Maine Indoor Air Quality Council

IAQ & Energy 2020 CONFERENCE

Energy & Healthy Home Assessments

at the Same Time! It Is Possible!

Kevin Kennedy and Joe Medosch

Maine Indoor Air Quality Council

IAQ & Energy 2020 CONFERENCE



Children's Mercy KANSAS CITY

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HAYWARD SCORE

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Hayward Score
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Can you perform an Energy Assessment and Healthy Home Assessment at the Same Time?

Yes

Questions?

kkennedy@cmh.edu

JoeMedosch@gmail.com

Free home assessment resources here:

http://jmp.sh/16babVa

Thank You

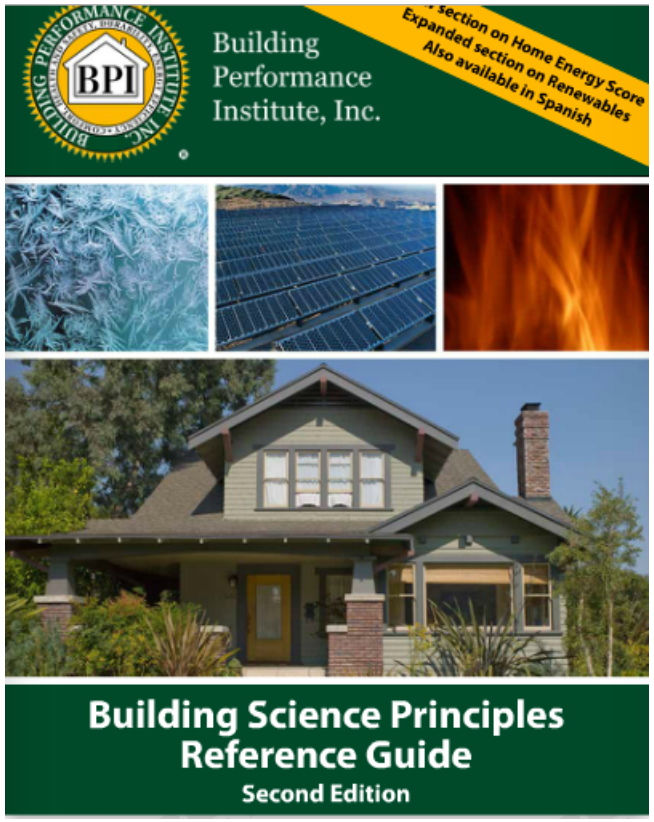
Can you perform an Energy Assessment and Healthy Home Assessment at the Same Time?

Yes

Maybe

No

Announcing…


Building
Performance
Institute, Inc.
section on Home Energy Score
Expanded section on Renewables
Also available in Spanish
Building Science Principles
Reference Guide
Second Edition


Building
Performance
Institute, Inc.
Healthy Housing Principles
Reference Guide
First Edition

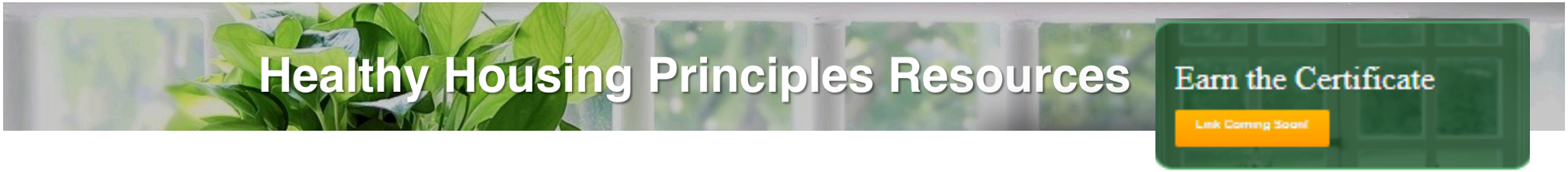
- Clean
- Dry
- Pest-Free
- Contaminant-Free
- Safe
- Ventilated
- Comfortable
- Maintained

Building Performance Institute, Inc.



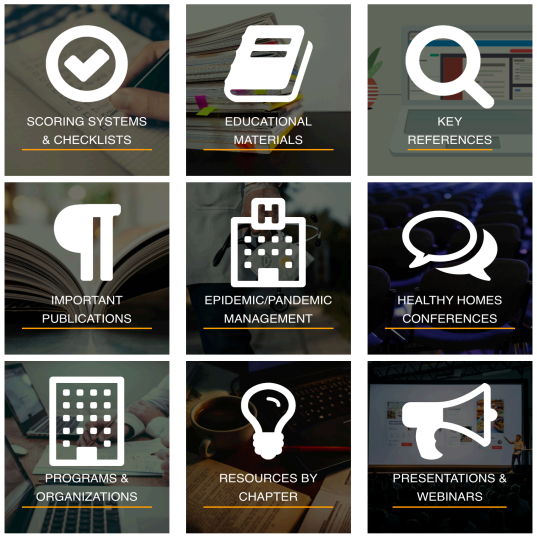


Healthy Housing Principles Reference Guide
First Edition

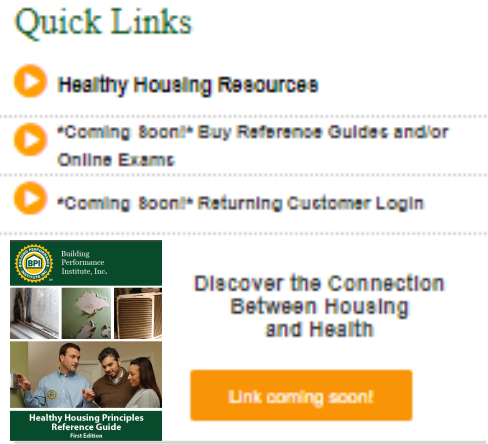


More information go to bpi.org/HHP

Download the full PowerPoint PDF - bpi.org/hhp



BUILDING PERFORMANCE INSTITUTE INC. BPI SM



Assumptions for this session

- Pre COVID-19 and POST COVID-19
- COVID-19 Virtual solutions
- Energy audits are from a Home Performance perspective
- Healthy home assessments are from a
  - Weatherization Plus Health State rebate program
  - BPI Certified Healthy Home Evaluator
  - Professional assessor trained on Healthy Housing Principles
  - Indoor Environmental Professional

Assumptions for this session

- Single auditor
- 2 or more auditor
- Auditor AND Community Healthy Worker (CHW)





EE and HHE at the Same Time

Additional time for:

- Moisture issues – It's Not Mold, It's a Moisture Issue
- Particulates – minimal time
- Dust mite collection – 15min
- Communication – Environmental Risk Assessment

What is a Healthy Home?

Healthy Housing is designed, constructed, maintained, and rehabilitated in a manner that is conducive to good occupant health.

This definition was used by the surgeon general in the call for action for healthy housing from 2009 and is established and used by HUD, CDC, and EPA.



We will all likely experience chronic health problems in our lifetime

>80% of older adults of one chronic disease

>70% of older adults on Medicare have two

- We don't manage our health problems in a hospital.
- We manage them in our home.







National Council on Aging, 2020

https://www.pexels.com/creative-commons-images/
Pexel photos are free for use

The Reference Guide Covers the Eight Healthy Home Principles


KEEP IT CLEAN


KEEP IT DRY


KEEP IT PEST-FREE


KEEP IT CONTAMINANT-FREE


KEEP IT SAFE


KEEP IT VENTILATED


KEEP IT COMFORTABLE


KEEP IT MAINTAINED

You can do EE and HH at the same time.

Healthy Outcomes

- Reduce Contaminant pathways
- Reduce Allergen & asthma triggers
- Reduce Pest entry points
- Reduces moisture
- Improves comfort
- Improves ventilation
- Improved durability

Energy Efficient Measures

Air Sealing

Air Sealing

Air Sealing

Air Sealing

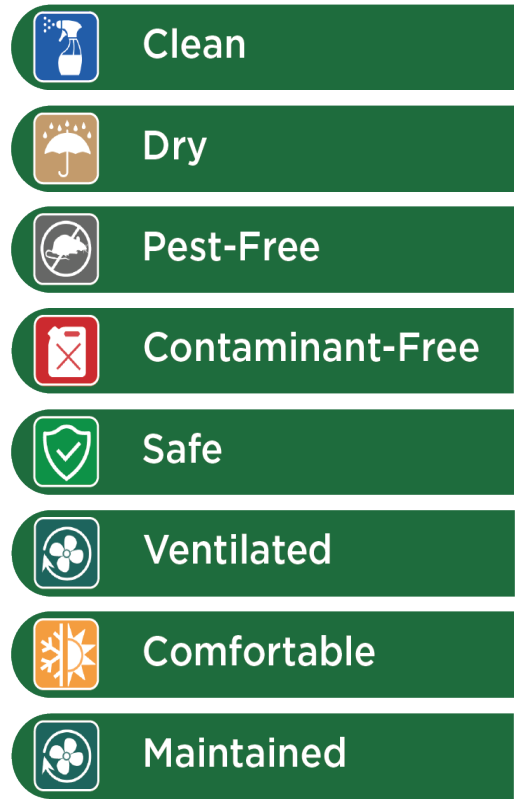
Greatest health savings opportunity

Exhaust fans Air Sealing

Insulation Air Sealing

Repairs & Homeowner education

Keep It Principles



Makes for happy, healthy comfortable users

Measure Its - *fundamentals*

- Temperature- ambient and surface (IR)
- Moisture Bulk and Vapor (Relative Humidity RH)
  - Dew Point Temperature
- Combustion gases (natural gas, methane and propane)
- Carbon Monoxide (CO) including low levels
- Water temperature
- Pressure and flow (manometer and flow devices)
- Particulates
- Lighting

What else…?

Measure Its – *advanced (part 2)*

- Nitrogen Dioxide (NO2)
- Carbon Dioxide (CO2)
- Mold and Pollens
- Allergens
- tVOCs
- Water contaminants
- Chemical composition (surfaces or air)
- and...

Knowledge = Certificate
HHP Healthy Housing Principles

Qualification = Credential
HHE Healthy Home Evaluator

Assessment

Diagnostics – don't leave home without!

Diagnostics

Brain – house as system

See – details

Smell – conditions

Hearing – conditions

Breathing – IAQ

Trust your gut!



Relating to client

Brain – clients needs to conditions in the home

Vision – relating to clients

Smell – (got nothing here)

Listening – clients

Communicating – clients

New Focus – Vision Test








Toxic Free Tips
for your home, school, work place, and community
Recipes For Safer Household Cleaners
Fresh idea! There are many uses for white distilled vinegar. Look at the flip side of each card.
Multi-purpose ☆ Tub & Sink ☆ Window & Mirror ☆ Toilet Bowl ☆ Drain ☆ Oven ☆ Bathroom Mold Remover
Toxic Free Tips
www.ecy.wa.gov/toxicfreetips
Ecology Publication No. 09-04-017, rev. August 2012
If you need a format for the visually impaired, call 360-407-6700. Persons with hearing loss, call 711. Persons with a speech disability, call 877-833-6341.
Multi-purpose greener Cleaner
(A multi-purpose cleaner that cleans and disinfects)
1 tablespoon soap (flakes, powder, or liquid) – not detergent
½ cup of white distilled vinegar
12 ounces (1 ½ cups) water
Add the ingredients to a clean 16-ounce spray bottle. Put the cap on and shake well.
DEPARTMENT OF ECOLOGY State of Washington
www.ecy.wa.gov/toxicfreetips
Cost per ounce:
This recipe: $.01
Commercial: $.12
Tub & Sink greener Cleaner
Baking soda
Liquid soap (not detergent). Castile or Murphy's Oil Soap are good options.
Use baking soda in place of scouring powder. Sprinkle it liberally on porcelain fixtures and rub with a wet rag. Add a little soap to the rag for more cleaning power. Rinse will to avoid leaving a hazy film. (Baking soda won't scratch the porcelain.
Baking soda and commercial scrubs cost about the same, but the baking soda is usually safer and more environmentally friendly.
DEPARTMENT OF ECOLOGY State of Washington
www.ecy.wa.gov/toxicfreetips
Window & Mirror greener Cleaner
¼ cup white distilled vinegar
16 ounces of water
Pour ingredients into a clean spray bottle. Spray on surface. Rub with a lint-free rag, such as a diaper or sheets of newspaper.
DEPARTMENT OF ECOLOGY State of Washington
www.ecy.wa.gov/toxicfreetips
Cost per ounce:
This recipe: $.08
Commercial: $.12


Lysol
DISINFECTANT
Kills viruses, bacteria, mold & mildew
Kills 99.9% of Germs in 30 seconds
Eliminates Odors
Cleans Large Carpet Areas
REMOVES RUST! ¡QUITA EL OXIDO!
BAR KEEPER FRIEND
Cleanser & Limpiador
Dust
Air sanitizer
febreze
EXTRA STRENGTH
Mr Clean
POWERS AWAY GREASE
CLASSIC
DAWN
apple blossom
TREAT NOW WASH LATER
SPRAY n WASH
Stain Stick
Orange GLO
Wood Furniture
EASY



Determine – it's dry and no significant damage to drywall or floor



Evidence of pests – roach trap and droppings. Occupant said they were eliminated years ago.



Even if eliminated years ago, these droppings and roach parts called “frass” can cause allergic reactions to occupants that have asthma or allergies.



EPA - free downloadable guide that states if the area is <3sqft it can be cleaned up soap and water. Many groups have expanded that to 10 sqft

https://www.epa.gov/mold/brief-guide-mold-moisture-and-your-home

KEEP IT SAFE

KEEP IT PEST-FREE

KEEP IT DRY



KEEP IT MAINTAINED

KEEP IT CLEAN

KEEP IT CONTAMINANT-FREE

All home walk throughs should now include a visual assessment of environmental exposure and safety risks

Use your 5 best assessment tools

Look

Listen

Smell

Touch

Taste



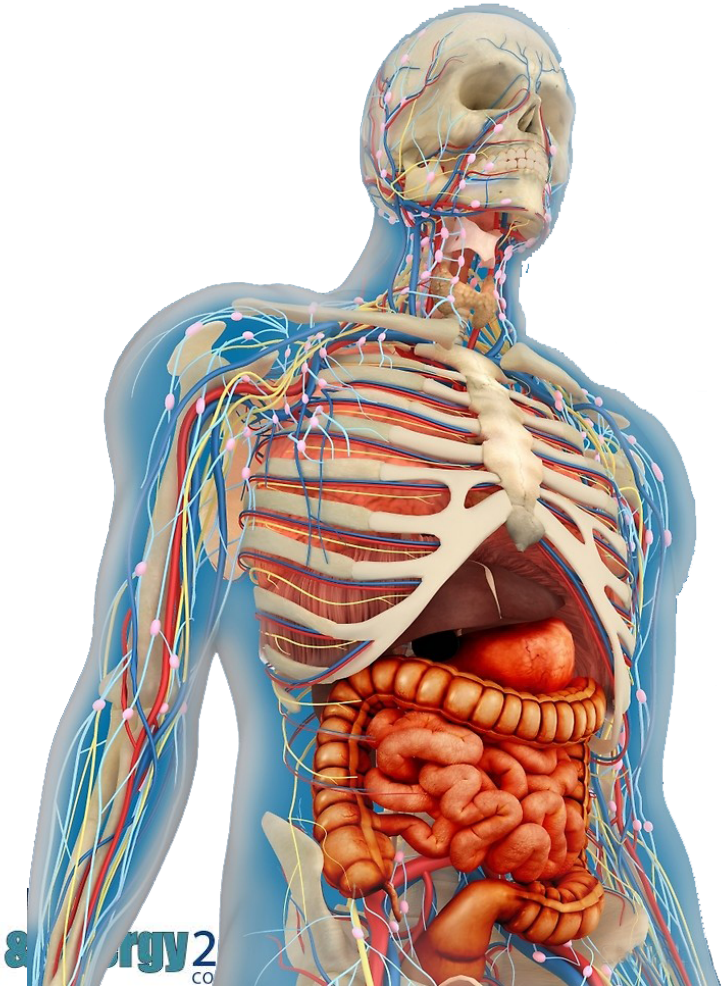


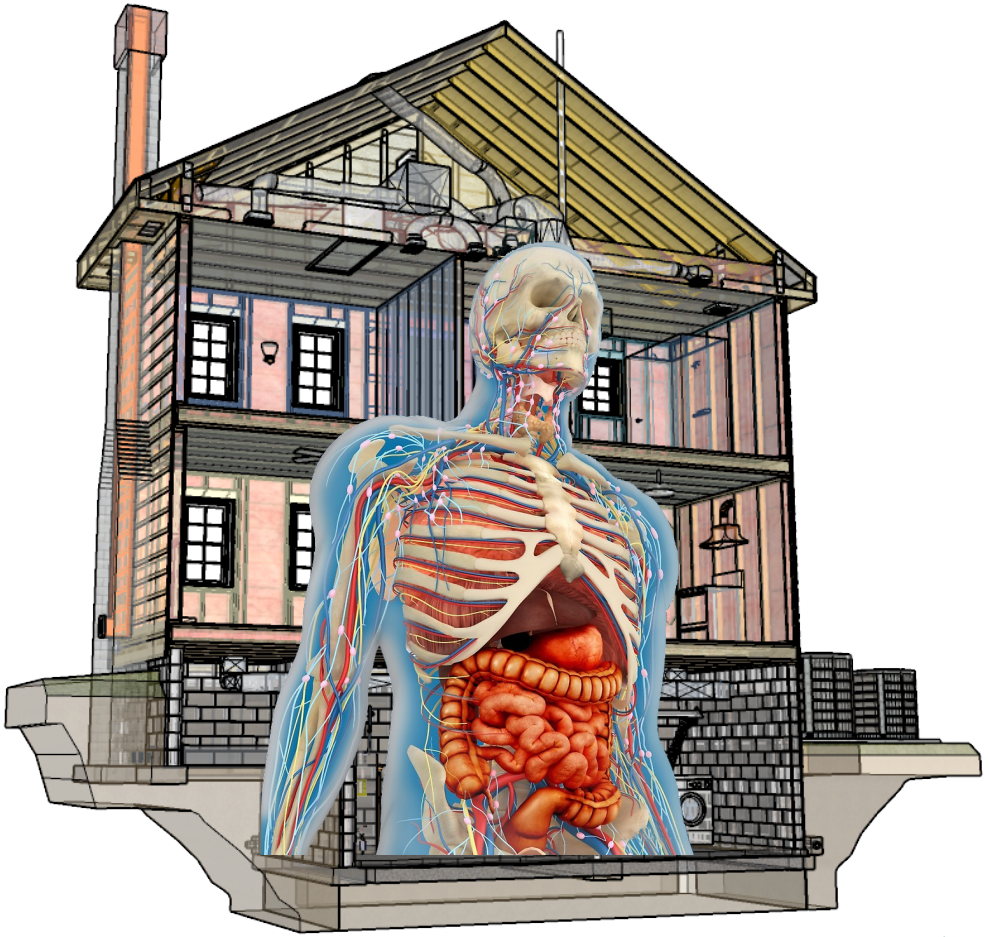
Looking in new locations for exposure concerns

Communicate with your client about best healthy home practices



Occupants are more complicated than the indoor environment.

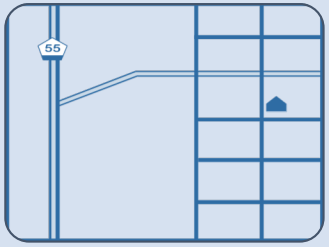




Other factors are important in trying to understand the signs and symptoms reported



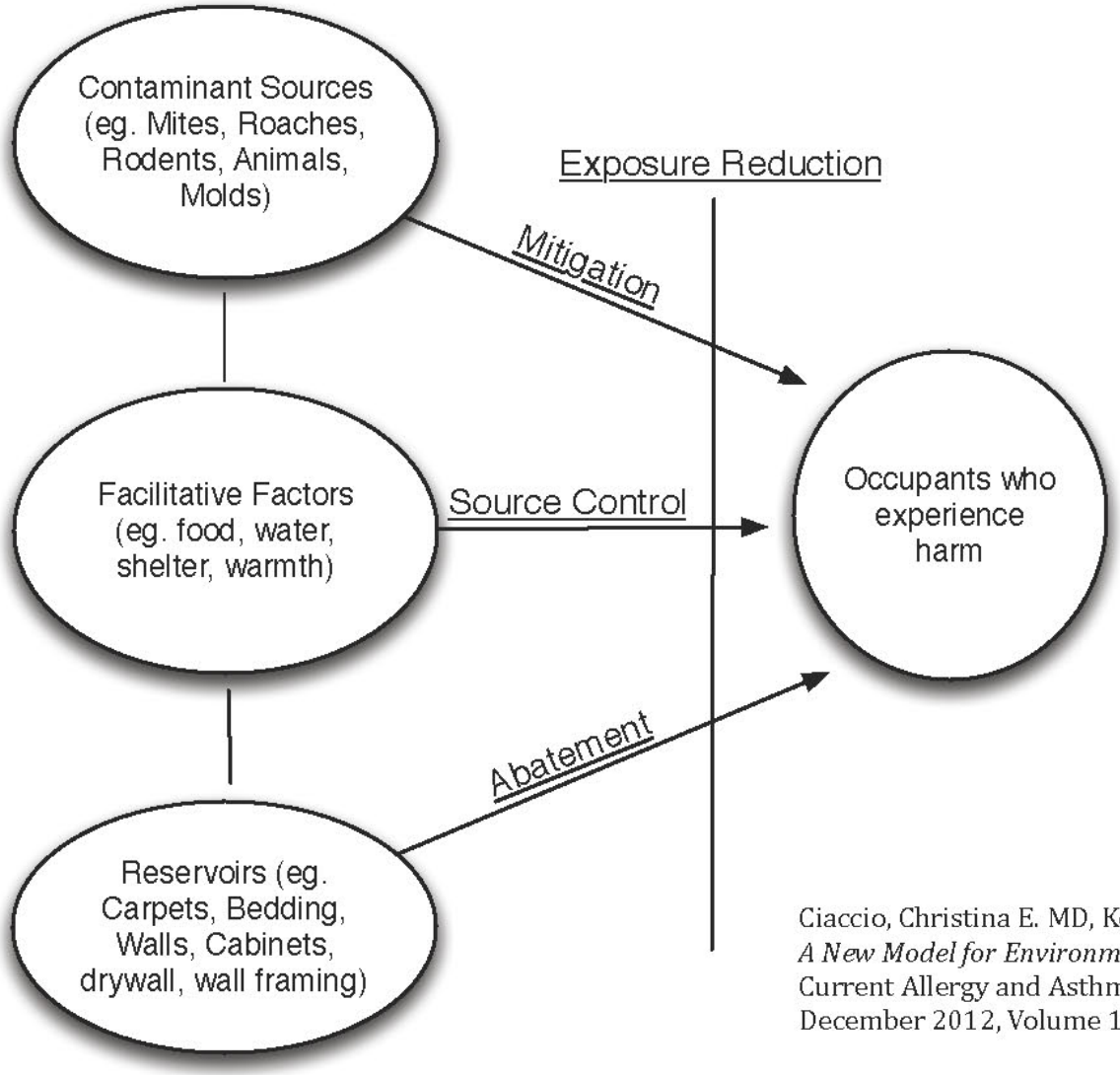
Timing



Location



Corroboration

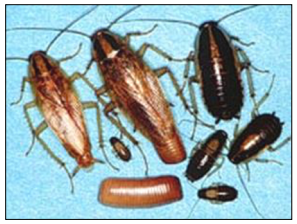


Healthy home environmental assessments are intended to guide interventions that reduce exposure

Ciaccio, Christina E. MD, Kevin Kennedy, MPH, Jay M. Portnoy, MD,
A New Model for Environmental Assessment and Exposure Reduction
Current Allergy and Asthma Reports
December 2012, Volume 12, Issue 6, pp 650-655

Home Hazards to Look For:
Top Environmental Triggers for Asthma






Asthma is a major chronic disease that has been increasing in prevalence in the US for the last 40 years.



Indoor combustion sources can be a significant health issue (CH_4, CO, NO_2 , H_2O?)

Examples of combustion sources



- Gas Appliances and Water Heaters
- Gas Furnaces
- Gas/Fuel Space Heaters
- Candles and Incense



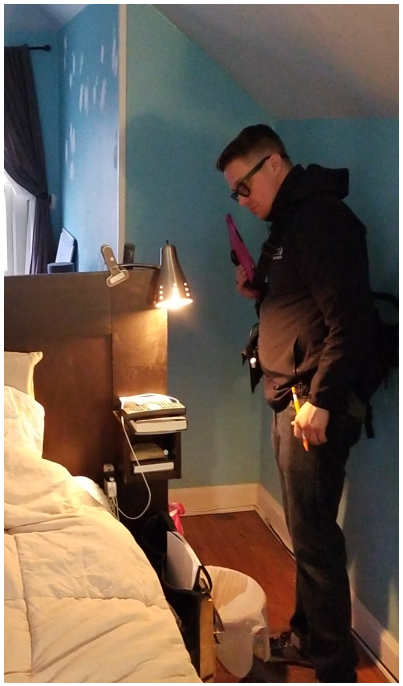




There are a variety of other contaminant sources to evaluate for exposure in homes



- Excessive dust
- Gases and fumes
- Household chemicals
- Fragrances
- Sewer gas
- Outdoor pollutants and fumes



It's important to ask about home management practices



Maintenance

- How often clean?
- Vacuum versus sweep?
- Vacuum upholstery?
- Pets in home?
- Food/water left out?



Household products

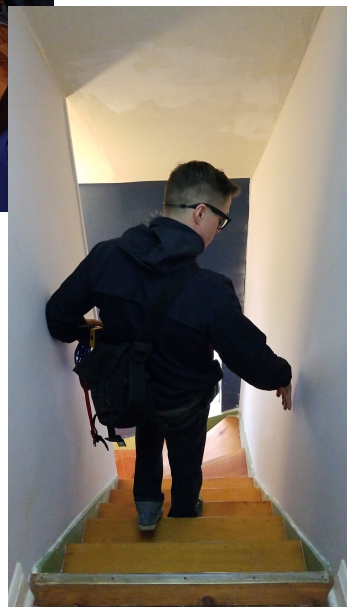
- What products used?
- How often?
- Read instructions?
- Body protection needed?

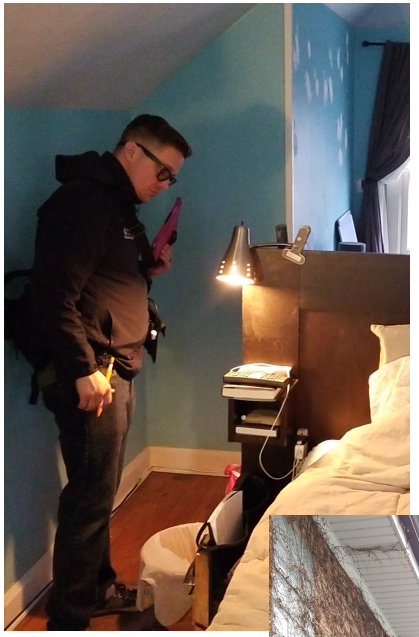
EE and HH at the Same Time













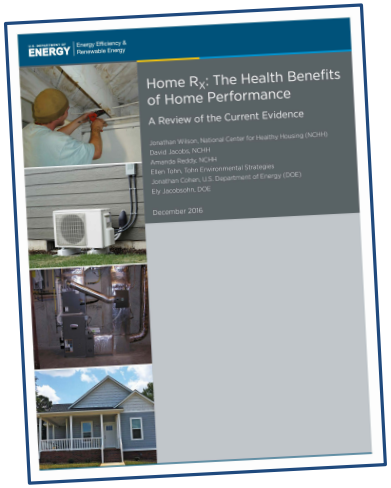
Childs Bedroom

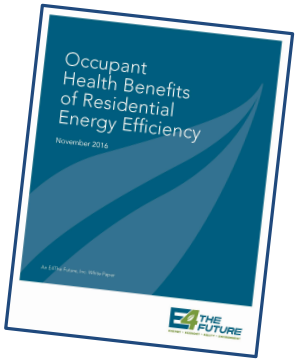


Air Sealing, Thermal upgrades and Heating Tune-Up

Contaminants Reduced through assessment, education and interventions

gases and particulates
less medications
dampness
mold
risk of cancer
arthritis
depression
energy bill
pollutants
days off work / school
cardiovascular issues
dust mites that are known to cause asthma
exposure to particulate and
contaminants that cause symptoms
use of chemicals





Improvements

savings / more income
general health
mental health
lower respiratory symptoms
blood pressure/hypertension or other
upper respiratory symptoms and headaches.
cooler climates improve comfort with less humidity
human health by reducing thermal stress
daily exposure to cleaner air
less stress and worry about “unknown” indoor air

most studies recommended IAQ Testing

Better quality of life

Remember for these health impacts it’s about long-term health impact and long-term costs in health care $$ and quality of life.

Energy Upgrades = Healthier Homes

- Residents w/ asthma reported **fewer hospitalizations and ED visits after weatherization**
- Children **missed fewer school days after their homes received energy efficiency services** from WAP
- Reducing energy costs means families have more money to spend on food, medicine & other essentials

https://nascsp.org/wp-content/uploads/2019/09/Final-Toolkit-Weatherization-Day-2019-Update.pdf

Energy Upgrades = Healthier Homes

- **After weatherization**, families' out-of-pocket **medical expenses decreased** by an average of **$514**
- **Weatherization returns $2.78** in health-and-safety related benefits **for every $1 invested**
- **Energy efficient homes lead to $82.4 billion in healthcare costs savings annually.**
- Weatherization leads to significant health benefits.

https://nascsp.org/wp-content/uploads/2019/09/Final-Toolkit-Weatherization-Day-2019-Update.pdf

Healthy Home Program Common Interventions Performed:

High Intensity Home Interventions (% of homes work performed)

- Furnace cleaning and maintenance - 93%
- Furnace repair - 64%
- Carpet removal/replacement - 23%,
- Carpet cleaning - 20%
- Bath exhaust ventilation - 23%
- Dryer exhaust ventilation - 21%
- Minor gutter repair – 20%
- Repair kitchen drain – 14%
- GFCI outlets installed near water sources- 47%
- Kitchen fire extinguisher – 71%
- Carbon monoxide alarms installed - 76%

Effective home interventions for asthma are well-known

Many interventions don't cost a lot

Cheapest - education & injury prevention

Most expensive - whole-house renovations

Table 5.1 Average Cost[a] of Interventions per Housing Unit[b,c]

Intervention Category	Cost per Housing Unit (Average)
Allergen reduction (n=17)	$1292
Education (n=16)	$211
Injury prevention (n=14)	$233
IPM (n=14)	$290
Lead hazard control (n=8)	$5312
Moisture control (n=13)	$1272
Weatherization (n=8)	$2266
Average total cost per unit for all interventions (n=10)	$3705

HUD Healthy Home Program Guidance Manual, 2014

Slips, Trips and Falls

- A combined injury prevention and weatherization service delivery is both feasible and effective.
- This study observed significant declines in falls (drop from 94% of study participant reporting a fall to 9%
- The median cost of the home modification repair work ($2,058) is reasonable if just one out of 17 interventions results in an avoided hospital stay (estimated at $35,000 for a hospital admission due to a fall).

1. Burns EB, Stevens JA, Lee RL, The direct costs of fatal and non-fatal falls among older adults U.S. J Safety Res 2016:58
2. Center for Disease Control and Prevention, National Center for Injury Prevention and Control Web-based Injury Statistics Query and Reporting System (WISQARS)

Assessing Home Environmental Health Risks

Home Visit from Community Health Worker and Healthy Home Evaluator	Community Health Worker	Healthy Home Evaluator*
Asthma or Respiratory Home Triggers		
Visual assessment: Moisture, pests, allergens, contaminants	✓	✓
Client engagement: tobacco smoke, allergens, pets, cleaning strategies, etc.	✓	✓
Full home moisture assessment: interior & exterior		✓
Heat/cooling system assessment & testing		✓
Ventilation assessment		✓
Assess thermal comfort: identify insulation & air sealing opportunities		✓
Recommends healthy home improvements		✓
Contaminants - Respiratory or Other Risks		
Carbon monoxide testing: heating systems and other potential CO exposure to residents		✓
Gas appliances testing		✓
Visual assessment: cleaning, painting, home products, etc.	✓	✓
Recommend smoke and carbon monoxide alarms	✓	✓
Recommends healthier home products	✓	✓
Medication Compliance and Respiratory Status		
Medication adherence (self-reported by patient)	✓	
Asthma control test (ACT) score: assess and document	✓	
Clinical referrals	✓	
Respiratory function testing	**	
Injury Risks		
Inadequate lighting in stairwells, hallways, porches, etc.	✓	✓
Trip and fall hazards: carpets, handrails, toilet height, etc.	✓	✓
Recommends home upgrades and actions to reduce risks	✓	✓

*Maintains building assessor credential (BPI Building Analyst)

** Depending on training and program design

Italics - Recommendation (rather than diagnosis/assessment)

https://nascsp.org/wp-content/uploads/2019/07/BPI-Home-Environmental-Assessment-Credential-Comparison.pdf





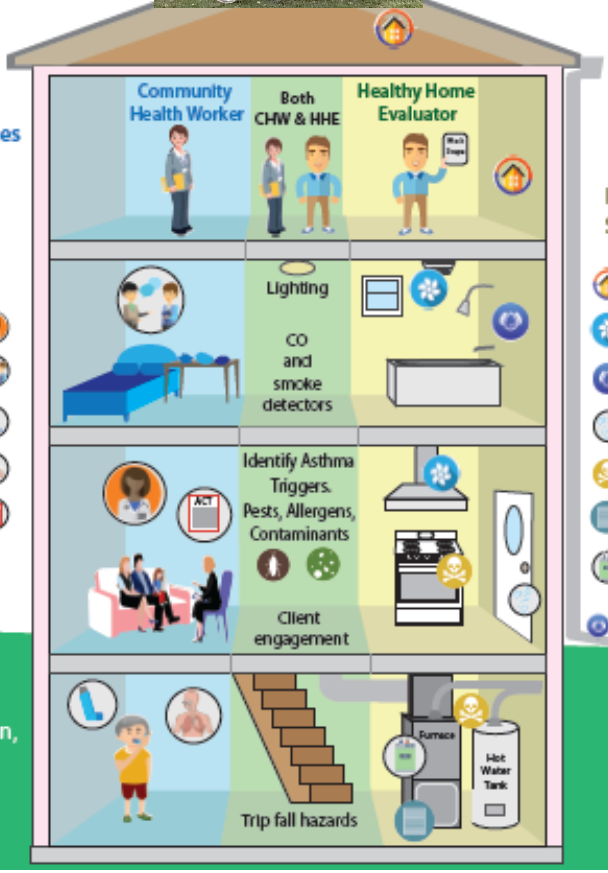


Community Health Worker

Patient Coaching for Health Issues

Medication Adherence

- Clinical referrals
- Patient coaching
- Medication adherence
- Respiratory function testing
- Asthma control test (ACT)



Healthy Home Evaluator*

*maintains Building Assessor Credential

Diagnostics to Create Work Scope for Home Improvements

- Thermal comfort evaluation
- Ventilation testing
- Whole house moisture assessment
- Air leakage & contaminant pathways
- Carbon monoxide testing
- Filtration evaluation
- Heating /cooling system testing

CHWs having strong competency in client coaching related to medication, behavior change and environmental home health risks

HHEs are skilled at testing and evaluating the building conditions and recommending repairs.

CHW Complete an Environmental Assessment and Education

- Ventilation
- Mold and moisture
- Fragrances
- Pets
- Pests
- General cleaning
  - Dust
  - Vacuum
  - Bedding
  - Household chemicals

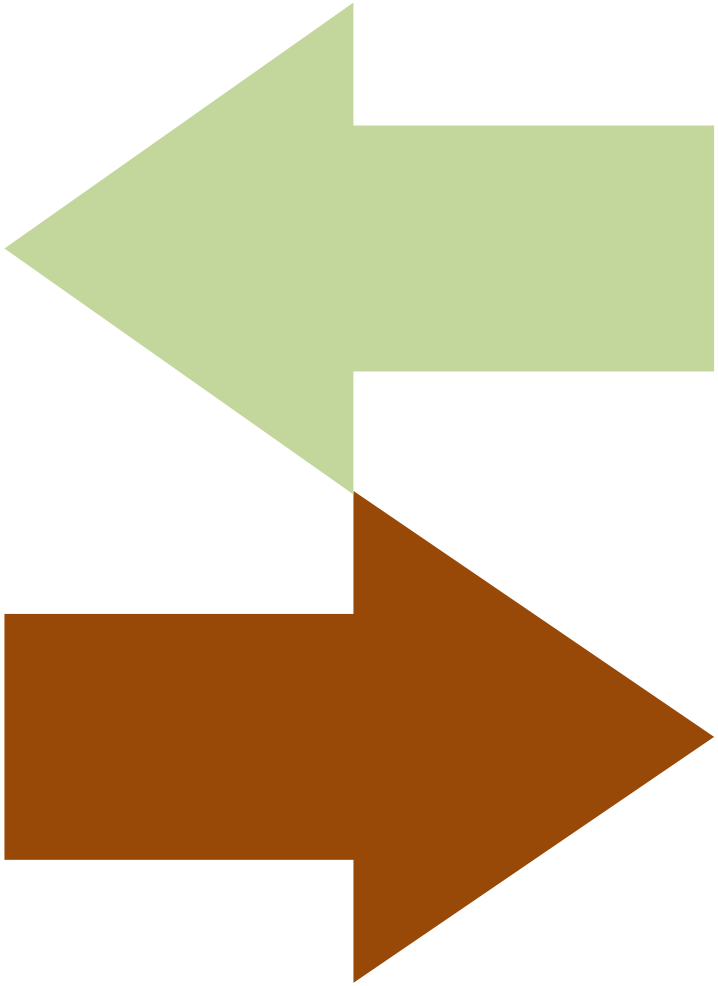




Energy Audit?

- Combustion safety
- Spillage test
- Carbon Monoxide tests
- CAZ testing
- Bathroom exhaust fan
- Kitchen exhaust fan
- Ventilation 62.2
- Mechanical ventilation
- Moisture damage
- Visible moisture growth
- Dryer vent
- And more ...

Non-Energy Efficient Measurments



Healthy Home Assessment

- Combustion safety
- Spillage test
- Carbon Monoxide tests
- CAZ testing
- Bathroom exhaust fan
- Kitchen exhaust fan
- Ventilation 62.2
- Mechanical ventilation
- Moisture damage
- Visible moisture growth
- Dryer vent
- And more ...

Energy Audit

- Introduction and confirm who you are.
- Overview of what will happen today.
- Access to all areas of the home.
- Paper work / signatures
- Resources and guides
    - Radon / Lead ...

Introduction





Healthy Home Assessment

- SAME
- Introduction and confirm who you are.
- Overview of what will happen today.
- Access to all areas of the home.

Community Health Worker

- Learn about their needs
- Potential health risks
    - Asthma / COPD

Energy Audit

- Condition of property
- Condition of interior
- Maintenance
- Behaviors
- Cleanliness
- Moisture concerns
- Defects
- Pets
- Deteriorated lead paint
- Pests

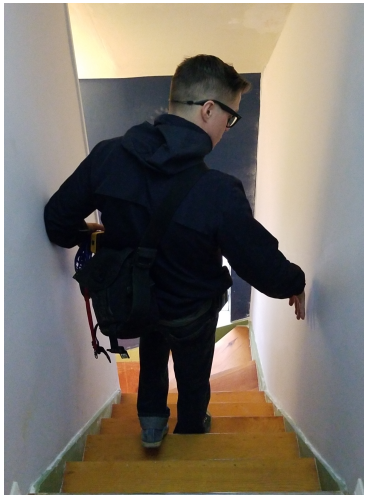
Visual Observations



Healthy Home Assessment

- Condition of flooring
- Condition of property
- Condition of interior
- Maintenance
- Behaviors
- Cleanliness
- Moisture concerns
- Defects
- Pets
- Deteriorated lead paint
- Pests

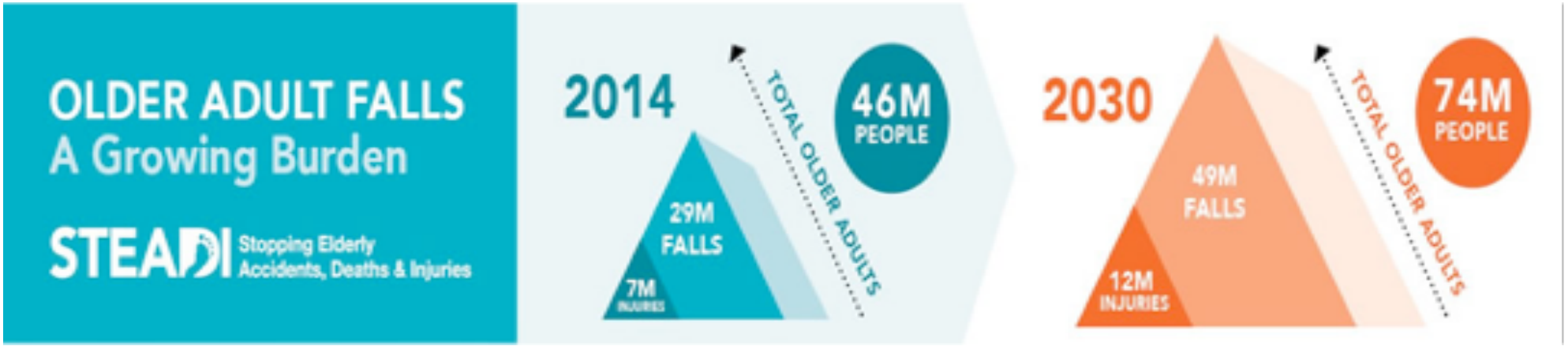
Energy Audit



Trip Fall

Healthy Home Assessment



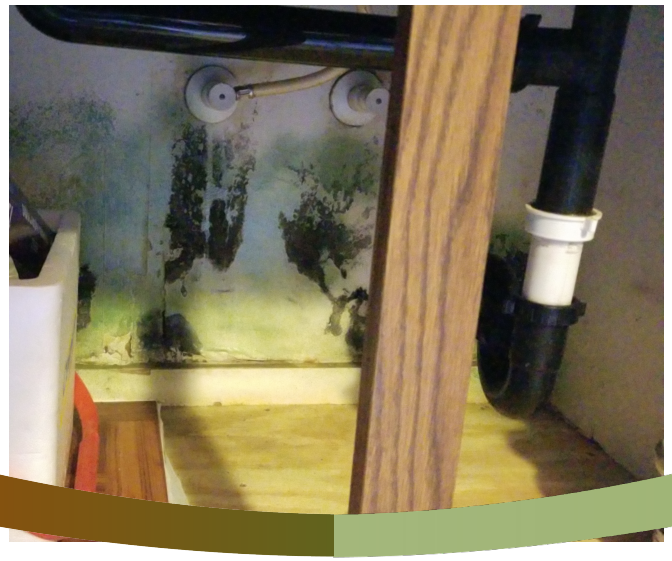


Energy Audit

- Observed moisture stains
- Signs of leaks
- Soft mushy floors
- Observed condensation
- Observed water damage
- Observed rotting
- Damp Smell
- Mold-like smell
- Observed suspect mold

Moisture Conditions





Healthy Home Assessment

- Observed moisture stains
- Signs of leaks
- Soft mushy floor
- Observed condensation
- Observed water damage
- Observed rotting
- Damp Smell
- Mold-like smell
- Observed suspect mold

Energy Audit

- Occupant discloses family members have asthma.
- What would you say to the occupant?

Contaminants – Chemical Exposure





Healthy Home Assessment

ewg
Know your environment.
Protect your health.
EWG.org



KEEP IT CONTAMINANT-FREE
KEEP IT SAFE
IAQ & Energy 2020 CONFERENCE

Children's Mercy KANSAS CITY
HAYWARD SCORE

Improvements, Upgrades, Installations, Interventions

Energy Audit

- Comfortable indoor temperatures
- Reduced energy cost
- Thermal comfort
-

Insulation Thermal Comfort





Healthy Home Assessment

- Comfortable indoor temperatures
- Lower indoor relative humidity
- Reduced allergens
- Reduced deaths due to temperature extremes
- Reduced symptoms of respiratory disease
- General emotional health
- Mental health

KEEP IT COMFORTABLE

IAQ & Energy 2020 CONFERENCE

Image source: J West / Anthony Cox

Children's Mercy KANSAS CITY

HAYWARD SCORE

Energy Audit

- Comfortable indoor temperatures
- Reduced energy cost
- Lower indoor relative humidity
- Thermal comfort
-

Air Sealing





Healthy Home Assessment

- Reduce exposure pathways
- Comfortable indoor temperatures
- Lower indoor relative humidity
- Reduced allergens
- Reduced deaths due to temperature extremes
- Reduced symptoms of respiratory disease

KEEP IT PEST-FREE

KEEP IT DRY

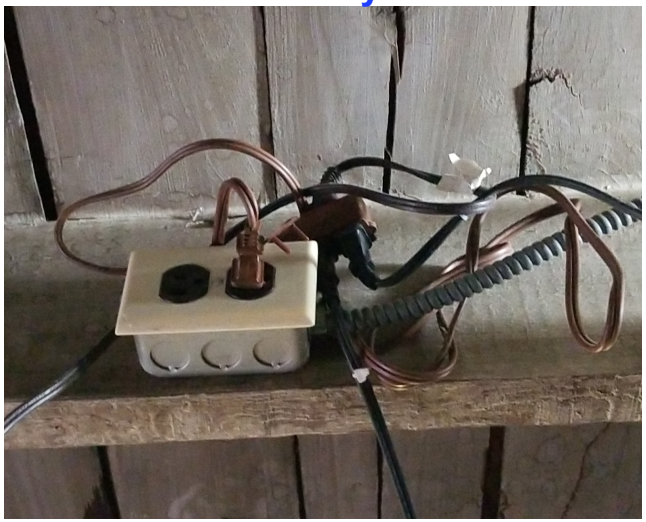
KEEP IT CONTAMINANT-FREE

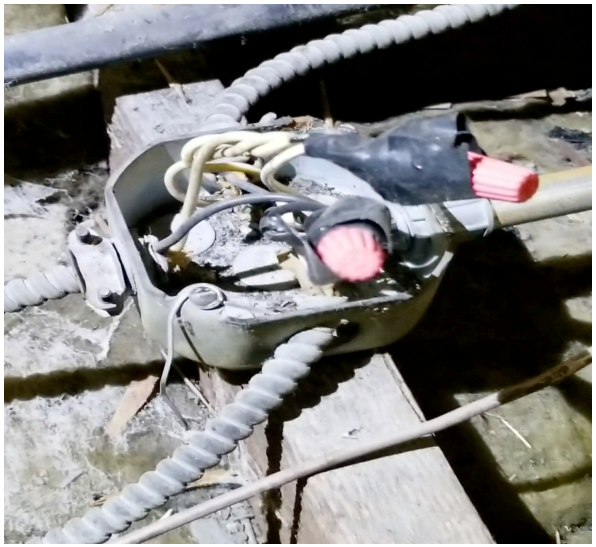
KEEP IT COMFORTABLE

Energy Audit

- a
- b
- c
- d
- e
- f

Safety





Healthy Home Assessment

- 1
- 2
- 3
- 4
- 5
- 6

KEEP IT SAFE

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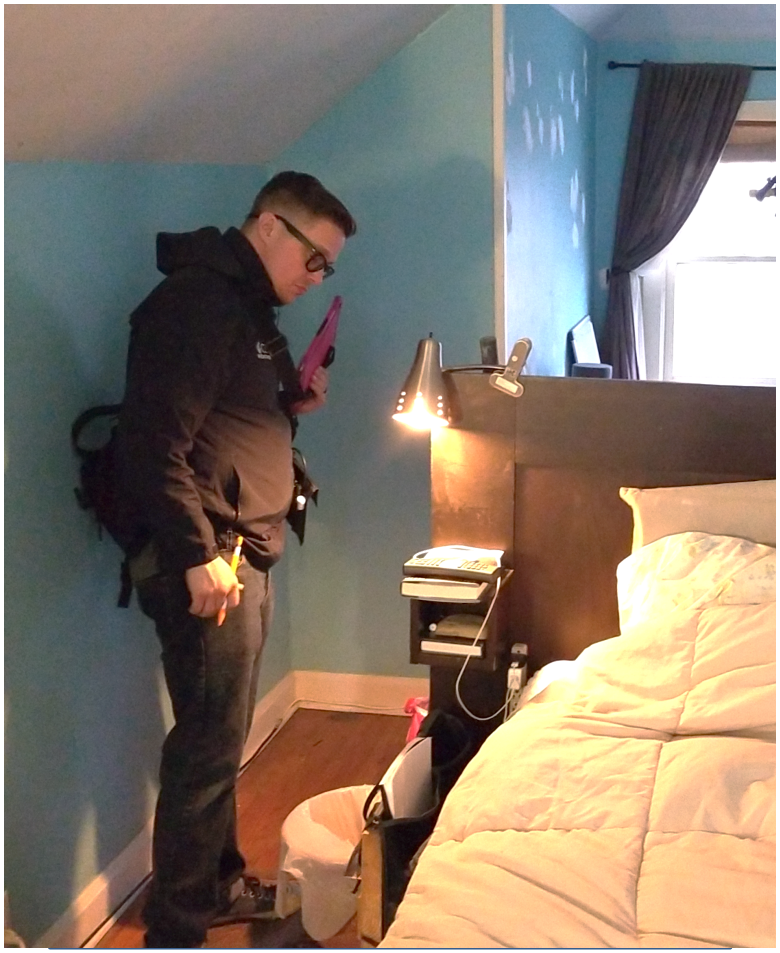
HAYWARD SCORE

Energy Audit

- a
- b
- c
- d
- e
- f

Asthma / Allergy conditions



Healthy Home Assessment

- 1
- 2
- 3
- 4
- 5
- 6

KEEP IT CONTAMINANT-FREE

KEEP IT CLEAN

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HAYWARD SCORE

Diagnostics

Energy Audit

- a
- b
- c
- d
- e
- f

Gas leak detection



Carbon Monoxide Test

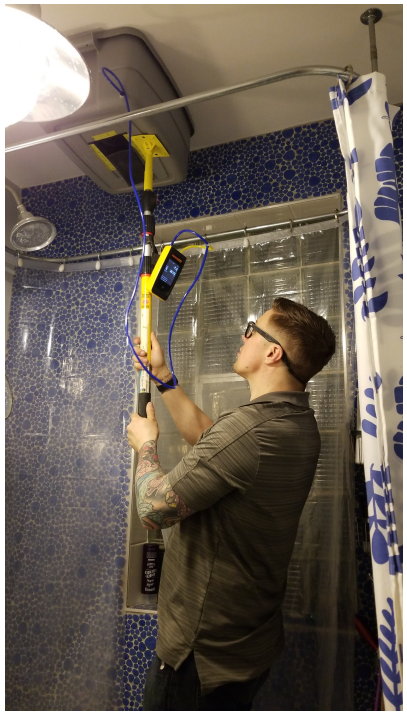


Healthy Home Assessment

- 1
- 2
- 3
- 4
- 5
- 6

KEEP IT CONTAMINANT-FREE

Energy Audit



Exhaust Fan Testing



Return air or Exhaust fans

Average the readings

Healthy Home Assessment



Hot wire anemometer

KEEP IT VENTILATED

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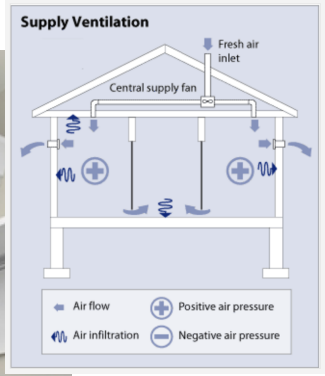
HAYWARD SCORE

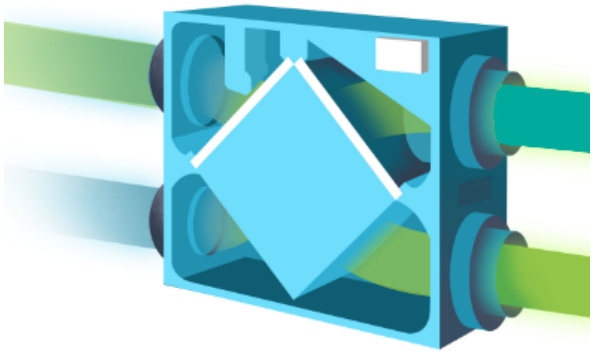
Energy Audit

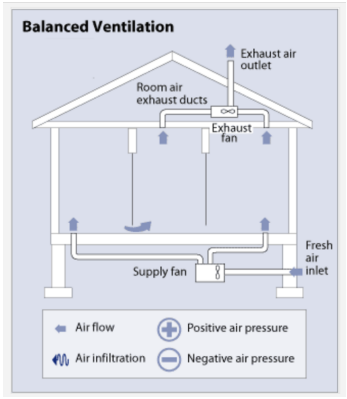
- Actually an energy penalty
- Typically Exhaust only
- Follow ASHRAE 62.2 X

Ventilation









Healthy Home Assessment

- Balanced Ventilation has significant improvements including a reduction in respiratory triggers such as formaldehyde and other VOCs, airborne mold and phthalates, carbon dioxide as well as radon and fewer asthma/respiratory symptoms.
- And associated with lower dust mite levels.

KEEP IT VENTILATED

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HAYWARD SCORE

Energy Audit

- Determine infiltration / air leakage
- Used to calculate SIR
- Find air leakage location
- Measure ZPD
- Air leakage = heat transfer
- See air sealing

Blower Door Test



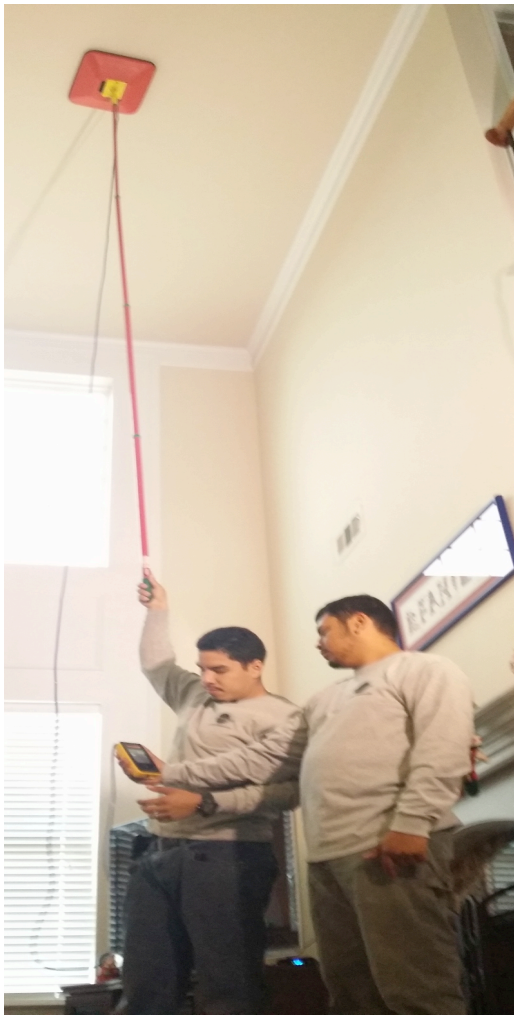
Healthy Home Assessment

- Exposure pathway measurement device
- Measure connectivity between locations with contaminants like garage, attic and crawlspace
- Tighter homes can reduce or contain moisture
- Tight homes require enhanced ventilation

Energy Audit

- Determine the pressure boundary
- Confirm if penetrations are sealed

Pressure Boundary Test



Healthy Home Assessment

- Exposure pathway locations

Sampling? – Something to consider



Indoor Air Test
VOC, formaldehyde ...

Vacuum Sample
for settled dust



Diagnostics – Advanced













Particulate Counter





Indoor Air Measurments



Chemicals & VOC Sampling Devices

Particle Counting

- Total Particle Count is usually performed using photometry (µg/m3) or optical particle counters (cts/m3)
  - Particle ranges 0.3um – 25um.





- Ultrafine Particle Counting is usually performed using agglomeration by condensation (cts/m^3). Does not measure size
  - Particle sizes <0.1 um.



Energy Audit

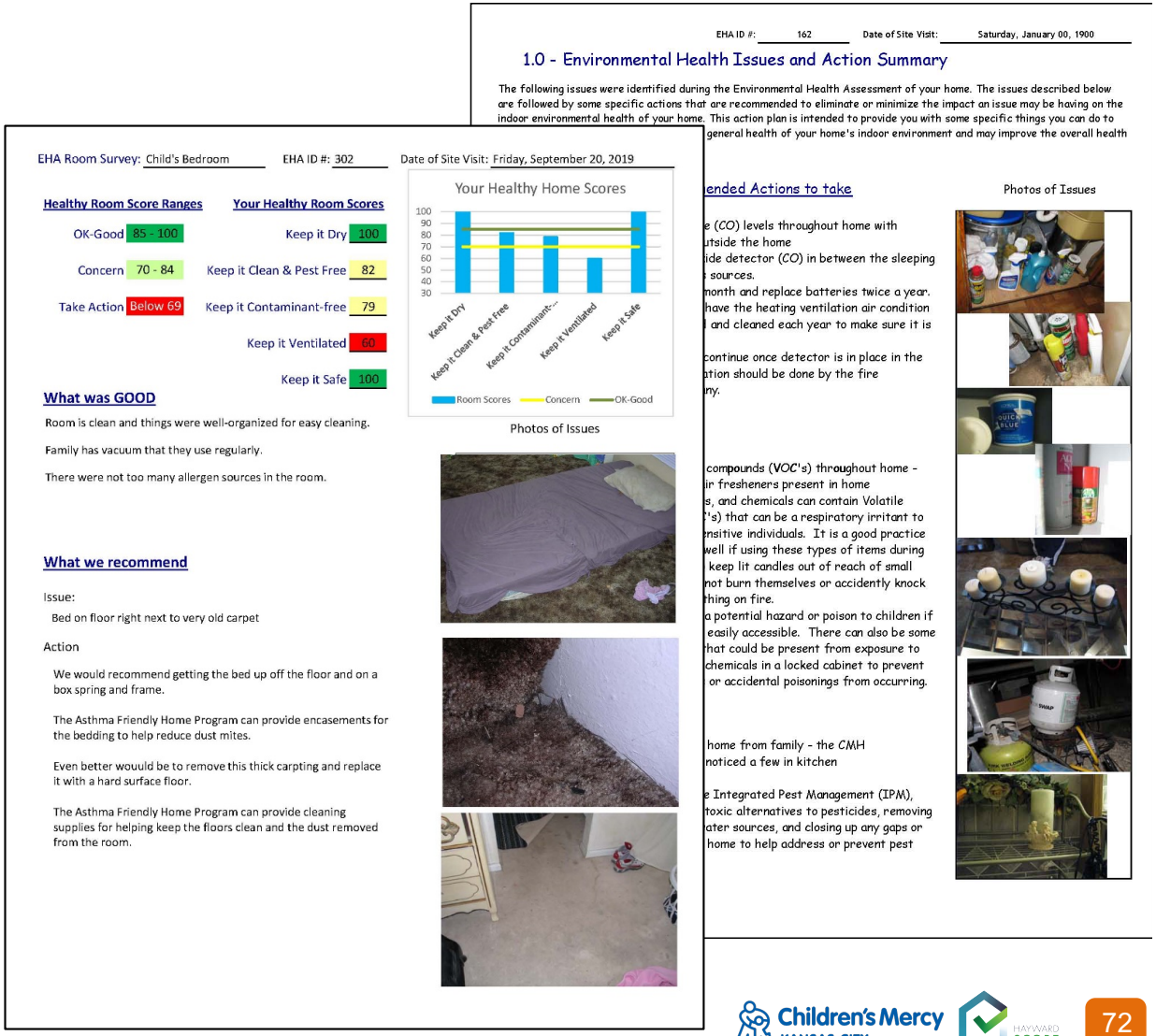
Communication & Education

Healthy Home Assessment



Assessment Report includes a healthy home action plan for family-

- Connects home assessment to education and interventions
- Identifies what our HH program will do and what the family is asked to do
- Prioritizes interventions based on hazard risk



EHA ID #: 162 Date of Site Visit: Saturday, January 00, 1900

1.0 - Environmental Health Issues and Action Summary

The following issues were identified during the Environmental Health Assessment of your home. The issues described below are followed by some specific actions that are recommended to eliminate or minimize the impact an issue may be having on the indoor environmental health of your home. This action plan is intended to provide you with some specific things you can do to general health of your home's indoor environment and may improve the overall health

ended Actions to take

Photos of Issues

e (CO) levels throughout home with
utside the home
ide detector (CO) in between the sleeping
sources.
nonth and replace batteries twice a year.
have the heating ventilation air condition
and cleaned each year to make sure it is

continue once detector is in place in the
ation should be done by the fire
ny.

compounds (VOC's) throughout home -
ir fresheners present in home
s, and chemicals can contain Volatile
's) that can be a respiratory irritant to
nsitive individuals. It is a good practice
well if using these types of items during
keep lit candles out of reach of small
not burn themselves or accidently knock
thing on fire.
a potential hazard or poison to children if
easily accessible. There can also be some
that could be present from exposure to
chemicals in a locked cabinet to prevent
or accidental poisonings from occurring.

home from family - the CMH
noticed a few in kitchen

e Integrated Pest Management (IPM),
toxic alternatives to pesticides, removing
ater sources, and closing up any gaps or
home to help address or prevent pest

EHA Room Survey: Child's Bedroom EHA ID #: 302 Date of Site Visit: Friday, September 20, 2019

Healthy Room Score Ranges		Your Healthy Room Scores	
OK-Good	85 - 100	Keep it Dry	100
Concern	70 - 84	Keep it Clean & Pest Free	82
Take Action	Below 69	Keep it Contaminant-free	79
		Keep it Ventilated	60
		Keep it Safe	100

Your Healthy Home Scores

Keep it Dry, Keep it Clean & Pest Free, Keep it Contaminant-..., Keep it Ventilated, Keep it Safe

Room Scores, Concern, OK-Good

Photos of Issues

What was GOOD

Room is clean and things were well-organized for easy cleaning.

Family has vacuum that they use regularly.

There were not too many allergen sources in the room.

What we recommend

Issue:

Bed on floor right next to very old carpet

Action

We would recommend getting the bed up off the floor and on a box spring and frame.

The Asthma Friendly Home Program can provide encasements for the bedding to help reduce dust mites.

Even better wouuld be to remove this thick carpting and replace it with a hard surface floor.

The Asthma Friendly Home Program can provide cleaning supplies for helping keep the floors clean and the dust removed from the room.





There are some misunderstood challenges with health data collection and its use

- Anyone can educate and advocate about the poor housing conditions that are known health hazards
- Association is not causation - connecting environmental conditions to direct health impacts is a high bar. Focus on environmental improvement
- Be familiar with the research that supports any recommendations for home interventions.
- Seek training that provides new science and evidence-based recommendations

For any risk and liability issues, always seek the advice of your legal counsel

Indoor airPLUS for Existing Homes

Why does indoor air quality matter?

People are increasingly concerned about mold, radon, carbon monoxide, and toxic chemicals in their homes. Poor indoor air quality can lead to eye irritation, headaches, allergies, respiratory problems such as asthma, and other serious health problems.

EPA studies show that levels of many indoor air pollutants can be two to five times higher than outdoor levels. And since most people spend close to 90% of their time indoors, keeping indoor pollution levels as low as possible is the right thing to do for you and your family.

How can building practices help improve indoor air quality?

Builders can use a variety of construction practices and technologies to decrease the risk of poor indoor air quality, including careful selection and installation of building materials; heating, ventilating, and air-conditioning (HVAC) systems; combustion-venting systems; and moisture control techniques.

It's not easy for homebuyers to keep track of all the preferred construction details that lead to improved indoor air quality. That's why EPA created the Indoor airPLUS label. Ask for it in your next new home.

Coming Soon: Indoor airPLUS for Existing Residential Buildings



Only ENERGY STAR Certified Homes are eligible to earn the Indoor airPLUS label.

Office of Air and Radiation
EPA 402/F-14/001 | February 2014

www.epa.gov/indoorairplus

EPA

ask about Indoor airPLUS

Breathe Easy In Your NEW Indoor airPLUS Home

Designed and built for improved indoor air quality and energy efficiency.



All Indoor airPLUS qualified homes also meet strict guidelines for energy efficiency set by ENERGY STAR, the nationally-recognized symbol for energy efficiency.

LEARN MORE AT energystar.gov


FOR
DATE
Rx
Get a Healthy
Home Evaluation
ASAP!
M.D.
DISPENSE AS WRITTEN

Maine Indoor Air Quality Council

IAQ & Energy 2020 CONFERENCE



Children's Mercy KANSAS CITY

Kevin Kennedy
Program Director
Environmental Health Program
Children's Mercy Kansas City
kkennedy@cmh.edu



HAYWARD SCORE

Joe Medosch
Healthy Building Scientist
Hayward Score
www.HaywardScore.com
jmedosch@haywardscore.com

Questions?

kkennedy@cmh.edu

JoeMedosch@gmail.com

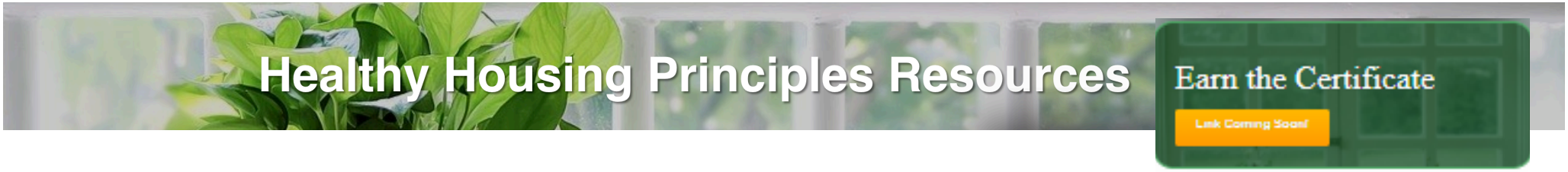
Free home assessment resources here:

http://jmp.sh/16babVa

Thank You

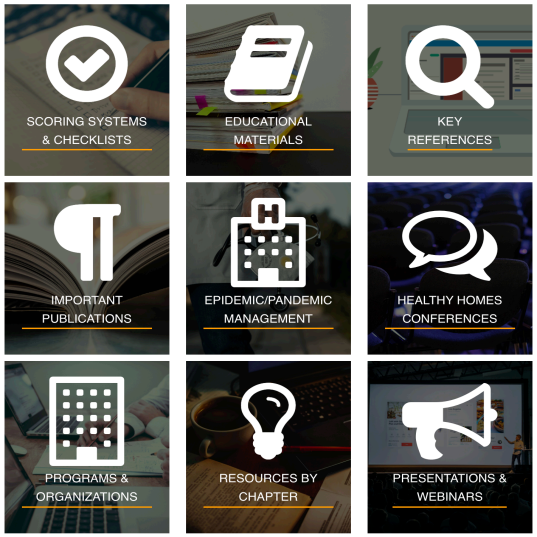
Be The Source

Of The Source



More information go to bpi.org/HHP

Download the full PowerPoint PDF - bpi.org/hhp



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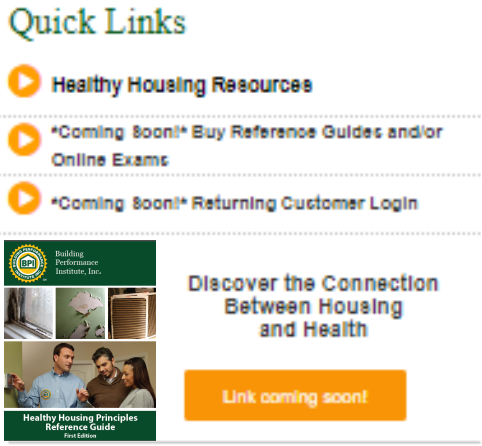




NEVER HOME ALONE

From MICROBES to MILLIPEDES,
CAMEL CRICKETS, and HONEYBEES,
the NATURAL HISTORY of WHERE WE LIVE

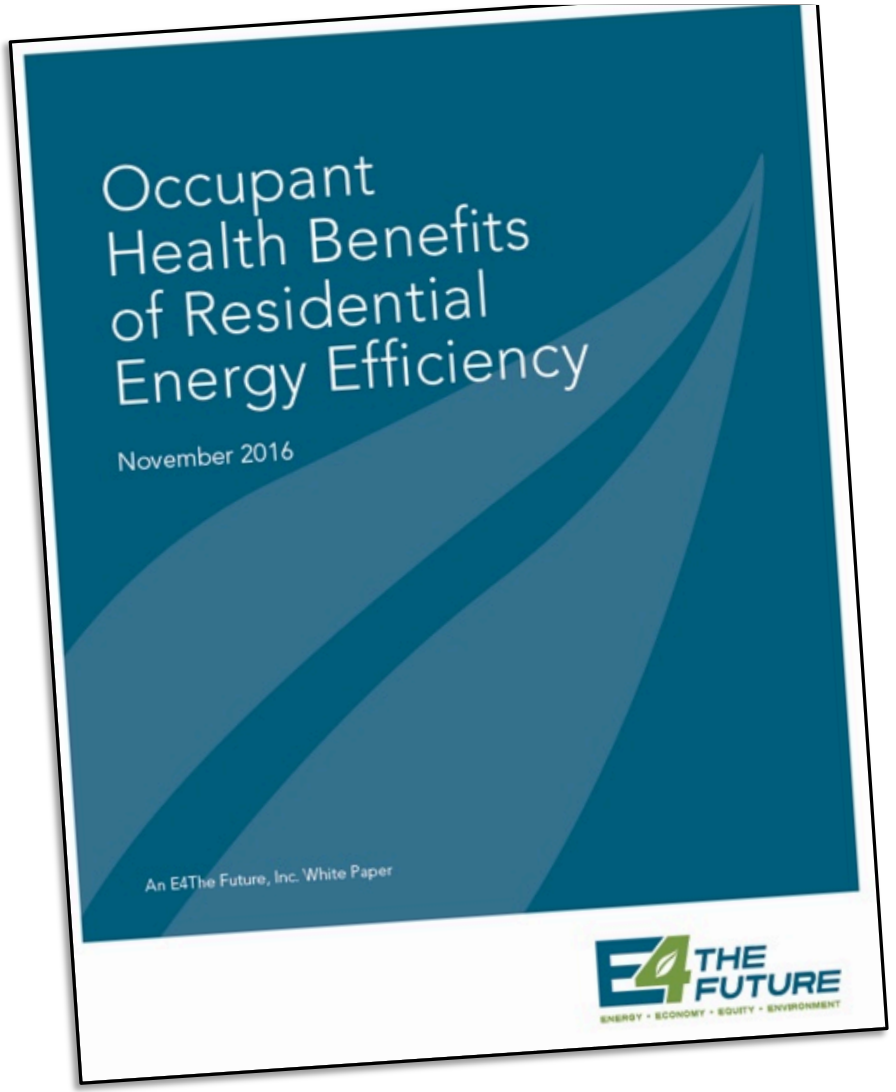
ROB DUNN

Healthy Housing Manuals / resources



No Specific Protocol / Standard

Occupant Health Benefits of Residential Energy Efficiency

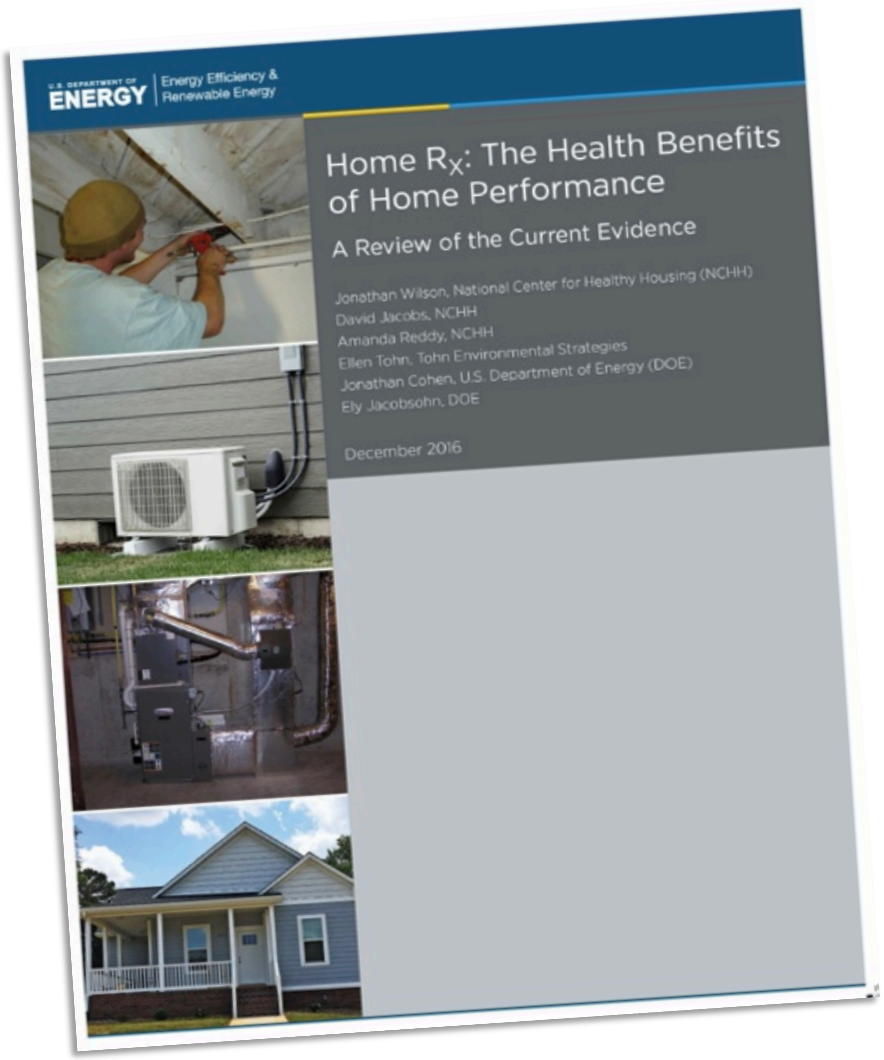


https://e4thefuture.org/wp-content/uploads/2016/11/Occupant-Health-Benefits-Residential-EE.pdf

New EPA Home RX - The Health Benefits of Home Performance

Research and justification

- Health & Energy
- Health Outcomes
- Case studies



https://betterbuildingssolutioncenter.energy.gov/sites/default/files/attachments/Home%20Rx%20The%20Health%20Benefits%20of%20Home%20Performance%20-%20A%20Review%20of%20the%20Current%20Evidence.pdf

Energy-Plus-Health Playbook

Section 3: Choosing the Energy-Plus-Health Program Model that is Right for You



For readers who plan to develop Energy-Plus-Health programs and need support finding the right program model and tips for getting started. This section reviews three program tiers and helps readers determine which is the best fit for their situation.

Energy-Plus-Health Playbook



July 2019

VEIC
veic.org

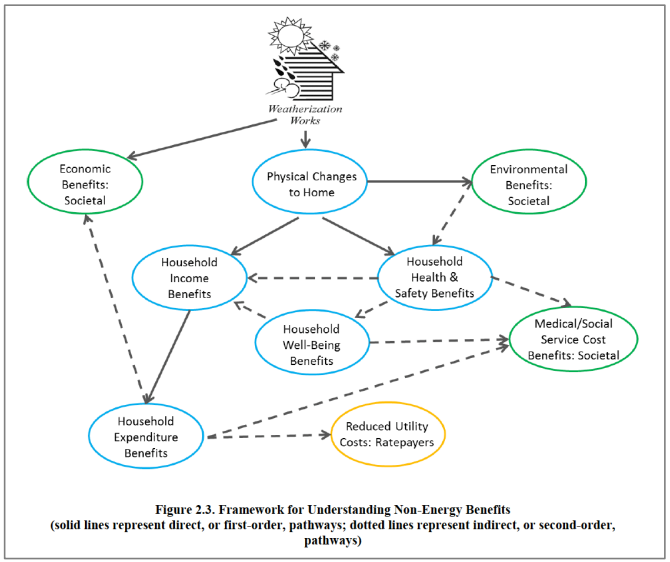


Figure 2.3. Framework for Understanding Non-Energy Benefits
(solid lines represent direct, or first-order, pathways; dotted lines represent indirect, or second-order, pathways)

Table E.S.1. Present Value of Per Unit and WAP Program Health-Related Benefits of Weatherization

	Total	Total (Value of Life Excluded)	Tier 1		Tier 2		Tier 3	
			Societal	Household	Societal	Household	Societal	Household
Asthma	$2,009	-	$1,852	$157				
Thermal Stress-Cold	$3,911	$172	$3,892	$19				
Thermal Stress-Heat	$870	$85	$855	$15				
Food Assistance Reduction	$832	-	$832					
Reduction in Missed Days at Work	$201	-	$40	$161				
CO poisoning	$154	$7			$153	$1		
Improvement in Prescription Adherence	$1,929	-			$1,929	-		
Reduction in Use of Short-Term Loans	$71	-			-	$71		
Home Fires	$831	$175					$768	$63
Increased Productivity at Work Due to Improved Sleep	$1,813	-					$1,813	-
Increased Productivity at Home Due to Improved Sleep	$1,329	-					-	$1,329
Reduction in Low-Birth Weight Babies from Heat-or-Eat Dilemma	$198	-					$198	-
Total by Tiers (Present Value Per Unit)	$14,148	-	$7,471	$352	$2,082	$72	$2,779	$1,392
			$7,823		$2,154		$4,171	
Total by Tiers (Present Value WAP Program)	$1,136,883,221	-	$600,333,094	$28,295,957	$167,310,541	$5,766,863.04	$223,324,724.16	$111,878,910.72
			$628,629,051		$173,077,404		$335,176,766	

Health and Household-Related Benefits Attributable to the Weatherization Assistance Program



Bruce Tonn
Erin Rose
Beth Hawkins
Brian Conlon

September 2014

OAK RIDGE NATIONAL LABORATORY
MANAGED BY UT-BATTELLE FOR THE US DEPARTMENT OF ENERGY

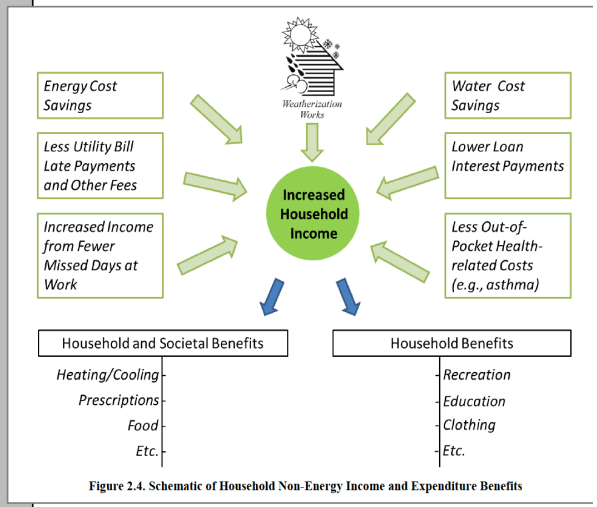


Figure 2.4. Schematic of Household Non-Energy Income and Expenditure Benefits

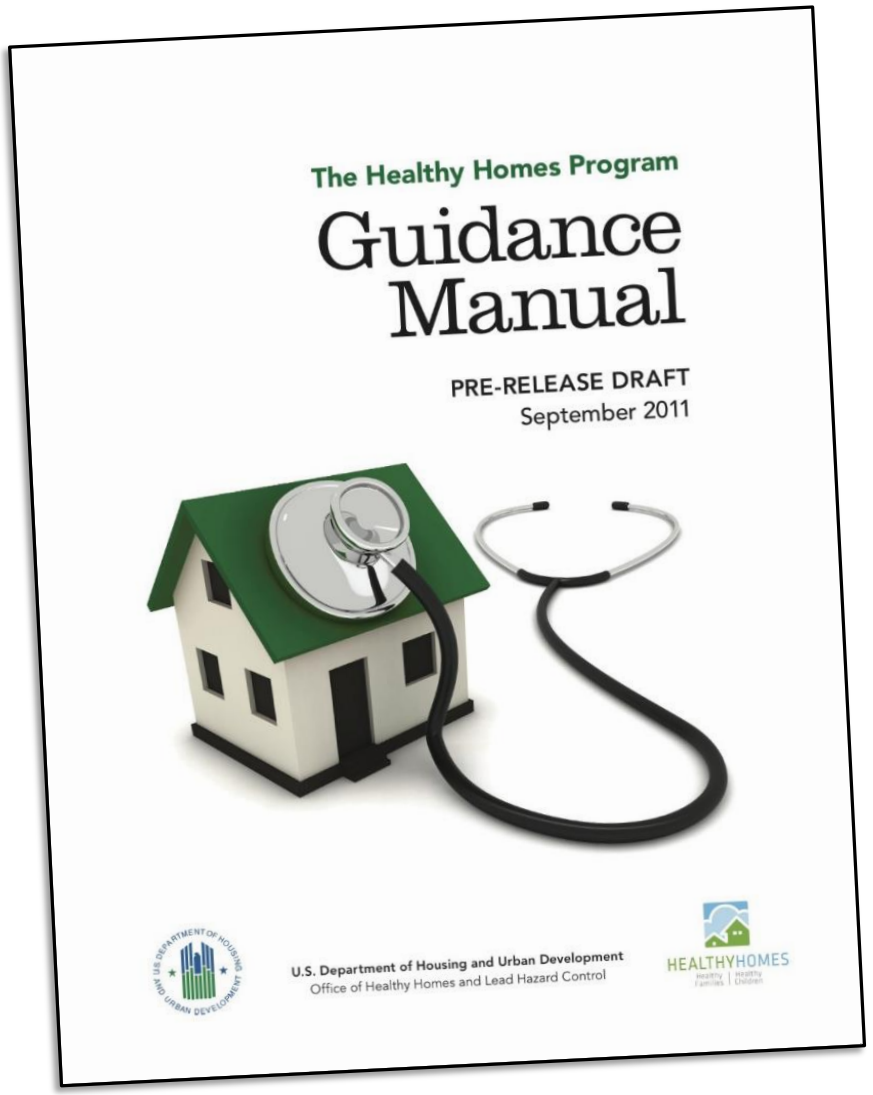
https://weatherization.ornl.gov/wp-content/uploads/pdf/WAPRetroEvalFinalReports/ORNL_TM-2014_345.pdf

A Guide for Healthy Home Program Development and Operations

Fully comprehensive guide

- Program overview
- Interview tools
- Assessment chapter
- Intervention chapter
- Diagnostic guidance

http://portal.hud.gov/hudportal/HUD?mode=disppage&id=HHGUIDANCEMANUAL



Interventions

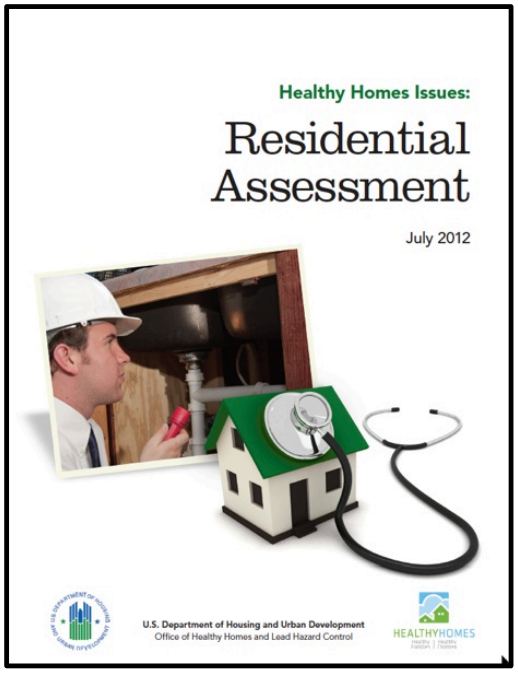
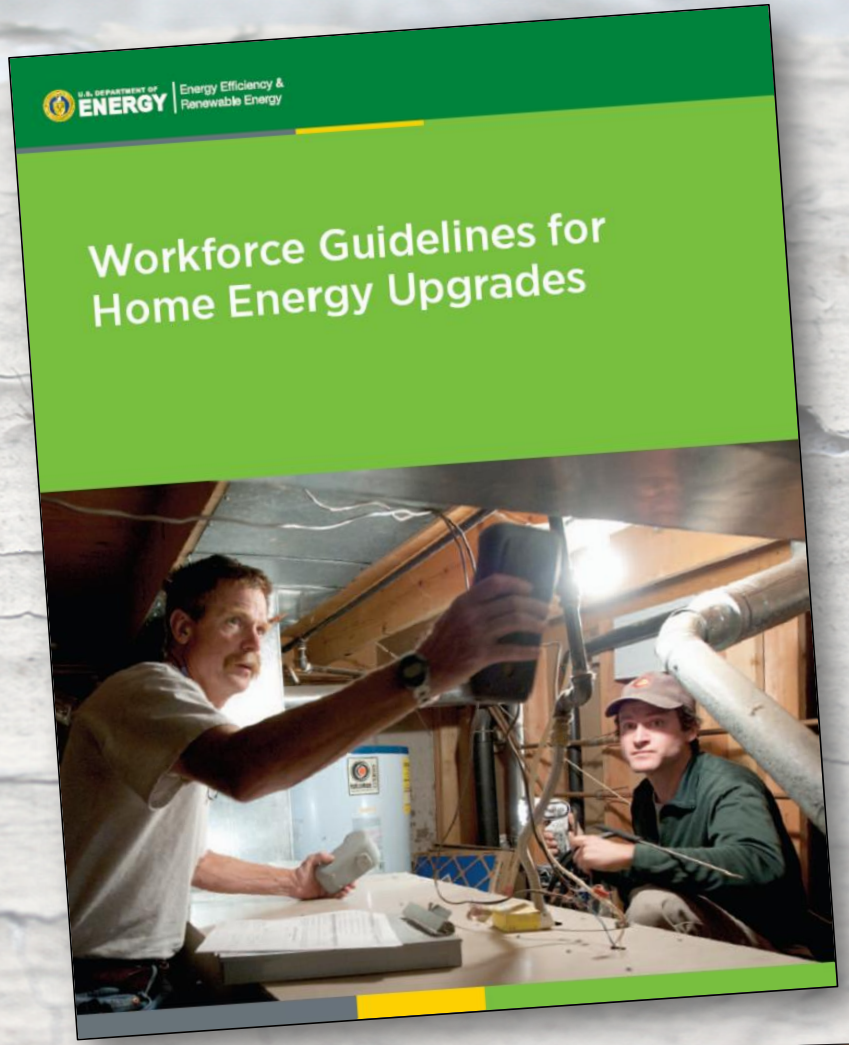


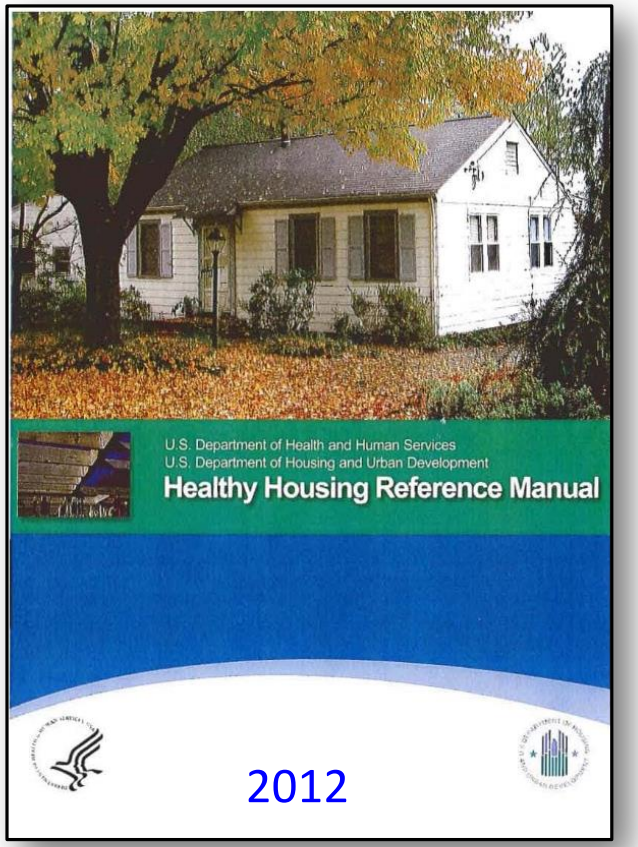
Table 3. Overview of Assessment Strategies for Selected Residential Hazards

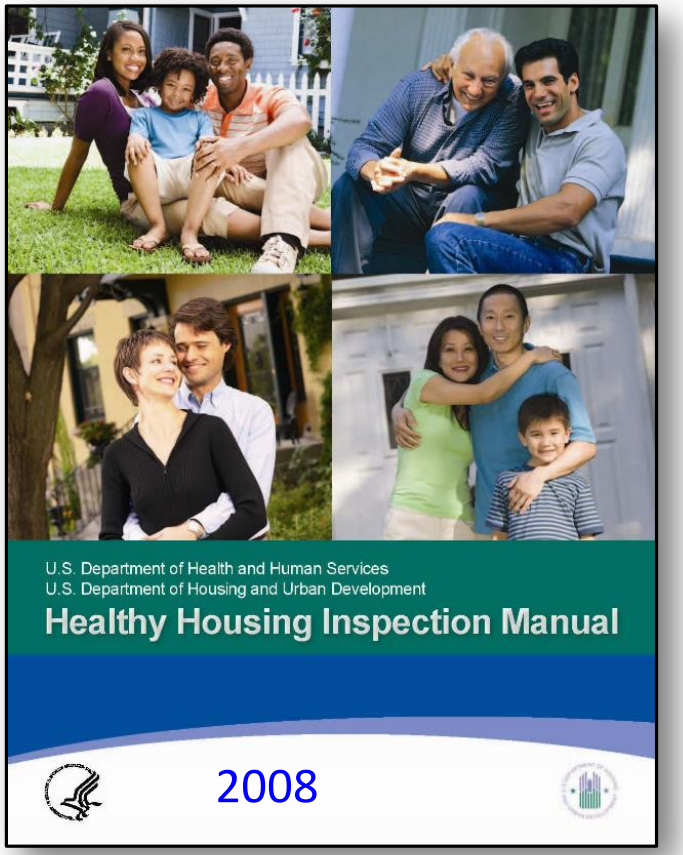
Residential Hazard	Assessment Strategy				
	Visual Assessment	Occupant Survey	Environmental Sampling		Building Performance Testing
			Dust	Air	
Biological Hazards					
Dust mite allergens	X[5]		X[1]	X	
Cockroach allergens	X[5]	X	X[1]	X	
Rodent allergens	X[5]		X[2]	X[2]	
Pet allergens	X[5]	X	X[2]	X[2]	
Mold	X[4]	X[2]	X[2]	X[2]	
Bacterial endotoxins	X[5]		X	X	
Chemical Hazards					
Pesticides	X	X[4]	X[2]	X[2]	
Carbon monoxide	X	X[3]		X	X
VOCs, including formaldehyde	X[5]	X[4]		X	X
Lead			X		
Radon				X	
Particulate Matter (e.g., $PM_{2.5}$)				X	
NO_2				X	
Structural Hazards					
Structural defects	X	X[2]			X[7]
Excess moisture	X	X[2]		X	X
Poor ventilation	X				
Unhygienic conditions	X	X		X	
Carbon dioxide (CO_2, fresh air indicator)					
Slip, trip, fall hazards	X			X	X
Un-cleanable surfaces	X				
Missing/malfunctioning safety devices (e.g., smoke and CO alarms)	X	X			
Behavioral Hazards					
Cigarette smoking/2nd- & 3rd-hand smoke	X	X		X	
Poor safety practices (e.g., no childproofing)	X	X			
Lack of supervision of children		X			
Unsafe use of products and appliances	X	X[4]			

SWS-
Helpful Guidance For Some
Important Interventions

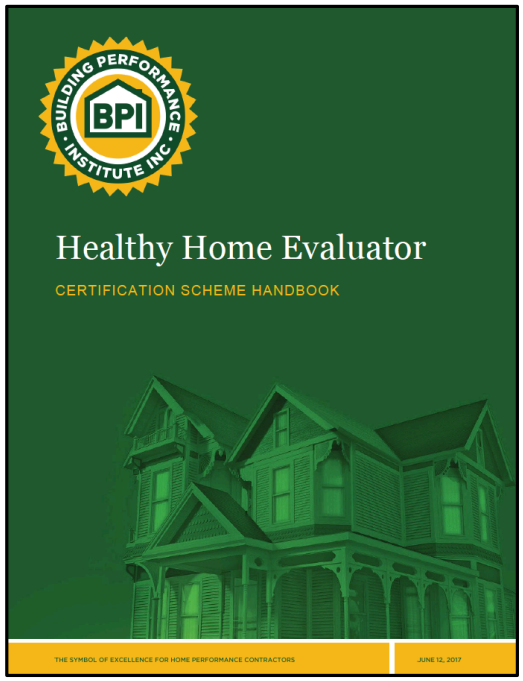


Healthy Housing Manuals / resources

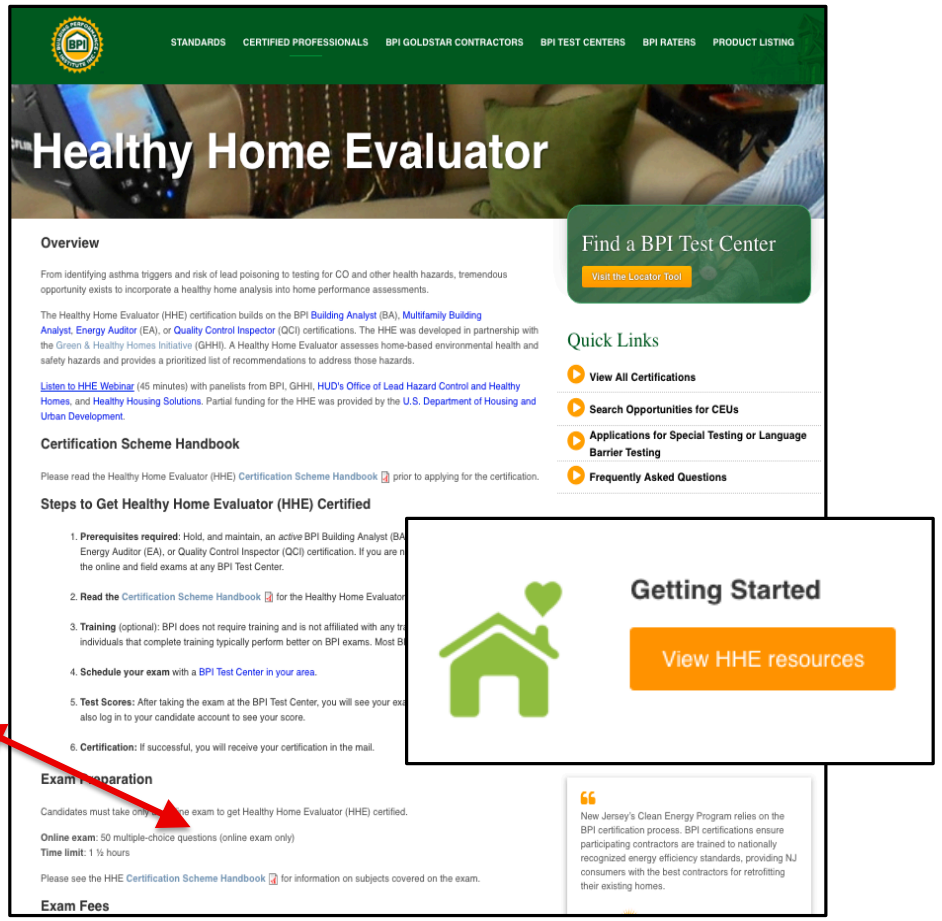




BPI Resources



Healthy Home Evaluator
Certification Scheme Handbook



Test Methods and Protocols for Environmental and Safety Hazards Associated With Home Energy Retrofits

Testing

- Qualitative
- Quantitative
- Familiar tests related to health risk

