Dry and Well Ventilated Housing

Green and Healthy Strategies for
Multi Family Properties
Prepared with Assistance from:
Tohn Environmental Strategies &
Steven Winter Associates

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Mold & Moisture Related Health Effects

- Upper respiratory tract symptoms
- Coughing
- Wheezing
- Asthma symptoms
- Hypersensitivity pneumonitis

Source: Institute of Medicine, 2000

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Dampness and Asthma

Health Outcome	Estimated % Increase in Damp Homes
Upper respiratory tract symptoms	52%
Cough	50%
Wheeze	44%
Current asthma	50%
Ever-diagnosed asthma	33%

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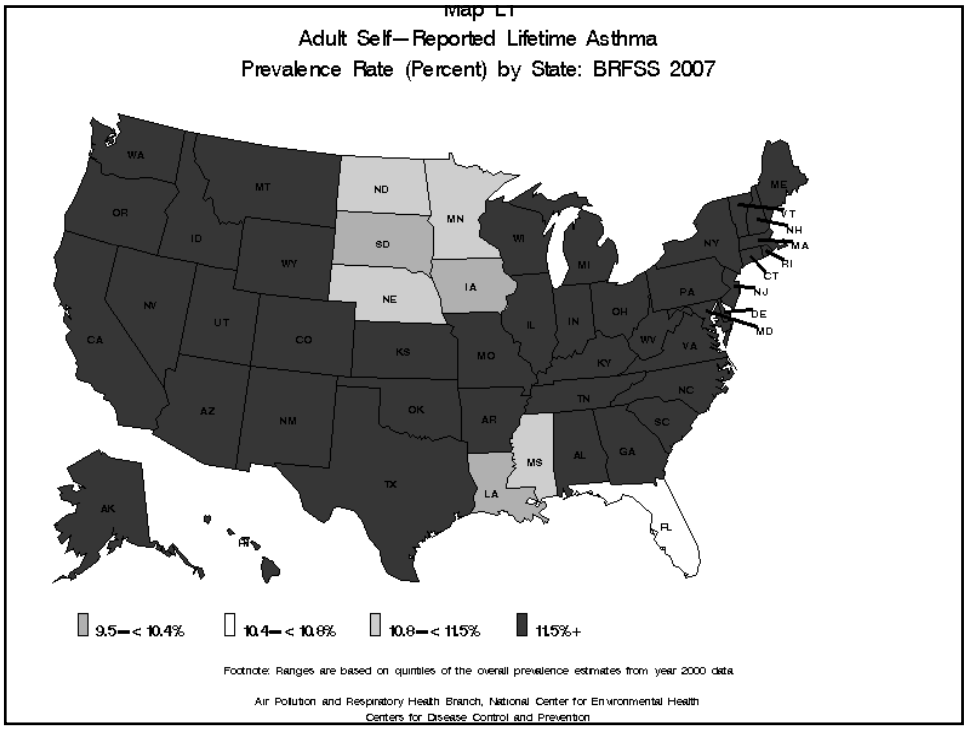
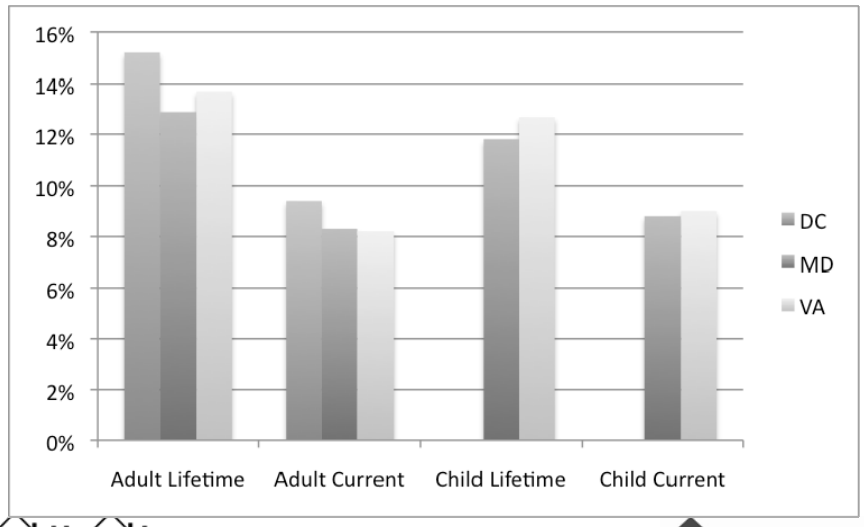


Asthma Rates Mid Atlantic



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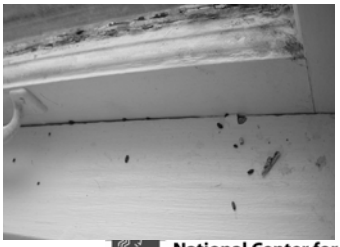
Asthma Triggers



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Moisture Sources

- Poorly managed rainwater/groundwater
  - Poor roof, wall, window and foundation drainage
  - Defects in rain barriers
- Plumbing leaks
- Condensation on surface
  - Surfaces chilled by mechanical equipment, earth contact, outdoor air contact
- Construction moisture
  - Concrete, wet spray cellulose, gypsum mud
  - Damp earth in crawlspace

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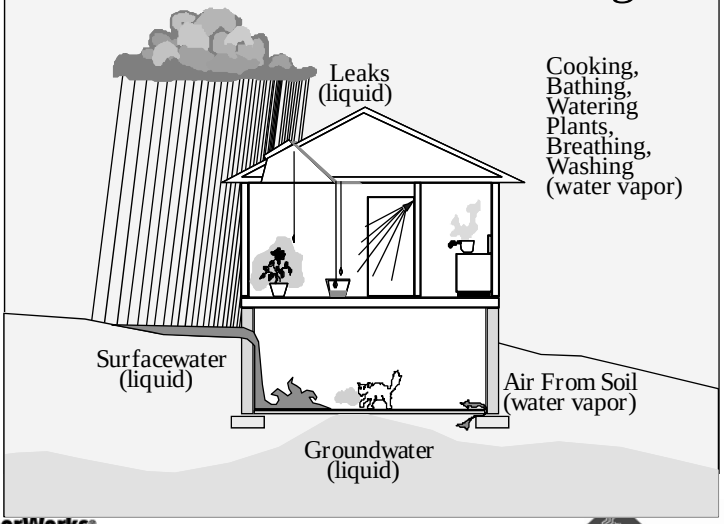
How Water Enters a Building



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Windows leak?
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Air conditioner condensate drains into building
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Bad Flashing

- Erica do you have a good shot for this?

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Plumbing Leaks

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Condensation when cold outside
Condensation

Mold due to poor insulation or wind blowing through insulation.

Mold around window where there is no insulation.

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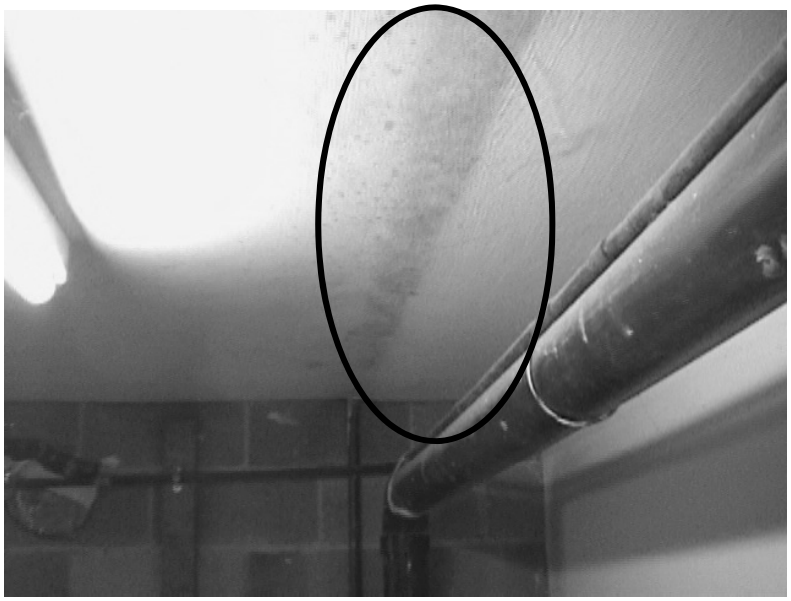

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Mold Responses –Have a Plan

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After a Flood

- Dry water damaged areas & items within 24-48 hours to prevent mold growth.
- In areas of excessive moisture, consider using a high volume commercial dehumidifier.
- Remove items which cannot be dried rapidly.
- BIOCIDE TREATMENT is not necessary, and does NOT replace the above steps.
- Avoid ozone and chlorine dioxide treatments.

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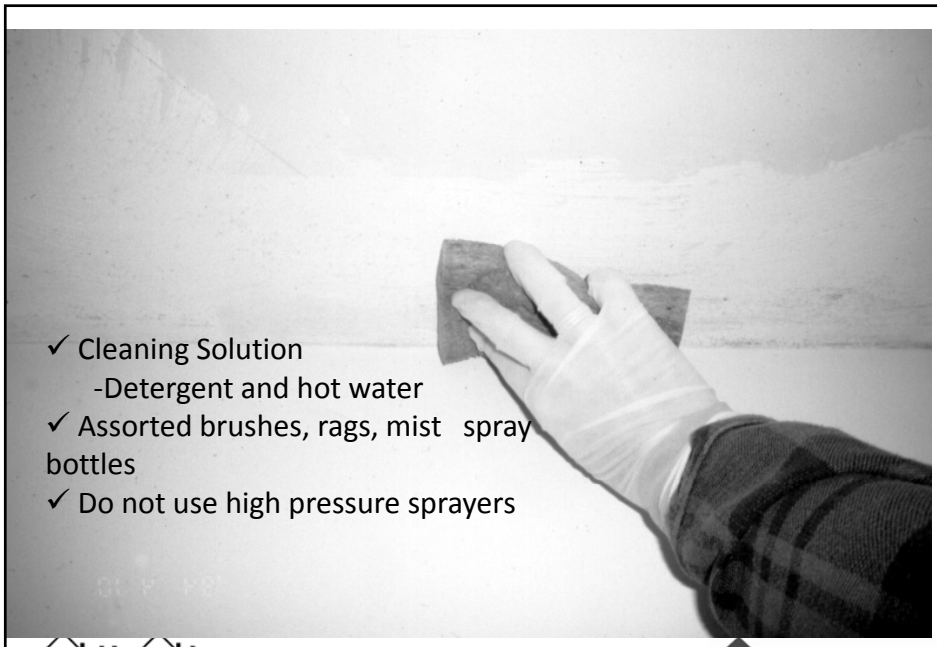

- ✓ Cleaning Solution
  -Detergent and hot water
- ✓ Assorted brushes, rags, mist spray bottles
- ✓ Do not use high pressure sprayers

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For Bigger Jobs

MUST HAVES:

- Respirator
  - P100 or P95 particulate filter
- Eye protection
- Rubber gloves
- Coveralls
  - remove/bag them before you leave the work area
- Isolate work area

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Mold Response Resources

- EPA Mold Guidance – www.epa.gov/mold/
- NY City Mold Guidance - "Guidelines on Assessment and Remediation of Fungi in Indoor Environments" www.nyc.gov/html/doh/html/epi/moldrpt1.html
- National Center for Healthy Housing Flood Clean Up Guide - www.nchh.org/Research/Archived-Research-Projects/New-Orleans-Healthy-Rebuilding.aspx

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Well-Ventilated Buildings Provides:

- **Local Exhaust Ventilation** to remove moisture, odors, and other pollutants at the source
- **Whole House Ventilation** for supplying fresh air to reduce contaminants by dilution
- **Control of airflow** through building so crazy airflows can't carry contaminants into and around the house

What to ventilate? Standards?

- Bathrooms
- Clothes dryers
- Kitchen ranges
- Boilers, furnaces, hot water heaters
- Fireplaces, wood burning stoves
- Key Standards: ASHRAE 62.2 < 4 stories or 62.1> 4 stories; ICC




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Why Well Ventilated?

Ventilation reduces: hazards from:

- Moisture
- Smoke from cigarettes, cigars, incense or candles
- Allergens (such as cockroach and mice droppings)
- Mold
- Carbon monoxide
- Volatile organic compounds (VOCs)
- Radon

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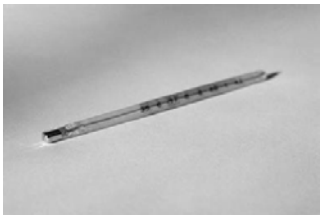
Related Health Effects

- Higher rates of respiratory irritation and illness in housing with poor ventilation
  - Common colds
  - Influenza
  - Pneumonia
  - Bronchitis



increased rates of absence from school or work … and reduced energy costs

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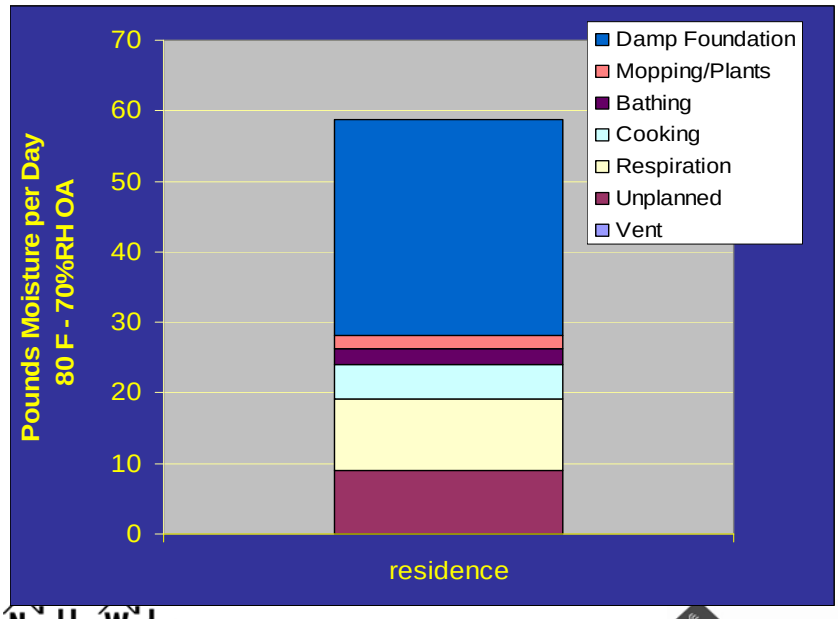

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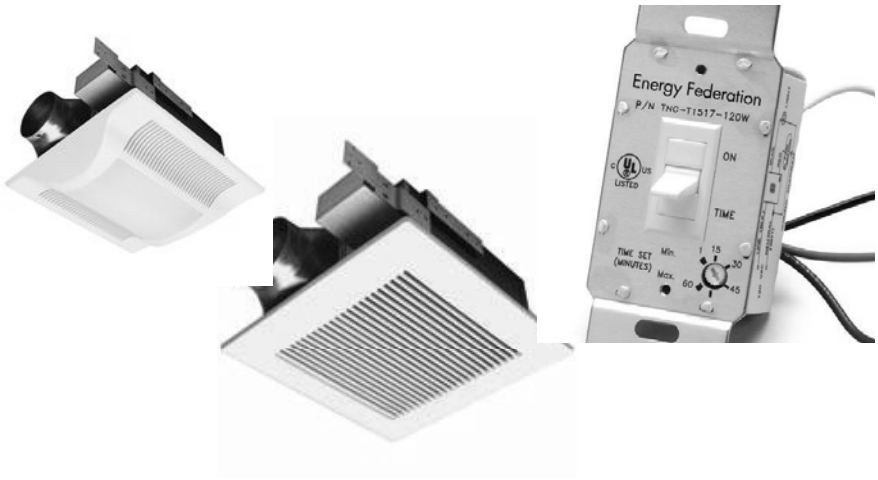
Testing Exhaust Fan: The Charmin Method

Energy Star Fans & Timers



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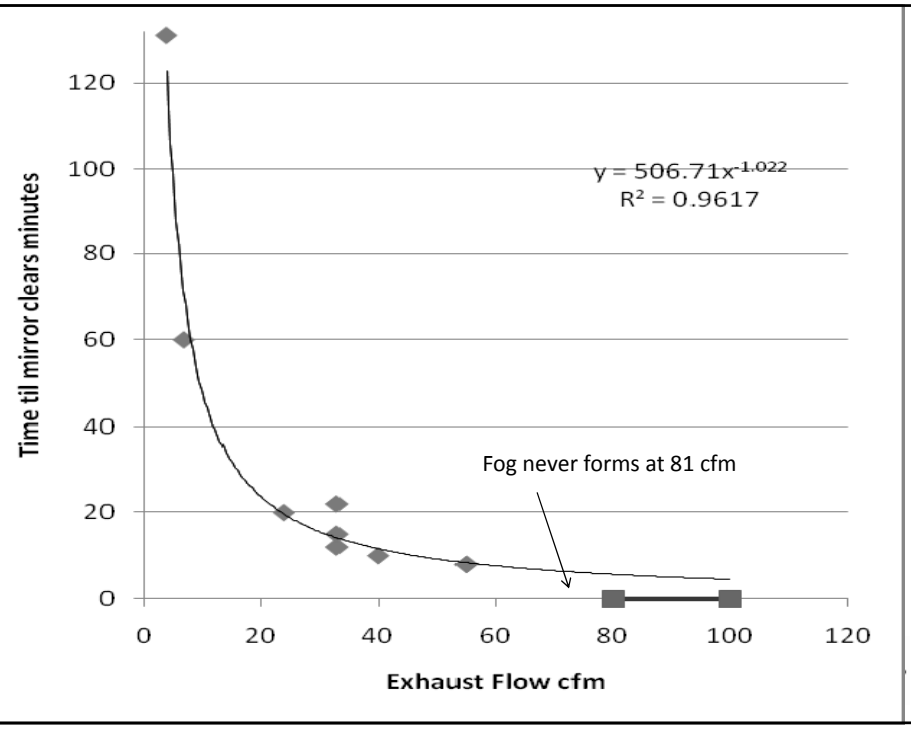

Kitchen Exhaust

Ducts for kitchen vents had 90 bends and long runs. Duct layout decreases the effectiveness of the fan.

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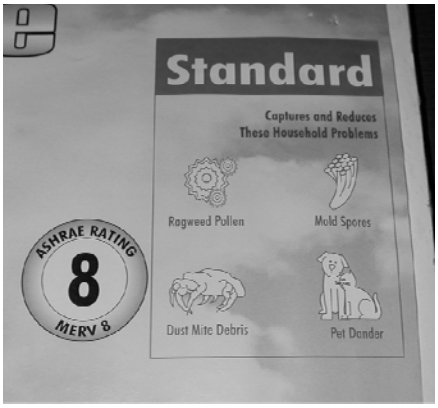
MERV



Minimum Efficiency Rating Value (MERV)

ASHRAE Standard 52.2 – Efficiency in collecting very small particles

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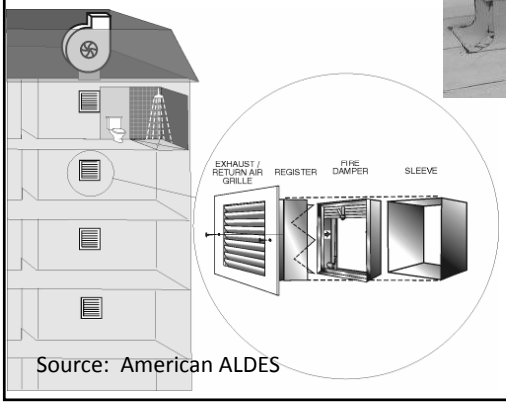
MERV Ratings

MERV	PARTICLE SIZE (μm)	TYPICAL CONTROLLED CONTAMINANT
1 – 4	>10.0	Pollen, sanding dust, textile and carpet fibers
5 – 8	3.0 – 10.0	Mold, spores, hair spray,cement dust
9 – 12	1.0 – 3.0	Legionella, lead dust, welding fumes
13 – 16	0.3 – 1.0	Bacteria, most tobacco smoke, insecticide dust, copier toner
17 - 20	≤ 0.3	Virus, combustion particles, radon progeny

Central Exhaust Systems

Roof Fans

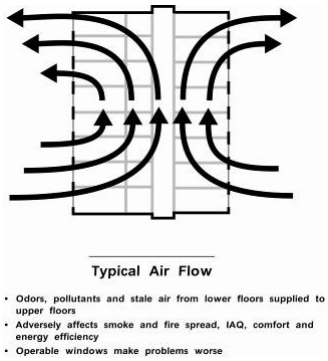
- Vertical shaft
- Horizontal take-offs
- Sidewall or ceiling grilles at each floor



Source: American ALDES

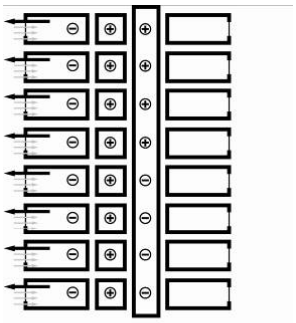
All or Nothing

- Continuous Venting (preferable)
- Intermittent Venting



Typical Air Flow

- Odors, pollutants and stale air from lower floors supplied to upper floors
- Adversely affects smoke and fire spread, IAQ, comfort and energy efficiency
- Operable windows make problems worse



Distributed Ventilation

- Units ventilated individually
- Make-up air is provided from exterior not from corridors
- Corridors are pressurized only for smoke and odor control, not for make-up air requirements
- Corridors are pressurized by individual fans supply each corridor, not by a central roof-top system
- Ductwork between floors avoided

Multi-family dwellings should have planned fresh air supply because:

–Neighbors are closer together

–Stack effect- this dominates in cold weather

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Resident Complaints What Can They Tell us About Ventilation

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Ventilation Case Study

- To remove pollutants at their source
  - Kitchens & Baths
- To provide effective apartment air change rate during all seasons

Apartment Size	Ventilation Rate Required to Ensure 0.35 Air Changes per Hour
500 ft^2	25 CFM
1000 ft^2	50 CFM
1500 ft^2	75 CFM

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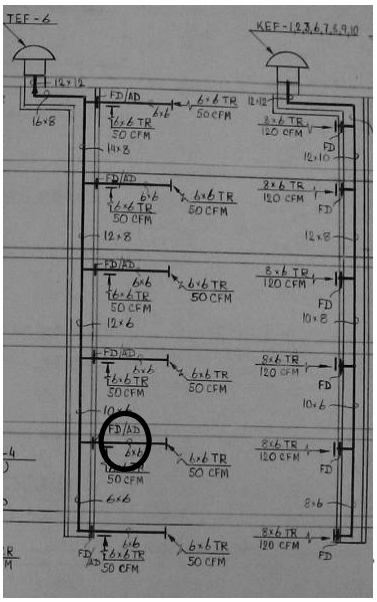
How We Try to Get There: The Mechanical Designers World View

- Balancing damper → transferring liability
- Many grilles on different floors + relatively low exhaust CFM targets = difficult to balance.
- Constantly changing wind and stack effect pressures
- Contractors don't have the right gauges



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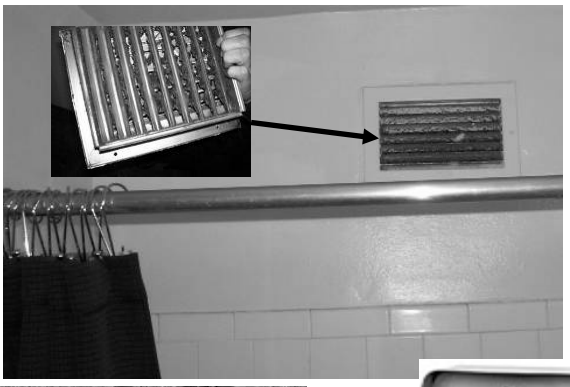
not to mention…

Covered

Loose or BrokenBelts

Clogged



OFF

(IAQ)

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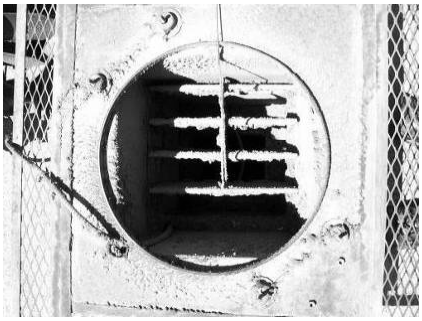
Older Systems Need Cleaning!



Asthma Trigger?

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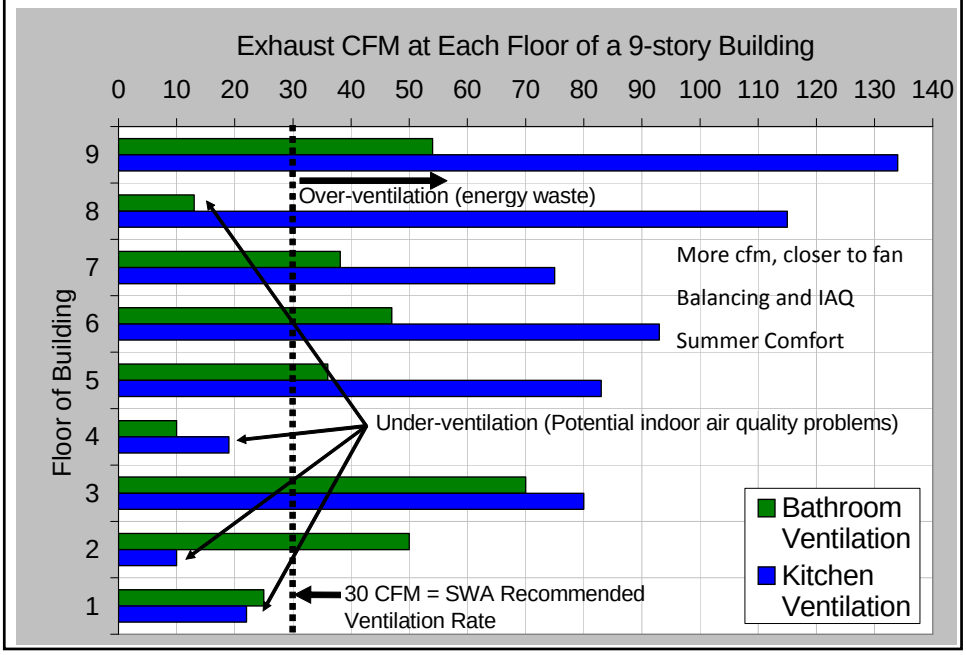
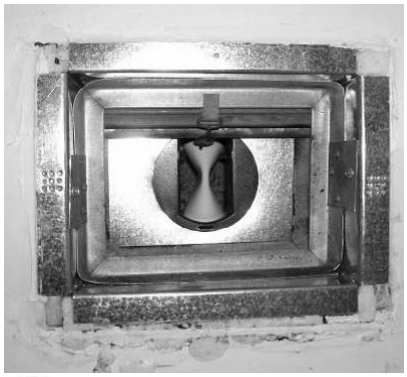
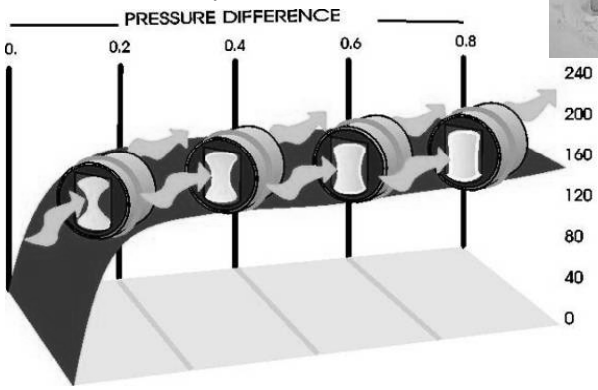
What actually happens



One Solution…

- American ALDES Constant Air Regulator (CAR) dampers
- Balancing from floor to floor and season to season
- Factory calibrated for dialing in to CFM (especially important at lower rates)





- No manual balancing required
- "Pays for itself…"

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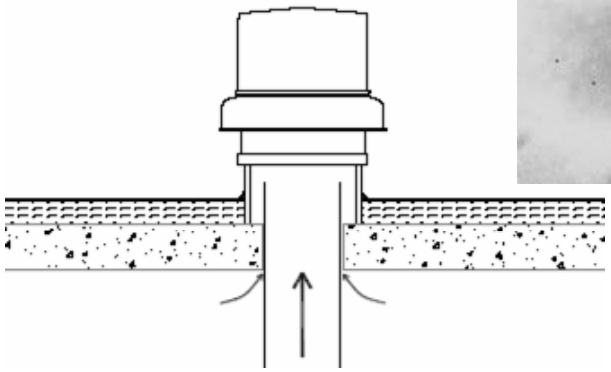
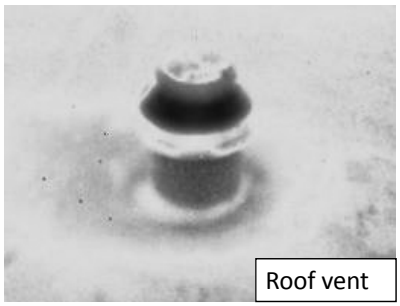
Need to pay attention to the ducts…..

Leakage at Roof Curb





Roof vent

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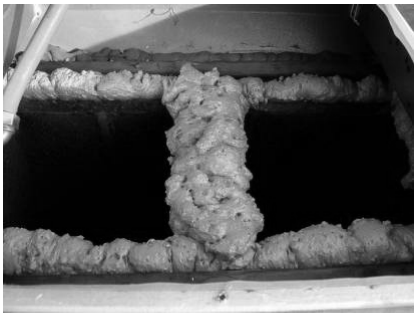
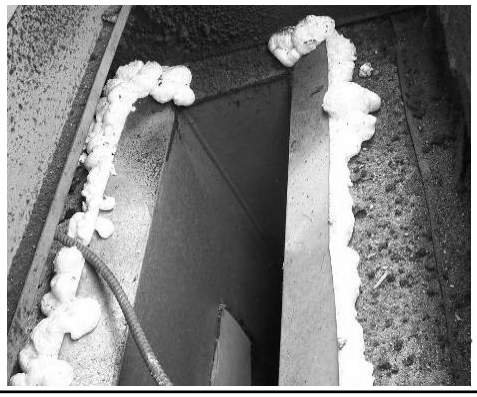


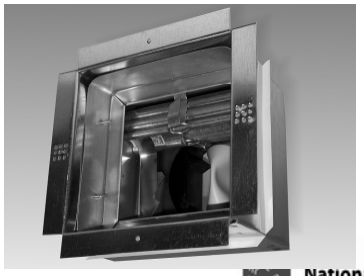


Leakage at Sheetrock Connection

with gasketed CAR dampers

Unit bathroom exhaust fan. Red is a gap between dry wall and fan.

SWA's Call for a Solution



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The good news…

- Roof curb and sheetrock connection leakage is relatively easy to address in ALL buildings.
- … and these details may represent up to 50% of total system leakage!!!

But what about the other 50% ???

(in both new and existing buildings)

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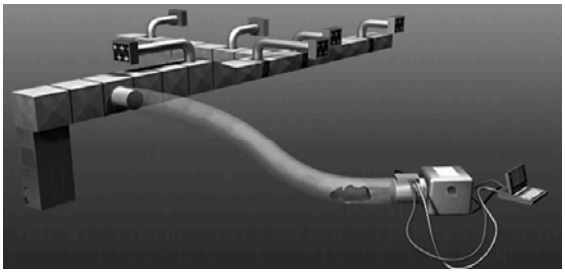
Carrier AEROSEAL System



- Seals holes up to ½" (ideal for sheet metal)
- Sealant remains rubbery
- Vinyl polymer is safe
- No lingering odors or off-gassing
- Lasts 10+ years; >25,000 homes &400 commercial buildings
- Other non invasive spray seal systems can do this!

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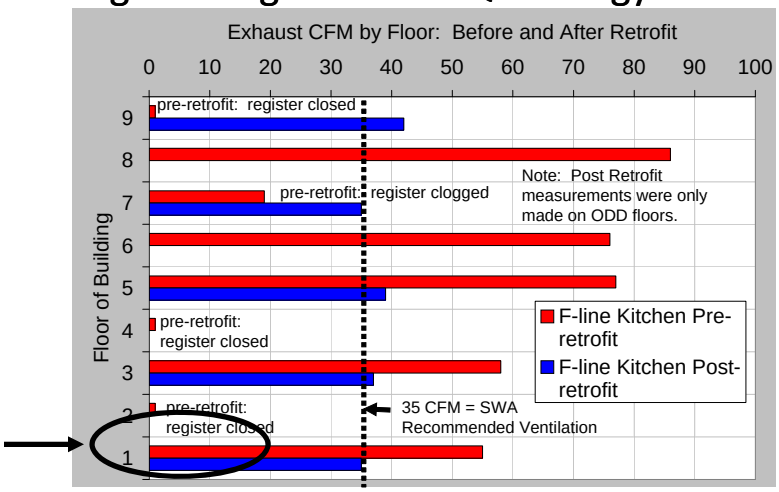
Existing Building Result: IAQ + Energy Benefits



~$1 - $2 per CFM of Ventilation Load Reduction (NYC) IF the heating system is smart enough

Plus additional fan electricity savings

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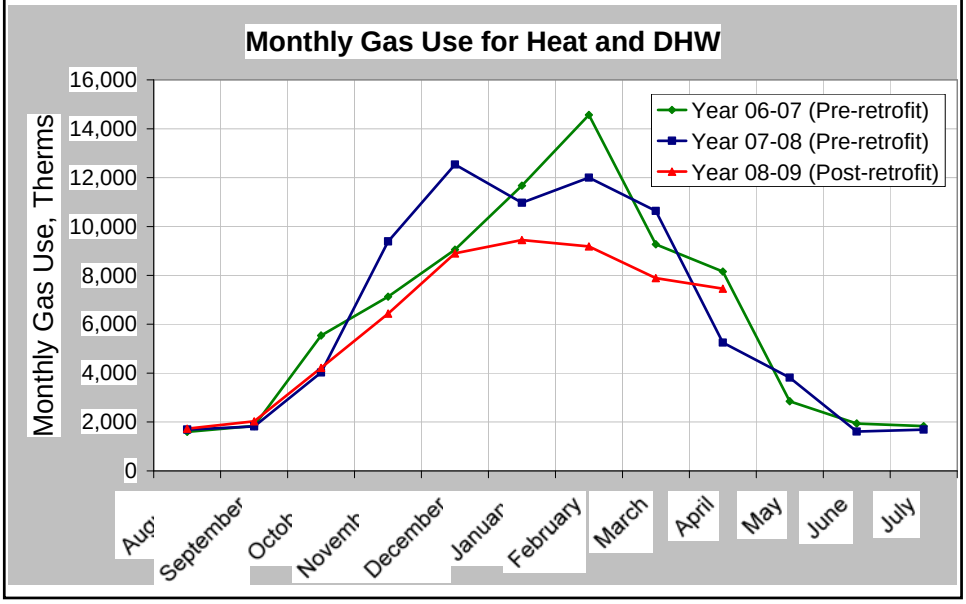
Pre and Post Retrofit Energy Comparison
99,000 ft² (108 unit) building



Pre and Post Retrofit Energy Comparison
99,000 ft² (108 unit) building

- In energy geeks terms: 25% reduction in heating gas use

	Pre-retrofit Performance (avg of 2006-2007 and 2007-2008)	Post-retrofit Performance (2008-2009)	Savings (Pre-retrofit - Post retrofit)
BTU/SF/HDD	12.2	9.1	3.2
Weather Normalized Heating Cost per SF	$0.69	$0.51	$0.18

  - $18,000 per year in operating cost savings @ $1.16 per therm
  - Would be $25,000 per year savings @ $1.60 per therm (NYC)

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Ventilation Assessments Central Roof Exhaust

- Check roof fans
  - How many?
  - Do they work?
  - Are they on timers? – can be counterproductive
  - Flow rates? – compare to design standard
- Check roof connections for obvious leakage
- Check bath exhaust grilles 20% units on multiple floors
  - Dirt, clogged, leakage, complaints
  - Flow rates compare to 62.2 and ICC standards
- Check kitchen exhausts – measure flows
- Add to Energy Audits and Annual Inspections

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Ventilate Combustion Appliances – Avoid Carbon Monoxide

- Gas stoves or furnaces can give off carbon monoxide. Maintain them properly.
- Charcoal grills, gas-fueled space heaters, or portable kerosene heaters used inside can give off carbon monoxide. NEVER use these inside.

Health Effects

- Fatigue, headaches, dizziness, confusion, death
- 500 deaths/yr & > 15,000 healthcare visits/year

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CO Alarms

- Required in > 15 states
- Place near sleeping areas
- Options with longer battery life

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