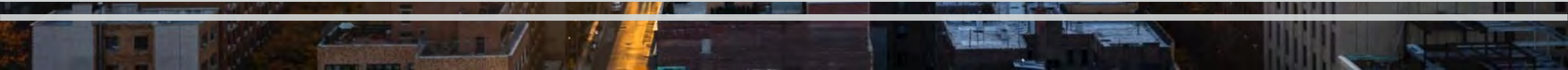
Electrify Your Health!

How Public Health Research Can (and Should) Influence Your Buildings



Learning Objectives

- Identify top health concerns in buildings through recent public health research
- Understand the relationship between energy performance and health
- Describe how going all-electric can improve health in buildings
- Recognize resources that are available to promote the design of healthy buildings

BUILDINGENERGY NYC

THURSDAY, SEPTEMBER 26, 2019 • NEW YORK, NY • NESEA.ORG/BENYC19

How do buildings impact **human health?**

"We shape our buildings, and afterwards our buildings shape us"

-Winston Churchill

Lauren Hildebrand, Steven Winter Associates, Inc.
Sustainability Director

Steven Winter Associates, Inc.

Why I Care


Rock 'n' Roll
MARATHON SERIES
READY. SET.
9585
LONG BEACH ISLAND
90

Why YOU Should Care

90% Time we spend indoors

75% Deaths caused by chronic disease, up from 13% in 1800

85% Of the 82,000 chemicals in use lacking available health data

Today's kids are the first generation expected to have shorter life expectancy than their parents

Source: Fitwel Ambassadors Training Video 2017

What determines health outcomes?

>5%	Genetics/biology
≈20%	Lifestyle/behavior
≈20%	Medical care
≈55%	Physical & social environment

It's not your genetic code...

it's your zip code!

Source: https://www.cdc.gov/nchhstp/socialdeterminants/faq.html

Health in the Headlines

EPA: Human Health is affected by…

- Environmental Tobacco Smoke
  40,000 deaths/year just secondhand

- Biological contaminants
  mold, pollen, dander, bacteria, viruses

- Combustion byproducts
  Effective kitchen exhaust?

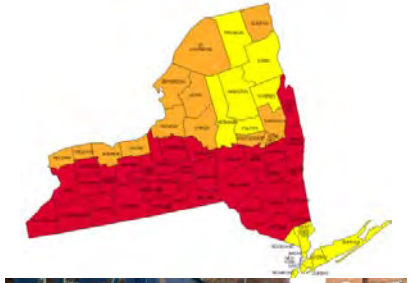
- Household products/practices
  Harder to clean surfaces = more chemicals

Source: EPA, CDC and others

cont'd: Human Health is affected by...

- Toxic materials
  Living Building Institute resource
- Radon
  22,000 deaths/yr in US
- Safety and security
  Creative solutions
- Diet & Exercise
  Encourage movement, health

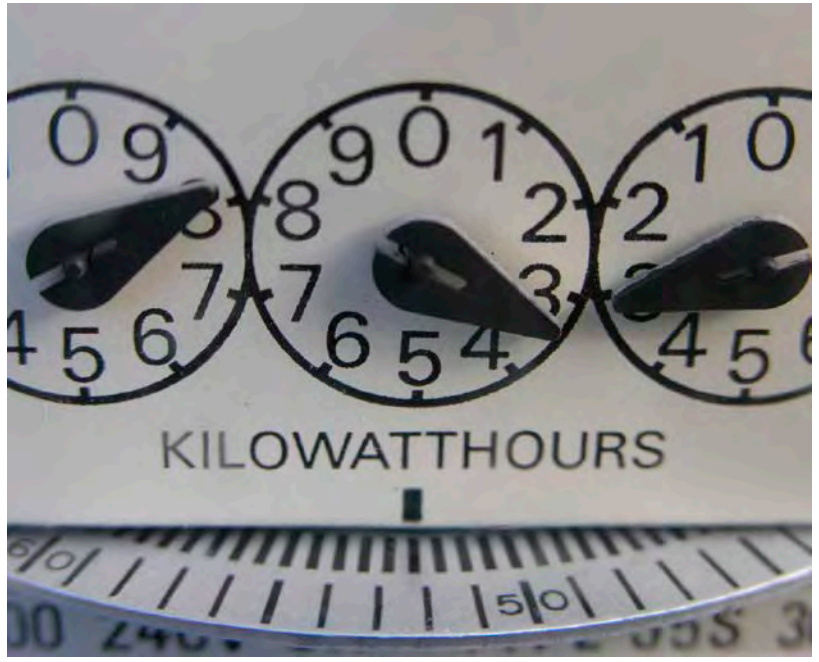
The 'Red' List



Source: EPA, CDC and others

Reasons for Hope:

We know more now than ever!



Five Ways Electrification Improves Human Health

1. **It's Cleaner**
   - Improved Air Quality
2. **It's More Comfortable**
   - Moisture/Temp/Humidity Control
3. **It's Quieter**
   - Improved Acoustics
4. **It's Safer**
   - Lower CO & Fire risk
5. **BONUS: It's More Cost Effective!**
   - Energy & Health ROI

1. It's Cleaner

Pollutants (Indoor, Outdoor, Both)

- Particulate matter (PM10, PM2.5, Ultrafine particles, Metals, Acids, Condensed organics)
- Nitrogen dioxide (NO2)
- Ozone
- Carbon monoxide (CO)
- Radon
- Pests. Pets. Kids?
- Mold and dampness
- Allergens in air and dust
- Gas-phase organics (VOC) (Formaldehyde ,Other aldehydes, Benzene, Acrolein, Organic acids, Semi-volatile organics (SVOC))
- Bioeffluents including CO2

Pollution Is Destroying Our Health!

- 9 out of 10 people now breathe polluted air
- 93% of children <15 years old (= 1.8 BILLION) breathe toxic air
- Air pollution kills 7 million people every year
- 1/3 of deaths from stroke, lung cancer and heart disease are due to air pollution

Source: World Health Organization

Fossil Fuel Pollution Impacts Our:

- Respiratory system:
  - Lung Cancer - leading cause of cancer in the U.S.
  - COPD - 3rd leading cause of death
  - Asthma
- Circulatory system:
  - Coronary heart disease - leading cause of death in the U.S.
- Nervous system:
  - Strokes
  - Loss of intellectual capacity from mercury exposure poisoning

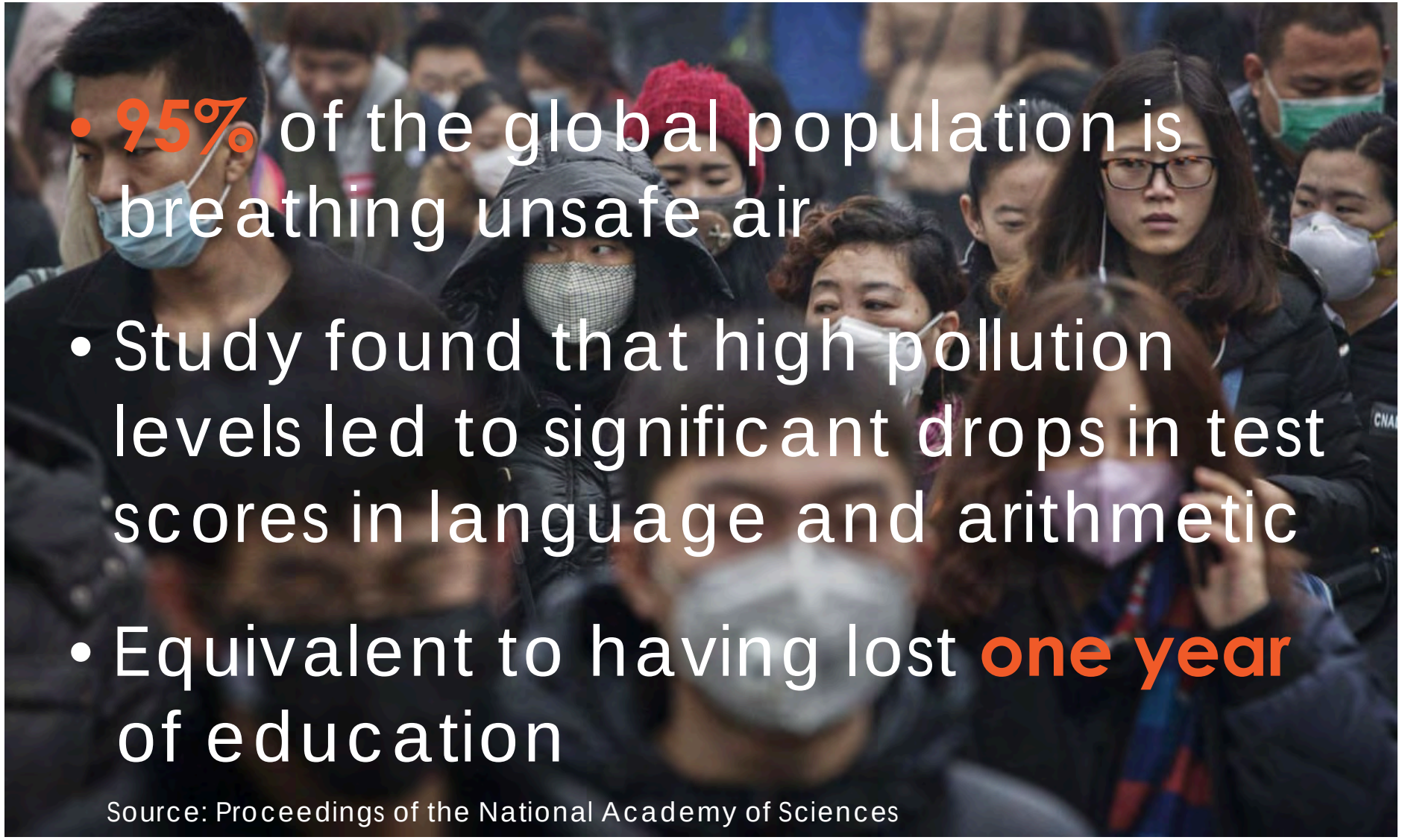
Source: American Council for an Energy Efficient Economy and by the Physicians for Social Responsibility

Especially in Kitchens...

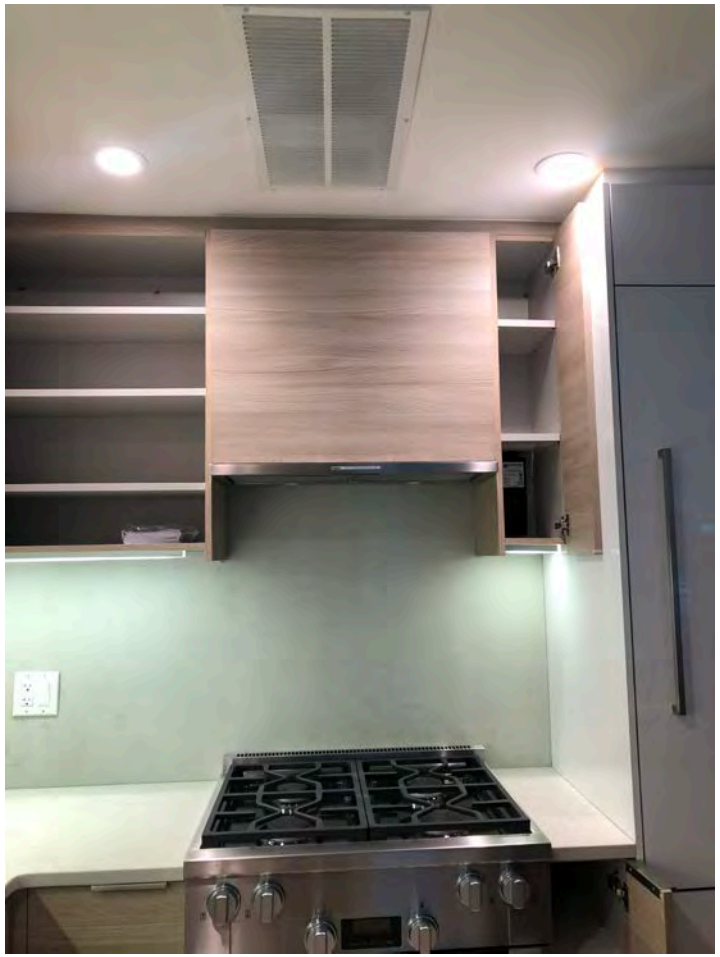
- 60% of homes that cook at least once a week with a gas stove can reach pollutant levels that would be illegal if found outdoors. That equates to:
- 12 million Californians routinely exposed to nitrogen dioxide levels that exceed federal outdoor standards
- 10 million exposed to formaldehyde exceeding federal standards
- 1.7 million exposed to carbon monoxide exceeding ambient air standards in a typical week in winter.

Source: LBNL Berkeley Lab

Pollution Makes you Dumber



Combustion Byproducts – Kitchen Exhaust



- Poorly vented appliances release toxic fumes, CO
- “Room” exhaust is not great (but allowed)… couple with charcoal recirc hood
- Hoods should cover all burners, and be placed as low as practical for capture
- Consider NOISE & CONTROLS for better usability
- 150 cfm is probably plenty
- Start thinking about makeup air in tight homes

Kitchen Exhaust, Good to Best

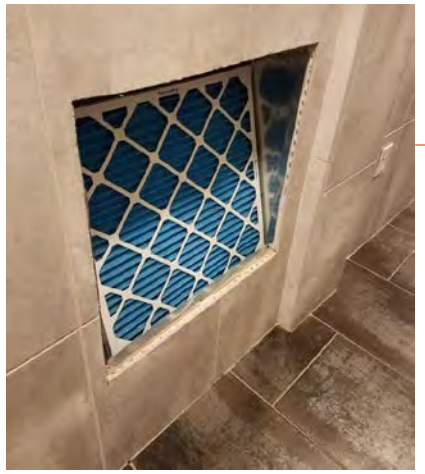
BETTER

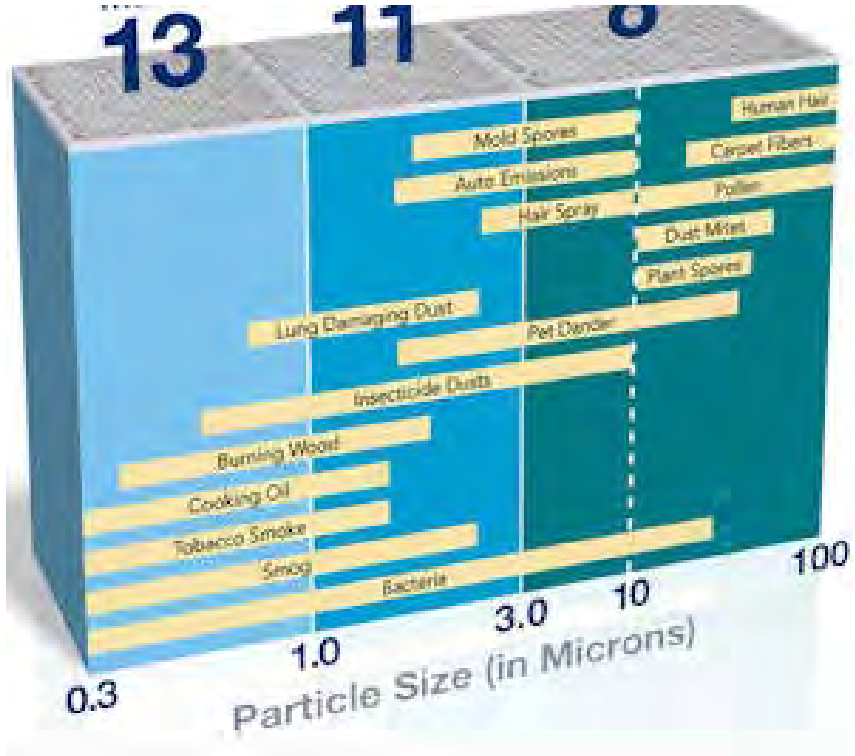
- Ducted kitchen exhaust
- Ducted range hood
- Range hood placed for effective capture
- Effective range hood < 2 sone and > 200
- All that interlocked with cooktop or sensors
- ELECTRIC

Bring in (and Treat) Fresh Air

The Solution to Pollution is Dilution!

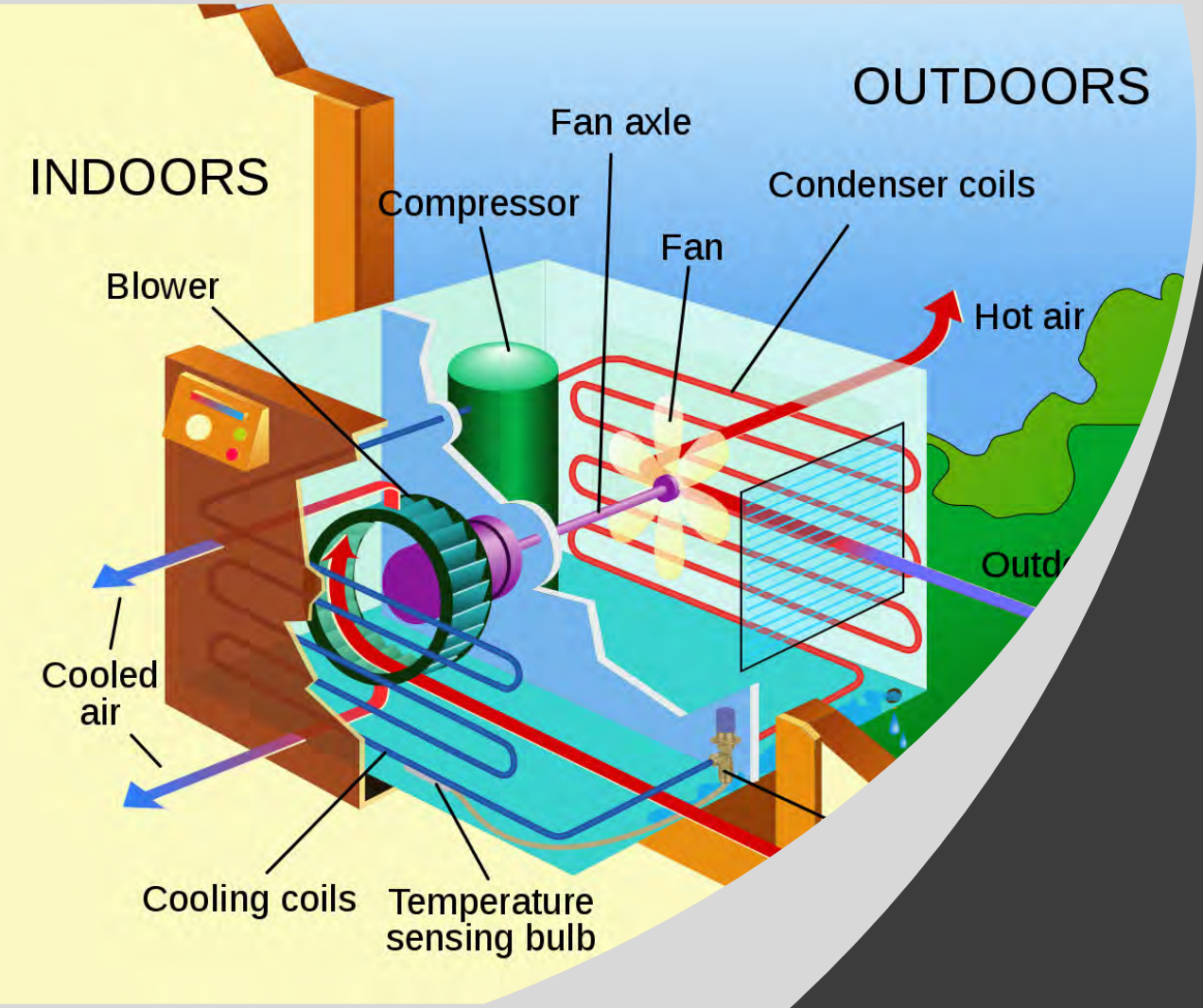
- Balanced ventilation strongly preferred. Heat Recovery/Energy Recovery even better!
- Fresh air is expensive… distribute it wisely
- Always check the controls at installation. If the contractor can't explain it to you, he can't explain it to the building manager either.
- Shut-offs are important (skunks, fire, asphalt)
- Test/Balance/Test/Maintain





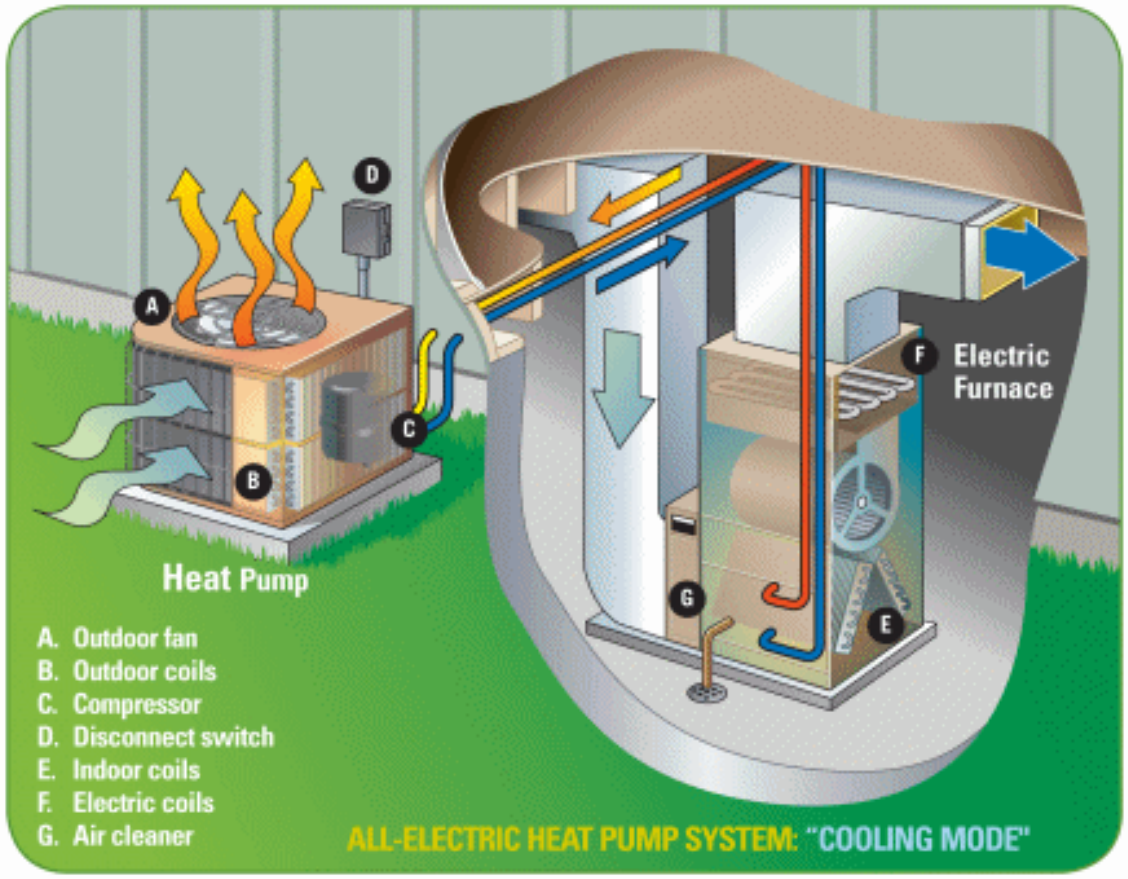
Don't Forget the Filters!

- MERV 13 is the lowest that can meaningfully capture PM 2.5
- Pleated, 2" or 4" thick
- Charged/"Electret" can help with pressure drop
- Filter Grille design… do not allow bypass, leave access
- Grille/filter sizing… likely larger than you think to keep pressure drop in check
- Filters must be changed often!



2. It's More Comfortable

Humidity/Temp/Moisture Control



- In addition to proper air sealing & water management, all electric buildings can be:
  - Warmer
  - Dryer
  - Better Ventilated
    - Lowers risk of illnesses and mold growth
- Replace gas fired domestic hot water and space heaters with electric DHW and heat pump
- Independently control temperature in each room – decentralized

3. It’s Quieter

Manage Noise, Manage Stress

TARGET LEVELS
20 dB Bedrooms
40 dB Living rooms

Heat Pumps Can be Quieter

- Indoor air handler part of a heat pump is generally quieter than single-stage gas furnaces. Hydronic type heaters function in near silence (if installed correctly).
- Steam radiators – eliminate constant “clang”

Other Recommendations:

- Use air sealing and sound attenuation to separate multi-dwelling units
- Choose fans based on sone ratings
- Remote-mount fans
- Study ‘free area’ for grilles and louvres to avoid whistling
- Test background sound!

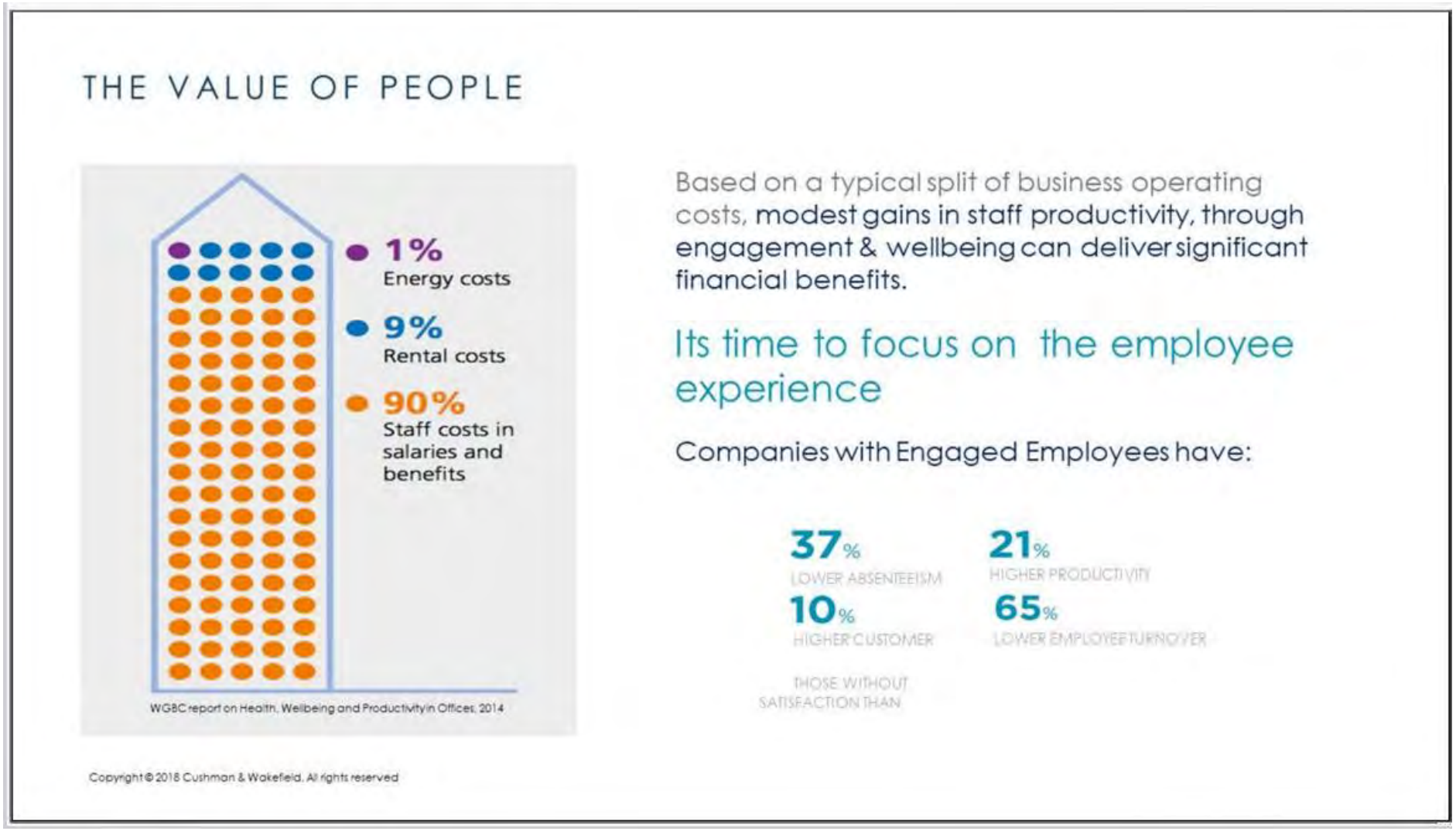
4. It’s Safer

Safety: Less Gas, Less Worry

- Less Risk of Carbon Monoxide Poisoning
  - Still recommend CO monitors in all units
- Fire & Explosion Safety
  - Clothes Dryers: check your ductwork
  - Gas Cooktops: it's a mini fire in your house!
  - DHW: Your chances of an explosion from a gas leak are much greater than electrocution from faulty wiring to your tank.

5. It's More Cost Effective & Equitable

Leverage the Value of PEOPLE in Buildings



Source: WGBC's Health, Wellbeing & Productivity in Offices

Our Employees Will Be Happier

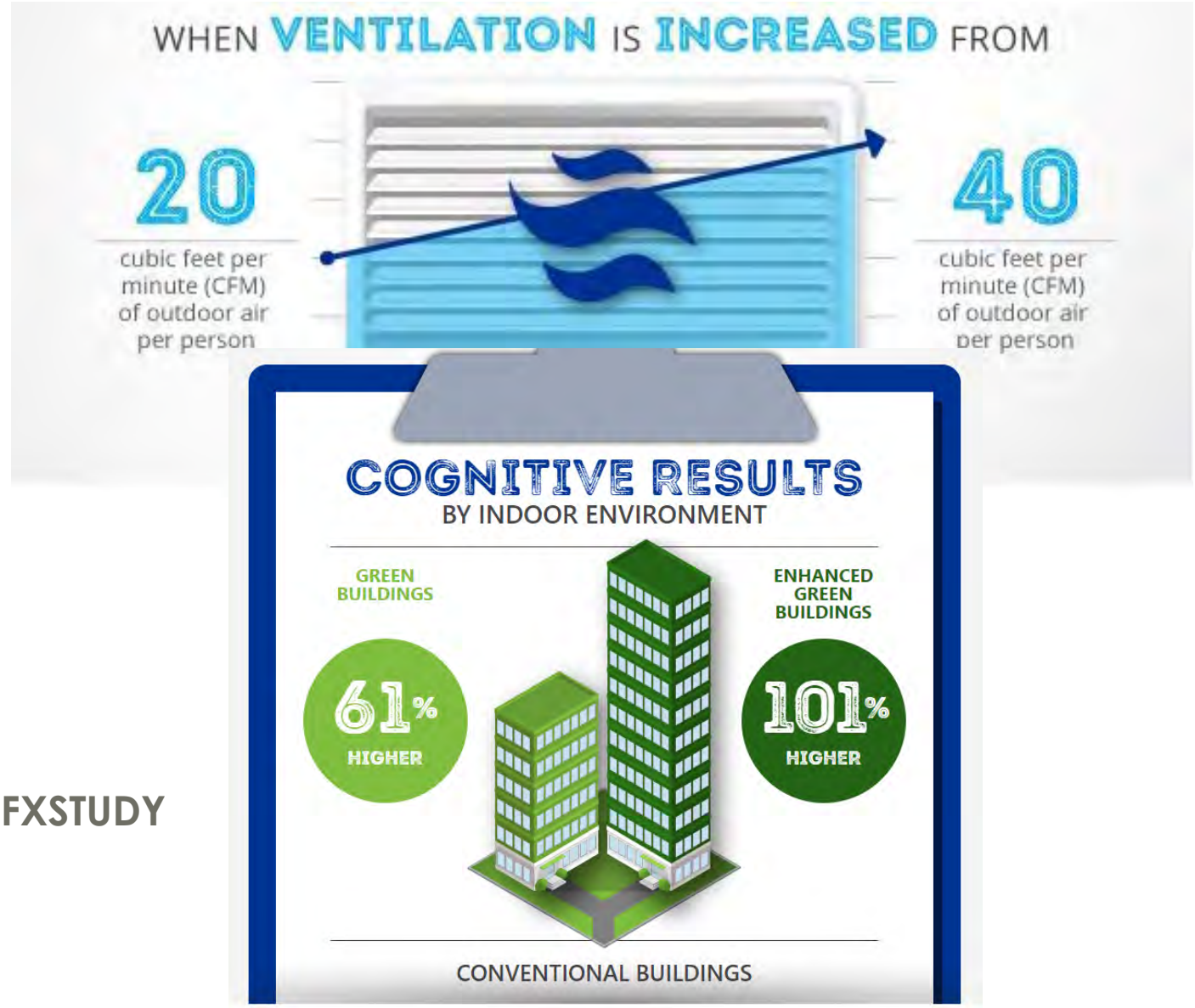
Employees are Happier, Healthier, More Productive in LEED Green Buildings:

- 93%: of those who work in LEED buildings are satisfied with their job
- 81%: enhanced air quality improves their physical health and comfort
- 85%: access to outdoor views and natural sunlight boosts productivity and happiness
- 79%: employees opt for a job in a LEED building vs non-LEED building

Our Residents Will Breathe Easier

- 2-yr study of effects of green building on building residents with asthma
- Evaluated ER visits, sleepless nights, days with reported symptoms
- Days with asthma symptoms decreased, 6.9 to 3.4 at 6 months and 2.2 at 12 mos

Good fresh air makes YOU smarter



Source:
#THECOGFXSTUDY

In other words...Healthy Buildings = PROFIT

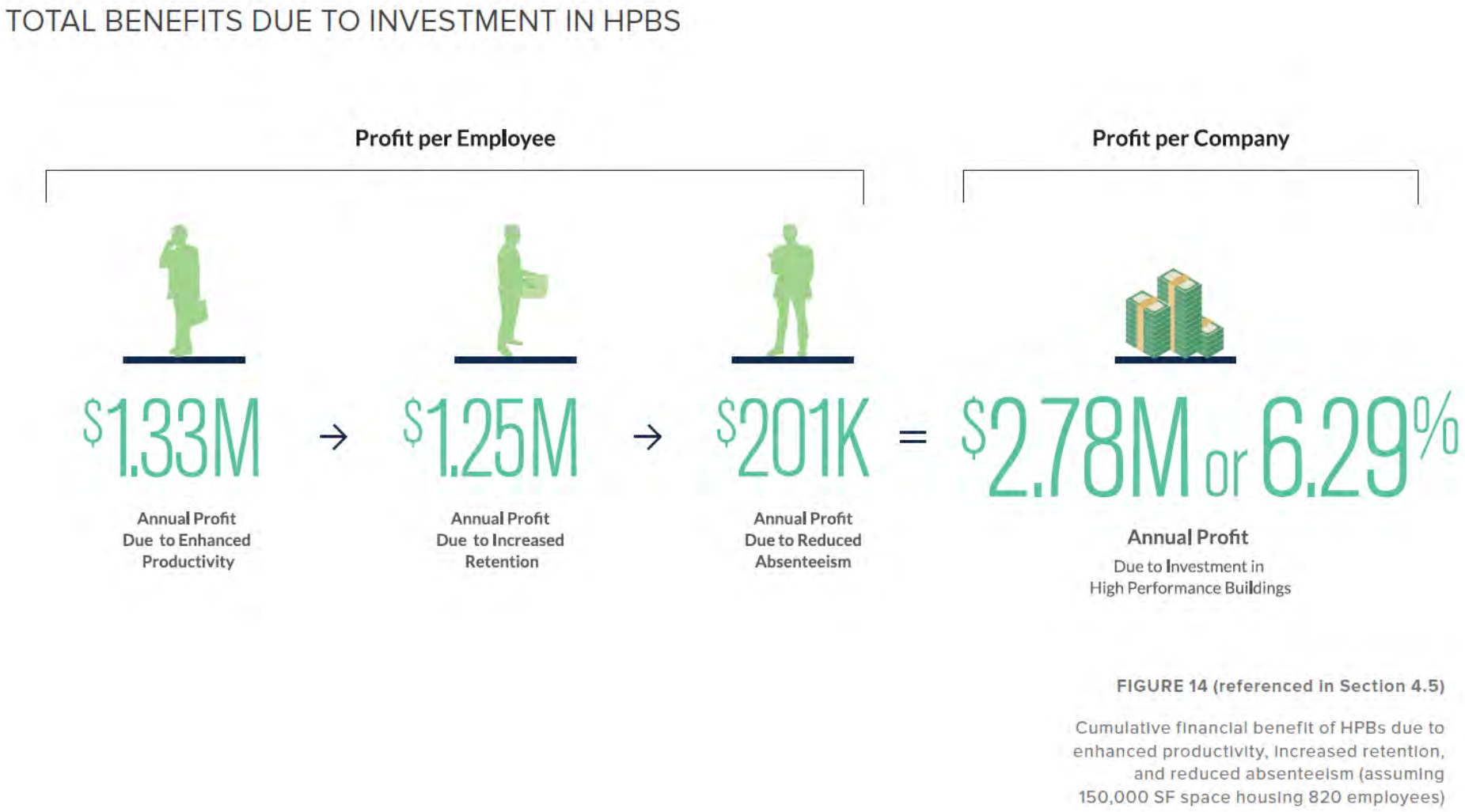


FIGURE 14 (referenced in Section 4.5)

Cumulative financial benefit of HPBs due to enhanced productivity, increased retention, and reduced absenteeism (assuming 150,000 SF space housing 820 employees)

A reminder about Asthma $$$

- People/yr treated for asthma: 15.4 million
- US total annual cost in 2015: $81.9 billion
- Asthma-related mortality cost: $29 billion/year
- Missed work & school days: $3 billion/yr
  - 8.7 million workdays lost
  - 5.2 million school days lost

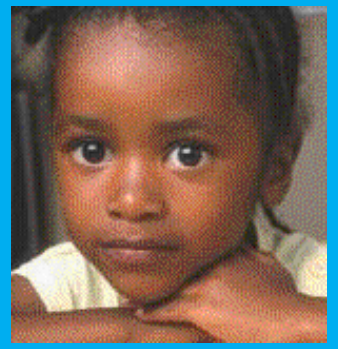
Health Based Building Incentives

- (NY)SERDA and DOH's NYS Healthy Homes Pilot
  - Pilot will test a residential "healthy homes" intervention that combines energy efficiency measures, asthma trigger reduction measures, and home injury prevention measures provided to a group of 500 Medicaid member households in several pilot locations throughout the State.
- Enterprise's *Health Begins with Home* Initiative
  - $250 million to work over 5 years promoting health as a top priority in affordable housing
- Get More Utility Providers Involved
- Insurance Underwriting

Pick your reason(s)

Studying The Optimal Ventilation for Environmental Indoor Air Quality:

STOVE IAQ



Elizabeth Garland, MD, MS
Department of Environmental Medicine and Public Health

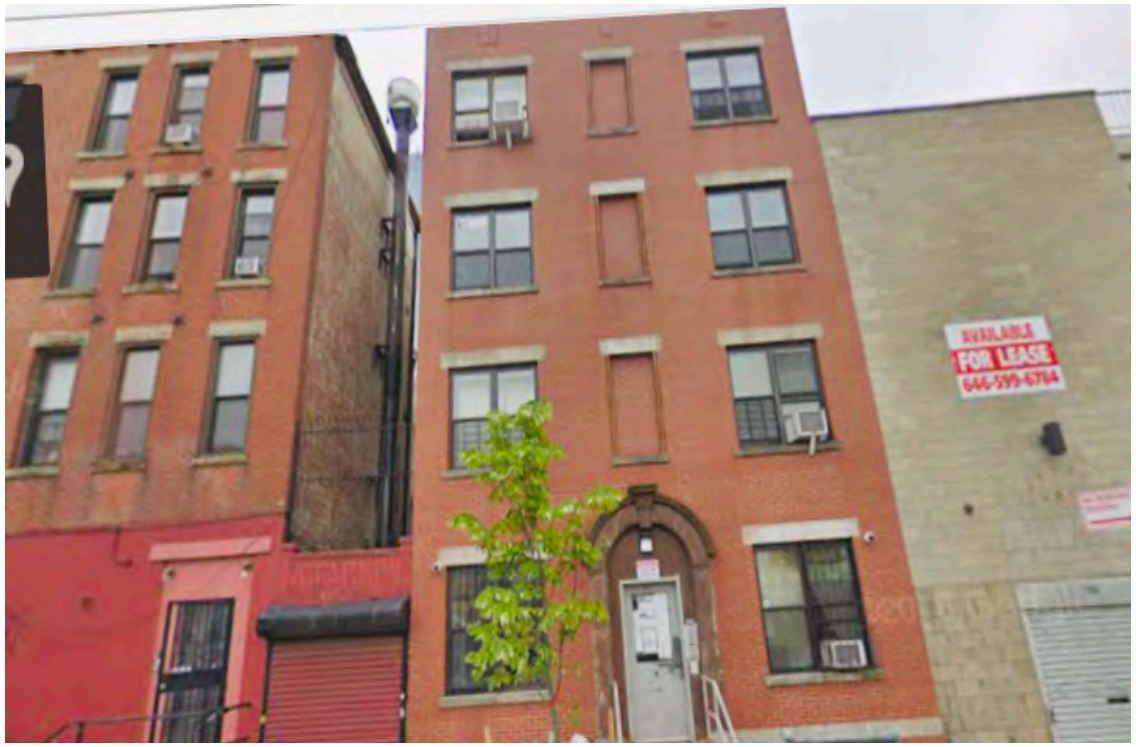
Mount Sinai

Purpose of the Study

- Multicity collaboration
- Enterprise Green Community Partners
- National Center for Healthy Housing

Determine if ASHRAE 62.2 (2010 or later) in multifamily Green Communities housing is associated with:

- variations in indoor air quality
- general health measures



Study Hypothesis

Multifamily Green Communities housing with ASHRAE-compliant ventilation will have:

- Significantly lower indoor levels of
  - $PM_{2.5}$
  - Formaldehyde
  - NO2
  - CO
  - CO_2
- Resulting in better general and respiratory health

Eligibility of Buildings

- Multifamily housing units previously rehabilitated to Green standards within the past 5 years
- Working gas stove
- Open to all people

- National Center for Healthy Housing and Enterprise Green Communities confirm eligibility

Study and Comparison Groups

- **Study group**:
  - –ASHRAE-compliant buildings
  - –continuous or intermittent (e.g., 20 minutes/hour) ventilation in each dwelling
  - –exhaust ventilation over stoves

- **Comparison group**:
  - –Non-ASHRAE-compliant building

Phases

- Recruitment
- Screening– determine eligibility

- Three phases:
  - Baseline
  - 4 months after baseline
  - 8 months after baseline

Study Methods

- Screen: meet inclusion criteria
- Home Interview
- Health Interview
- Environmental Assessment
- Visual Assessment
- Dwelling performance

Dwelling Performance

- Unit characteristics
- Duct System
- Ventilation Flows
- Pressures
- Microsoft Access

Conducted by independent contractor at baseline

Home Interview

- Questions answered by primary adult
- Contains questions about:
  - Household income
  - Housing conditions
  - Pets
  - Pests
  - Comfort
  - Safety
  - Smoke in the home

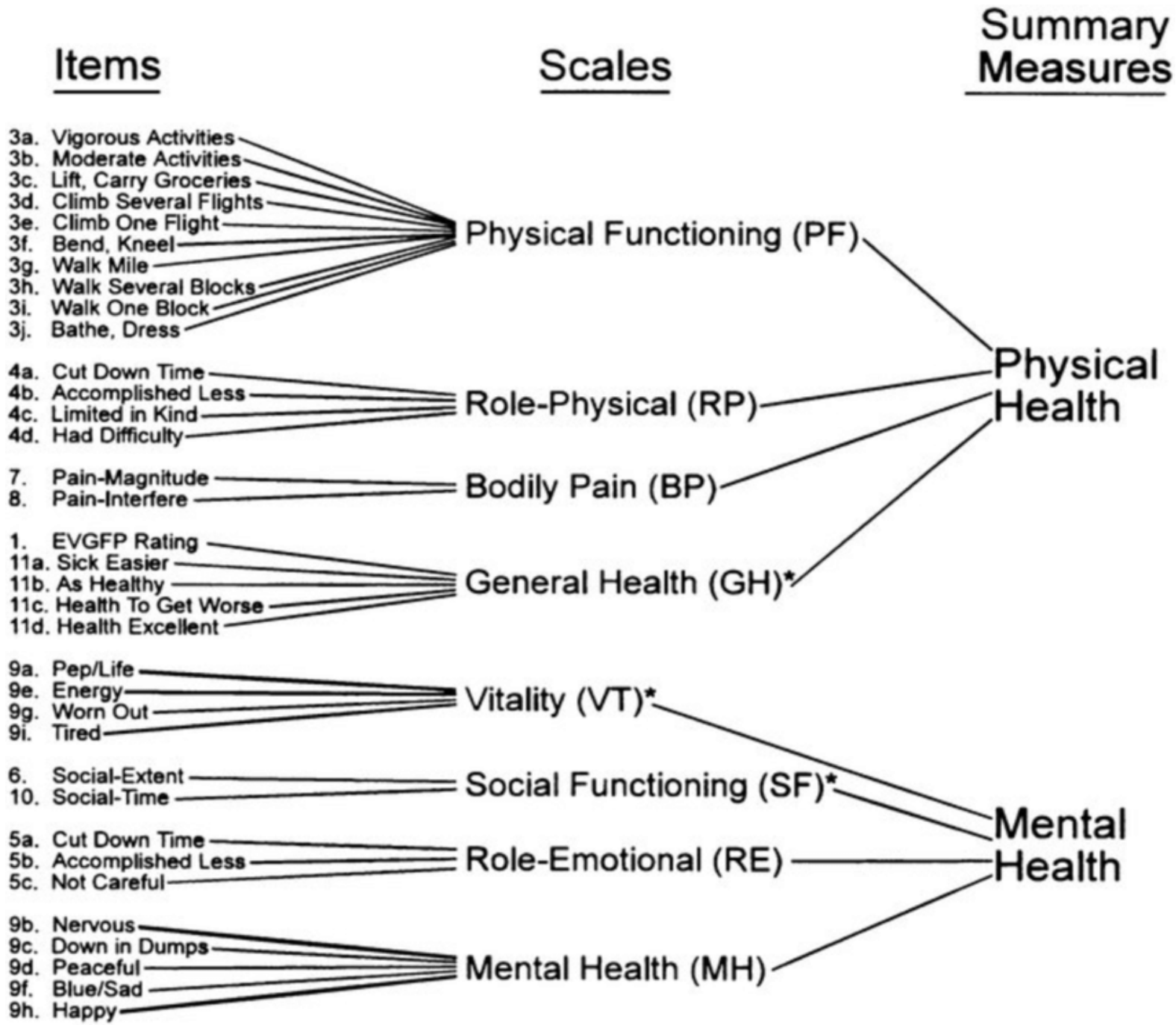
Health Interview

- **Respiratory:** Asthma, allergies, nasal
- **Adult:**
  - SF-36, health-related-quality of life
  - smoking
  - stress
  - Medical conditions (e.g., COPD)
- **Child:**
  - SF-12
  - smoking (if age≥12)
  - Medical conditions (e.g., ear infections)

_____

In general, would you say your health is:

1 - Excellent
2 - Very good
3 - Good
4 - Fair
5 - Poor


Items
Scales
Summary Measures
3a. Vigorous Activities
3b. Moderate Activities
3c. Lift, Carry Groceries
3d. Climb Several Flights
3e. Climb One Flight
3f. Bend, Kneel
3g. Walk Mile
3h. Walk Several Blocks
3i. Walk One Block
3j. Bathe, Dress
Physical Functioning (PF)
4a. Cut Down Time
4b. Accomplished Less
4c. Limited in Kind
4d. Had Difficulty
Role-Physical (RP)
7. Pain-Magnitude
8. Pain-Interfere
Bodily Pain (BP)
1. EVGFP Rating
11a. Sick Easier
11b. As Healthy
11c. Health To Get Worse
11d. Health Excellent
General Health (GH)*
Physical Health
9a. Pep/Life
9e. Energy
9g. Worn Out
9i. Tired
Vitality (VT)*
6. Social-Extent
10. Social-Time
Social Functioning (SF)*
5a. Cut Down Time
5b. Accomplished Less
5c. Not Careful
Role-Emotional (RE)
9b. Nervous
9c. Down in Dumps
9d. Peaceful
9f. Blue/Sad
9h. Happy
Mental Health (MH)
Mental Health

Bill Walsh

HEALTH, EQUITY & ETHICS:
Strategies For Addressing High GWP & Toxic Chemicals In Insulation

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HBN HEALTHY BUILDING NETWORK
KNOW BETTER

Mission

To advance human and environmental health by improving hazardous chemical transparency and inspiring product innovation.

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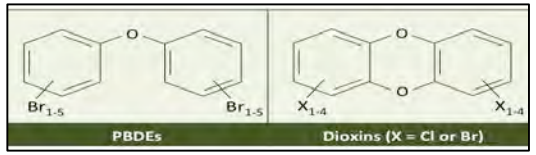
Health Equity Ethics

Chemicals Of Concern

- Persistent, Bioaccumulative Toxicants (PBTs)
- Halogenated flame retardants
- Formaldehyde-based binders
- Isocyanates
- High Global Warming Potential



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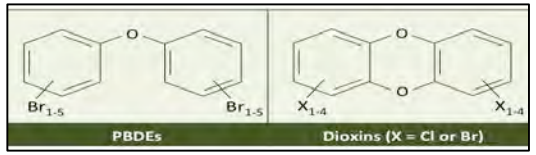
Health Equity Ethics

Health Impacts

- Cancer
- Reproductive Capacity
- Brain Development
- Asthma & Respiratory Disease
- Climate Change



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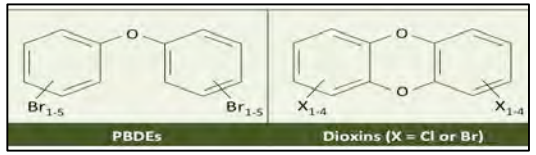
Health Equity Ethics

Impacted Communities

- Building Occupants
- Construction Workers
- Manufacturing Workers
- Fenceline Communities
- Poor & People of Color
- Global Environment



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Health **Equity** Ethics

Centering Equity in the Sustainable Building Sector

WWW.NAACP.ORG
NAACP

"Whether it's as policymakers, advocates, architects, project managers, contractors, or even in the construction workforce, the most impacted communities are underrepresented in the design, construction, and occupancy of sustainable, regenerative, healthy buildings."

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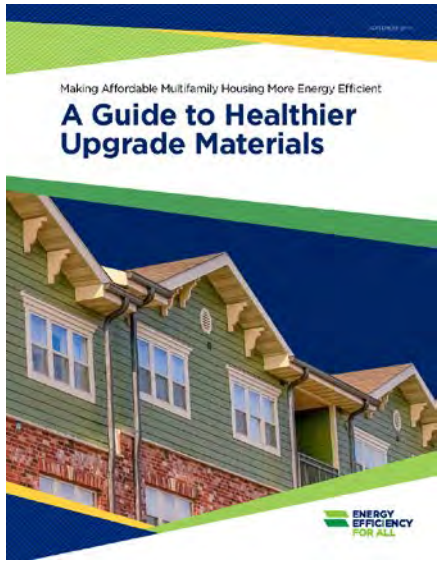
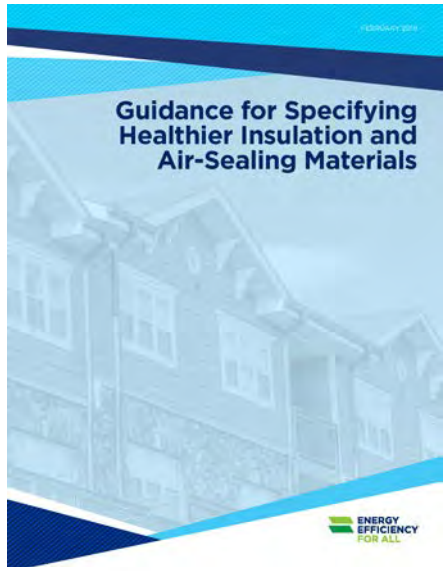
Strategies For Chemical Hazards



Healthybuilding.net



ENERGY EFFICIENCY FOR ALL
energyefficiencyforall.org
THE JPB FOUNDATION
ENERGY FOUNDATION
NATIONAL HOUSING TRUST
NRDC NATURAL RESOURCES DEFENSE COUNCIL
ELEVATE ENERGY Smarter energy use for all

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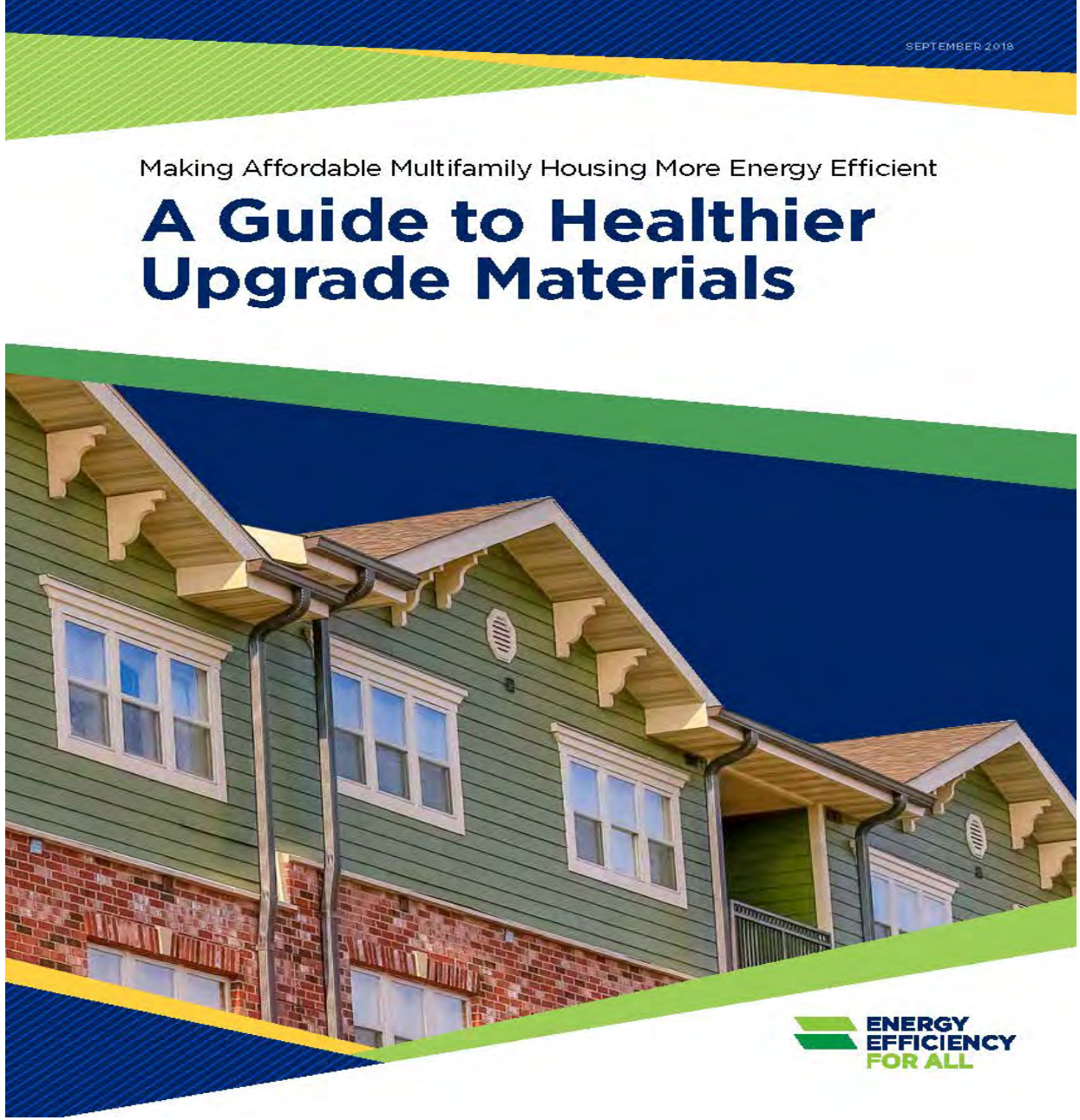
In Depth Analysis

Multi-factor Product Evaluation



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BUILDING INSULATION – RECOMMENDED AND OTHER MATERIALS, COST, PERFORMANCE, TRANSPARENCY, AND INSTALLATION CONSIDERATIONS

Health-Based Ranking (Green is best; red is worst)	Insulation Type	R-Value per Inch*	Relative Installed Cost per R-Value**	Special Installation Equipment Required	Vapor Retarder^	Air Barrier Material^^	Level of Transparency on Chemical Content^^^ (Less shading indicates more transparency within a product type)
	Expanded Cork Board	3.6-4.2	$$$$	no	Class III	Information not available	
	Blown-In Fiber Glass						
	Loose-Fill Fiber Glass	2.2-3.1	$	yes	Vapor permeable	Not an air barrier	
	Dense-Pack Fiber Glass	3.7-4.6	$-$$	yes	Vapor permeable	Not an air barrier but does reduce airflow	
	Spray-Applied Fiber Glass	4.0-4.3	$-$$	yes	Vapor permeable	Not an air barrier but does reduce airflow	
	Fiber Glass Batts/ Blankets (Kraft-Faced and Unfaced)	2.9-4.3	$	no	Kraft-faced: Class II; Unfaced: Vapor permeable	Not an air barrier	
	Fiber Glass Batts/ Blankets (PSK or FSK-Faced, Basement Wall Insulation)	Duct wrap: 2.7-3.2# Basement wall insulation: 3.0-3.5	$-$$	no	Class I (except basement wall insulation where facing is perforated to allow for moisture transfer)	Facing may be an air barrier material	
	Cellulose/Cotton Batts and Blankets (Unfaced)	3.5-4.0	$$-$$$	no	Vapor permeable	Not an air barrier	

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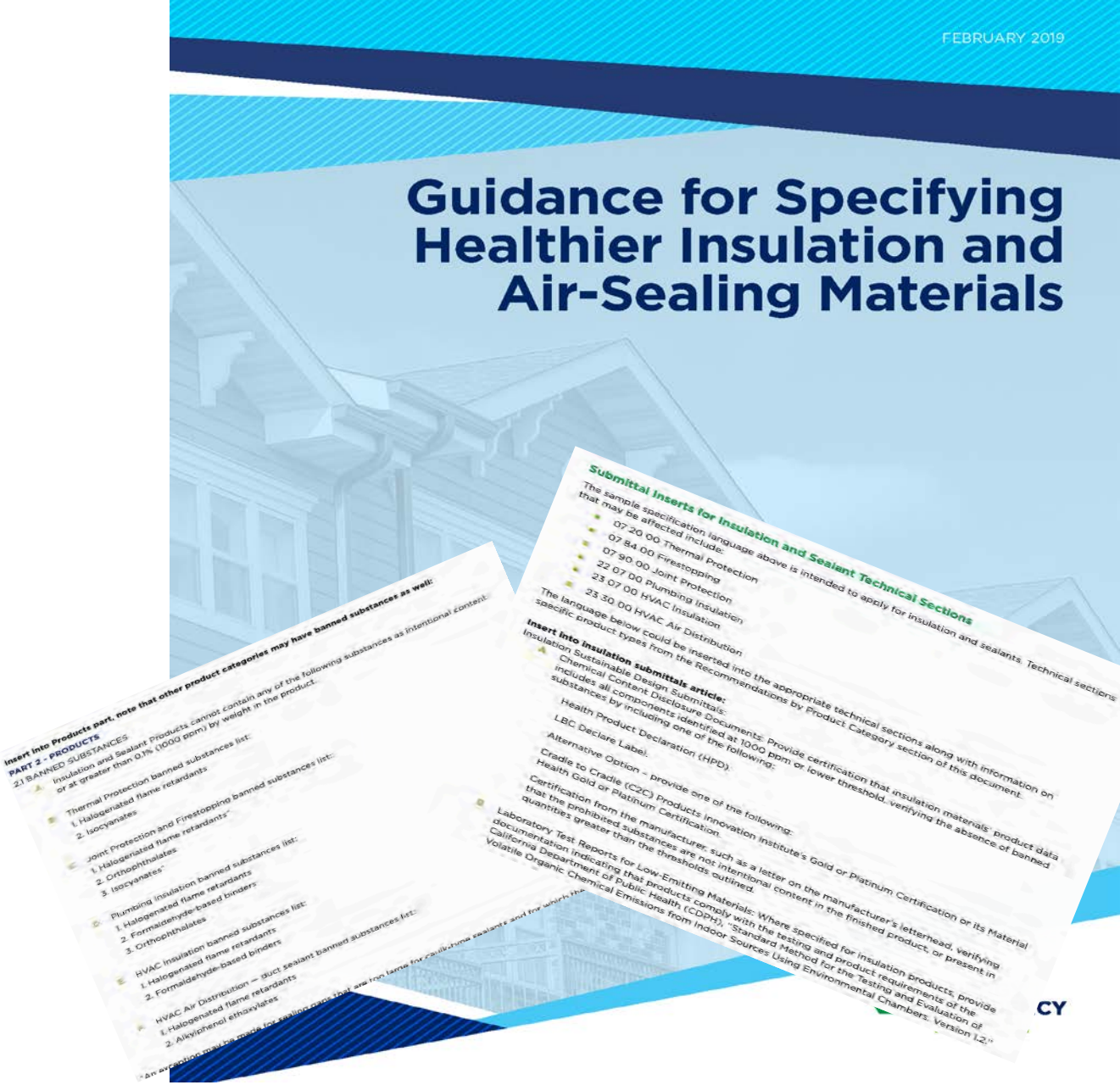
- Recommendations by Product Category
- Spec Language
- Submittal Inserts



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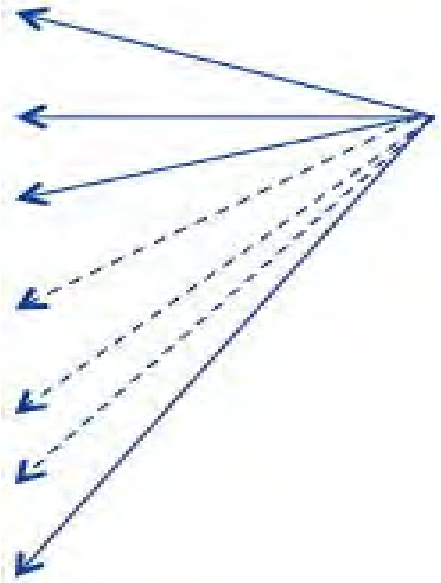
Recommended Materials

- Cork
- Blown-In Fiber Glass (Loose Fill, Dense Pack, and Spray-Applied)
- Kraft-Faced and Unfaced Fiber Glass Batts
- Unfaced Cellulose/Cotton Batts
- Blown-In Cellulose (Loose Fill, Dense Pack, and Wet-Blown)
- PSK or FSK-Faced Fiber Glass Batts or Blankets
- Mineral Fiber Batts and Boards
- Fiber Glass Board (Duct Insulation)
- Polyisocyanurate
- Expanded Polystyrene (EPS)
- Extruded Polystyrene (XPS)
- Spray Foam Insulation (SPF)



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In Summary

INSULATION — HEALTHIER MATERIAL RECOMMENDATIONS

- Expanded cork board is top ranked
- Prefer fiber glass and cellulose insulation
- Avoid products with formaldehyde-based binders
- If board insulation is required, prefer rigid mineral wool insulation
- Avoid foam insulation, whether board or spray-applied
- Use mechanical installation methods

In Summary

AIR SEALING — HEALTHIER MATERIAL RECOMMENDATIONS

- Prefer caulk-type sealants over spray foam sealants
- Prefer foam sealing products that are not reacted on site
- Avoid phthalate plasticizers
- Prefer acrylic-based sealants with very low levels of VOCs
- Prefer foil-backed butyl tape for HVAC sealing
- Avoid products that are marketed as being antimicrobial

HBN KNOW BETTER

Thank you!
Any Questions?

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