

# Good HVAC Design vs. Barely Enough

- 600 to 800 CFM/ton vs. 350 CFM/ton
- 0.15 to 0.26 Watts/CFM vs. 0.45 Watts/CFM
- 600 to 1000 sq. ft. / ton vs. ???
- Unmeasurable to 2% Duct Leakage vs. 5% Lkg.
- 4" Deep Filter Box vs. 2" Deep
- R-38 Duct Insulation vs. R-8 Duct Insulation
- Variable Fan-off Time Delay vs. 60 to 90 sec.
- Heat Pump HSPF 9.5 vs. 8.2
- EER 12.5 vs. SEER 14
- Refrigerant Charge Correct
- Filter Location Label

# Ventilation for Indoor Air Quality

Rebuild Green Expo

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# Why Ventilate Your Home

- To reduce the level of pollutants:
  - Formaldehyde
  - Particles (PM 2.5, etc.)
  - NO<sub>2</sub>
  - Other Volatile Organic Compounds (VOCs)
- These cause Health Effects:
  - Cancer
  - Asthma
  - Heart Disease
  - Respiratory Disease

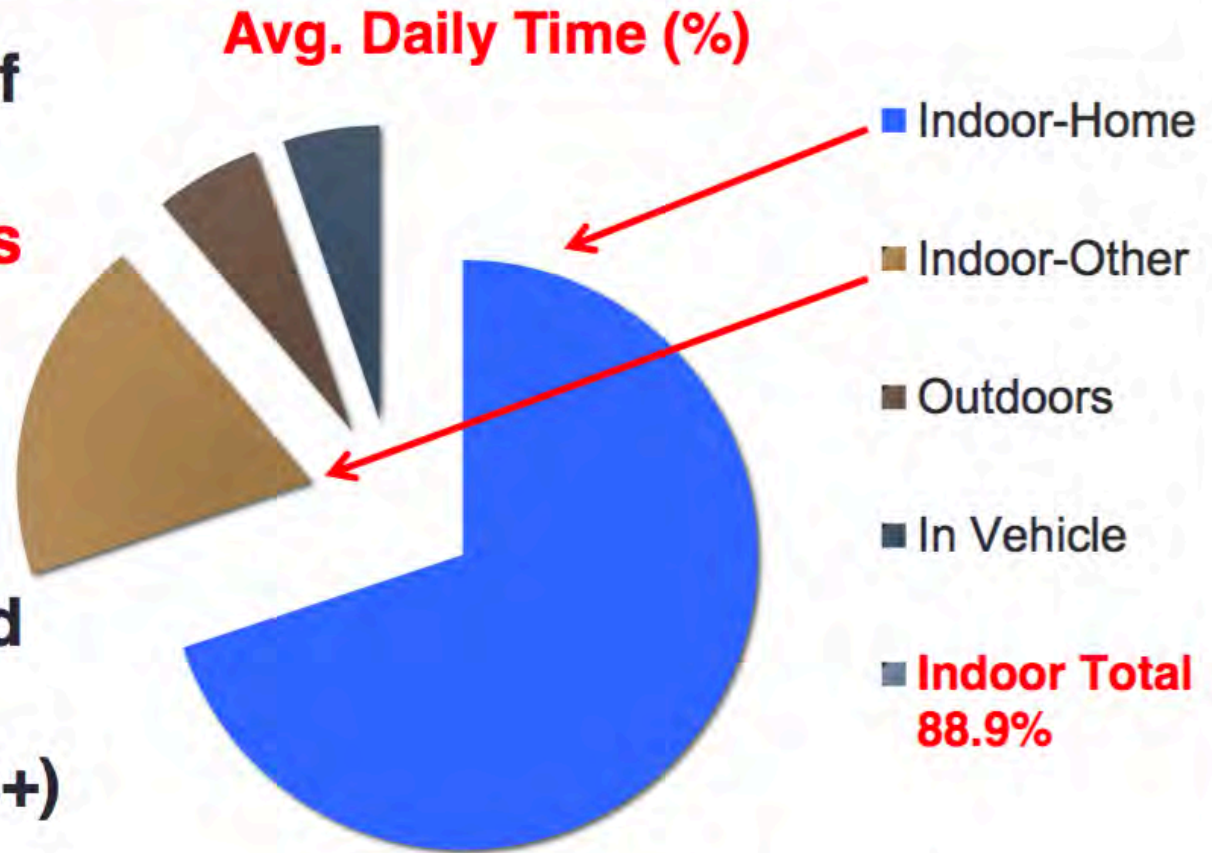
# Where Do These Come From?

- Building Materials
- Paint
- Cooking
- Furniture
- Carpet
- Pollutants are particularly strong in new construction, but they never disappear.

# Time in Indoor Air

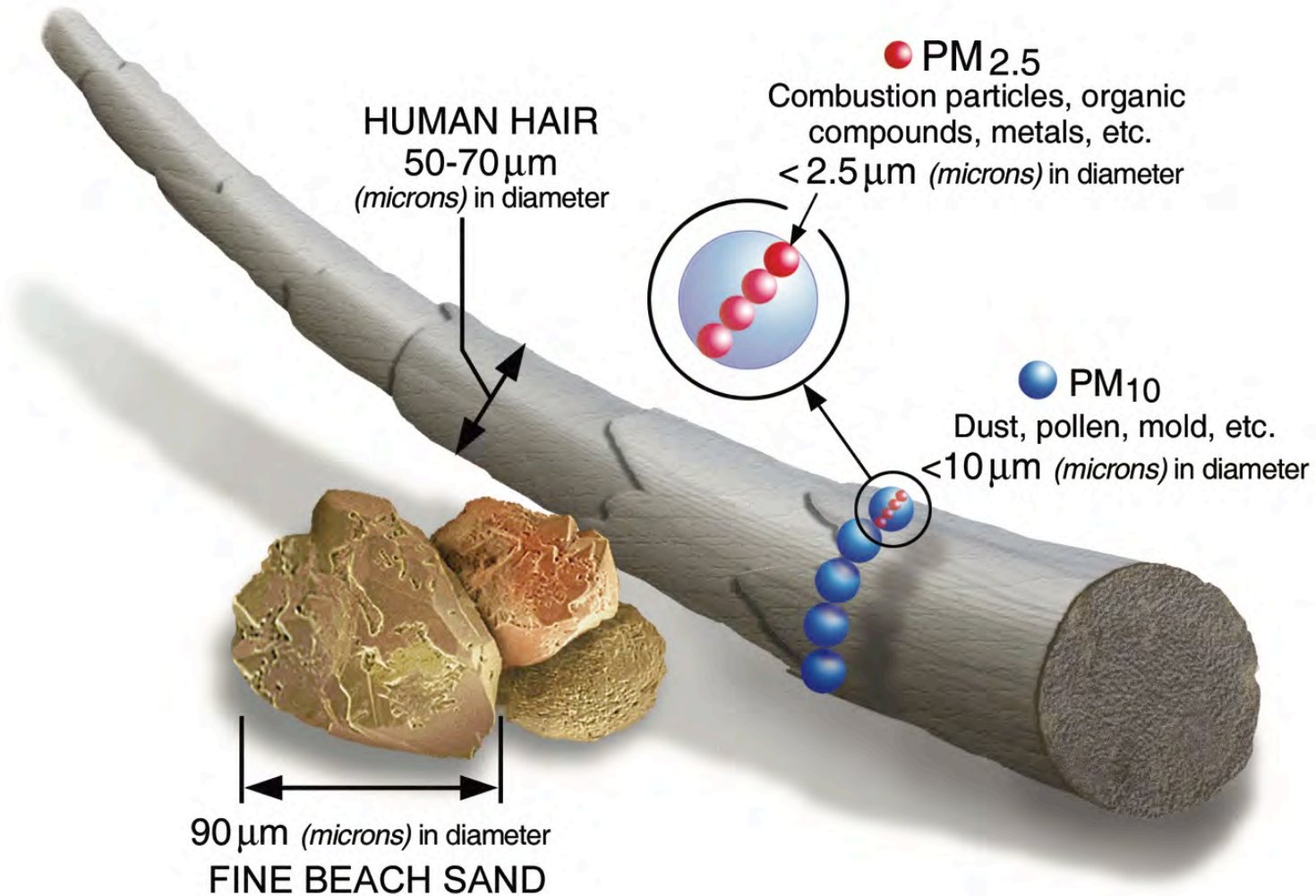
➤ About **90%** of our time is spent **indoors**

➤ **Vulnerable groups** spend more time indoors (**95%+**)



*Canadian Human Activity Pattern Survey 2, 2010-11*

# What is a PM2.5?



# How Much Continuous Ventilation is Barely Enough (CFM)? T24

Floor Area, ft <sup>2</sup>	Bedrooms				
	1	2	3	4	5
<500	30	38	45	53	60
501–1000	45	53	60	68	75
1001–1500	60	68	75	83	90
1501–2000	75	83	90	98	105
2001–2500	90	98	105	113	120
2501–3000	105	113	120	128	135
3001–3500	120	128	135	143	150
3501–4000	135	143	150	158	165
4001–4500	150	158	165	173	180
4501–5000	165	173	180	188	195

# Types of Whole Building Ventilation

- Exhaust Only
- Supply Only
- **Balanced**
- Heat Recovery
- **Distributed** or Not Distributed
- **Continuous** or Intermittent



# Whole Building Ventilation Watt Draw

- Exhaust Only
- Supply Only
- **Balanced**
- **7 to 10 Watts per 50 CFM**  
(hvi.org)
- Slightly higher for  
Balanced
- **Heat Recovery**
- <https://tinyurl.com/ya59bu5r>

# Controls

- On – Off
- Operation and Maintenance

# Spot Ventilation for Point Sources

- Vented Range Hood – 100 CFM
- Bathroom – 50 CFM
- Other – Hobby Room, etc.

# Why not just build houses that breathe?

- They take big pauses in breathing
- They heat up fast in the summer
- They cool off fast in the winter
- Thus driving huge utility bills
- You cannot turn the ventilation system off at times of high outdoor pollution

# Filtration

- A 1" pleated filter ruins the efficiency of your air conditioner or heat pump
- Build the filter box for a 4" pleated filter



# Recommended Filter Size

Filter thickness	4 inch
Material	Pleated
MERV	13
AC Tons	
1	350 Sq. In.
1.5	525 Sq. In.
2	700 Sq. In.
2.5	875 Sq. In.
3	1050 Sq. In.
3.5	1225 Sq. In.
4	1400 Sq. In.
5	1750 Sq. In.

Filter size for  
0.05 IWC initial  
pressure drop

A 1" pleated  
MERV 8 filter  
would require  
almost the same  
filter size  
310 Sq.in. per Ton

# Big Ventilation and Bad Ventilation

- Whole House Fan
- Attic Vent Fan

**End of My Ventilation Presentation**



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# Effective and Efficient Heating and Cooling

Rebuild Green Expo  
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# How to get a Santa Rosa Appropriate Air Conditioner

1. Keep the coil indoor warmer so little moisture is gathered on the coil
  - This produces high sensible capacity and high system sensible efficiency.
  - You do it with high airflow (CFM per ton)
  - Which takes **SHORT DUCTS**
  - Which takes a good duct system and fan motor
2. Evaporate the moisture off the coil at the end of the cycle

# Back to More CFM

- More CFM comes from:
- LESS RESTRICTIVE DUCTS which are:
  - **SHORT DUCTS**
  - MINIMUM TURNS
  - PROPER DIAMETER

# So What Makes a Santa Rosa Duct System?

- **SHORT DUCTS**
  - Minimum Turns
  - Proper Diameter
  - Big Returns (include 2" or 4" filter)
- and**
- Well Insulated (R ?) or
  - Inside Conditioned Space

# Buried Ducts



# Some Numbers

- SHORT DUCTS insulated to attic R value
- Replacement ECM Motor
- Downsized FROM 2.5 to 1.25 Tons
  
- Went from 212 CFM/ton to 540 CFM/ton
- 0.12 Watts per CFM
- Went from 339 to 678 sq. ft. per ton

# Why Are Ducts Number One?

- They generate LOSSES:
  - They are a really big heat exchanger
  - They are very effective at losing the capacity of your AC, HP or furnace through conduction and leakage



# Minimize Ducts

- Short
- **Really Short**
- Insulated
- **Super Insulated**
- Tight
- **Leakless Tight**

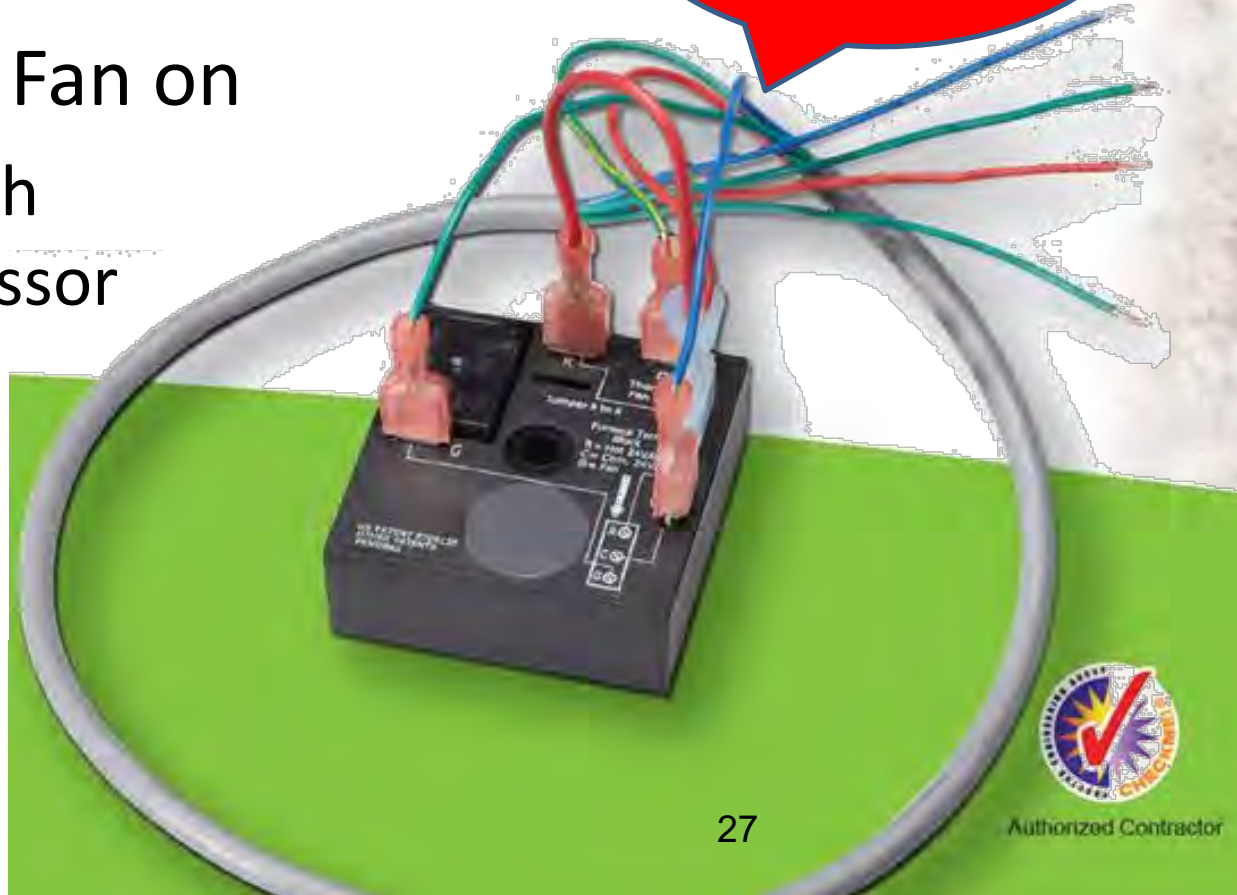
# There are Two Ways to get a Dry Climate Air Conditioner

1. Keep the coil indoor warmer so little moisture is gathered on the coil
  - This produces high sensible capacity and (if done right) high system sensible efficiency.
  - You do it with high airflow (CFM per ton)
  - Which takes a good duct system
- 2. Evaporate the water off the coil at the end of the cycle**

# Western Cooling Control™

- Compressor on Fan on
  - On time logged
- Compressor off Fan on
  - Time varies with logged compressor time
  - Evaporates off the coil = Cool air

Over 100,000  
successfully  
installed



Authorized Contractor

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