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.)
  – NO2
  – 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%+)

Avg. Daily Time (%)
- Indoor-Home
- Indoor-Other
- Outdoors
- In Vehicle
- Indoor Total 88.9%

Canadian Human Activity Pattern Survey 2, 2010-11

What is a PM2.5?

HUMAN HAIR
50-70 µm (microns) in diameter

PM 2.5
Combustion particles, organic compounds, metals, etc.
< 2.5 µm (microns) in diameter

PM10
Dust, pollen, mold, etc.
<10 µm (microns) in diameter

90 µm (microns) in diameter
FINE BEACH SAND
How Much Continuous Ventilation is Barely Enough (CFM)?

<table>
<thead>
<tr>
<th>Floor Area, ft²</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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</thead>
<tbody>
<tr>
<td>&lt;500</td>
<td>30</td>
<td>38</td>
<td>45</td>
<td>53</td>
<td>60</td>
</tr>
<tr>
<td>501–1000</td>
<td>45</td>
<td>53</td>
<td>60</td>
<td>68</td>
<td>75</td>
</tr>
<tr>
<td>1001–1500</td>
<td>60</td>
<td>68</td>
<td>75</td>
<td>83</td>
<td>90</td>
</tr>
<tr>
<td>1501–2000</td>
<td>75</td>
<td>83</td>
<td>90</td>
<td>98</td>
<td>105</td>
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<tr>
<td>2001–2500</td>
<td>90</td>
<td>98</td>
<td>105</td>
<td>113</td>
<td>120</td>
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<tr>
<td>2501–3000</td>
<td>105</td>
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<td>120</td>
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<td>135</td>
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<tr>
<td>3001–3500</td>
<td>120</td>
<td>128</td>
<td>135</td>
<td>143</td>
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<tr>
<td>3501–4000</td>
<td>135</td>
<td>143</td>
<td>150</td>
<td>158</td>
<td>165</td>
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<td>4001–4500</td>
<td>150</td>
<td>158</td>
<td>165</td>
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<td>180</td>
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<tr>
<td>4501–5000</td>
<td>165</td>
<td>173</td>
<td>180</td>
<td>188</td>
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</table>
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
- Heat Recovery
- 7 to 10 Watts per 50 CFM (hvi.org)
- Slightly higher for Balanced

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
Why Are Ducts El Primo?

• They generate LOSSES:
  – They are a really big heat exchanger
  – They are very effective at loosing the capacity of your AC or HP through conduction and leakage
Filtration

• A 1” pleated filter ruins the efficiency of your air conditioner or heat pump
• Title 24 minimum filter box is 2” deep.
• Build the filter box for a 4” pleated filter
<table>
<thead>
<tr>
<th>Filter thickness</th>
<th>Rec</th>
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<tbody>
<tr>
<td>Material</td>
<td>Pleated</td>
</tr>
<tr>
<td>MERV</td>
<td>13</td>
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<tr>
<td>AC Tons</td>
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</tr>
<tr>
<td>1</td>
<td>350 Sq. In.</td>
</tr>
<tr>
<td>1.5</td>
<td>525 Sq. In.</td>
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<tr>
<td>2</td>
<td>700 Sq. In.</td>
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<tr>
<td>2.5</td>
<td>875 Sq. In.</td>
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<td>3</td>
<td>1050 Sq. In.</td>
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<tr>
<td>3.5</td>
<td>1225 Sq. In.</td>
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<tr>
<td>4</td>
<td>1400 Sq. In.</td>
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<tr>
<td>5</td>
<td>1750 Sq. In.</td>
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</tbody>
</table>
Big Ventilation and Bad Ventilation

- Whole House Fan
- Attic Vent Fan