



# Track A: IAQ/Ventilation

Wednesday July 20 9:40- 10:40

# 2004

## National Workshop on

## State Building Energy Codes

Philadelphia, Pennsylvania July 19-22

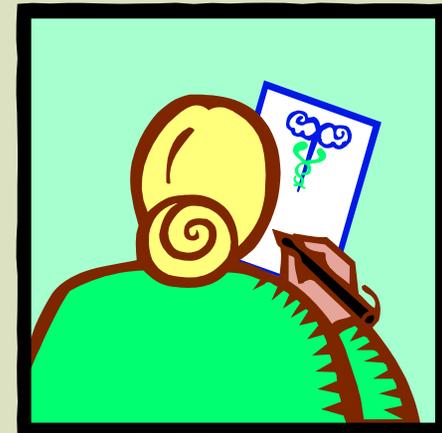
Presented by: Joe Nagan



## Generally speaking:

**“A house is said to have poor Indoor Air Quality when the inside air contains enough of a substance to adversely affect the comfort, health or safety of the occupants”**

**BUT:** How do they know just what's in the air? They have **no way** of telling !



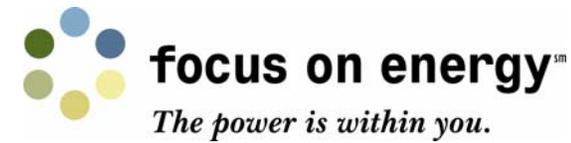
What's the **most critical** item ?



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**Lots of IAQ & moisture sources**





Check under your sink lately ?; ouch



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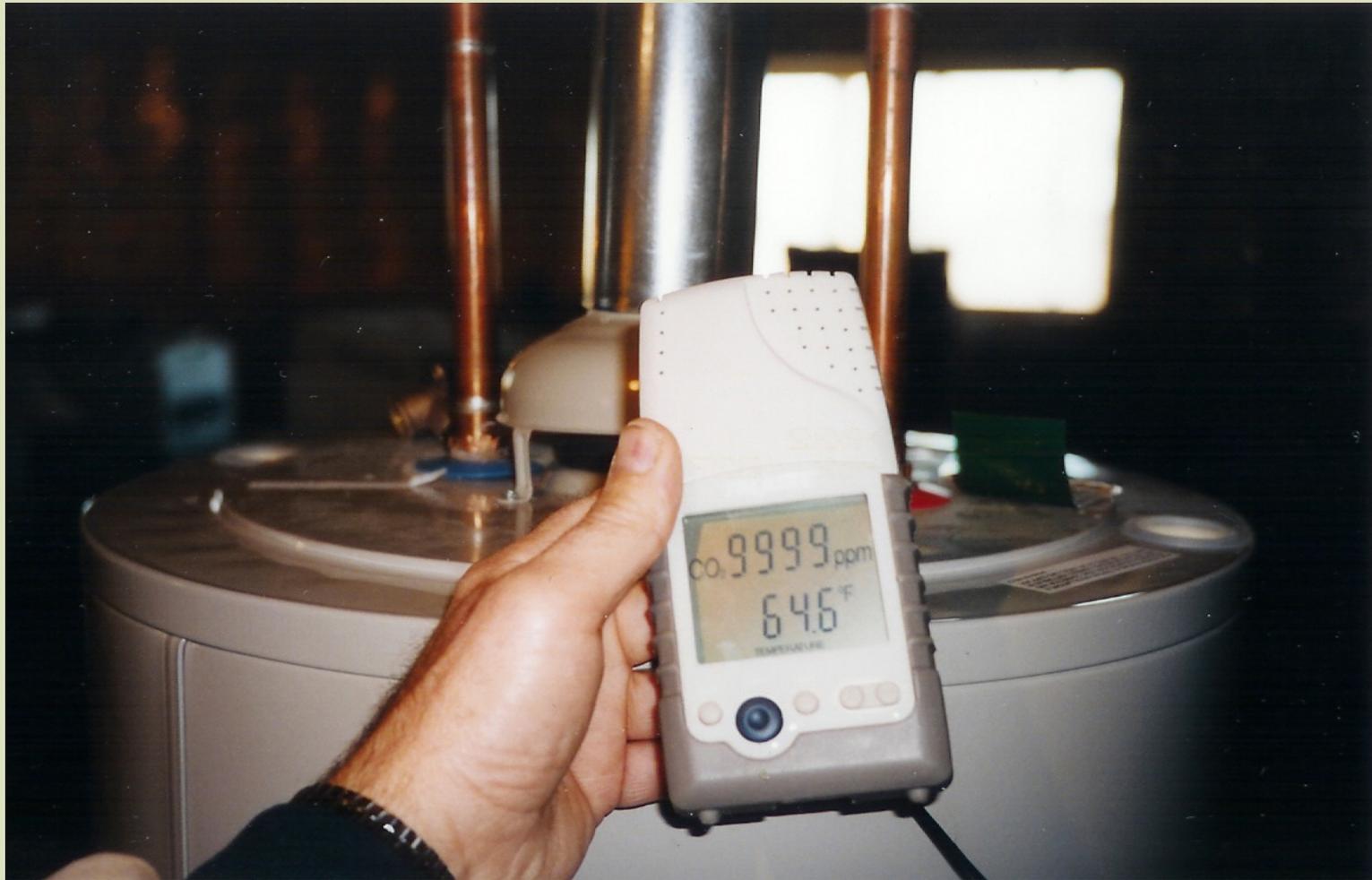


**Need I say more ? What is that ?**



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High CO2 levels: over **9,999 ppm**



**Is this a problem ?**



Everything seems fine here



**This lady doesn't think so**

# What “IS” Ventilation ?

The **INTENTIONAL** exchange of air, between the inside and outside of a home



## Why do we ventilate?

- A) To **improve** the indoor air quality for the occupants, in other words: for **People**
- B) To **control excess** moisture which improves building durability & **reduces call-backs!**

How much ventilation do you need ?



Home owners need to hear the **IAQ message** similar to the seatbelt campaign!



Is this a job for codes ?



# Ventilation requirements by code

## Wisconsin Uniform Dwelling Code:

### Comm 23.02 design

**(3) 4. (d)** Rooms with toilets, tubs or showers. Any room with a toilet, tub or shower shall be provided with exhaust ventilation capable of exhausting **50** cubic feet per minute on an **intermittent** basis or **20** cubic feet per minute on a **continuous** basis.



Will this work in a '**bag-tight**' home ?



## Ventilation requirements by ASHRAE

'ASHRAE' **62-89 standard** for residences calls for either **15 cubic feet per minute** per person or **.35** air changes per hour **which ever is greater**

'ASHRAE' *standard 62.2p* requires **7.5 cubic feet per minute per person**, plus 1 cubic feet per minute per 100 sq/ft of floor area to be provided by mechanical ventilation

Which standard is right or you ?

**QUICK!** This house isn't breathing!



**Breaking down old beliefs**

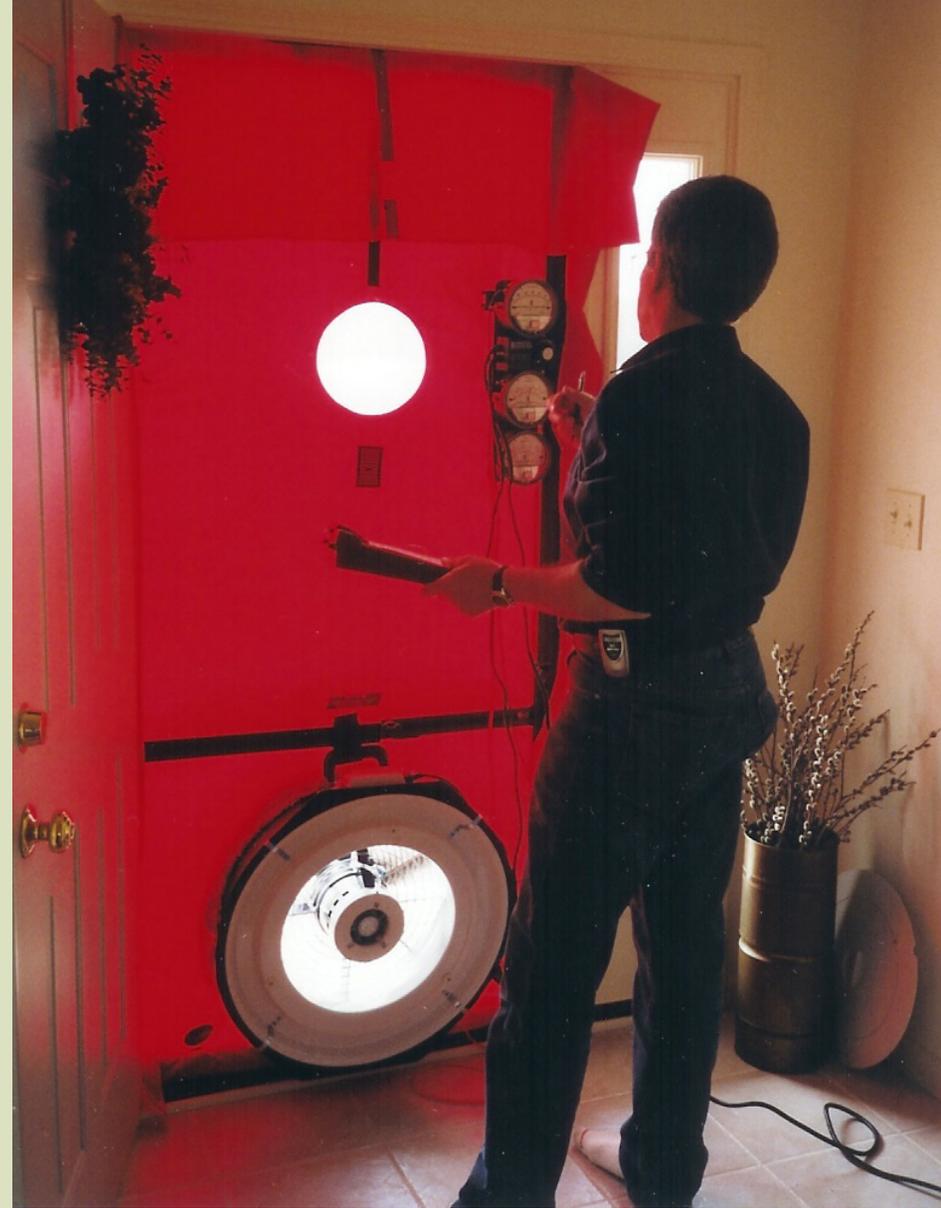
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## Are homes too tight ?

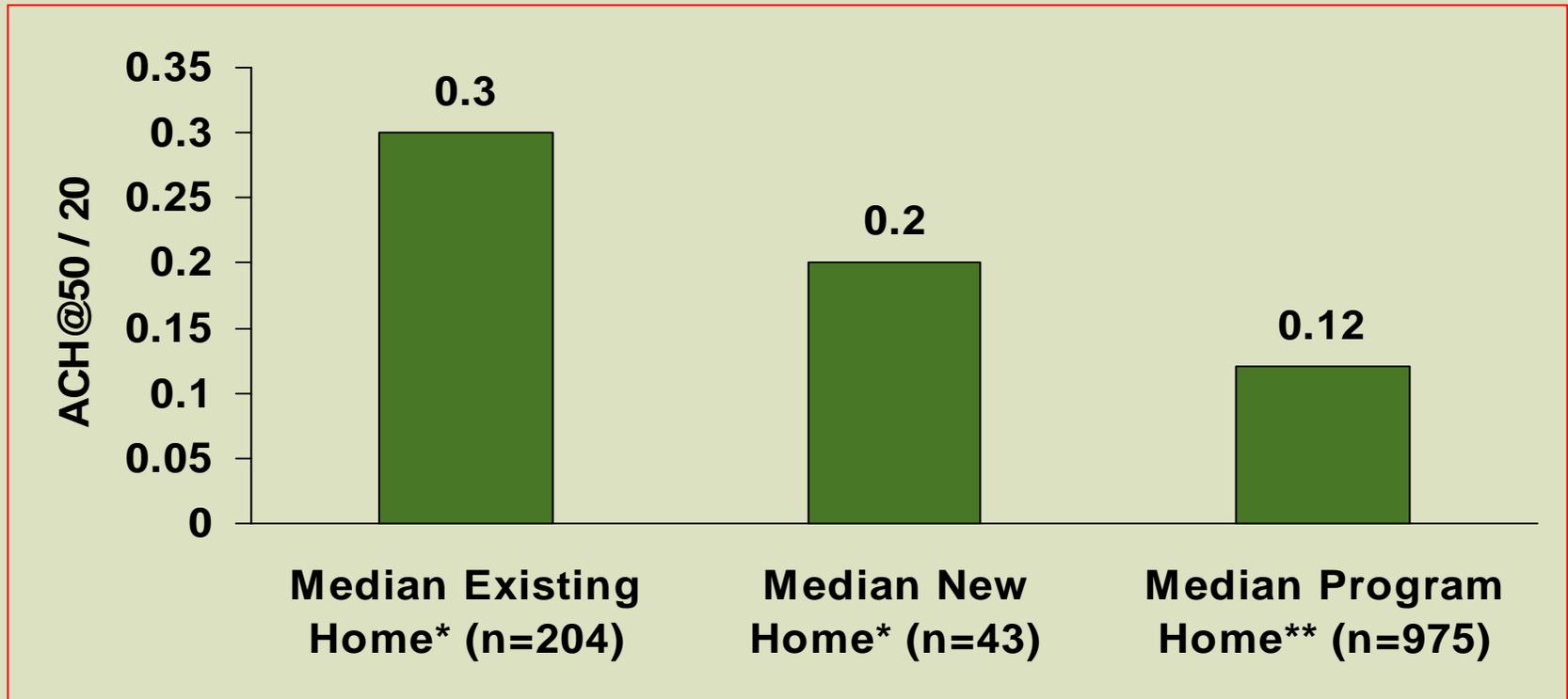
Only testing can verify

Blower- door testing  
provides other benefits:

- ✓ Quantifies **tightness**
- ✓ Used for **quality control**
- ✓ Ventilation **design aid**



# Program homes are considerably tighter than average



\*source: Wisconsin Residential Characterization Study

\*\*source: program tracking data

**Several are below 0.05 est nat/ach**

# Ventilation performance in Wisconsin Energy Star Homes

Report prepared by Scott Pigg; Senior Project Manager

Energy Center of Wisconsin

With contributions by:

**Ed Carroll**, Wisconsin Energy Conservation Corp.

**Greg Nahn**, Wisconsin Energy Conservation Corp.

**Joe Nagan**, Home Building Technology Services

**Presented by; Joe Nagan**



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Complete report available at: [www.ecw.org](http://www.ecw.org)

Report # 216-1



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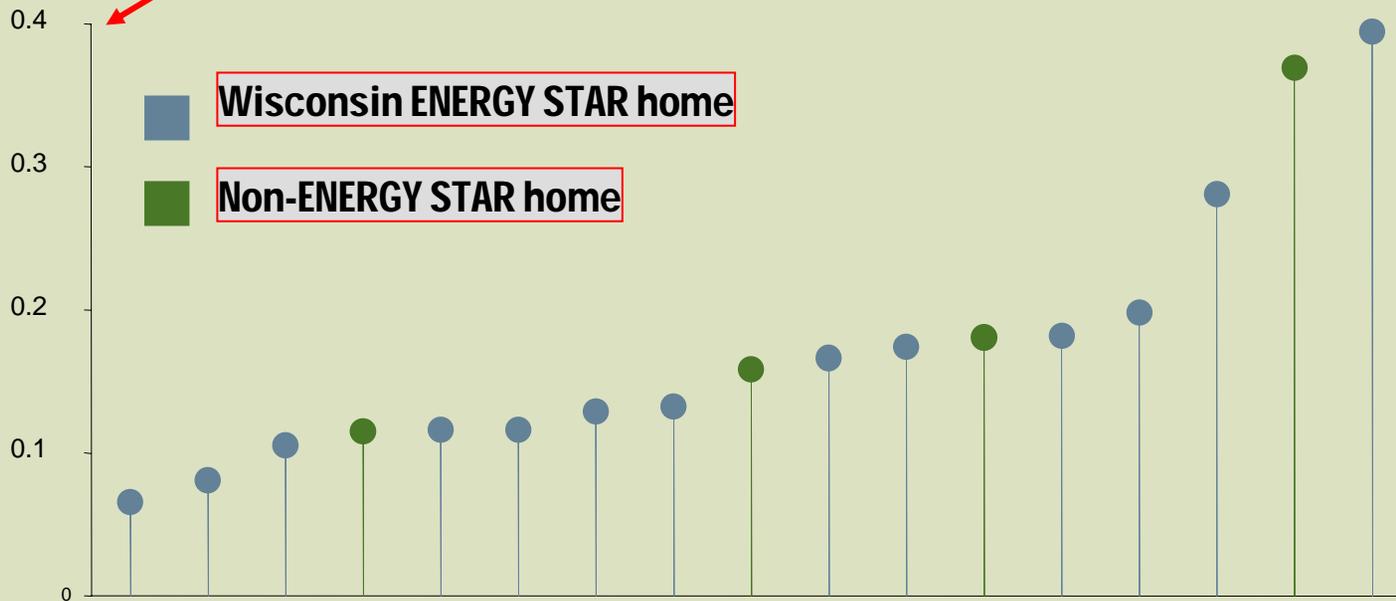
# Testing and Monitoring Parameters

- Blower door test
- Ventilation device **flow** measurements
- Continuous monitoring (10-minute interval) of:
  - **CO2**
  - **Temperature**
  - **Relative Humidity**
- Logging of **on-off status** of ventilation equipment, furnaces, water heaters and dryers
- Passive **tracer gas** measurement of air exchange over 2 week period
- Occupancy log maintained by homeowners

**What will we find out ?**

# 'PFT results' --- most homes tracked between 0.1 and 0.25 ACH

## Measured Air Changes per Hour



By home, from lowest to highest air change rate

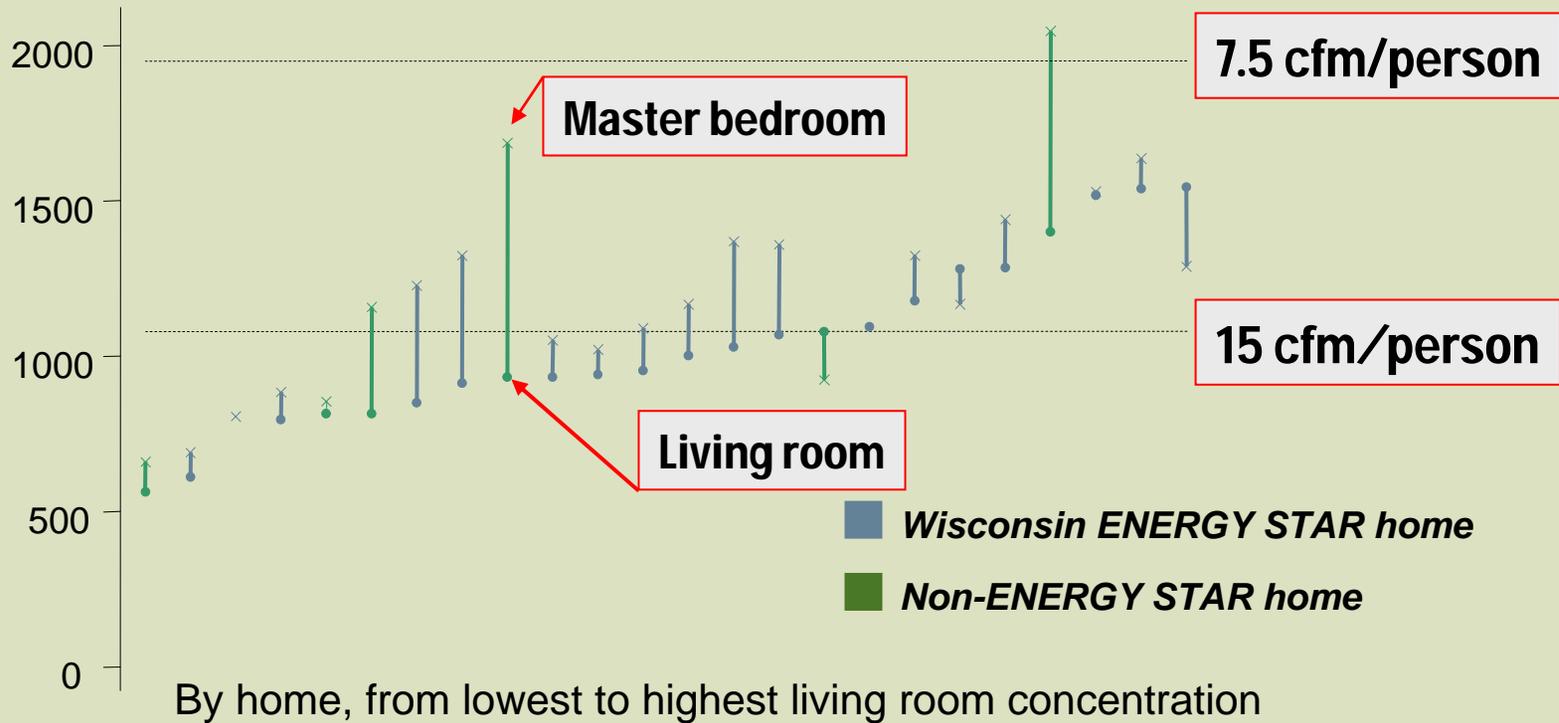
(Note: no results for 7 homes)

## Tracer gas monitoring results

# Carbon Dioxide Concentration

**Carbon dioxide concentration  
Median daily peak (ppm)**

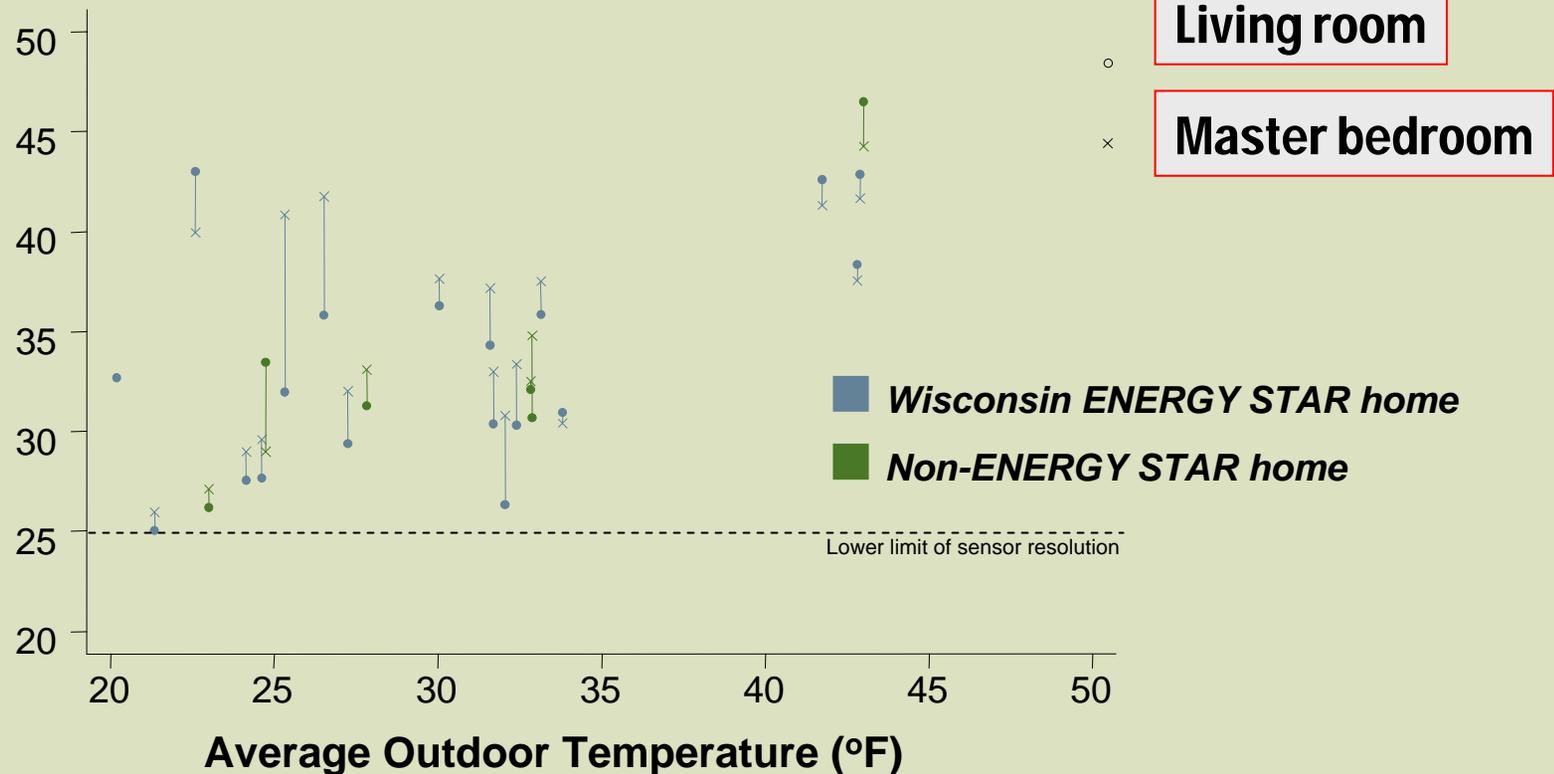
*Equilibrium concentration  
for given ventilation rate  
based on 400ppm outdoor  
concentration*



**Is this a problem ?**

# 'Relative Humidity' --- there were few signs of excessive humidity

Average relative humidity (%)

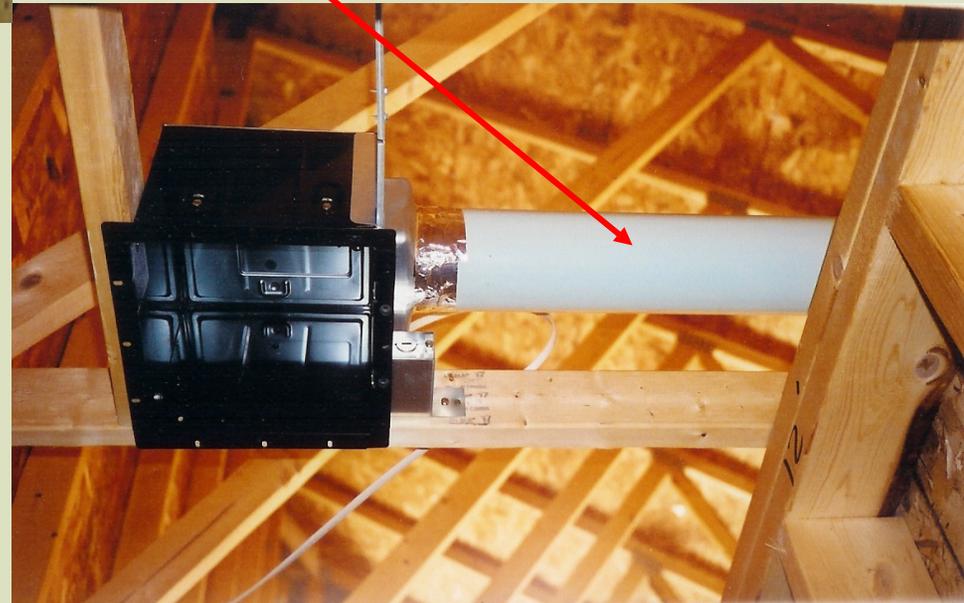


House **moisture** monitoring



**Multiple ducting strategies**

**Upgraded very quiet fan**



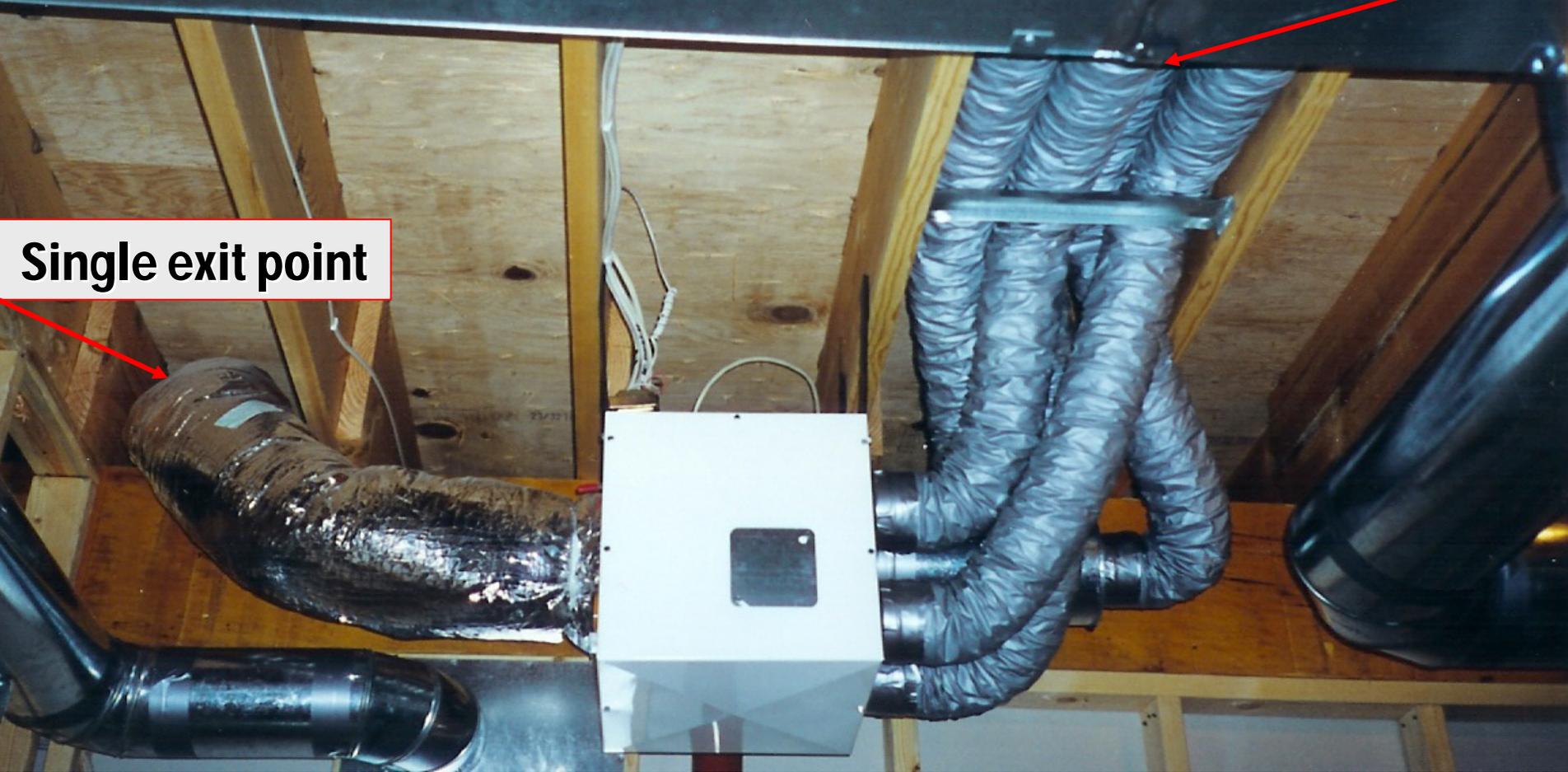
**Exhaust only: single point pickup**



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**Exhaust picks from multiple rooms**

**Single exit point**



**Remote: multi-port exhaust**



**Balanced: w/recovery 'HRV' or 'ERV'**



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# # 1 problem: Very few people test anything

## Benefits

- The **ONLY** way to know if your equipment is working
- Learn what **does** and **doesn't** work
- Reduce callbacks
- Create paper trail
- Manage expectations



**Airflow testing**

# # 2 problem: Very restrictive ductwork



Exit grille is over here !

**Poor ducting installation**

The wiring doesn't have any problems with sharp corners, **what's the big deal ?**



**Fan & duct placement decisions**



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I bought 25 feet and I'm going to use it **all** up !



**Ducting decisions: which way to go**



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**HEY !**, you're only paying  
me for fascia & soffitt  
installation. I'm not a  
**'duct guy'**

**Everyone impacts performance**



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**Soffitt guy doesn't do pipe**



**Any problem with a **little extra** ?**



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This is the reading from a **110 cfm** fan: **OUCH!**



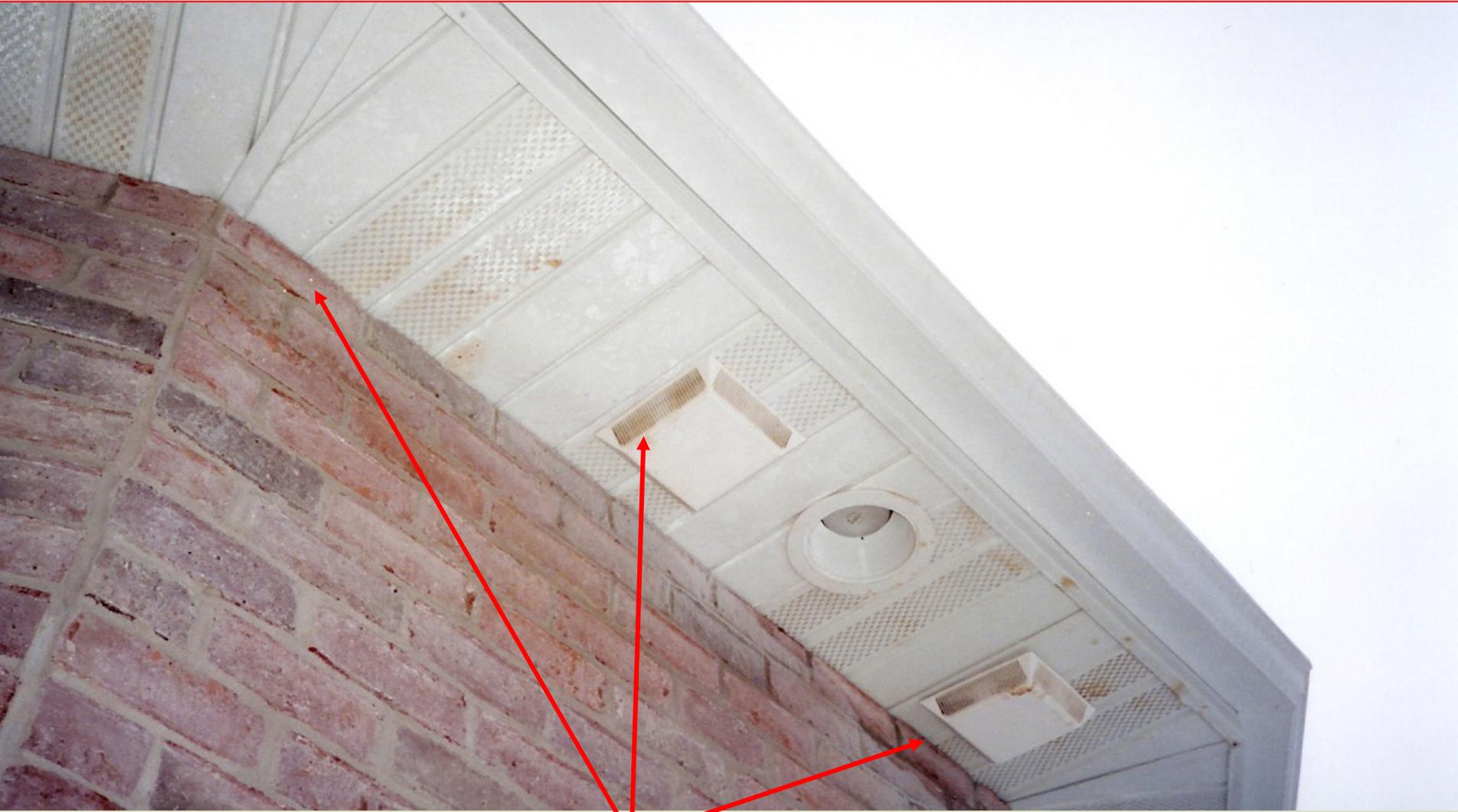
Testing tells the whole story

# # 3 Problem; **poor choice** of termination grilles



Select low restriction types

# # 4 Problem: Poor grille placement



**Moisture off of roof sheeting !**

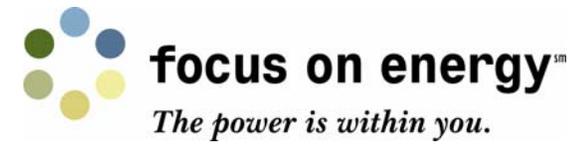
# Results of poor planning; transfer of **moisture**



**Not good; Who will fix this ?**



Wisconsin can get **Honk'** in **cold** in the winter !

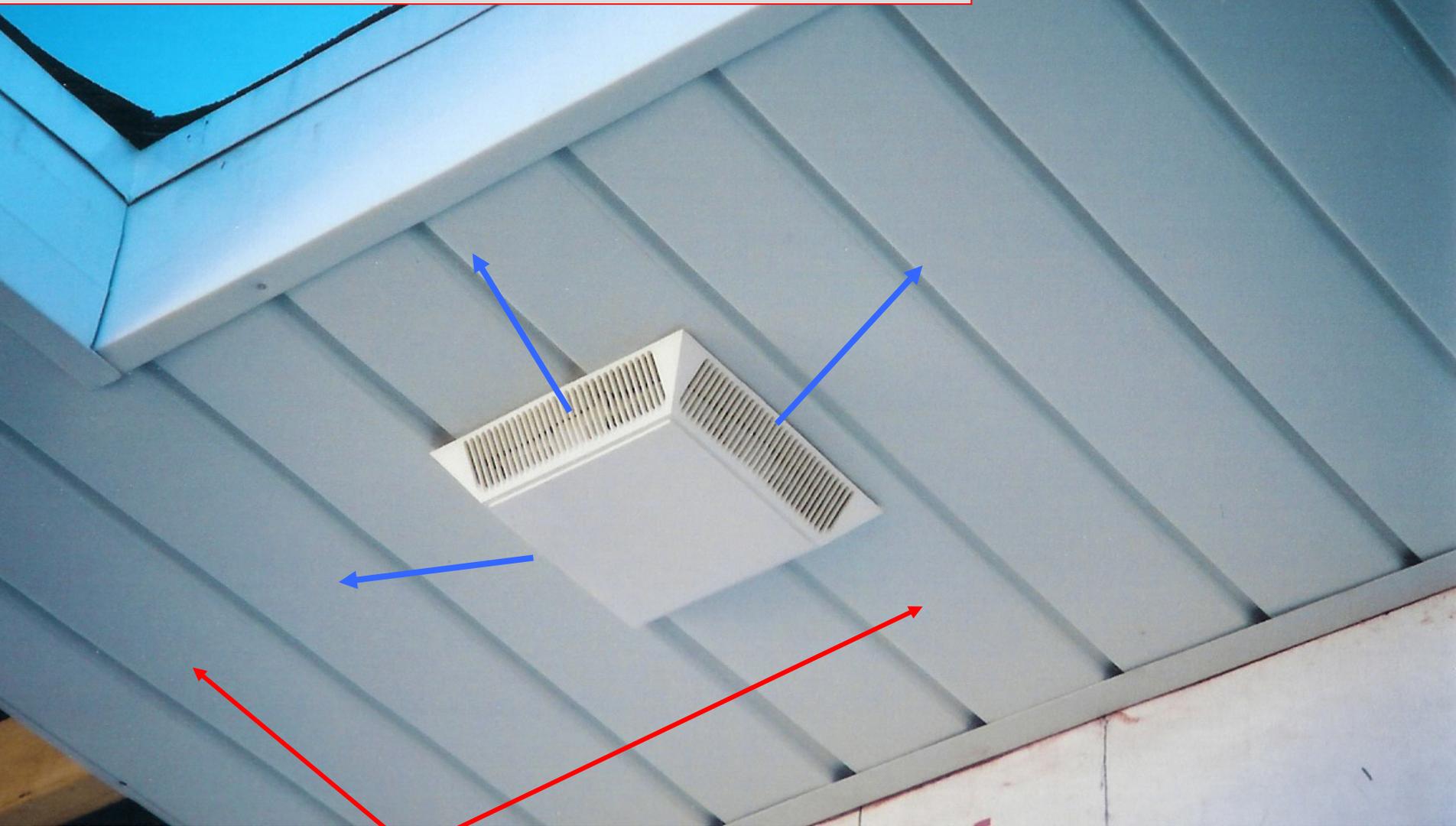


# # 4 Solution: Place grille in unvented soffitt



**Avoid callbacks**

Do **not** dump moisture into attic



Use **unvented** soffitt at grille

# Let's look at what we're finding for **tested** airflow

## Test results for "Spot Fans"

Location / Category	Sample size	Average <b>rated</b> flow	Average <b>tested</b> flow	<u>Minimum</u> flow	<u>Maximum</u> flow	Performance % of <u>rated flow</u>
Bathroom Rated <75	2,269	61	44	20	75	<b>73 %</b>
Bathroom Rated >75	1,468	94	56	20	273	<b>60 %</b>
Kitchen Rated <150	146	114	80	20	233	<b>70 %</b>
Kitchen Rated >150	1,193	204	113	20	1,436	<b>55 %</b>

**“Customer satisfaction **pays off!**” Show them how to operate their equipment**



**# 5 Challenge; Customer education**



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# I would like to thank our Sponsors!

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**Energy & Environmental Building Association**

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**Session's over, let's take a break!**

