THE NEED FOR VENTILATION AND MOISTURE CONTROL FOR SPRAY FOAM HOMES

The comments and opinions in this presentation do not necessarily represent or reflect those of SPFA.
ABOUT ULTRA-AIRE

• A Division of Therma-Stor
• Established in 1977
• We specialize in dehumidification and heat reclaim products
• Made in America – Madison, WI
• Pioneers of whole house ventilating dehumidifiers
THERMA-STOR
Benefits of ventilation and dehumidification to the home and its occupants

Understanding the capabilities and limitations of the HVAC system

What SEER means

Why dedicated dehumidification can be more cost effective than air conditioning

Advantages and disadvantages of equipment options and control strategies

How to talk to homeowners, HVAC contractors and builders about the need to bring in fresh controlled air and how to prevent (fix) moisture issues in spray foam homes
Air goes from warm to cold

Moisture goes from warm to cold

Moisture goes from more to less
Close the window you're letting the cold in......

THERMODYNAMICS II: THE HEAT GOES OUT!!
Indoor air quality is increasing in importance because it directly affects the health and comfort of building occupants.

The three key components that impact air quality are:
1. Airborne materials (pollutants), often referred to as the quality of the air
2. Moisture level (contributing to humidity, condensation and mold)
3. Ventilation/air exchanges (replenishing oxygen levels and diluting air pollutants impacting air changes and safety)
“We also recommend to ‘Do No Harm’ when we design and recommend ventilation for homes tightened with SPF. The SPF contractor must always install a proper ventilation system in a home air-tightened with SPF, or assure that the home owner’s or general contractor’s HVAC contractor has provided adequate ventilation.”
THE NEED FOR FRESH AIR
“SO EASY A CAVE MAN CAN DO IT”
For a long time there were two schools of thought with respect to ventilation.

- Architects and Engineers
  - Providing comfort
  - Freedom from noxious odors
  - Effects of oxygen depletion and/or carbon dioxide accumulation
- Physicians
  - Minimizing the spread of disease

Different approaches resulted in various recommendations for fresh air rates.
We already know that the driving force for the development of ventilation was the fact that indoor air quality affects both comfort and health.

- Big debate is how much fresh air should be the standard?
  - Everyone responds differently to pollutants
  - Bringing in fresh air costs $$$$  
- Airflow through buildings is effected by
  - Wind forces
  - Thermal effects (stack effect)
  - HVAC system.
Moisture and pollutants recirculate and build up.
VENTILATION
HOW MUCH FRESH AIR?

- ASHRAE 62.2 – Residential
  (1) whole house mechanical ventilation to maintain acceptable air quality, and
  (2) local exhaust fans in each kitchen and bathroom to reduce the levels of contaminants and moisture in these spaces.
- ASHRAE 62.1 – Commercial
- Building Science Corporation – Residential

Key point is these are all MINIMUM ventilation rates
The amount of whole house mechanical ventilation required is determined using a formula that takes into consideration the size of the building and the potential number of occupants.

- The formula is; \((\text{total square footage of the home}/100) + ((\text{number of bedrooms}+1) \times 7.5 \text{ cfm})\).

2500 square foot house with 3 bedrooms needs 
\((2500/100) + ((3+1) \times 7.5) = 25 + 30 = 55 \text{ cfm}\).
**Exhaust** - Exhaust ventilation systems pull stale air out of the home creating a negative pressure in the house and rely on make-up air leakage through the structure.

**Supply** - Supply ventilation systems push air into the home creating a slight positive pressure and provides make-up air for kitchen hoods and bathroom fans.

**Balance** - Balanced ventilation systems use one fan to bring fresh air into the home and another to exhaust an equal amount to the outdoors.
Exhaust ventilation systems pull stale air out of the home creating a negative pressure in the house and rely on make-up air leakage through the structure.

- In-line duct fans
- Bathroom fans
- Kitchen hoods
Supply ventilation systems push air into the home creating a slight positive pressure and provides make-up air for kitchen hoods and bathroom fans.

- Controlled mechanical damper
- Whole house ventilating dehumidifier
SUPPLY VENTILATION
CONTROLLED DAMPERS

Positive Pressure
Mechanical Ventilation System

AHU = air handler unit, the blower unit in the heating & cooling system
MD = mechanical damper, for controlling air flow rate
ED = electronic damper, for controlling when mech. ventilation system operates
SUPPLY VENTILATION
WHOLE HOUSE VENTILATING
DEHUMIDIFIER

Fresh Air Intake (optional)
Indoor Air Return
Motorized Damper
UA Indoor Air Return
Indoor Air Supply
Ultra Aire™
Balanced ventilation systems use one fan to bring fresh air into the home and another to exhaust an equal amount to the outdoors.

- Energy Recovery Ventilator
- Heat Recovery Ventilator
Can they control RH?

- Not 100% efficient (the exchange is not perfect)
  - Adds humidity when humid outside
  - Dries slowly when dry outside
- No ability to dry to a specific set-point
- Needs own duct work
- In humid climates homes need a slight positive pressure
VENTILATION ALSO EFFECTS MOISTURE IN HOME

Typical Moisture Loads

50 cfm of fresh air ventilation = 1.7 lbs/hour
Four people @ .25 lbs/ hour = 1 lb/hour
Structural load 1 lb/ hour

Total 3.7 lbs/ hour or 88 lbs/ day
MOISTURE CONTROL
- Designed to reach a temperature set-point
- New units have dehumidification set-points – still cooling

A common misperception is that hot, humid days are the most challenging days to control moisture in a home. But in these conditions the air conditioner runs a lot in order to cool the home, and removes moisture in the process.
The SEER rating of a unit is the cooling output during a typical cooling-season divided by the total electric energy input during the same period. The higher the unit's SEER rating the more energy efficient it is.

- **High SEER AC**
  - Larger coils that are very efficient at getting to a cool temp quickly equals less run time
  - Coils do not get as cold as older AC systems (10 SEER)
  - Less water removed from air and going down drain
  - Risk re-evaporation into living space
Two factors in air-conditioner equipment performance have changed to achieve the SEER 13.0 efficiency ratings required by the federal government.

1. Average operating temperatures over a run cycle have gone up (reducing moisture removal capacity)

2. Fans run longer after the compressor shuts down in order to take advantage of all of the compressed refrigerant and the energy it took to compress it. Running fans after the compressor cuts off not only allows the cooling coil to go above the dew-point temperature (preventing so water vapor/moisture from being condensed out of the air) but also causes condensed water on the coil to be re-evaporated and pushed back into the living space.
VARIABLE SPEED A/C

- Slows air conditioner blower down to remove more moisture
- A/C makes a smaller amount of colder air
- Colder surfaces (ducts, registers, etc.) may form condensation
- Does not solve 70°F/raining scenario!
Why is overcooling a problem?

- Can create cold surfaces that actually lead to condensation, mold or other damage
- It is expensive, 10% higher per extra degree of cooling
- Wear and tear on the air conditioning unit – adds unnecessary run time to the equipment
WHOLE HOUSE VENTILATING DEHUMIDIFIERS

- Remove excess humidity
- Provide precise time & volume control of fresh air
- Match air filtering requirements to needs
- Are quiet and draft free
- Provide make-up air for exhaust devices
- Provide a slight positive pressure to house
WHY MORE COST EFFECTIVE THAN A/C

- Uses less energy to bring in the required amount of fresh air
- Uses less energy to treat the air
- 70 raining/nighttime
4. HVAC Systems

4.1 HVAC Sizing and Design

NOTE: Completion of the ENERGY STAR checklists now satisfies the following indoor airPLUS requirements:

• Properly size all heating and cooling equipment to accommodate design loads for each room as determined using ACCA Manual J, ASHRAE Handbooks, or equivalent software, as well as the pressure drop from all specified filters (HVAC-C2).

Additional Indoor airPLUS Requirements:

• In “Warm-Humid” climates as defined by 2009 IECC Figure 301.1 (i.e., Climate Zone 1 and portions of Zones 2 and 3A below the white line), equipment shall be installed with sufficient latent capacity to maintain indoor relative humidity (RH) at or below 60 percent. This requirement shall be met by either:
  ○ Additional dehumidification system(s), OR
  ○ A central HVAC system equipped with additional controls to operate in dehumidification mode.

• Exception: Climate Zones 4-8, 3B, 3C and the portions of 3A and 2B above the white line as shown by 2009 IECC Figure 301.1.

• Advisory: Although not required to meet this specification, independent dehumidification is recommended in Climate Zones 4A and 3A above the white line as shown in 2009 IECC Figure 301.1.
WHAT NEEDS TO BE ADDRESSED WITH HOMEOWNERS, BUILDERS AND HVAC CONTRACTORS

- Homes don’t need to breathe – people and pets in the home need to breathe
- Identify moisture problems or issues
  - Spray foam helps prevents moisture from coming in but also traps moisture generated inside.
- 70 and raining/night time
- Sell the value of the investment
  - *Improved Indoor Air Quality & Comfort*
  - *Asset Protection*
  - *Health of the Homeowners (children!)*
  - *Potential Energy Savings*
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