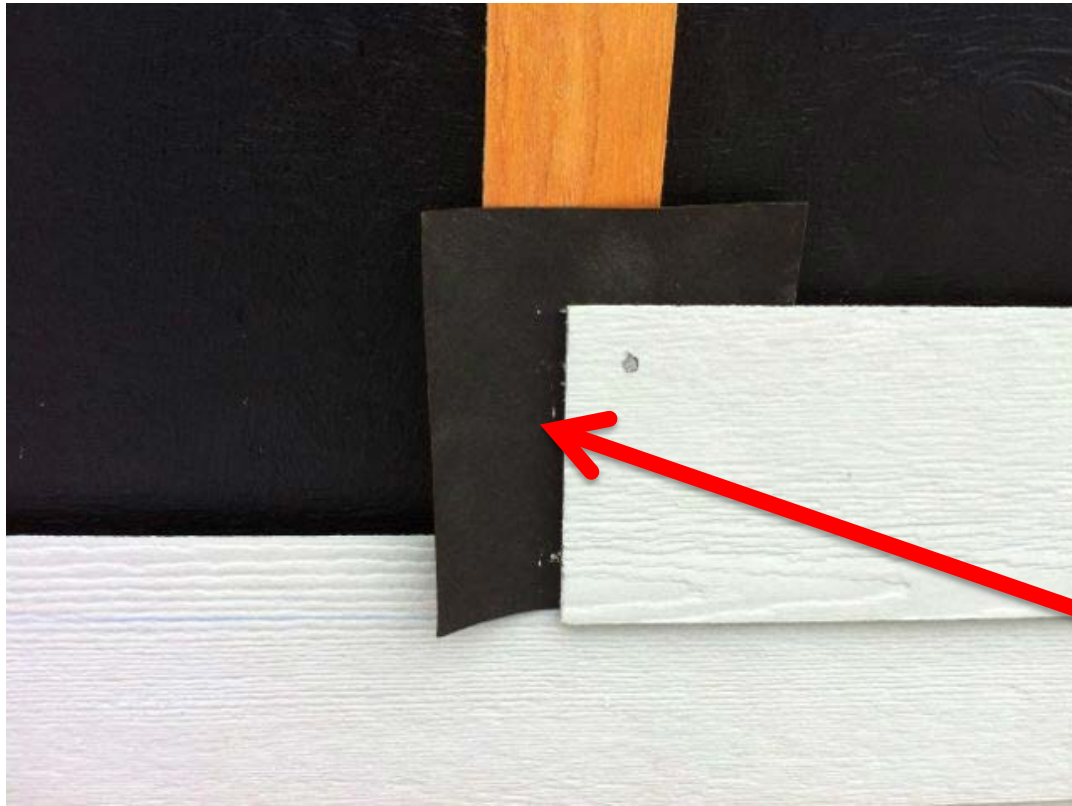


Law of Gravity for Moisture

Water moves downward.



Wind-Driven Rain



Water will get behind the cladding.

Felt at siding joints

The Drainage Plane

Housewrap



The Drainage Plane

Foamboard

Seams must be taped



The Drainage Plane

Taped Sheathing



The Drainage Plane

Liquid-applied



The Drainage Plane

Peel-and-Stick

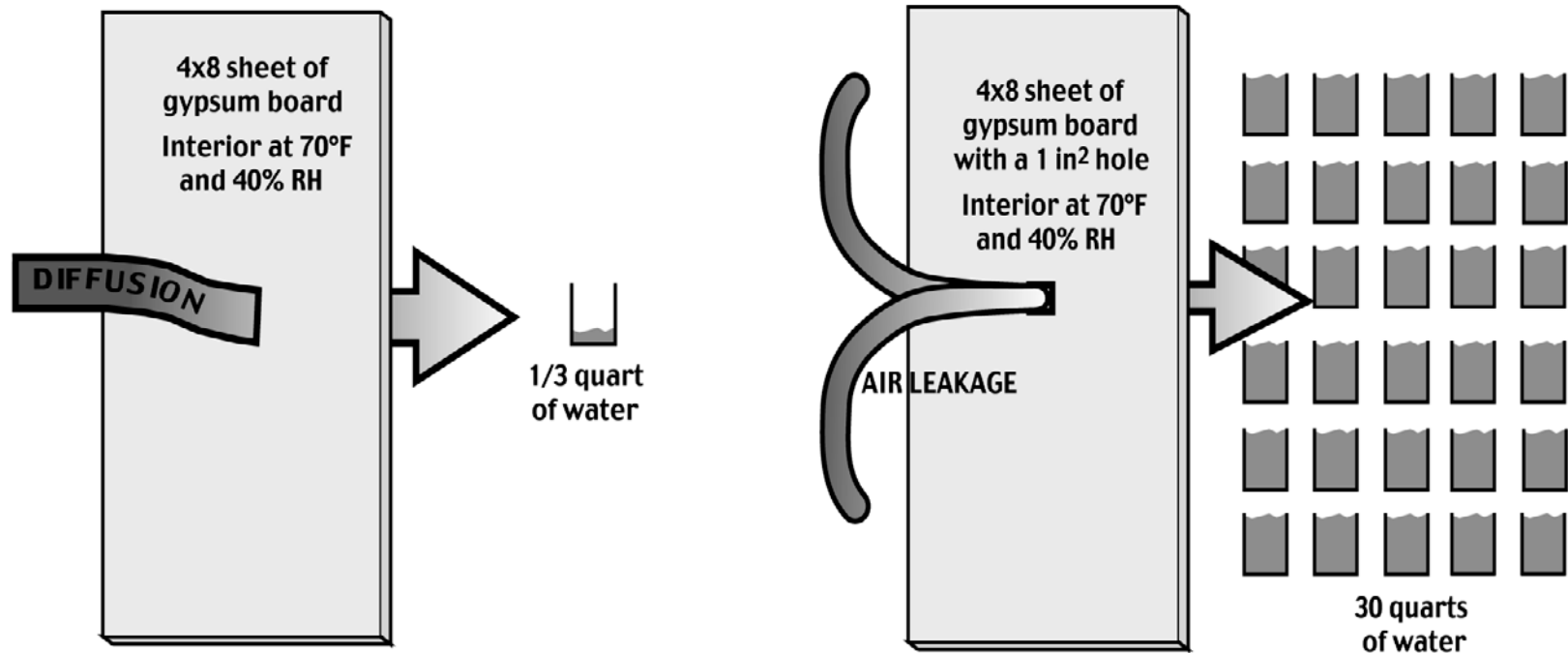


The Drainage Plane

Felt

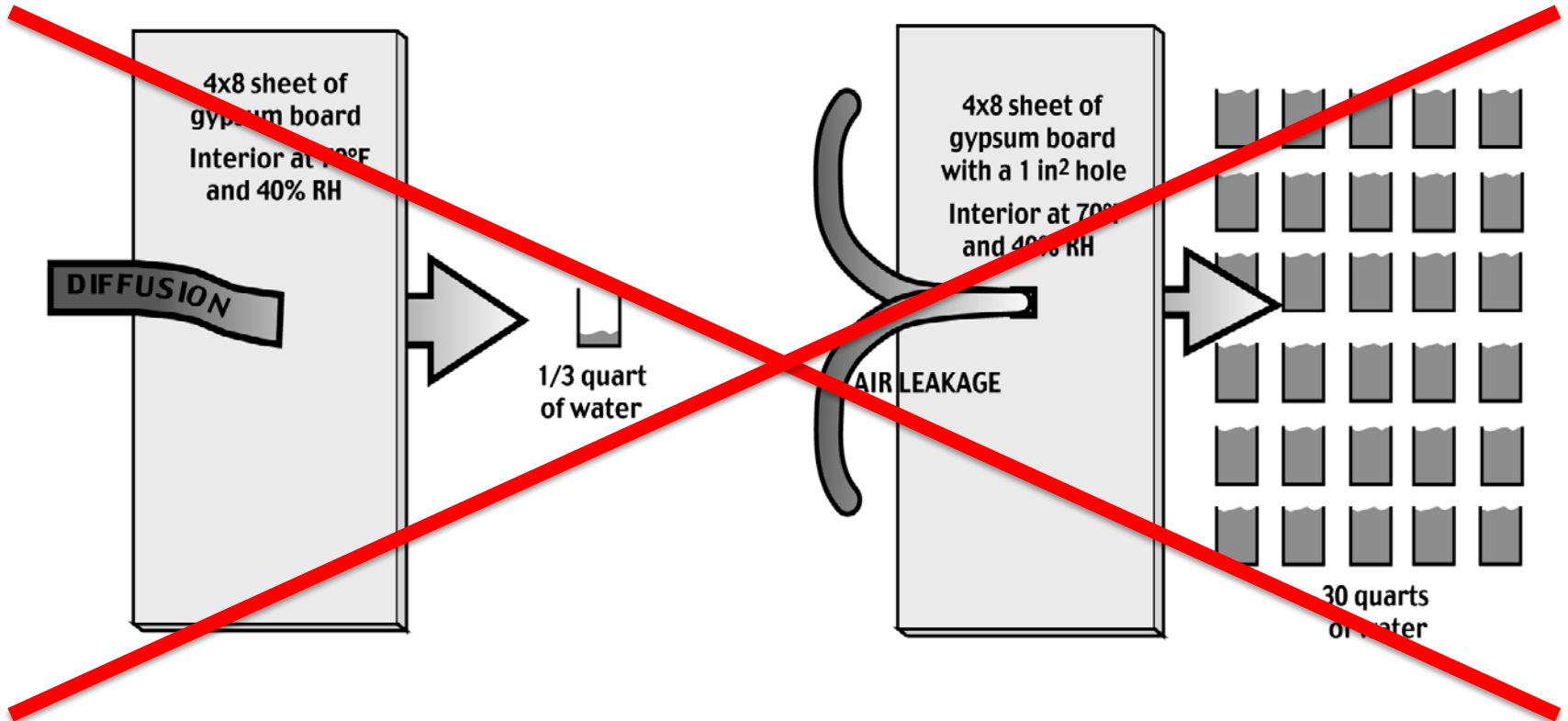


Diffusion vs. Infiltration



~100:1 ratio favoring air leakage?

Diffusion vs. Infiltration



Lstiburek now says it's more like a 10:1 ratio.

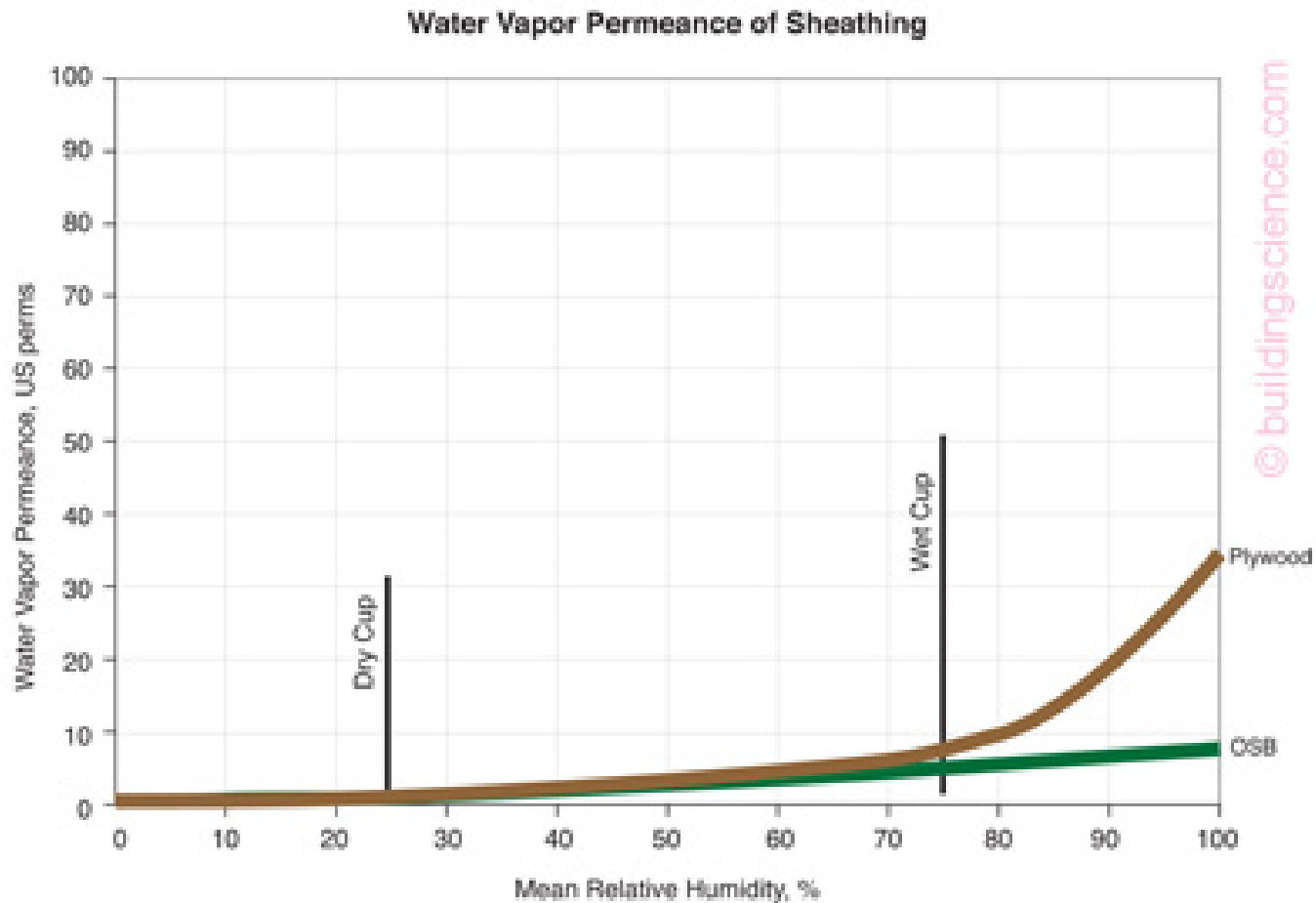
Permeance & Vapor Retarders

- **Class I: ≤ 0.1 perm**
 - polyethylene
 - nonperforated aluminum foil
- **Class II: 0.1 to 1 perm**
 - Kraft paper facing on batts
 - XPS foam > 1 " thick
- **Class III: 1 to 10 perms**
 - latex paint
 - #30 felt
 - plywood
- The lower the number, the less permeance the material has.
- Some people call a Class I vapor retarder a vapor barrier.

Permeance vs. Permeability

- **Permeance** – Depends on thickness; analogous to weight
 - 1" XPS → 1.1 perms
 - 2" XPS → 0.55 perm
- **Permeability** – Does *not* depend on thickness; analogous to density
 - Roughly inversely proportional to thickness

Plywood vs. OSB



QUESTION

What does this graph say about the effect of the switch from plywood to OSB for sheathing homes?

OSB works if you...

Add an air gap:

- Furring strips
- Crinkled house wrap
- Plastic mesh



Rain Screen vs. Drainable Wrap



Home Slicker



HydroGap

Both made by Benjamin Obdyke

“The three biggest problems in buildings are water, water, and water.”

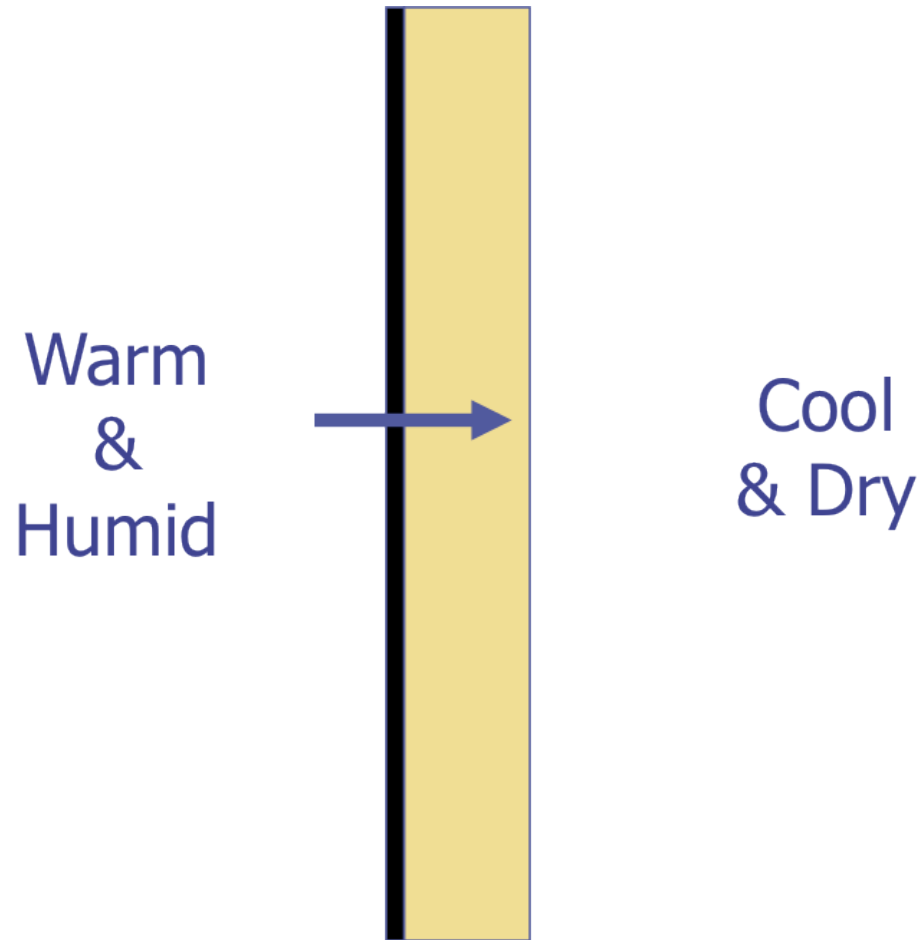
~ Gus Handegord

Fundamental Rule of Material Wetness

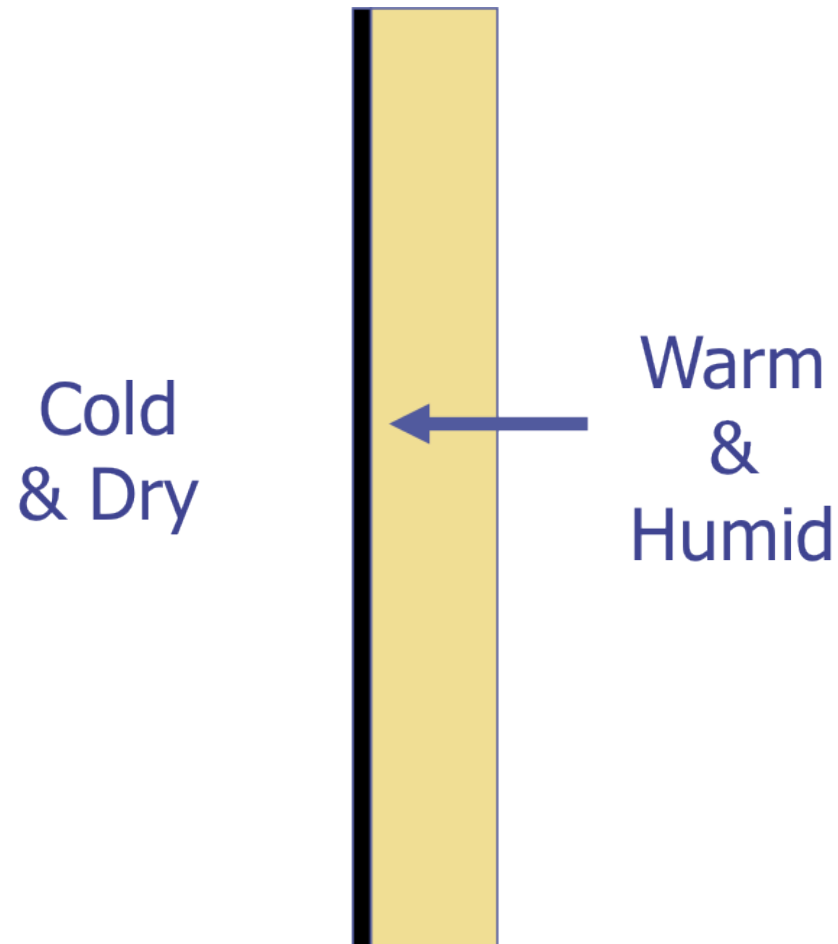
*Cold materials tend to be
wet and warm materials
tend to be dry.*

from *Water in Buildings* by Bill Rose

Condensing Surface



Condensing Surface



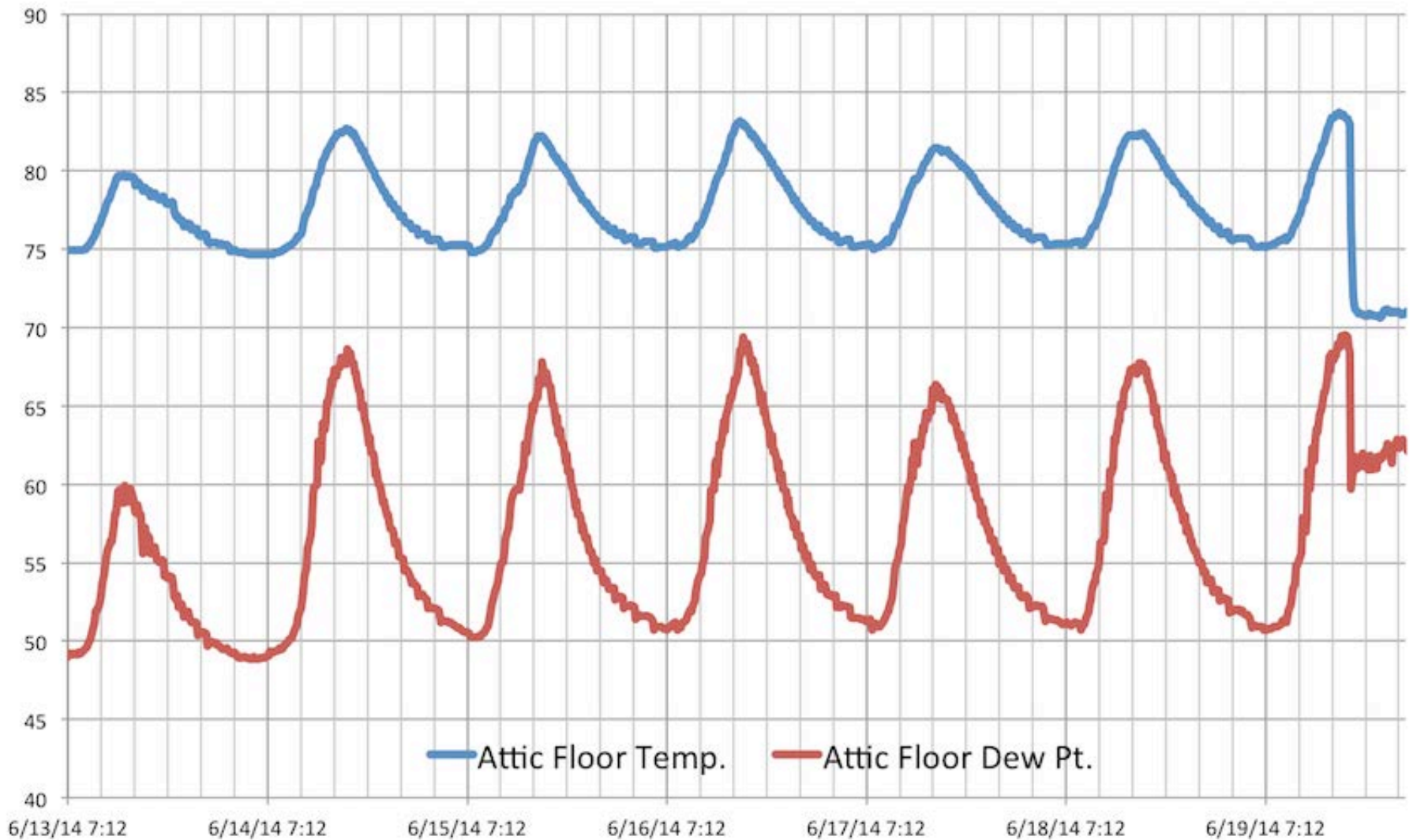


N3
(5-½-in. ocSPF)

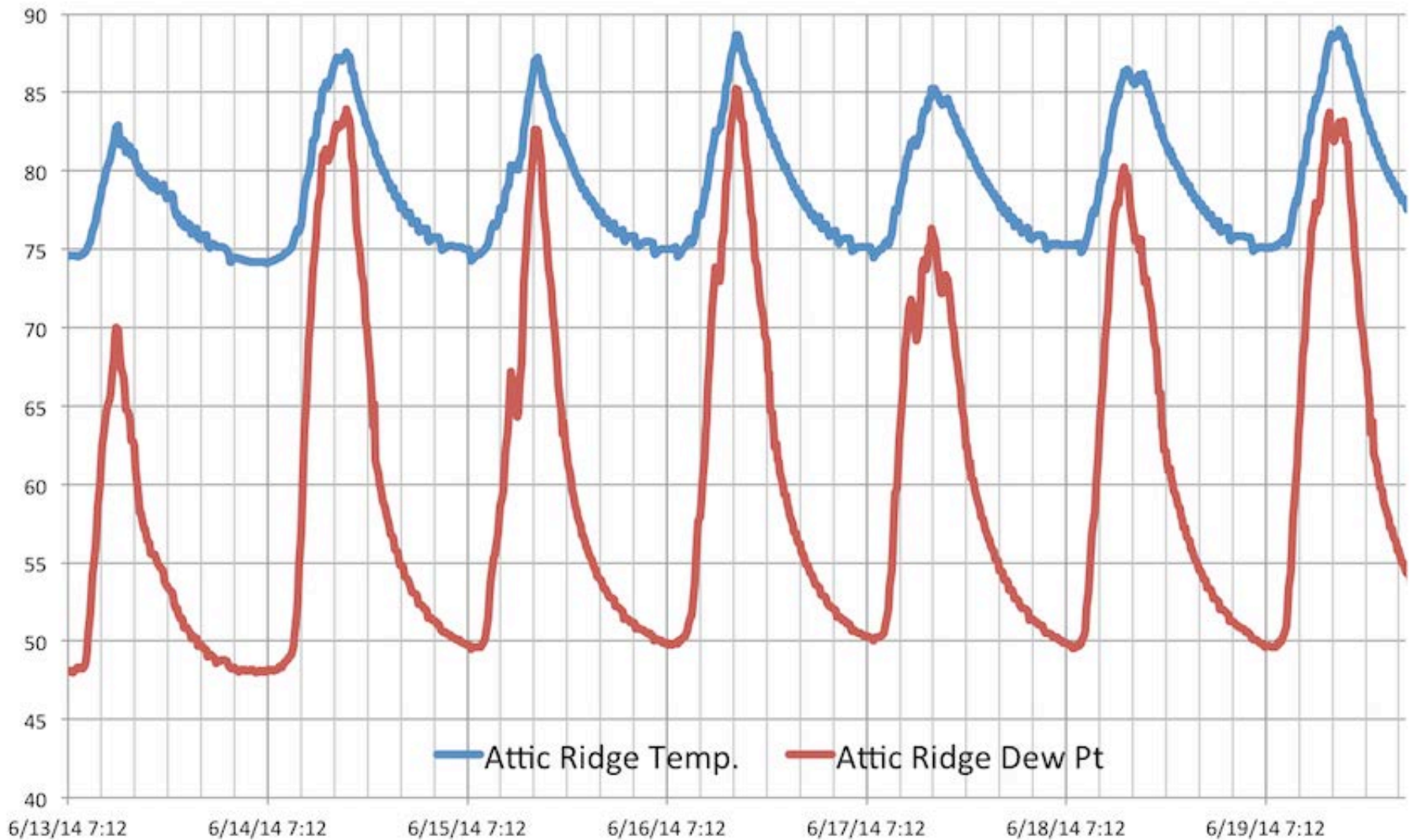
N2 **N1**
(12-in. cellulose) **(12-in. ocSPF)**

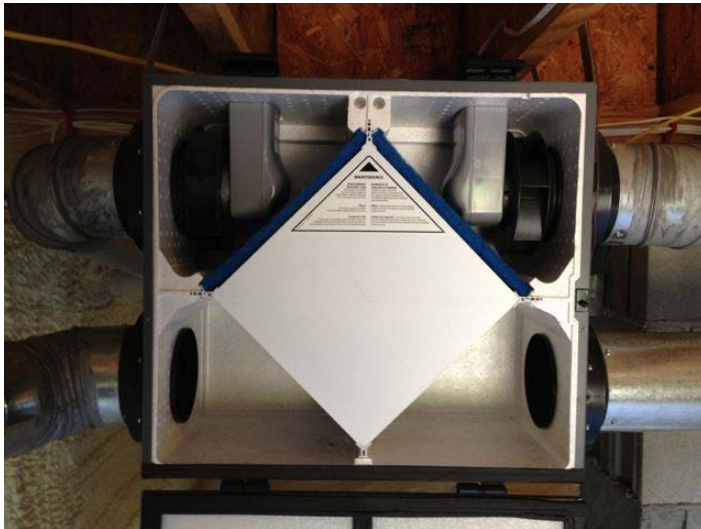


Attic Floor Temperature & Dew Point



Attic Ridge Temperature & Dew Point





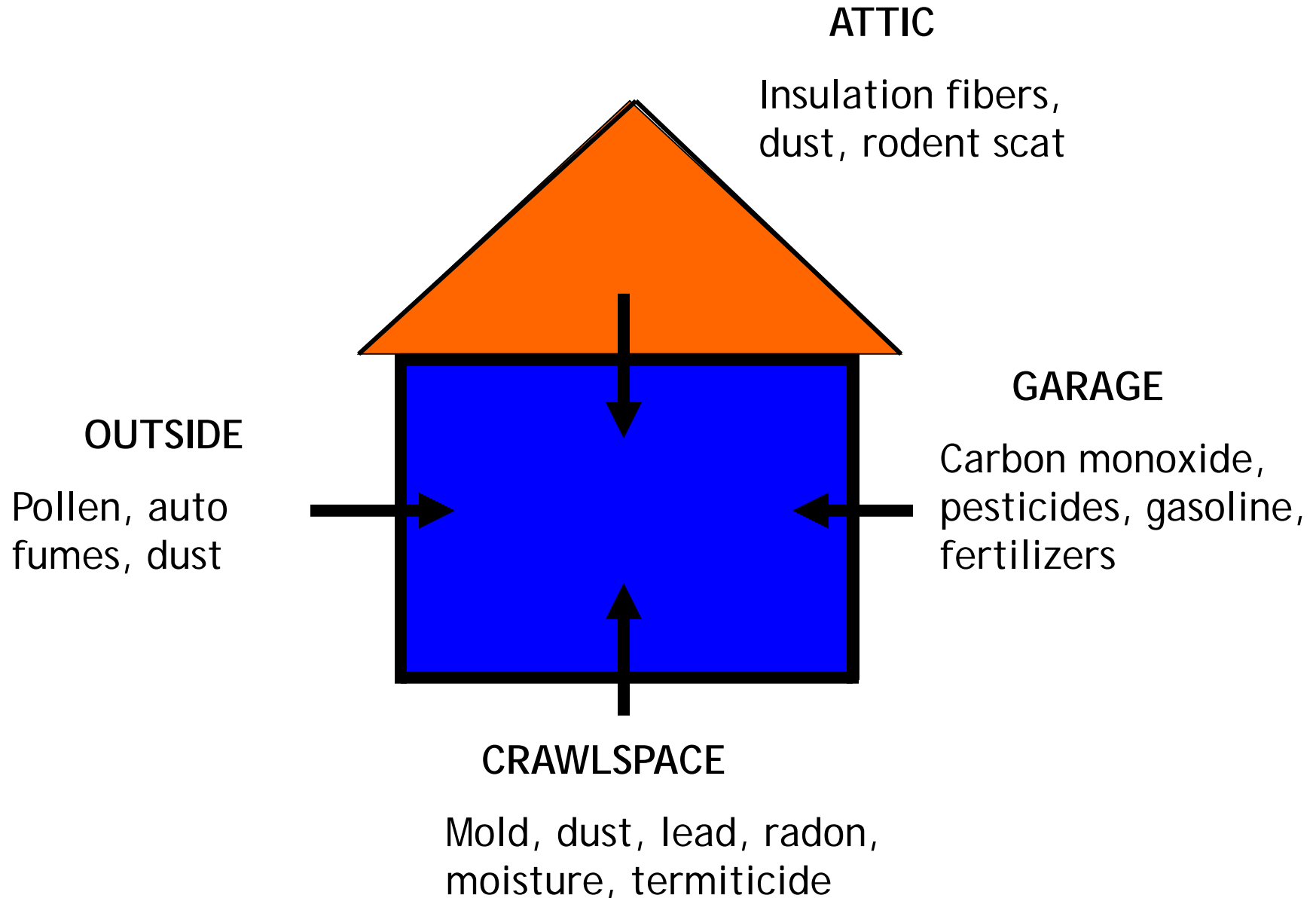
Choosing a Residential Ventilation Method

Why We Need Ventilation



Airtight
enclosures

Infiltration Doesn't Cut It



Bad Stuff in the Air

CO₂

VOCs

Formaldehyde

NO_x

Radon

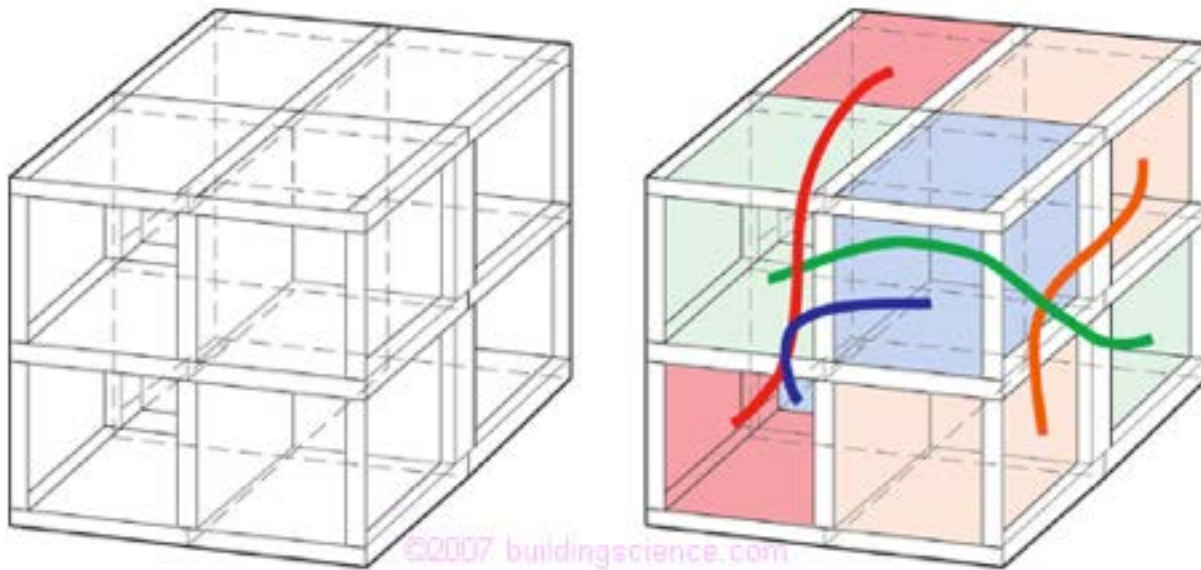
...and more!



2 Ways to Achieve Good IAQ

Source control

Mechanical Ventilation



“If there is a pile of manure in a space, do not try to remove the odor by ventilation. Remove the pile of manure.”

~ Max von Pettenkofer, 1858



Build Tight Ventilate Right

3 Types of People

1. Those who can do math
2. and those who can't.



3 Types of Ventilation

1. Whole house
2. Local
3. Buffer space



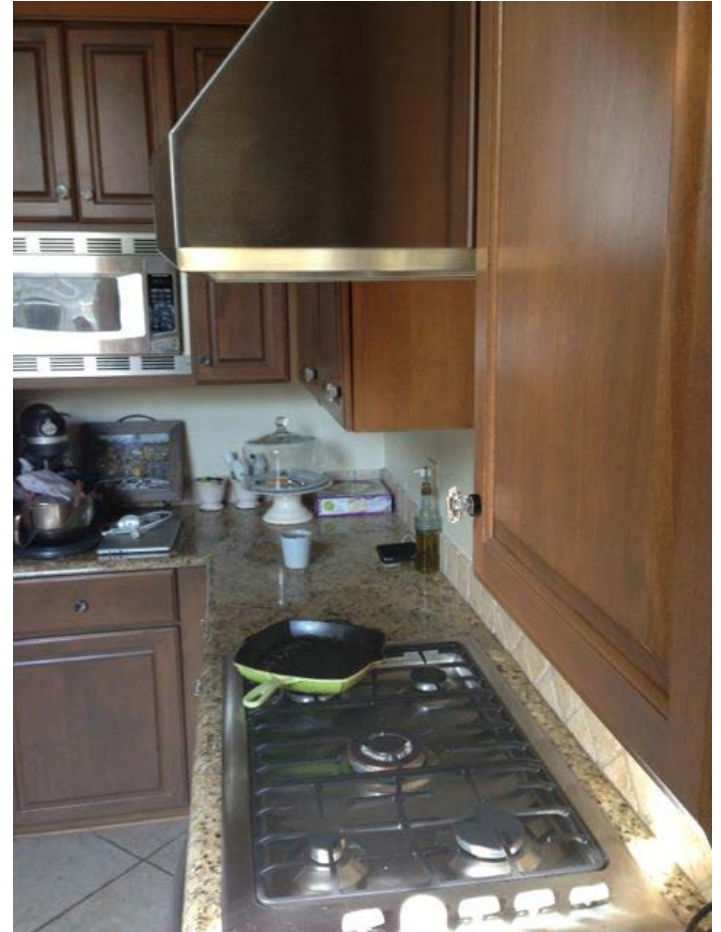
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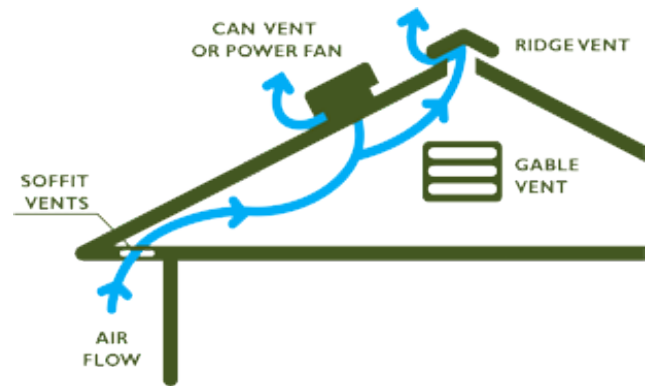
Local Ventilation

- Bathrooms
- Kitchens



Buffer Space Ventilation

- Radon
- Crawl space
- Garage
- Attic



Resources

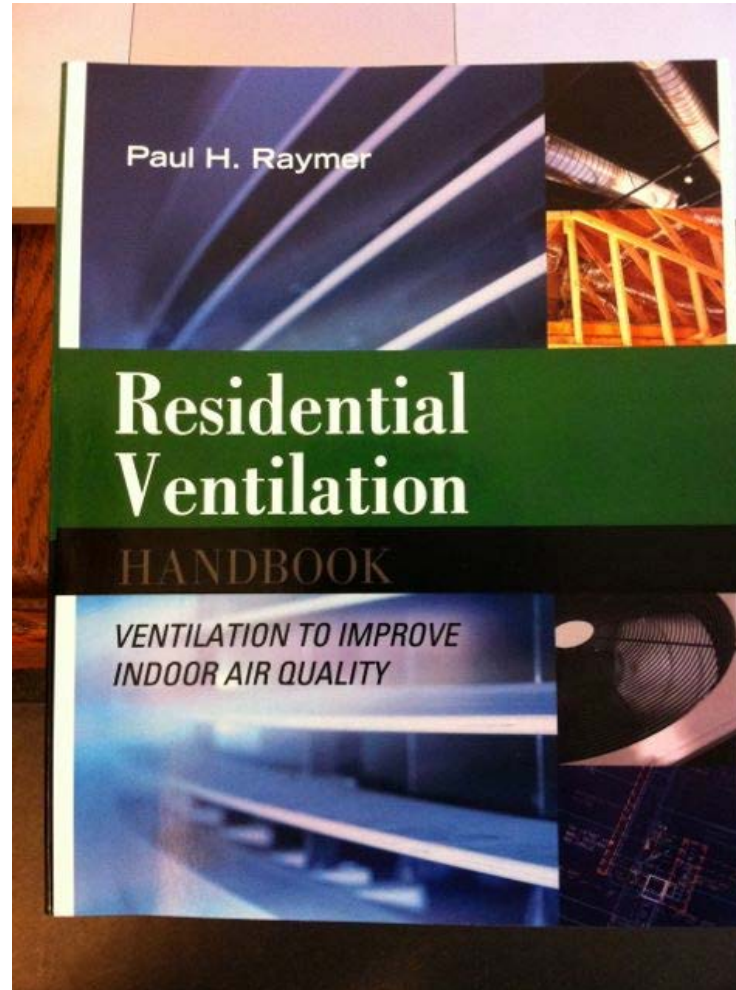
Ventilation Guide

by Armin Rudd



Residential Ventilation Handbook

by Paul Raymer



Contact Info

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