

# Tools for Healthier Communities

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How do buildings  
**impact human health?**

# What determines health outcomes?

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

**It's not your genetic code...**

**it's your zip code!**

# Scary statistics

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**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**

# Research Example: #THECOGFXSTUDY

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The business case for healthy buildings:  
extrapolating workplace findings to  
dwellings



THE IMPACT OF GREEN BUILDINGS ON  
**COGNITIVE FUNCTION**

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STUDY 1: INDOOR ENVIRONMENTAL QUALITY 

[Home](#)



THE IMPACT OF GREEN BUILDINGS ON  
**COGNITIVE FUNCTION**

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STUDY 2: BUILDINGOMICS 

# HUD's 8 Healthy Homes Principles

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1. Keep it Dry
2. Keep it Clean
3. Keep it Safe
4. Keep it Well Ventilated
5. Keep it Pest-free
6. Keep it Contaminant-free
7. Keep the Home Maintained
8. Maintain Thermal Control



# 9 Foundations of a Healthy Building

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1. Ventilation
2. Air Quality
3. Thermal Health
4. Moisture
5. Dust & Pests
6. Safety & Security
7. Water Quality
8. Noise
9. Lighting & Views



# EPA: Human Health is affected by...

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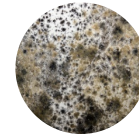
- Environmental Tobacco Smoke

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



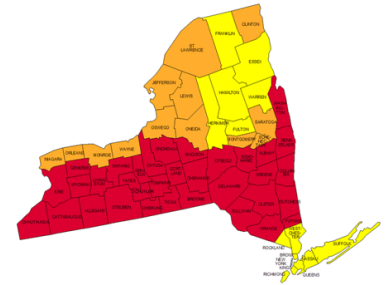


# cont'd: Human Health is affected by...

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- 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



# THE RED LIST

A list of commonly used chemicals in buildings that are worst-in-class for:

THE RED LIST

- Polluting the environment
- Bio-accumulating up the food chain until they reach toxic concentrations
- Harming construction and factory workers

Research fatigue?  
Where do we start?  
**Tools Overview**

# Tools we can access today include...

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- ENERGY STAR Homes
- Indoor airPLUS
- Green Communities 2015
- LEED v4
- WELL Building Standard (MF)
- Active Design Guidelines
- Fitwel (MF)

	ES	IAP	EGC 2015	LEED v4	WELL	Fitwel
Environmental Tobacco Smoke			✓	✓	✓	✓
Biological contaminants	✓	✓	✓	✓	✓	✓
Combustion byproducts	✓	✓	✓	✓	✓	
Household products/practices			✓	✓	✓	✓
Toxic materials		✓	✓	✓	✓	✓
Radon		✓	✓	✓	✓	
Safety and security						✓
Diet & Exercise			✓	✓	✓	✓

# Indoor airPLUS

## CONSTRUCTION SPECIFICATIONS



# Indoor Air Plus Construction Specs

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- ENERGY STAR Homes v3
- Moisture Control
- Radon
- Pests (light touch)
- HVAC Systems including filtration
- Combustion Pollutants
- Materials (paint, carpet, composite wood)

	ES	IAP	EGC 2015	LEED v4	WELL	Fitwel
Environmental Tobacco Smoke			✓	✓	✓	✓
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Radon		✓	✓	✓	✓	
Safety and security						✓
Diet & Exercise			✓	✓	✓	✓





# 2015 ENTERPRISE GREEN COMMUNITIES CRITERIA

# 2015 Green Communities Criteria

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In addition to IAP items...

- Design for Health & Health Action Plans
- Access to fresh local food
- Active design & Universal design
- Low-emitting adhesives, sealants, coatings, hard flooring
- Asthmagen-free materials option (no phthalates, PVC finishes)
- Smoking ban option
- Integrated pest management for MF

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Radon		✓	✓	✓	✓	
Safety and security						✓
Diet & Exercise			✓	✓	✓	✓



# Health Optimization

	ES	IAP	EGC 2015	LEED v4	WELL	Fitwel
Environmental Tobacco Smoke			✓	✓	✓	✓
Biological contaminants	✓	✓	✓	✓	✓	✓
Combustion byproducts	✓	✓	✓	✓	✓	
Household products/practices			✓	✓	✓	✓
Toxic materials		✓	✓	✓	✓	✓
Radon		✓	✓	✓	✓	
Safety and security						✓
Diet & Exercise			✓	✓	✓	✓

# THE SEVEN CONCEPTS OF THE WELL BUILDING STANDARD

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**AIR**

**WATER**

**NOURISHMENT**

**LIGHT**

**FITNESS**

**COMFORT**

**MIND**

# WELL

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- Water

- Testing for organic, inorganic, and agricultural contaminants
- Drinking water promotion

- Light

- Light levels, color temperature, and circadian lighting design
- Blackout shades for better sleeping



# WELL

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- **Comfort**

- Ambient noise levels, exterior and interior sources

- **Mind**

- Biophilic design

- Health and wellness awareness (education of occupants)

	ES	IAP	EGC 2015	LEED v4	WELL	Fitwel
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Developed by CDC + GSA to address workplaces.

Meant to be do-able for all, with a much lower bar to entry than WELL, and used for benchmarking as well as certification.

Available for buildings, tenant spaces, and now **multifamily**.

# Fitwel's 7 Health Impact Categories

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- Impacts community health
- Reduces morbidity + absenteeism
- **Social equity for vulnerable populations**
- Increases physical activity
- Promotes occupant safety
- Provides healthy food options
- **Instills feelings of well-being**

We do not have to do  
everything at once.

It is OK to pick and choose  
strategies.

# Choosing the best strategies

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## Example: **Smoke Free Building**



**BEST** • WELL : Smoking ban

**BETTER** • LEED v4: ban in public areas;  
compartmentalization required;  
points for nonsmoking

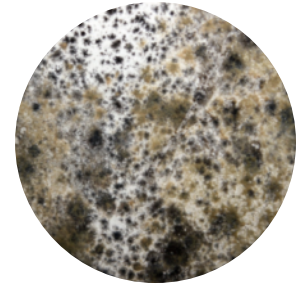
• IAP: silent (targets homebuilders)

**GOOD** • EGC 2015: points for nonsmoking

# Choosing the best strategies

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## Example: **Biological Contaminants**



- BEST?**
- WELL : IAQ testing mandatory; air & water borne; pest management
  - LEED v4: water managed systems; stringent ventilation; pest mgmt
- BEST?**
- IAP: detailed building science mold prevention measures; pest mgmt
  - EGC 2015: water managed systems; pest mgmt

Next Level  
**Healthy Homes**



# 1. Increase fresh air to 62.2-2013 +

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- $\approx 50\% > 62.2-2010$
- Use ERV or HRV to minimize energy impacts
- Distribute air effectively
- Filter outside air MERV 13+
- Train end users on filters, maintenance, and what to do in event of poor outdoor air quality (fire, family of skunks)

WHEN **VENTILATION IS INCREASED** FROM

**20**

cubic feet per  
minute (CFM)  
of outdoor air  
per person



**40**

cubic feet per  
minute (CFM)  
of outdoor air  
per person

## COGNITIVE RESULTS

BY INDOOR ENVIRONMENT

GREEN  
BUILDINGS

**61%**  
HIGHER



ENHANCED  
GREEN  
BUILDINGS

**101%**  
HIGHER

CONVENTIONAL BUILDINGS

Source:  
**#THECOGFXSTUDY**



IRR

**IMPROVED PRODUCTIVITY**  
PER PERSON PER YEAR



THE INCREASED  
**PRODUCTIVITY**  
OF AN EMPLOYEE IS MORE THAN

**150x**  
GREATER THAN



THE RESULTING ENERGY COSTS

ON AVERAGE, GREENHOUSE GAS EMISSIONS EQUIVALENT TO

**0.03**



**ADDITIONAL CARS**  
ON THE  
ROAD / BUILDING / YEAR

AT THE HIGHEST VENTILATION RATE  
(40 CFM/PERSON) WITH AN  
ENERGY RECOVERY VENTILATOR.

## 2. Improve kitchen exhaust

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- Exhaust at source (hood)
- Capture hood over all burners
- Remote-mount fan for quieter operation
- Provide integrated makeup air to keep pressure  $< -5\text{Pa}$
- Train end users

# 3. Avoid a new Chemical of Concern

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- **Phthalates** plasticizers
- **Diisocyanates** Toluene & Methylene Diphenyl - urethanes, foams
- **Antimicrobials**
- **Flame retardants**

# Resource: Known 3rd Party Proxies

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VOCs limits;  
Phthalate limits;  
Formaldehyde limits



VOCs limits;  
No Phthalate limits



Phthalates & hundreds more;  
see Wikipedia for list!

# \$\$\$ A reminder about Asthma \$\$\$

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- 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



## 4 . Strive for Radon 0-2 pCi/L

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World Health Organization:  
Reducing radon from  
4 pCi/L to 2 pCi/L cuts risks  
of lung cancer in half.

**NO SAFE LEVEL!**

- Test your own home!
- Question radon map boundaries
- Use recommended passive prevention strategies
- Prepare for future changes
- Educate end users in the importance of ongoing testing



# 5. Optimize Lighting Temp & Intensity



Lighting affects our:

- Alertness
- Productivity
- Decision-making
- Sleep - Circadian Rhythm

## SIMPLIFIED LIGHTING STRATEGY

	DAYTIME	EVENING
Intensity	300-500 lux, or 28-46 lumens/SF	10-150 lux, or 0.9- 14 lumens/SF
Color Temperature	8000-9000 K (very blue!)	2000 K (warm)

## 6. Manage Noise, Manage Stress

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### TARGET LEVELS

20 dB Bedrooms

40 dB Living rooms

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

# 7 . Link to Nature, Manage Stress

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## Biophilic Design: bringing nature indoors



- Views to outdoors
- Benches, roof gardens
- Murals, pictures
- Living walls
- Patterns from nature

Questions...

**Tools for Healthier  
Homes**