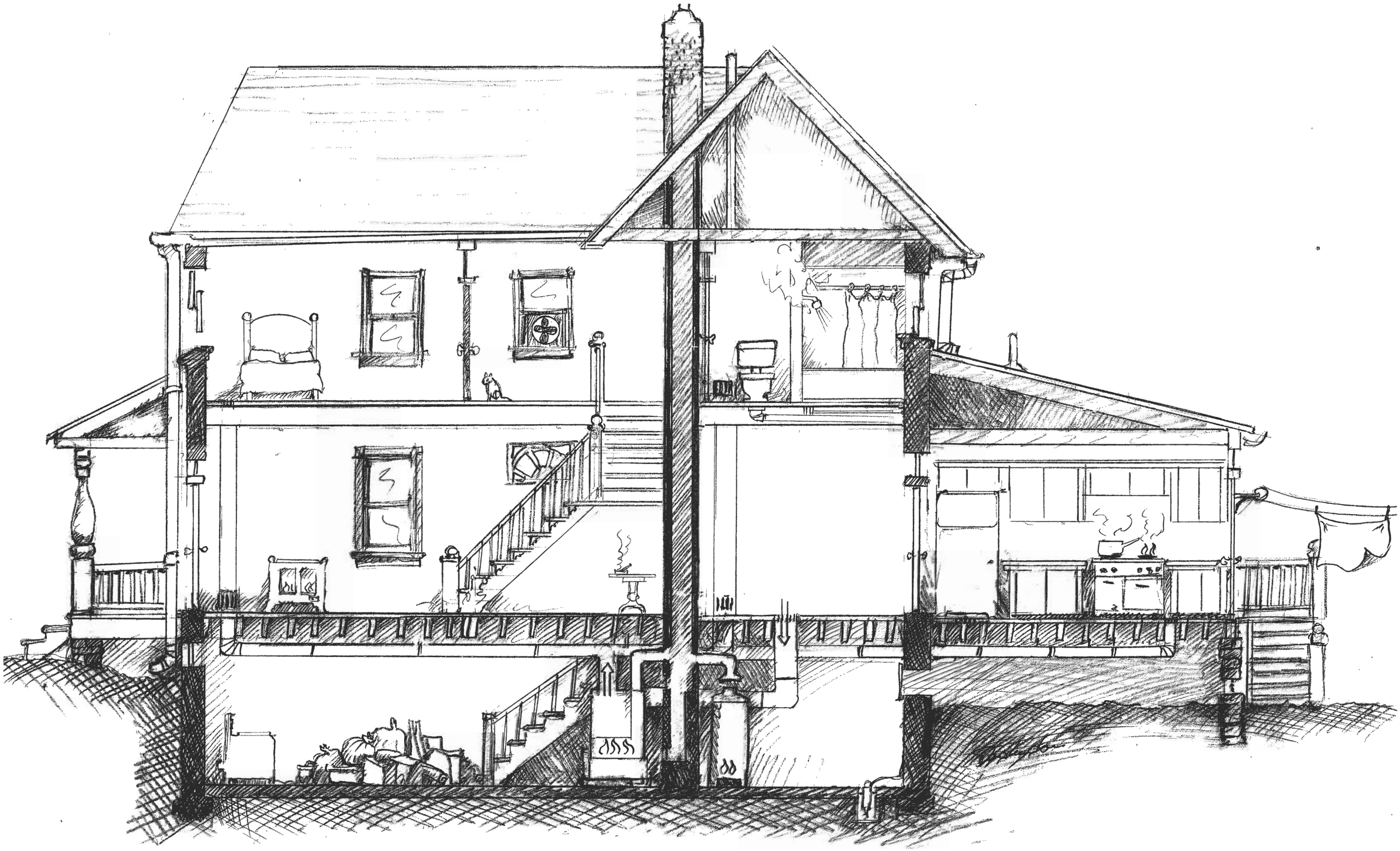
Essentials for Healthy Homes Practitioners

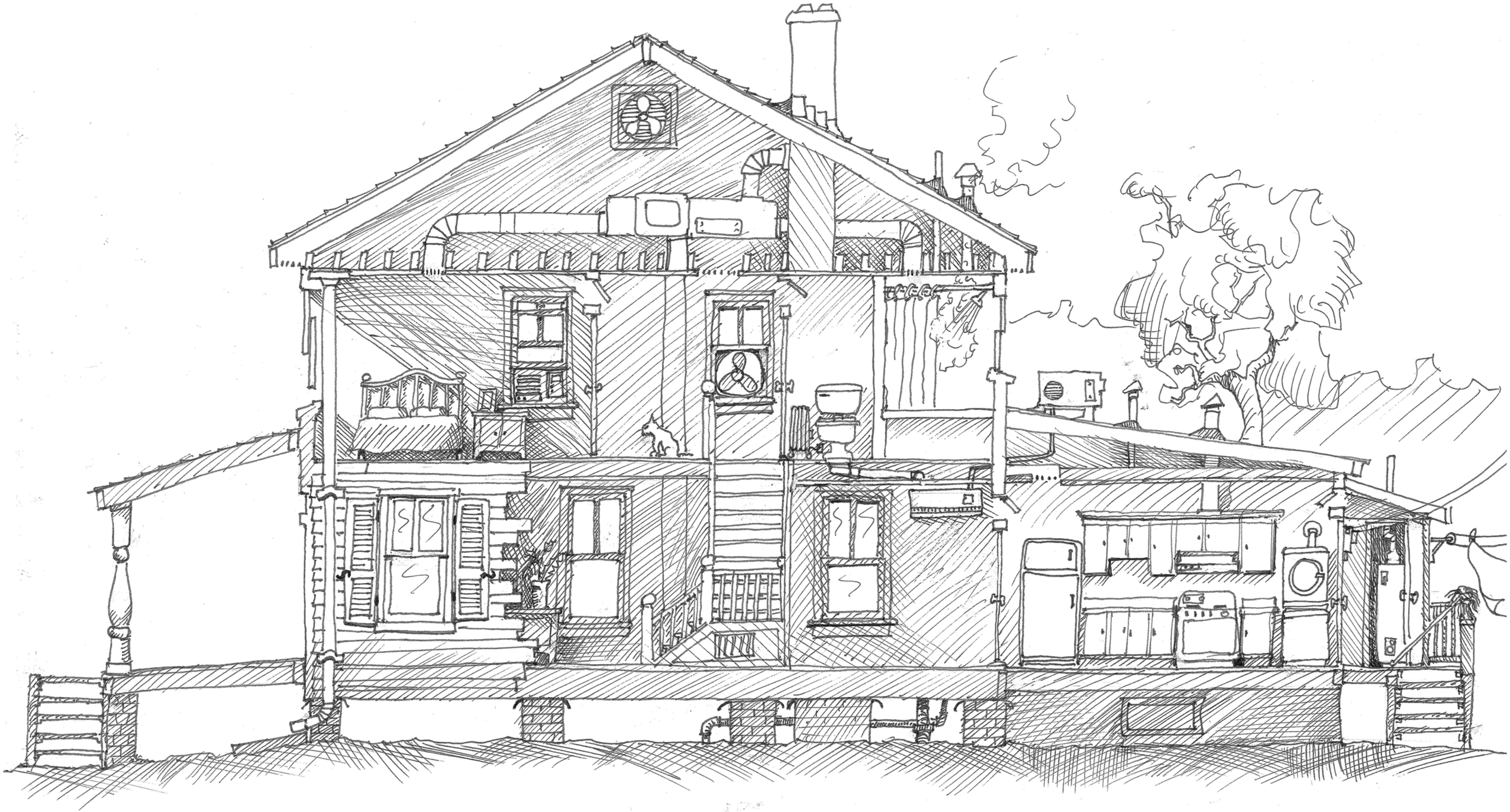
Student Manual

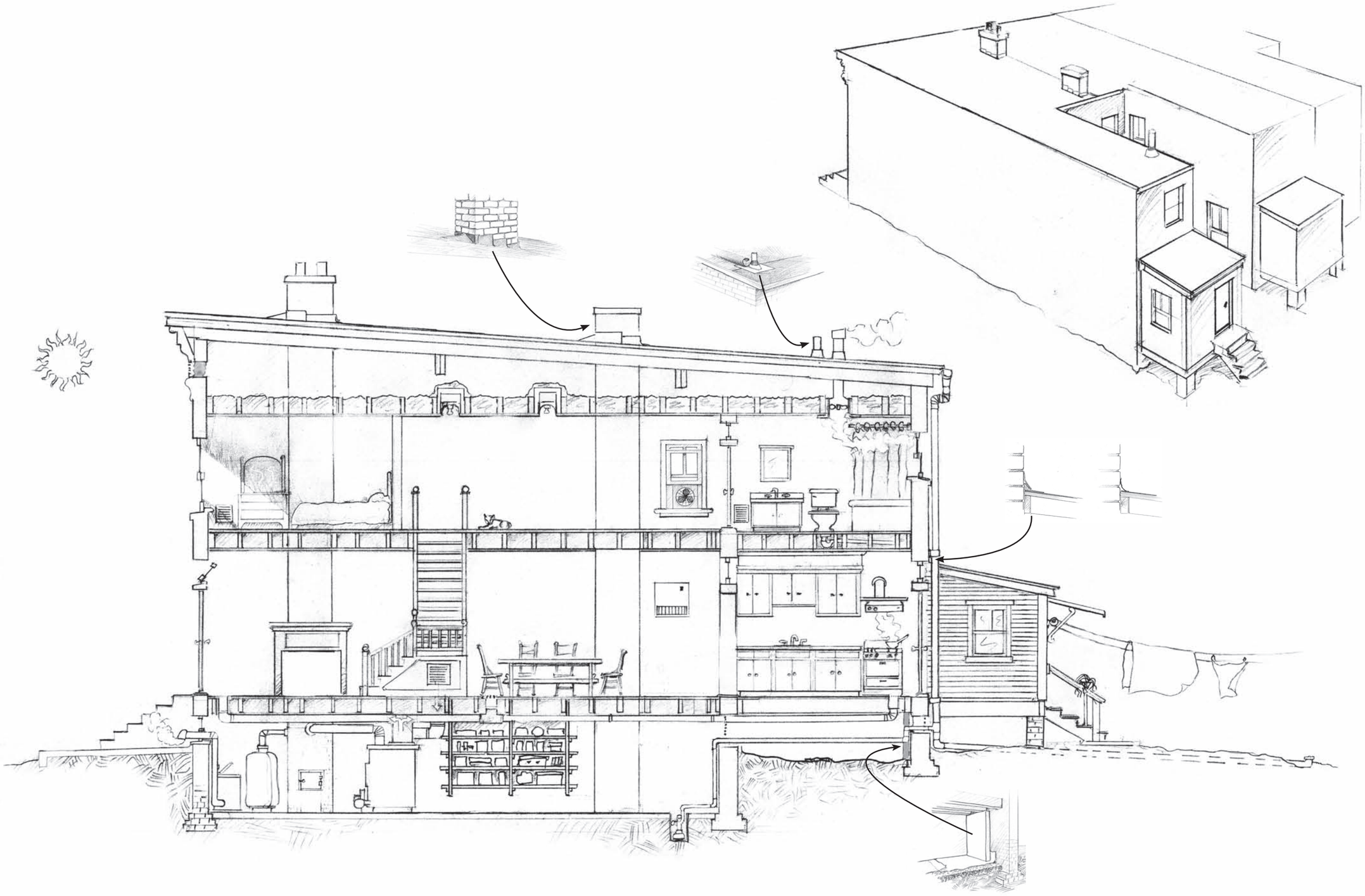
June 2014

NATIONAL HEALTHY HOMES TRAINING CENTER™ & NETWORK

www.healthyhousingsolutions.com







Model Agenda

Day 1

Welcome and Introductions	30 min
Overview—Making the Connection	1 hr
Break	**15 min**
Overview—Housing Statistics and Codes	75 min
Start With People	30 min
Lunch	**1 hr**
House As a System	30 min
Keep It Dry	75 min
Break	**15 min**
Keep It Clean	1 hr
Keep It Pest-Free—Introduction	50 min
Review of Day 1/Preview of Day 2	10 min
Adjourn Day 1 of Essentials Course	

Day 2

Keep It Pest-Free (cont.)	1 hr, 45 min
Break	**15 min**
Keep it Ventilated	1 hr
Keep it Safe	30 min
Lunch	**1 hr**
Keep It Contaminant-Free	45 min
Keep It Maintained	1 hour
Break	**15 min**
Making It Work—Visual Assessment	45 min
Adjourn Essentials Course	

NATIONAL HEALTHY HOMES
TRAINING CENTER™
& NETWORK

The National Healthy Homes Training Center and Network (Training Center) offers cutting edge training and professional development in the field of healthy housing. The Training Center has trained almost 28,000 people since its inception in 2003, and is creating a workforce that understands how to find and resolve hazards in the home environment. Visit the website at healthyhousingsolutions.com/hhtc/.

The Training Center:

- **Brings together public health and housing practitioners** to promote practical and cost-effective methods for making homes healthier.
- **Serves as a forum** for exchanging information on new research and best practices.
- **Promotes cross-training** of public health and housing practitioners.
- **Identifies and optimizes opportunities** for networking, collaboration, and partnerships.
- **Provides continuing education units (CEUs)** for most courses.

Training with a higher purpose

Our trainees are dedicated professionals committed to making a difference in their communities through safe and healthy housing. In 2009, the U.S. Surgeon General's *Call to Action to Promote Healthy Homes* underscored the public health importance of healthy housing and endorsed the "seven principles of healthy housing," which serve as the cornerstone of the Training Center's curricula.

Trainees learn critical skills and increase their knowledge of the principles, while also becoming inspired to serve as resources, thought leaders, conveners, and advocates in their communities.

The Training Center operates across the country and provides training through a network of experienced partners. To see a list of partners and their contact information, go to healthyhousingsolutions.com/hhtc/training-partners/.

The Training Center offers three types of courses to meet the needs of all students: (1) face-to-face, (2) online self-paced, and (3) online instructor-led.

Essentials for Healthy Homes Practitioners

This is the Training Center's flagship course. Over 14,000 students have taken the course, and nearly 97% of participants say they would recommend it to a colleague. Eighty-five percent say they could immediately incorporate the concepts they learned into their daily work.

This is what a few of our trainees have said about the Essentials course:

"The breadth of the course and practical application to in-home assessments (how to clean up mold, green cleaning supplies) was terrific. Plus the instructor's range of knowledge and experience was a great added value to the training materials."

"Information presented in practical, real world examples by presenter with solid experience with weatherization and healthy homes practices."

"The training was comprehensive and could relate to all types of homes."

Funding for the Training Center is provided by the U.S. Department of Housing and Urban Development (HUD)

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Classroom courses:

Code Inspection for Healthier Homes – This is a one-day course for code inspectors and others interested in learning more about how effective housing enforcement and programs can improve the health of occupants. The course provides information on the health-related provisions of state and local housing codes and the International Property Maintenance Code (IPMC).

Eco-Healthy Child Care Course® – The five-hour Eco-Healthy Child Care® Train-the-Trainer curriculum offers information on 11 core content areas: pesticides, poor indoor air quality, household chemicals, lead, mercury, furniture and carpets, art supplies, plastics, arsenic, radon and recycling. The course prepares individuals to become a resource for their localized communities.

Essentials for Healthy Homes Practitioners – If you visit homes to provide health or inspection services of any type, you will benefit from this course. The training will help you understand the connection between health and housing and how to take a holistic approach to identify and resolve problems that threaten the health and well-being of residents.

Green and Healthy Management Strategies for Multifamily Properties – This course provides property owners/managers with tools to implement green and healthy practices that can reduce energy, water, contaminants, and improve resident health conditions.

Healthy Home Evaluator Study Course – This course is designed to prepare students for the Healthy Home Evaluator certification offered through the Building Performance Institute (BPI). Students identify and evaluate health related hazards in a client's home. Students learn how to apply good practices to work with residents, identify housing-related health hazards, use tools to measure hazardous conditions, prioritize hazards, and identify and communicate solutions to residents. The course includes a site visit to a home and a number of case studies. Students will also learn how to protect themselves as they conduct home visits.

Healthy Homes Assessment and Interventions – This course enables students to learn about the importance of the resident interview, develop strategies for assessing the health-related hazards in a home, conduct an on-site inspection, and develop a comprehensive action plan.

Healthy Homes Assessment for Community Health Workers – This course enables is designed specifically for community health workers (CHWs), and other home visitors who provide health education to residents. The course provides these individuals with the knowledge and skills needed to perform a basic healthy home assessment.

Healthy Homes Assessment: Principles and Practice – This course provides knowledge and skills that individuals need to perform healthy home assessments. It is intended for those professionals who have completed either the Essentials for Healthy Homes Practitioners or the Healthy Homes Essentials for Environmental Professionals course and who plan to perform home assessments as part of their professional activities.

Funding for the Training Center is provided by the U.S. Department of Housing and Urban Development (HUD)

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Healthy Homes for Community Health Workers – This course teaches Community Health Workers (CHWs) how to provide healthy homes information to members of their communities. The course trains CHWs to provide one-on-one and large group education on healthy homes, provide general advice about specific healthy homes problems, and to recommend healthy homes approaches to be taken by families, landlords, and other community members.

Healthy Homes Essentials for Environmental Professionals – This course is an accelerated version of the Essentials for Healthy Homes Practitioners course for those individuals who already have certification as a professional in a healthy home field of expertise.

Health Opportunities in Energy Audits and Upgrades – This course provides an opportunity for energy auditors to learn about healthy homes and understand that energy efficiency is only one part of a safe and healthy home. Students become aware of a wider array of housing problems they will encounter and may be able to address once they are working in a home.

Integrated Pest Management in Multifamily Housing – This course is designed to help property managers implement a comprehensive integrated pest management (IPM) program by bringing stakeholders, especially resident leaders, together to develop the skills and practices needed to effectively eliminate pests such as cockroaches and rodents from multifamily housing. This course is available both in the classroom and online.

Launching a Healthy Homes Initiative – This course brings together health and housing professionals from state and local agencies as well as other health and housing organizations. The goal is to identify policies and practices to establish robust programs to make homes healthier. The course provides elements of a strategic planning process to initiate a healthy homes program in your community.

Online Self-Paced Courses:

Basic Principles of Healthy Housing – This course is engaging and interactive. Whether you're a community health worker, home assessor, home inspector, program manager, or anyone concerned about healthy housing, you will learn about the well-documented link between health and housing and become familiar with the eight principles of keeping your home healthy.

Eco-Healthy Child Care – This interactive course is designed for early care and learning professionals and those who offer technical assistance and/or training to child care providers. Parents will find it useful for the home environment as well. Learn why children are uniquely vulnerable to common environmental health hazards (e.g., lead, pesticides, household chemicals, unsafe plastics), and receive practical and low-cost to no-cost strategies for preventing children's exposures to toxic substances.

Integrated Pest Management in Multifamily Housing – This course is designed to help a property manager, including a public housing authority, to implement a comprehensive integrated pest management (IPM) program by bringing stakeholders, especially resident leaders, together to develop the skills and practices needed to effectively eliminate pests such as cockroaches and rodents from multifamily housing. This course is available both in the classroom and online.

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Pediatric Environmental Home Assessment – This course is designed to prepare nurses to recognize potential environmental hazards as part of a primary prevention approach, and recommend preventative action or make appropriate referrals for conditions that may be caused by a housing-related hazard.

Online instructor-led courses*:*

Bed Bug Management for Affordable Housing Providers – During this four-hour webinar, you will learn how to take an active role in solving common challenges, identifying problems, learning what strategies work to kill bed bugs, and how to find a good pest management professional.

Making Homes Healthier for Residents Who Hoard – This one-hour webinar discusses how hoarding impacts healthy homes. Participants learn about using a tool that helps a healthy home practitioner measure the level at which the resident's hoarding could have an impact on his or her health. They also learn about what does and does not work in addressing health-related hazards in a hoarder's house.

Making Homes Healthier for Residents With Limited Finances – This one-hour webinar will help participants identify alternative sources of funding for healthy home fixes. Instead of focusing solely on what their programs can pay for, participants will learn how to take a broader view on finding potential funds. Participants will also learn about the importance of starting locally when looking for resources, including programs that address housing repairs. Additionally, the webinar will provide a brief overview of federal and state programs.

To locate Training Center classes that are currently being offered, visit our Schedule of Classes at http://healthyhousingsolutions.com/register.

If you have any questions about the Training Center, contact Laura Titus at ltitus@healthyhousingsolutions.com.

Funding for the Training Center is provided by the U.S. Department of Housing and Urban Development (HUD)

Continuing Education Certificate of Completion

National Environmental Health Association

Name of Program: Essentials for Healthy Homes Practitioner 2019

Location: Various Dates: Various

Total Number of NEHA Authorized CE Contact Hours: 12.50

STEP 1. Name and Address of Attendee

Name:_____Date Completed Training_____

Address: _____

City: _____ State: _____ Zip: _____

Daytime Phone: _____ Email: _____

NEHA Membership Number (if applicable): _____

NEHA Credential ID Number (if applicable):_____

STEP 2. Competencies

Please list the new competencies you have developed.

⇨

⇨

⇨

⇨

Step 3. Total CE Hours

Number of Hours attended: _____

(-) Breaks/Lunches: - _____

(-) Dinners: - _____

(-) Business Meetings - _____

Total CE Hours: = _____

Step 4. Completion Verification (Representative from Pre-Approved CE Program, please sign below)

SIGNATURE: _____

Step 5. Submission Instructions

1. If you are credentialed with NEHA:

- ✓ Log into your My NEHA account using your email address as your login ID.
- ✓ On the right side of the screen, look for " My Credentials and CEs". Then click on "Report CE Credits".
- ✓ Complete the Self-Report CE Credits form.
  Retain this form for your records. In the event you are audited this form will serve as your proof of attendance.

2. If you are currently not credentialed with NEHA:

- ✓ Retain this form for your records. This form will serve as your proof of attendance.

Common Household Contaminants: The Hazards and the Laws

The National Center for Healthy Housing (NCHH) developed this summary to serve as a short guide for health and housing professionals on common household contaminants. It is not comprehensive. As a guide, NCHH provides only short descriptions intended as a reminder to professionals. Professionals need a solid understanding of the contaminants to make the best use of this guide. See references at

http://healthyhousingsolutions.com/wp-content/uploads/2015/06/Essentials_Refs_Connections_BW_Jan20141.pdf

Table 1
Hazards Posed by Common Household Contaminants

Contaminant (sorted by name)	Primary Health Impact	Common Sources in Home	Primary Routes of Exposure	"Keep Its" (listed by priority)
Asbestos	• Lung cancer • Asbestosis (scar tissue buildup in lung) • Mesothelioma (cancer of the lining of chest and abdomen)	• Insulation / Vermiculite • Floor tiles • Sheet vinyl flooring • Cement shingles or roofing • Plaster and joint compound • Gaskets	• Inhalation of fibers from deteriorated, damaged or disturbed material	Maintained Contaminant-Free Dry Clean
Arsenic	• Skin cancer	• Copper Chrome Arsenate (CCA) Treated lumber (produced before 2004) • Private wells (in some locations)	• Ingestion of residue from wood or soil • Splinters • Drinking water	Maintained Safe
Carbon Monoxide	• Death • Central nervous system damage	• Combustion appliances • Attached garage	• Inhalation	Ventilated Maintained Clean
Cockroaches	• Asthma • Allergies • Stomach Illness • Communicable disease	• Walls, cavities and other places to hide	• Inhalation • Ingestion	Pest-Free Clean Dry Maintained
Formaldehyde	• Respiratory Irritation & Sensitization • Nasal Cancer	• Glues • Press wood products	• Inhalation	Contaminant-Free Ventilated
Lead	• Nervous system / brain damage • Learning, behavioral Problems • Cancer	• Deteriorated paint • Lead in soil and dust • Lead in water • Some consumer products	• Ingestion • Inhalation of dust from renovation, or disturbing lead-based paint.	Maintained Clean Dry Contaminant-Free
Mercury	• Nervous system / brain damage	• Florescent lamps • Thermometers • Switches	• Inhalation	Maintained Ventilated Clean Contaminant-Free

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Common Household Contaminants: The Hazards and the Laws

Table 1 Hazards Posed by Common Household Contaminants				
Contaminant (sorted by name)	Primary Health Impact	Common Sources in Home	Primary Routes of Exposure	"Keep Its" (listed by priority)
Mold	• Asthma • Hypersensitivity pneumonitis • Coughing / Wheezing • Upper respiratory tract symptoms	• Damp indoor environments • Water damaged materials	• Inhalation • Ingestion	Dry Maintained Clean Ventilated
Nitrogen Oxides	• Asthma Exacerbation	• Combustion appliances	• Inhalation	Ventilated Maintained
Pesticides	• Depends on pesticide used, often nervous system	• Current use • Residue from past use	• Inhalation • Ingestion • Dermal	Pest-Free Contaminant-Free Maintained Ventilated
Radon	• Lung cancer	• Soil, clay or rock from around and underneath foundation	• Inhalation	Ventilated Contaminant-Free Maintained Dry
Rodents	• Asthma (mice) • Infectious disease • Bites	• Walls, cavities, crawlspaces and other places to hide	• Inhalation • Ingestion • Bites	Pest-Free Maintained Dry Clean
Sewer Gas	• Fire & explosion • Central nervous system damage • Respiratory system damage	• Broken sewers • Empty drain traps	• Inhalation	Maintained Ventilated
Volatile Organics (VOCs)	• Depends on chemical, often nervous system damage • Can be poisoning hazard	• Air fresheners • Glues & building materials • Sprays & coatings • Household cleaners	• Inhalation • Ingestion	Contaminant-Free Safe Ventilated

Notes:
- Only some common household contaminants with significant potential hazards are listed.
- Contaminants are sorted alphabetically.
- Primary health impact is based on hazard posed by contaminant in common household settings.
- "Keep Its" refers to the Seven Principles of Healthy Housing.
- "Keep Its" are listed by their importance to addressing hazard.

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Common Household Contaminants:
The Hazards and the Laws

Table 2 **Federal/State Requirements for Homes Regarding Common Household Contaminants**					
Contaminant	Sale or Use	In-Home Hazard Level	Disclosure to Resident	Renovation Work Practices	State Requirements
Asbestos	EPA banned sale in textured paint, patching / joint compounds, and thermal systems insulation in 1977. *Note: EPA banned sale in most products reversed by court in 1991.*	EPA - Friable asbestos containing material confirmed by lab to be asbestos. *Note: Testing not required.*	*None*	● EPA requires work practices if renovation of housing with more than four units per building. ● EPA requires work practices if any demolition. ● OSHA requires work practices.	● Most states adopt EPA work practices & professional licensing standards. ● Some states require disclosure.
Arsenic	EPA banned CCA lumber production in 2004.	*None.*	*None*	*None*	Some states set standards in soil
Carbon Monoxide	*Not applicable*	CPSC – Alarm sounds at life-threatening conditions. *Note: Alarm not required.*	*None*	*None*	Some states require alarms. IRC requires alarm when getting permit.
Cockroaches	*Not applicable*	HUD HQS - Free of infestation	*None*	*None*	IPMC and some states prohibit infestation and set cleanup stds.
Formaldehyde	HUD sets stds on wood products in manufactured housing.	*None*	HUD requires warning in manufactured housing.	OSHA has exposure limits and requires controls and work practices.	California sets stds on wood products in use except mfg hsg.
Lead	CPSC ● Banned sale or application in new paint after 1977. ● Strictly limited lead in children's products after 2/10/2009	EPA ● Deteriorated lead-based paint. ● High levels of lead in dust or soil. See Table 3 ● No imminent & substantial endangerment. *Note: HUD requires testing in federally-assisted housing. CPSC requires testing*	EPA/HUD required for: ● Housing sale or lease. ● Contractors must give pre-renovation notice.	● EPA requires: o Pre-renovation notification o Work practices (effective 4/22/10) ● HUD requires work practices on subsidized property ● OSHA requires work practices.	● IPMC & some states prohibit deteriorated paint. ● Most state adopt EPA work practices and professional licensing standards. ● Some states require more.

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Table 2
Federal/State Requirements for Homes Regarding Common Household Contaminants

Contaminant	Sale or Use	In-Home Hazard Level	Disclosure to Resident	Renovation Work Practices	State Requirements
		after 2/10/10.			
Mercury	CPSC banned sale in interior latex paint.	*None*	*None*	*None*	Some states ban mercury in some products.
Mold	*Not applicable*	*None*	*None*	*None*	Some states require cleanup and licensing.
Nitrogen Oxides	*Not applicable*	*None*	*None*	*None*	*None*
Pesticides	EPA bans sale or use of unregistered pesticides.	EPA - Depends on pesticide.	*None*	All required by EPA to follow label. Most states license contractors using pesticides.	Many states require licensing of professionals. Some states restrict use.
Radon	*Not applicable*	Recommended action level of 4 picocuries per liter of air	*None*	*None*	Some states require testing, licensing and remediation.
Rodents	*Not applicable*	HUD HQS - Free of infestation	*None*	*None*	IPMC and some states prohibit infestation and set cleanup stds.
Sewer Gas	*Not applicable*	*None*	*None*	*None*	IPMC and some states require drain traps to be have water.
Volatile Organic (VOCs)	*None*	HUD HQS - Free of pollutants in air at levels that threaten health	*None*	*None*	*Unknown*

Notes:
- CPSC = U.S. Consumer Product Safety Commission
- EPA = U.S. Environmental Protection Agency
- HQS = HUD's Housing Quality Standards for property covered by Housing Choice Vouchers (Section 8 Vouchers)
- HUD = U.S. Department of Housing and Urban Development
- IPMC = International Property Maintenance Code
- IRC = International Residential Code.
- OSHA = U.S. Occupational Safety and Health Administration

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Table 3 **Key Federal Work Practice Requirement for Asbestos and Lead-Based Paint**			
Lead-Based Paint Renovation Work Practices			
Agency Rule	Professional Licensing	Trigger for Requirements	Clearance Testing
EPA LPB Activities – 40 CFR 745 Subpart L - 8/29/1996	● **Dust Sampling Technician** – Conducts clearance. ● **Inspector** – Determines if paint is lead-based paint. Conducts clearance. ● **Risk Assessor** – Determines if paint is lead-based paint. Conducts clearance. Evaluates hazards and recommends corrections. ● **Abatement Contractor, Supervisor, and Worker** – Conduct abatement.	**Abatement** – permanent elimination of lead-based paint hazards but not renovation. Pre-renovation notice to EPA (or authorized state).	Independent risk assessor or inspector must confirm levels less than: ● 40 µg/ft^2 on floors; ● 250 µg/ft^2 on window sills; ● 400 µg/ft^2 in window trough (cleanup if window disturbed); ● 400 ppm in soil in play area; and ● 1200 ppm in soil in other areas
HUD Lead-Safe Housing – 24 CFR Part 35 - 9/6/1996	None unless abatement required but HUD requires training for: ● Supervisor and worker completes HUD-approved lead-safe work practices course; or ● Supervisor completes Abatement Supervisor course and trains workers.	Federal subsidized property disturbing more than: ● 2 ft^2 per interior room; ● 20 ft^2 in exterior; or ● 10% of component; ● of paint in pre-1978 housing.	● Independent risk assessor, inspector, or dust sampling technician must confirm levels less than: ● 40 µg/ft^2 on floors; ● 250 µg/ft^2 on window sills; and ● 400 µg/ft^2 in window trough (cleanup if window disturbed)
EPA Renovation, Repair & Painting – 40 CFR 745.80 to 745.91 - 4/22/2010	● **Certified Renovation Firm** with **Certified Renovator**	**Renovation** – Disturbing more than: ● 6 ft^2 per interior room, ● 20 ft^2 in exterior; or ● Window replacement or paint demolition. ● of paint in pre-1978 housing over 30 days.	● Certified renovation conducting post-cleaning verification by comparing wipes to card. ● Option for independent clearance testing per HUD rule.

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Table 3 **Key Federal Work Practice Requirement for Asbestos and Lead-Based Paint**			
Asbestos Renovation Work Practices			
EPA NESHAP – 40 CFR 61.145 - 1990	● **Inspector** – Determines if material contains asbestos. ● **Management Planner** – Determines if material contains asbestos. Evaluates hazards and recommends corrections. ● **Project Designed** – Designs renovation to comply with requirements. ● **Abatement Contractor, Supervisor, and Worker** – Conduct abatement.	Disturbing more than: ● 260 ft on pipes; ● 160 ft^2 on other components; or ● 35 ft^3 removed. ● of friable asbestos-containing material in calendar year. Pre-renovation notice to EPA (or authorized state).	Zero visible emissions to the outside air from transport or disposal of asbestos waste.

Notes:
- *CFR = Code of Federal Regulations*
- *EPA = U.S. Environmental Protection Agency*
- *ft^2 = Square feet*
- *HUD = U.S. Department of Housing and Urban Development*
- *LBP = Lead-Based Paint*
- *NESHAP = National Emission Standard for Hazardous Air Pollutants*
- *$\mu g/ft^2$ = micrograms of lead per square foot of horizontal surface.*

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Instructions to Obtain Continuing Education Credits

Healthy Housing Solutions offers the Essentials for Healthy Homes Practitioners course to professionals from a variety of fields within public health, environmental health and housing.

The purpose of the course is to help you understand the connection between health and housing and how to take a holistic approach to identify and resolve problems which threaten the health and well-being of residents. It identifies root causes of health problems in a home and links them to seven principles of healthy housing: keep it dry, keep it clean, keep it pest-free, keep it ventilated;, keep it safe, keep it contaminant-free, and keep it maintained.

This course has been approved for continuing education hours for the following professionals:

Occupation	# of Contact Hours	Accrediting Organization	Requirements for CEU Award
Public Health Nurses	12.75 contact hours	Ohio Nurses Association *- - This continuing nursing education activity was approved by the Ohio Nurses Association an accredited approver by the American Nurses Credentialing Center's Commission on Accreditation . (OBN-001-91). Approval valid through 6/4/2020. Assigned ONA #21544.* *Approval valid through June 4, 2020.*	1. Attend the entire training. 2. Complete the online post-course evaluation form, making sure to complete the four nursing questions. 3. A signed certificate of completion showing the number of earned contact hours is emailed to student. *- There is no conflict of interest for anyone with the ability to control content of this activity.* *- This course has no sponsorship from our training partners.*
Registered Environmental Health Specialist/ Registered Sanitarian (REHS/RS) and Certified Environmental Health Technician (CEHT)	12.50 contact hours	National Environmental Health Association	1. Attend the entire training. 2. Complete the online post-course evaluation form. 3. Log into your MY NEHA account using your email address as your login ID. 4. Follow Step 5 instructions on the NEHA form in your binder.
ASHI Home Inspector	13 ASHI CE hours	American Society of Home Inspectors (ASHI)	1. Attend the entire training. 2. Be a member of ASHI. 3. Complete the online post-course evaluation form. 4. A certificate of completion showing the number of earned CEs is emailed to student.

Essentials for Healthy Homes Practitioners

InterNACHI Home Inspector	15.0 contact hours	International Association of Certified Home Inspectors	InterNACHI members are required to load all details of their continuing educational accomplishments to the **members-only education log**. All other proof of completion of the course should be retained by the member.
Social Workers	13.5 CEUs	National Association of Social Workers	1. Attend the entire training. 2. Complete and submit the online post-course evaluation form. 3. A signed certificate of completion showing the number of earned contact hours is emailed to student.
Certified Industrial Hygienist / Certified Associate Industrial Hygienist	2.0 Industrial Hygiene CM points	American Board of Industrial Hygiene (ABIH)	1. Be a certified by ABIH. 2. Attend the entire training. 3. Complete and submit the online post-course evaluation form. 4. A signed certificate of completion showing the number of earned contact hours is emailed to student.
Indoor Air Quality Professionals and Technicians	15 RCs (recertification credits)	American Indoor Air Quality Council (AmIAQC) / American Council for Accredited Certification (ACAC)	1. Attend the entire training. 2. Complete and submit the online post-course evaluation form. 3. A signed certificate of completion showing the number of earned contact hours is emailed to student.
BPI Certified Professionals	8 BPI CEUs	Building Performance Institute	1. Attend the entire training. 2. Complete and submit the online post-course evaluation form. 3. Your instructor is responsible for adding your name and course into the BPI portal for obtaining CEUs.

Overview

- Welcome to the Essentials for Healthy Homes Practitioner course. In this Overview module, we will discuss
- Why are healthy homes important?
- The connection between housing and health
- A holistic approach to healthy housing
- The Eight Principles of Healthy Housing Basic Statistics – American Housing Survey
- Can We Make Change?
- Codes Related to Healthy Homes
- Federal Health Priorities: Healthy People 2020 Objectives
- Green Building Properties
- National Healthy Homes Training Center & Network
- Course Outline
- Key Messages
- Review Learning Objectives

"The connection between health and the dwelling of the population is one of the most important that exists."

Florence Nightingale[1]

Overview
Start with People
House as a System
Keep It:
1. Dry
2. Clean
3. Pest-Free
4. Ventilated
5. Safe
6. Contaminant-Free
7. Maintained
8. Climate Controlled
Making it Work

Learning Objectives for this module

- Describe four housing conditions and their associated health problems
- Identify three populations at higher risk for housing related disease and injury
- Identify three types of codes used to enforce remediation of housing-related hazards.

Why Are Healthy Homes Important?

The role of housing as a contributor to health known for decades, while new agents and pathways continue to be discovered and explored. In the early 1800s, the relation between housing conditions and health was recognized among public health practitioners in the United States and Europe and led to the rise of the sanitary reform movement.

Slum clearance and improving the quality of housing and sanitation were important components of 19th and 20th century campaigns to control typhus, tuberculosis, and other infectious diseases. Interest in housing as a determinant of health has fluctuated in response to housing-related infectious disease outbreaks (e.g, cholera in New York City in the 1830's), social unrest and class conflict, industrial interest in maintaining a healthier workforce, and economic downturns leading to crises in housing availability and quality.

Why do we care?
Housing affects health both directly and indirectly through:

- Physical, chemical, biological exposures, and
- Psychological impacts

The physical home environment as a determinant of health is gaining renewed attention. Researchers have linked indoor air pollution and other exposures in homes to acute and chronic diseases, including cancer.

Today, we know that the primary exposure setting for most Americans is the indoor environment. Most of us, especially children, spend more time inside than outside. Young children spend about 70% of the time in their home.[2] The air we breathe and things we touch inside matter. Yet the primary focus of health and environmental regulations are on the outside environment.

Housing is a multi-dimensional construct, which affects health both directly and indirectly. A significant body of research acknowledges and supports the case that housing conditions have a direct effect on health. Research also points to the health dangers associated with overcrowding, excessive expenditures on shelter, and homelessness. Inside the home, there is the potential for physical, chemical and biological exposures. Housing is also seen as a component of general well-being—it confers a sense of security, privacy, and control. It also is related to one's perception of social status, in both individual and community contexts.

A range of health problems result from hazards in houses including injuries, asthma and other respiratory illnesses, carbon monoxide poisoning, cancers, and childhood lead poisoning.

Why do we care?

Here are some estimates of the costs associated with unhealthy housing. The estimate of $54.9 billion listed below is likely low because it considers only four categories of illness and does not include the cost of lost days from school and work.

Annual costs for environmentally attributable childhood diseases in the U.S.: $76.6 billion			
Lead Poisoning	**Neurobehavioral disorders**	**Asthma**	**Childhood Cancer**
$50.9 Billion	$23.4 Billion	$2.2 Billion	$95 Million

- Additional costs from asthma care for the more than 10 million missed school days a year.
- Asthma contributes to approximatley 3% of total health care costs.

How significant is the problem?

American Housing Survey			
Occupied Housing Units	**Severe Physical Problems**	**Moderate Physical Problems**	**Total**
2007	1.8 million	4.0 million	5.8 million
2009	1.9 million	3.9 million	5.8 million
2011	2.1 million	4.1 million	6.2 million
2013	1.9 million	3.9 million	5.8 million
2015	1.5 million	5.2 million	6.7 million

Based on 2007 data, the Centers for Disease Control and Prevention (CDC) set a goal of reducing the number of occupied homes with severe and moderate physical problems from 5.2 % to 4.2%. CDC uses the American Housing Survey to measure progress to this goal. In 2011, the percent of occupied homes with severe and moderate problems was 5.4%.

In the broadest sense, housing is the right to not just basic shelter but to "adequate housing" in terms of legal security of tenure; availability of services, materials, facilities, and infrastructure; affordability; habitability; accessibility; and location and cultural adequacy.

Maslow's Hierarchy of Need

The graphic on the next page illustrates Maslow's Hierarchy of Needs. Housing is related to safety and security. The key message is that you must satisfy basic needs first then you can get to the other needs. For people to be contributing members of society, we need to address their safety and security concerns – that means they must be safe and secure in their home.

Physiological needs: Include basic necessities such as air, water, food, sleep.

Safety and Security: Includes keeping ourselves out of danger and from feeling threatened, having shelter from the environment, and feeling safe when walking in a neighborhood.

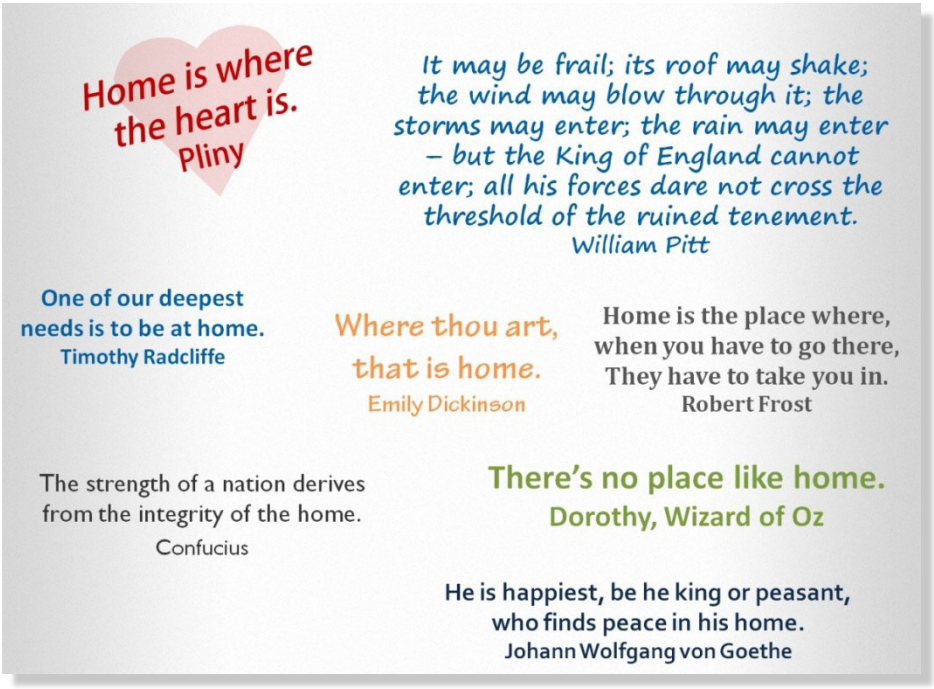
Belonging: Humans have a desire to belong to groups (clubs, work groups, religious groups, family) because we need to feel loved and desired by others.

Ego: Humans have:

- Esteem needs to achieve, be competent, gain approval, and gain recognition.
- Cognitive needs include the need to know, to understand, and to explore.
- Aesthetic needs or a desire for symmetry, order, and beauty.

Self-actualization: Human need to find self-fulfillment and realize one's full potential.

This graphic below emphasizes the very special place a home has in our history and our emotions. While Maslow's Hierarchy of Need makes analytical sense, it misses this emotional mark. This page was developed by Deb Millette at CDC. The first quote on the right—by William Pitt—captures the information perfectly: it may have serious physical problems but it



The Connection Between Health and Housing

Two Key Institute of Medicine (IOM) Reports

The 2000 IOM report called "Clearing the Air" addressed the connection between asthma and exposures in the home. It laid the foundation for the healthy homes effort. The second IOM report was published in 2004 and evaluated the connection between dampness and health. See pages 1–2 of the References section.

Pay special attention to the first two rows of the reports – "Sufficient evidence of a causal relationship" and "Sufficient evidence of a relationship." Note that the first report differentiates between hazards on the left half of the page (causing asthma to develop) and hazards on the right–half of the page—those that can trigger asthma attacks (exacerbation).

Also on page 5 of the References section, you will see the 2005 World Health Organization (WHO) report exploring evidence of quantifiable linkages between diseases and housing.

As noted above, the two IOM summary reports are from 2000 (biological and chemical exposures and asthma) and 2004 (health outcomes and damp indoor environments). Those two reports are still the authoritative sources for the association between asthma and biological and chemical exposures in the home and between asthma and damp indoor environments. However, there are a number of more recent papers published that support the IOM conclusions and provide small updates.

In addition, the 2009 World Health Organization Guidelines for Indoor Air Quality (on Dampness and Mold) update the associations between dampness and mold and several health conditions. This report directly addresses the 2004 IOM report on health outcomes and damp indoor environments.

Updated information:

1. Stronger evidence on the association between asthma and mice:

- The 2000 IOM report said there was inadequate or insufficient evidence to determine if an association exists between asthma and rodents.
- A study published that year (Phipatanakul et al. 2000) concluded that mouse allergen may be an important indoor allergen in inner-city children with asthma. The study stated that "we believe that mouse allergen is likely to be an important indoor allergen that has thus far been underrecognized."
- Another study published in 2006 (Matsui et al. 2006) came to the same conclusion. That paper stated that "In mouse-sensitized inner-city children, exposure to mouse allergen may be an important cause of asthma morbidity.

2. Stronger evidence on the association between asthma and rats:

- The 2000 IOM report said there was inadequate or insufficient evidence to determine if an association exists between asthma and rodents.
- A study published in 2003 (Perry et al 2003) concluded that rat allergen sensitization and exposure are associated with increased asthma morbidity in inner-city children.

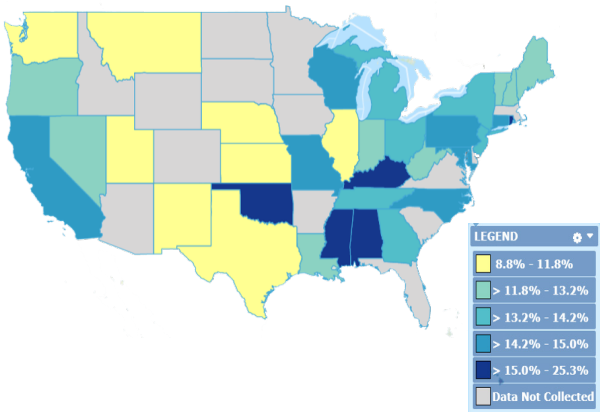
3. Updated information from the 2009 World Health Organization Guidelines for Indoor Air Quality (on Dampness and Mold):[6]

- Dampness/mold and Asthma exacerbation (or asthma symptoms in sensitized persons) stays in the Sufficient Evidence of an Association.
  - Note that the Guidelines state that: "For . . . asthma exacerbation, we consider the evidence to be sufficient to document an association and almost sufficient to document causality of dampness-related factors. A number of newly available studies added to the evidence of an association between dampness and asthma exacerbation." (Pages 70–71.)

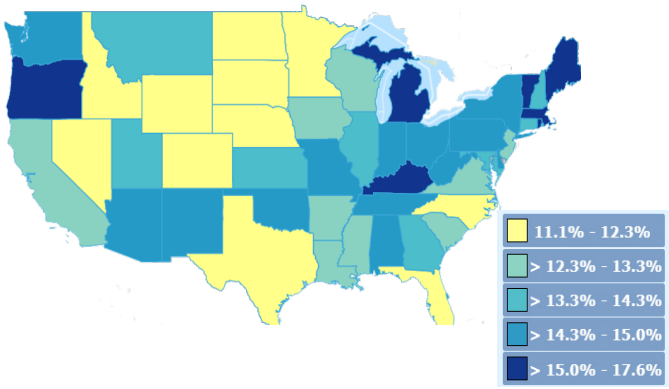
- Dampness/mold and Asthma development moves from **Limited or Suggestive Evidence of an Association** to ⇨ **Sufficient Evidence of an Association.**
- Dampness/mold and Current asthma (not evaluated in 2004) is placed in **Sufficient Evidence of an Association**.
- Dampness/mold and Respiratory infections (not evaluated in 2004) is placed in **Sufficient Evidence of an Association**.
- Dampness/mold and Upper respiratory tract symptoms, cough, and wheeze all stay in the **Sufficient Evidence of an Association**.
- Dampness/mold and Shortness of breath (dyspnoea) moves from: **Limited or Suggestive Evidence of an Association Association** to ⇨ **Sufficient Evidence of an Association.**
- Mold and Hypersensitivity pneumonitis stays in the **Sufficient Evidence of an Association**.
- Mold and Humidifier fever and inhalation fevers move from: **Limited or Suggestive Evidence of an Association** to ⇨ **Sufficient Evidence of an Association.**
- Dampness/mold and Allergic rhinitis and bronchitis is placed in **Limited or Suggestive Evidence of an Association**.
- Lung function, allergy or atopy, and "asthma, ever" is placed in **Inadequate or Insufficient Evidence to Determine Whether or Not an Association Exists**.

Also helpful to review are CDC maps showing the prevalence of childhood and adult asthma across the United States. The prevalence and number of persons with asthma have increased since 2001, and demographic differences among population subgroups persist despite improvements in outdoor air quality and decreases in cigarette smoking and secondhand smoke exposure. CDC's top priority is getting people to manage their asthma better. Asthma has been more prevalent among children than adults, women than men, and blacks than whites since 2001. Similarly, in 2009, asthma was more prevalent among children, women, non-Hispanic blacks, the poor, and in the Northeast and Midwest. The cause of this variation remains unclear and might be the result of multiple characteristics associated with asthma development and disease duration including genetic predisposition, history of atopy (a genetic tendency to develop an allergic reaction), health risk factors (e.g., smoking, obesity), earlier diagnosis, socioeconomic status (e.g., education or occupation), and exposure to environmental allergens or irritants (e.g., mold, tobacco smoke, secondhand smoke exposure, pet dander, outdoor air pollution, and any upper respiratory infection, such as influenza or common cold).

Childhood Asthma
Current prevelance, 2014 BRFSS data



Adult Asthma
Current prevelance, 2014 BRFSS data



You can find these and other maps online as part of the CDC Behavioral Risk Factor Surveillance System (BRFSS) or the CDC Environmental Public Health Tracking Network: You can find these and other maps online as part of the CDC Behavioral Risk Factor Surveillance System (BRFSS) or the CDC Environmental Public Health Tracking Network: http://ephtracking.cdc.gov/showAsthma.action (click on Search Data).

A Holistic Approach to Healthy Housing

In this course we are introducing a different way of thinking about the home environment. We are proposing that instead of using a categorical approach, we should be using a holistic approach.

This is an integrated approach that considers the people living in the home, the structure, and the potential health hazards. Considering health and housing problems together in a coordinated way is more efficient and prevention-effective. Healthy Homes programs offer a comprehensive and coordinated approach by promoting interagency collaboration, community participation, and cross training.

Holistic Approach Integrated approach that considers:

- People living in the home.
- The structure
- Potential health hazards

Deb Millette of CDC developed the charts on the next page to emphasize the connections between the hazards in a house.

Moisture/water intrusion

Mold

Asthma exacerbation

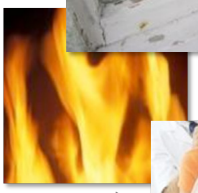
Moisture/ water intrusion

Structural damage

Structural damage

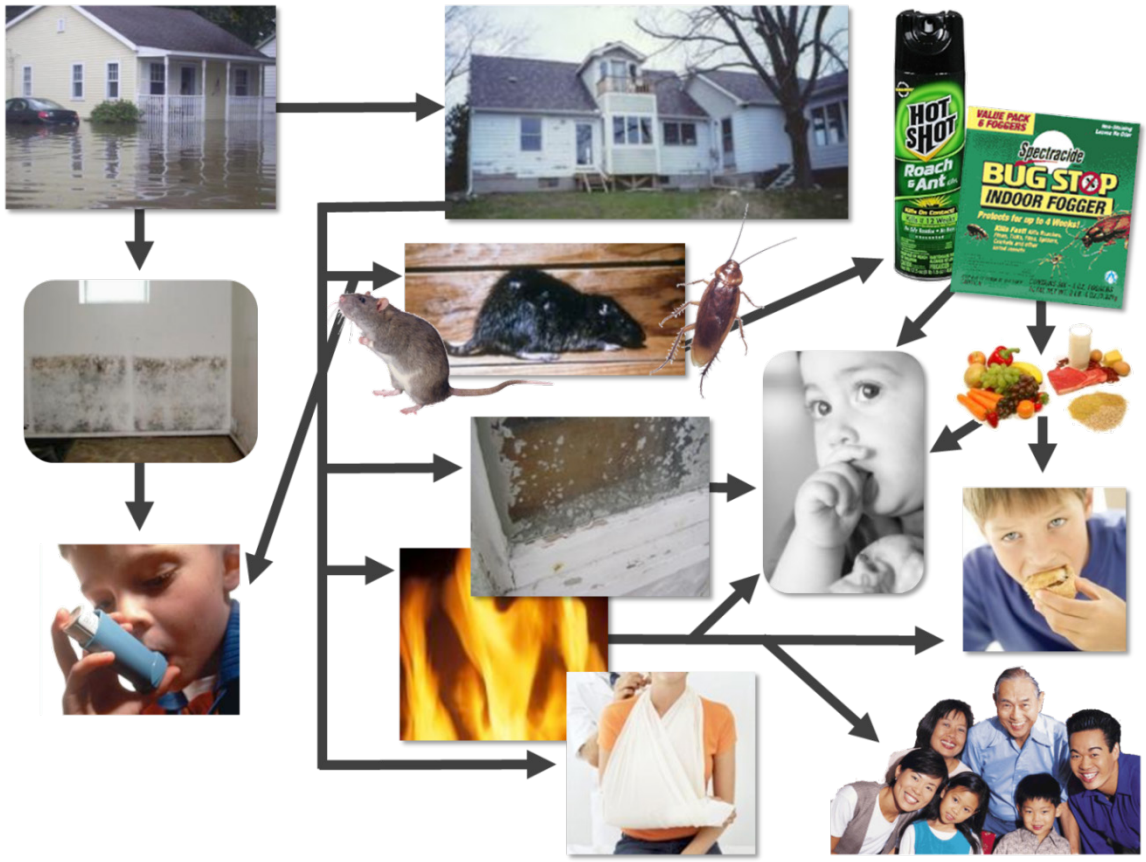
Pests

Deteriorated lead paint/ lead poisoning



Fire

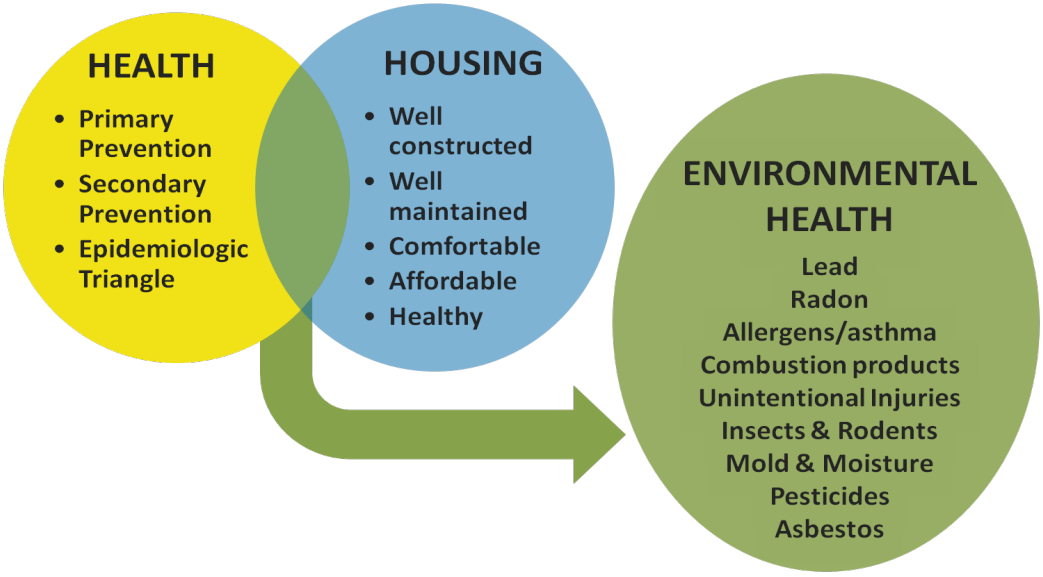
Injuries



This is a summary of the previous graphics. Note the confusing, multiple interconnections.

Essentials for Healthy Homes Practitioners

Below is a depiction of three different approaches to address the connection between health and housing.



This graphic shows the amount of overlap between health and housing, illustrating why bringing the two disciplines together is essential.

Understanding the landscape can help you navigate how your public agencies provide health and housing services.

Health in the graphic above refers to public health, as well as environmental health. Often environmental health is a department within the department of public health. However, it may also be a stand-alone department.

The Eight Principles of Healthy Housing

While there is no recipe that can guarantee a healthy home, you'll be learning about key principles that can help create healthier indoor environments. You'll hear about these principles throughout the course of the training.

Healthy homes is a systems level approach. We have few programs that look at the whole home environment and the total needs of a family. In this training, we are introducing a new way of thinking about the home environment—an integrated approach that considers the people living in the home, the structure, and the potential health hazards. Considering health and housing problems together in a coordinated way is more efficient and prevention-effective.

Healthy Homes programs offer a comprehensive and coordinated approach by promoting interagency collaboration, community participation, and cross training. That is why we have convened this multi-disciplinary training. By design, we have recruited public health, housing, and environmental health professionals. Many of the core healthy homes principles are captured in the codes and regulations designed to protect residents.

Keep It:

1. Dry
2. Clean
3. Pest-Free
4. Ventilated
5. Safe
6. Contaminant-Free
7. Maintained
8. Climate Controlled

What is Healthy Housing?

Healthy Housing is

- Designed
- Constructed
- Maintained, and
- Rehabilitated

—in a manner that is conducive to good occupant health.

This is the definition of healthy housing that the National Center for Healthy Housing uses. There is no statutory or regulatory definition of healthy housing. Note that the definition brings in occupant health – starting with people.

Basic Statistics - the American Housing Survey Data [AHS]

- Conducted by the U.S. Census Bureau
- Funded by HUD
- Conducted every two years since the 1980s
- Periodically for 47 Metropolitan Statistical Areas (MSA)
- Consistent set of homes
- Phone survey since 1997

Overview of the AHS

NCHH has created a summary of healthy homes elements from the 2011 national AHS data—see below and on the next page. Your instructor will go over data on the housing-related health hazards that are a significant problem in the United States. You should also become familiar with the AHS data on your nearest metropolitan statistical area (MSA). NCHH provides this data to your instructor as well as the national data. Here are the categories covered in the national AHS data

- General Description of Housing (including year built and type of foundation)
- Exterior Problems (including exterior water leakage)
- Interior Problems (including interior water leakage,
- rodents, and electrical)
- Sanitation/Water Problems & Safety Devices
- Heating/Fuel (including main heating, water heating, clothes dryer, problems)
- Selected Physical Problems and Overall Opinion of Structure.

Demographics	Exterior Problems
• 118.3 million homes • 37.3% rental • 63% single-family detached homes • 55.6% built pre-1980 • 22.1% basement under all of house*	• 20% exterior physical problems • 2.8% missing roofing material • 9.9% exterior water leakage

AHS National 2015

Essentials for Healthy Homes Practitioners

Additional Information Included in the Data Packet:

- Overview and Key Definitions. Note the tests for holds in floors and open cracks at the end.
- Overview and Key Definitions. Note the tests for holes in floors and open cracks at end.
- Rating System. This will help you understand what moderate and severe physical problems mean. These homes have serious problems.
- Potential Errors in AHS. You should understand that a high level of inconsistency means that a high level of inconsistency means that you need to use caution in using these numbers.
- Table Showing Relationship Between Interior and Exterior Problems

Interior Problems

- 8.5% interior water leakage
- 6.3% open cracks or holes
- 3.9% pipes leaked
- 11.2% mice or rats
- 8.5% blown fuses or breakers in the last three months

Heating

- 64.5% warm air furnace
- 0.5% room heater without flue
- 1% stove as main heating equipment
- 8.2% uncomfortably cold for 24 hours or more

AHS National 2015

Here is a sample of AHS data for a particular community.

	Outside Central City				Central City			
	Owner-Occupied		Rental		Owner-Occupied		Rental	
Characteristic	*Number/ Percent*	*National*	*Number/ Percent*	*National*	*Number/ Percent*	*National*	*Number/ Percent*	*National*
Number of units	449,400	-	257,600	-	59,200	-	89,500	-
Percent of Area	63.6%	-	**36.4%**	12,765,700	39.8%	-	60.2%	-
Median year of construction	1968	-	1965	-	1944	-	1950	-
% Pre-1940	9.5%	-	13.5%	-	**43.1%**	25.5%	38.2%	-
% Post-1979	27.3%	-	**18.1%**	29.6%	15.0%	-	**5.3%**	17.7%
% Below poverty	8.1%	-	**3.7%**	18.0%	**13.5%**	9.6%	**8.3%**	25.6%
Basic Housing Quality		-		-		-		-
Severe physical problems	0.9%	-	**3.5%**	2.4%	**1.1%**	1.6%	**6.5%**	4.6%
Moderate physical problems	2.2%	-	6.8%	-	2.7%	-	9.7%	-
Interior Problems		-		-		-		-
Holes in floors	0.2%	0.6%	**1.9%**	1.4%	0.7%	-	3.0%	-
Open cracks or holes in walls	7.4%	3.5%	10.8%	6.2%	9.3%	5.0%	13.4%	-
Broken plaster/peeling paint	**2.2%**	1.6%	6.4%	3.4%	4.4%	2.5%	10.0%	5.7%
Signs of rats	1.8%	0.6%	1.8%	1.0%	3.2%	1.0%	**3.4%**	2.2%
Signs of mice	6.4%	-	**8.1%**	5.6%	**7.9%**	5.6%	10.1%	-
Water leaks from inside	**10.9%**	8.0%	**17.4%**	11.7%	10.1%	-	17.4%	-
Water leaks from outside	**17.7%**	12.8%	16.1%	9.4%	30.3%	14.3%	18.4%	10.6%
Water supply stoppage	5.0%	-	9.9%	5.3%	2.4%	-	5.5%	-
Flush toilet breakdown	**2.7%**	1.7%	**6.8%**	4.6%	1.9%	-	6.0%	-
Sewage disposal breakdown	**2.1%**	1.3%	3.8%	2.1%	2.3%	-	**3.8%**	2.5%
Lacking complete plumbing	1.5%	0.8%	1.9%	-	2.6%	1.2%	2.5%	-
Heating equip breakdown	**2.4%**	1.5%	4.4%	2.3%	**1.5%**	2.0%	**6.0%**	4.3%
Space heater w/o flues	0.9%	2.8%	1.9%	3.8%	0.7%	3.0%	4.8%	-
Exposed wiring in unit	0.2%	0.5%	1.0%	-	0.0%	0.5%	**1.3%**	0.8%
Rooms w/o working elect. outlet	0.9%	-	2.7%	-	2.2%	1.3%	5.4%	2.4%
Lacking kitchen facilities	0.9%	0.5%	4.0%	-	1.2%	0.6%	**6.6%**	4.8%
Exterior Problems		-		-		-		-
Roofing problems	8.3%	4.5%	**11.5%**	7.0%	11.1%	6.1%	12.9%	7.1%
Siding problems	3.8%	2.0%	8.3%	4.0%	6.1%	2.7%	9.9%	5.2%
Window problems	**4.0%**	2.9%	**7.4%**	4.8%	8.3%	4.5%	**11.7%**	7.1%
Foundation problems	**3.1%**	1.9%	**4.6%**	3.0%	5.4%	3.0%	**5.8%**	4.0%

This one-page profile compares various types of housing to national averages. Green is good. More green is better. Red is bad. More red is worse.

The hyphens mean the local information is close to the national average for similar housing. Where the number is significantly better or worse, the national number is listed.

Data from the American Housing Survey also shows that there is clearly a relationship between interior problems and exterior problems in a house. If you were doing a windshield survey, for example, and see a house that has exterior problems such as a hole in the roof or broken windows, that home likely has interior problems as well.

No place like home!

Resident Overall Opinion of Structure, American Housing Survey – National 2015						
	Worst					Best
Type of resident	**1**	**2-4**	**5-7**	**8**	**9**	**10**
All	0.7%	2.0%	24.1%	25.8%	14.6%	32.7%
Renters	1.3%	4.0%	35.8%	26.6%	11.7%	20.5%
Below Poverty	1.7%	4.2%	29.2%	21.2%	10.0%	29.4%

People like their home, even if it has serious problems. If you are trying to make homes healthier, you must realize this challenge. The numbers above come from the 2015 National American Housing Survey. Residents rate their home on a 1 to 10 scale. 1 is the worst. 10 is the best. More than half of all groups rate their home at 8 or better—even those living below the poverty level. We think this means that people balance cost, health, comfort and other factors to make a decision. They also think there is no place like home.

Real World Complex

It is often difficult to address the many interrelated healthy homes issues. Part of the reason that this is so difficult is that the real world is extremely complex and many factors including the ones listed below contribute to the complexity.

- Current knowledge
- Economic factors
- Social and cultural
- Political and legal factors
- "DO NO Harm"

For example, we have to look at what we currently know and identify gaps in our knowledge. While we tend to focus on identifying health effects associated with exposure to one agent, often we don't know the health effects associated with exposure to several agents simultaneously.

Funding, social and cultural, and political issues also play a role in how we identify and address healthy housing issues.

Can We Make a Change?

Yes, we can make things change. In 2007, CDC published how the country had improved on Smoke-Free Home Rules. These are homes where the residents made a rule—not a law—that smoking is not allowed inside the home. More recent statistics concerning homes with a no smoking rule confirm this improvement: 43% in 1992–1993, 72% in 2003 and 81.8% in 2009–2010.

Change is in the Air: No later than Aug. 3, 2018, all public housing communities must implement a policy that bars the use of prohibited tobacco products in all public housing units, interior common areas, and outdoor areas within 25 feet of public housing and administrative office buildings. Prohibited tobacco products are defined as items that involve the ignition and burning of tobacco leaves, such as cigarettes, cigars, pipes, and water pipes (also known as hookahs).

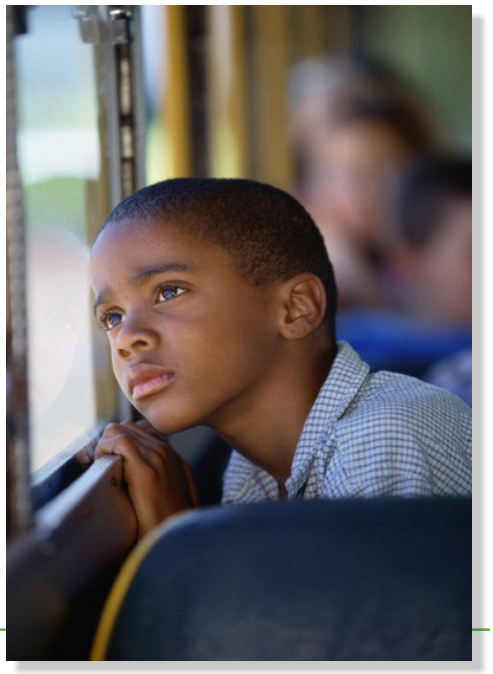
Healthy Homes Interventions

In 2008, CDC and NCHH convened an expert panel to evaluate the effectiveness of various healthy homes interventions. The expert panel considered a number of categories of health hazards in the home and the interventions available to deal with these hazards. According to available research, the expert panel placed each intervention into one of the following categories:

- Effective
- Needs More Field Evaluation
- Needs Formative Research
- No Evidence of Ineffective

See http://www.nchh.org/Research/Archived-Research-Projects/Housing-Interventions-and-Health-Outcomes.aspx for the full report.

Until effective standards for the domestic environment are devised, it is likely that children will continue to be employed as biological indicators of substandard housing. Improving the quality of the nation's housing can form a foundation for the health and well-being of families across the country. Reducing the amount of substandard housing and creating healthier neighborhoods is a task that requires public health and housing officials to find "a meeting place" for their shared interests – together they offer a powerful voice and the capacity to create large-scale system level change in the way we develop, deliver, and value housing in America.



Standards are in place to address some, but not all of the problems that result in unhealthy homes. The next section provides an overview of those codes and standards.

Codes Related to Healthy Homes

This section will cover the following types of codes:

- Health / Sanitation Codes
- Housing / Property Maintenance Codes
- Landlord–Tenant Laws
- Product Standards
- Hazard Management Laws

There are different names for housing and health codes. You should know the difference between housing, building, and zoning codes.

- Zoning codes define what kind of buildings can go into a community.
- Building codes define how buildings must be built or rebuilt
- Housing codes define how buildings must be maintained.

(See Laws, Rules and Codes for Healthier Homes: Review of Approaches Impacting Existing Homes and International Property Maintenance Code in the References section.)

International Property Maintenance Code (IPMC)?
A: *Yes, Definitely. You should review the IPMC requirements and identify which sections are violated by the house featured in this photo.*

These are common provisions in housing or a health code. Review your local code for these provisions

- Structural integrity
- Weatherproof
- Maintained
- Cracks and holes
- Loose or rotting materials
- Dampness and deterioration
- Peeling Paint
- Ventilation/windows
- Infestation
- Sanitation and trash
- Cleanability
- Clothesdryer
- Space heater

Codes for Housing

- Building Construction – International Building Code
- Residential Construction – International Residential Code
- Rehab–International Existing Building Code
- Electrical–International Code Council Electrical Code
- Fire–International Fire Code and National Fire Protection Association
- Ventilation–International Mechanical Code
- Plumbing–International Plumbing Code
- Sewage–International Prive Sewage Disposal Code
- All Buildings–International Property Maintenance Code

These are the nation's model codes as adopted by the International Code Council (ICC).11 The IPMC is the most important one because it applies to all buildings. When a state or community adopts a model code, they often modify it —adding, deleting or changing thre requirements.

International Property Maintenance Code (IPMC)

- **Adopted**
  - by more than 600 communities
  - or in use in 38 states and the District of Columbia
- Applicability
  - Existing buildings
  - Rental and owner-occupied homes
  - Local variations
- Code official enforces

Landlord-Tenant Laws

Landlord-Tenant laws are also an important part of healthy homes since rental property is generally in worse condition. Most states mandate that the lease require the landlord to comply with the housing code.

- Rights and responsibilities
- Common requirements
  - Certificate of occupancy
  - Duty to pay rent
  - Withholding rent to make repairs
  - Retaliation
- Eviction and enforcement

Federal Health Priorities: Healthy People 2020 Objectives

In addition to familiarity with codes, you should also be familiar with the federal health priorities as established by the Department of Health and Human Services. The federal government through the Department of Health and Human Services set long-term objectives for the nation's health. The program is call Healthy People 2020. The measurable objectives set a target to achieve by 2020. The objectives listed below are those that directly relate to healthy homes.

- **Reduce blood lead levels in children**
  - Eliminate elevated blood lead levels in children
  - Reduce the mean blood lead levels in children
- **Reduce pesticide exposures that result in visits to a health care facility**
- **Reduce indoor allergen levels**
  - Reduce indoor allergen levels: cockroach
  - Reduce indoor allergen levels: mouse
- **Increase the number of homes with an operating radon mitigation system for persons living in homes at risk for radon exposure**

- **Increase the percentage of new single family homes (SFH) constructed with radon-reducing features, especially in high-radon-potential areas**
- **Increase the proportion of persons living in pre-1978 housing that has been tested for the presence of lead-based paint or related hazards**
  - Increase the proportion of pre–1978 housing that has been tested for the presence of lead-based paint
  - Increase the proportion of pre–1978 housing that has been tested for the presence of paint-lead hazards
  - Increase the proportion of pre–1978 housing that has been tested for the levels of lead in dust
  - Increase the proportion of pre–1978 housing that has been tested for the presence of lead in soil
- **Reduce the number of U.S. homes that are found to have lead-based paint or related hazards**
  - Reduce the number of U.S. homes that are found to have lead-based paint
  - Reduce the number of U.S. homes that have paint-lead hazards
  - Reduce the number of U.S. homes that have dust-lead hazards
  - Reduce the number of U.S. homes that have soil-lead hazards
- **Reduce the proportion of occupied housing units that have moderate or severe physical problems**

Green Building Priorities

In February 2009, NCHH conducted a comparison of green building programs. NCHH considered the following major, national programs:

- Green Communities by Enterprise Community Partners
- Leadership in Energy and Environmental Design for Homes (LEED for Homes) by U.S. Green Building Council (USGBC)
- National Green Building Standard (ICC-700-2008) by the International Code Council (ICC) and National Association of Home Builders (NAHB)
- Energy Star with Indoor Air Package by U.S. Environmental Protection Agency (EPA)

These are the four national programs driving green building. NCHH compared the healthy homes aspects of each of the four programs.[13] See the Summary of National Green Building Programs in your Reference section.

National Healthy Homes Training Center and Network

The National Healthy Homes Training Center & Network is funded by a grant from the U.S. Department of Housing & Urban Development with support from the U.S. Environmental Protection Agency. Brings together public health and housing practitioners to promote practical and cost-effective methods for making homes healthier.

- Serves as a forum for exchanging information on new research and best practices.
- Brings together public health and housing practitioners to promote practical and cost-effective methods for making homes healthier.

Essentials for Healthy Homes Practitioners

Purpose of this course:

- Provide training for public health and housing practitioners in the assessment and treatment of housing related health hazards, with a focus on practical and cost-effective methods.
- Promote cross training of public health and housing practitioners.
- Create a forum for the exchange of practical guidance about healthy housing strategies among federal, state, tribal and local agency staff.
- Develop a mechanism for the ongoing introduction of new research findings into public health training and practice.
- Identify and optimize opportunities for networking, collaboration and partnerships.

Course Outline

- Overview
- Start with People
- House as a System
- Keep it:
  - 1. Dry
  - 2. Clean
  - 3. Pest-Free
  - 4. Ventilated
  - 5. Safe
  - 6. Contaminant-Free
  - 7. Maintained
  - Keep it Climate Controlled
- Making it Work

Key Messages

- There is a link between housing and health.
- Certain groups are at greater risk for adverse health effects.
- There are basic public health and housing principles that can help us understand the link between housing and health.
- The Healthy Homes movement is a holistic approach to promote health through better housing.
- Codes and regulations are tools that can help you achieve healthier housing in your community.

Learning Objectives

- Describe four housing conditions and their associated health problems.
- Identify three populations at higher risk for housing related disease and injury.
- Identify three types of codes used to enforce remediation of housing-related hazards.

Start with People

Start with People
House as a System
Keep It:
1. Dry
2. Clean
3. Pest-Free
4. Ventilated
5. Safe
6. Contaminant-Free
7. Maintained
8. Climate Controlled
Making it Work

You need to start with people to have a healthy home. A home is only healthy if it works for the resident, and people come in all shapes and sizes with varying needs. For example, a child with asthma would mean you need to pay special attention to asthma triggers. For an elderly person, you need to be especially sensitive to the risk of falls.

Why Do You Go Into Houses?

Think about the different purposes and motivations for why you go into houses and how that changes the dynamic and relationship you have with the resident. For example, a nurse is going to provide care and is usually a trusted resource. A home inspector is paid to identify problems in the sale of a house. When a home is being sold, there are opportunities to make important repairs. A code inspector is responding to a complaint and may be seen as government and not trusted by the resident.

Why Start with People?

- What good are they?
- What's difficult about people?
- How can you deal with people?

These questions may make you chuckle, but you should seriously consider what role people serve. They are a source of information about the home. They can point out problems that occurred in the past and may only be obvious at night (like pests).

You need to recognize the resident's agenda. They usually have a story that they want to tell. Until they tell the story, they may not be able to listen. The story may be a battle with a landlord or frustration with a contractor. You need to listen and then ask questions.

Closed-ended or direct questions to residents are likely to get yes or no answers. These answers often miss the detail that help get at information you need to know.

Open-ended questions are more likely to get more details. These details can help you understand hidden problems or past problems that may be hard to see.

You should note the challenge of using a checklist when talking to a resident. Checklists naturally are based on closed-ended questions. The box either gets a check or it does not. If you rely just on checklists, you are likely to miss important information.

Learning Objectives for this module

- Explain how to work with people to get important information from them about potential hazards in the home.
- Identify key routes of exposure and their relationship to housing hazards.

Bracketing

The first strategy for getting good information from residents is bracketing. Bracketing is an internal technique for staying calm and non-judgmental, and keeping the ability to listen and to coach. Here's what can get bracketed:

1. The negative feelings and critical statements communicated to you by others.
2. Your negative feelings and judgments of others.

Health service inequities may result from differences in expectations, assumptions, knowledge, and in perceived values that individual workers and residents may have. Recognizing when these differences affect one's ability to provide services is an important step in recognizing potential service disparities. Always consider the question: What barriers are preventing me from providing information to a client in the best way possible?

You may think you are carefully hiding your expression but people often can see it. A person who is illiterate has survived by reading expressions. Bracketing can help you acknowledge and move on rather than trying to hide it.

Open vs. Closed Questions

Open-Ended or Indirect

- How
- What
- Tell me about
- Describe for me

Closed-Ended or Direct

- Are
- Is
- Do

Example: You are in a residence providing a lead hazard evaluation. The house is a mess and you see lots of alcohol bottles around.

Your internal thought: I'm starting not to like these residents—they are so messy, there is dust everywhere, and it looks like they drink a lot. They don't seem to care one way or the other about lead.

Internal Bracket: [Your negative feelings about the residents; your judgments about their cleaning and lifestyle.]

Your revised internal thought: I may have negative feelings about these residents, but they may really need my coaching. Besides, they may not know that dust may be a lead hazard, or where the hazards can come from.

Your verbal response : "Would you like to sit down with me and find out what sorts of potential lead problems we found in your home?"

Result: You put aside (suspend) your feelings and judgment, and lay the foundation for the coaching partnership by proceeding with the non-judgmental assessment.

Many of the hazards people are exposed to in their homes are the result of sources that they bring in themselves.[1] A key example: tobacco smoke is an important contaminant source in indoor air. We know that children who have a smoking parent are at an increased risk for sudden infant death syndrome (SIDS), acute respiratory infections, ear problems, and more severe asthma.[2]

Other examples: frying foods releases large numbers of fine particles (a range hood helps to reduce their spread); pesticides used in the home are the largest pesticide exposure to US citizens.[3]

While these activities are common, sometimes people do fairly odd things in their homes that result in hazards including:

- Melting and casting lead
- Injecting molding plastics
- Welding
- Barbequing indoors

You should be prepared to identify resident behaviors that are important to consider. For example, most residents know that smoking is a problem. Often they will explain that they do it outside. But if you can see ashtrays around the home, they are hiding the truth.

The person in the picture below who is spraying pesticides (most likely to deal with wasps) misunderstands the danger. She is wearing a mask but no gloves. With her finger on the nozzle, it is the most likely route of exposure.

Special Communication Issues

- Language
- Cultural
  - Shoes in the home
  - Men and women
- Responding to Problems
  - Hoarding
  - Tolerance for clutter and pests

Think about the communication problems you may have had with clients you've visited. Also remember that there are cultural issues to consider – for example, if you are a man visiting a home and the resident is a married woman. In some cultures, the woman cannot let people in.

Issues like hoarding are particularly challenging and take a sustained effort. A social worker is often particularly adept at dealing with the problem. A simple cleaning is usually not sufficient because the problem will likely recur. There are also support groups such as Hoarders Anonymous or Messies Anonymous.

Remember too, that residents need to make difficult choices. Too often they need to balance their health, their comfort, and the cost of the correction.

In addition to identifying what is going on in the home, you need to understand what is going on in the neighborhood. Some neighborhoods have a history that predisposes houses to problems. Houses built on industrial, waste disposal or agricultural sites may have contaminants in the soil. Also, think about the sources of drinking water for residents and where sewage goes.

Resident Choices

- Health
- Comfort
- Cost

Risk = Hazard x Exposure

To understand how a contaminant can hurt a resident, you need to understand the primary routes of exposure. *The Contaminant Guide* that is part of the *Healthy Homes Specialist Credential* study guide can help here.

Normally, inhalation is the most important route of exposure. The resident cannot avoid breathing and what enters the lung can be directly absorbed into the blood through the alveoli, especially if it is a solvent or volatile organic compound. In addition, the lung has limited ability to repair damage. The body defends the lung with mucous and hair in the nose and cilia in the bronchi. The cilia collects the contaminant and moves it up the lungs until it is dumped into the throat where it is swallowed or coughed up.

Smoking paralyzes the cilia so particulate and other contaminants penetrate the lung deeper. That is why the risk of disease from radon and asbestos is greater for smokers. When the smoker stops smoking for awhile – like when they are sleeping – the cilia "wake" back up and dumps the collected material in the throat. The smoker wakes with the characteristic "smokers hack."

Ingestion is typically less important than inhalation but still significant. People can usually avoid ingesting contaminants by washing their hands and wearing gloves. But children play on the floor and suck their thumb; ingestion is a bigger worry for them. The stomach protects itself with acids that digest the contaminants. However, for some contaminants like lead, the acid dissolves the lead so it can be more easily absorbed. Finally, the stomach can repair itself by regularly replacing its inside lining.

Skin absorption is relatively uncommon especially in the home environment. Few chemicals can be absorbed through the skin. Usually these chemicals are found in harsh cleaning products or in hobbies. Phenol and methanol are examples. The skin repairs itself by regularly replacing itself. This will occur unless it has been irreversibly damaged. Irreversible damage can occur when exposed to a chemical labeled "corrosive."

Injection is very unusual but when it occurs it can be serious. It can occur with splinters. Splinters from treated lumber, especially lumber from before 2004 that may be treated with arsenic, are a common route of injection. They should not be a problem if the splinter is entirely removed.

Built-in protection mechanisms such as cilia and stomach relining help the body protect itself from contaminants. Remember that risk requires exposure to a contaminant. If you reduce exposure, the person will have less risk and be safer.

What's going on in the neighborhood?

- What neighborhood?
- What uses?
- How zoned?
- What services?
- Water?
- Sewer?
- Solid waste?
- How old?
- Who owns it?
- Water supply? Lead?

Routes of Exposure

- Inhalation
- Ingestion
- Skin Absorption
- Injection
- Built-in Protection Mechanisms

Signs and Symptoms of Diseases Related to Housing

How would you be able to detect signs and symptoms of diseases related to housing? First, signs of disease are things you can measure or an outside observer can see, and therefore are more objective. Examples of things you can measure include blood pressure, heart rate, and peak flow meter measures if you are visiting someone with asthma. It can also include observations of the person, like seeing evidence of a bloody nose or a rash. It can also includeyour physical examination of the person if you would normally do that. Symptoms of disease are things experienced and described by the person and therefore are more subjective. Examples include back pain, fatigue, headaches, etc.

There are some examples that are both a sign and symptom, something like shortness of breath, which can be observed sometimes and described by the patient. None are more important than others in determining a relationship between housing and health issues.

Timing and corroboration become important when trying to tie a sign or symptom to an environment. Timing becomes crucial since most people will describe a connection between a certain time of day or certain environment. Do the signs and symptoms occur at the same time each day? The same place each day? Is there a seasonality, where they only occur in certain times of year? If so, this could rule it out as a housing problem if it is more related to outdoor pollens. It could also rule it in as a housing problem if during rainy season the roof leaks and leads to more mold growth in the house.

Corroboration becomes important also. Are there other people with the same signs, symptoms and timing? This is not crucial to identifying a housing related health problem, but does offer more evidence to suggest one exists. Lastly, do these symptoms resolve after the person leaves the environment? This again goes to timing and location of when signs and symptoms occur and that they are not always present. Consider the example of carbon monoxide. People may experience high levels in the morning when the gas furnace turns on to warm up the house or someone warms up the car in the garage.

Poor housing conditions, including crowding and inadequate lighting, are associated with risk for poor mental health. Poor-quality, overcrowded, multifamily homes are associated with outcomes that include aggression and withdrawal, lower general health status and psychological distress, particularly among women and children. [4-8] Lack of light (e.g., from inadequate number and placement of windows) is related to depression.[9,10]

Although some studies have suggested an association of dampness or mold with depression, the Institute of Medicine concluded that evidence is insufficient to determine whether an association exists between either damp indoor environment or presence of mold and neuropsychiatric symptoms.[11,12]

Bed bugs may also affect mental health and result in anxiety and/or insomnia.

How can you identify the housing conditions that may affect health?

A resident may be able to recognize the signs and symptoms related to their health, but not be able to identify what's going on in the environment. Many exposures are only found out about because someone else asks. Some problems in the home are often overlooked, mostly because you can't see them or smell them so they are difficult to detect. Examples include lead, radon, and carbon monoxide.

What are the signs and symptoms of housing-related disease?

- Signs are things you can measure or an outside observer can see (objective)
  - Blood pressure, heart rate, peak flow
  - Bloody nose, rash
- Symptoms are experiences and described by a person (subjective)
  - Back pain, fatigue, headaches
  - Tolerance for clutter and pests
- Some can be a combination
  - Shortness of breath

Tying a Sign or Symptom to the Environment

Timing, location and corroboration are very important in relating to environmental problems:

Do signs and symptoms occur

- At the same time each day?
- In the same place each day?
- Only in certain times of the year?
- Do others have the same signs and symptoms and same timing?
- Do signs and symptoms go away when out of the environment?

For lead, a simple question about whether a home was built before 1978 would help determine if lead based paint could be present, since leaded paint was outlawed after that date. If the house was built before 1950, the likelihood of lead paint increased substantially since older homes can have more concentrated amounts of leaded paint. As the Keep it Maintained module will describe, lead paint exposure has been associated with a variety of health problems, including developmental delays and lower IQ in children.

For lead, a simple question about whether a home was built before 1978 would help determine if lead based paint could be present, since leaded paint was outlawed after that date. If the house was built before 1950, the likelihood of lead paint increased substantially since older homes can have more concentrated amounts of leaded paint. As the Keep it Maintained module will describe, lead paint exposure has been associated with a variety of health problems, including developmental delays and lower IQ in children.

For radon, simply asking about whether a home was ever tested for radon is crucial. Radon is an odorless gas that is the second leading cause of lung cancer.

For carbon monoxide, asking if a resident has a carbon monoxide detector will potentially save someone's life. Low dose chronic carbon monoxide exposure can also be a health hazard.

Other potential sources of housing related health problems are ones that people may be aware of in their home but are often ignored, such as second-hand smoke, consumer chemicals, and pesticides.

Second-hand smoke is a hazard that is brought into the home and is harmful to the people exposed. Asking whether the smoker wants help with quitting is an essential first step to getting second-hand smoke out of the home permanently. Asking if anyone who visits the home smokes may also be important, and whether the people smoke outside (not just in the other room or with the window open) is crucial.

Consumer chemicals is a broad category, but generally just asking what chemicals are used in the home is an important first step. Asking about cleaning chemicals is good since many people may not connect the headache they get every time they use the ammonia to cleaning the kitchen floor. Asking where they are stored is important to prevent accidental poisonings from children. Other consumer chemicals include air fresheners which can have chemicals that cause cough and runny noses in sensitive individuals.

Lastly pesticide use is often probable if people are trying to get rid of pests, such as mice or cockroaches. Asking which chemicals are used, and if people do not know, having them ask the pest exterminator, can be a vital first step. Exposure from pesticides is much higher with sprays and bombs and is much lower with gels. Baits and even over the counter sprays, such as Raid, have pesticides, which many people may not realize.

Often OVERLOOKED sources of health problems

- Lead
  - Was your home built before 1978? 1950?
- Radon
  - Was your home ever tested for radon?
- CO (Carbon Monoxide)
  - Do you have a carbon monoxide detector?

Often IGNORED sources of health problems

- Environmental Tobacco Smoke
  - Does anyone smoke in the family smoke?
  - Do they want help quitting?
- Consumer Chemicals
  - What cleaning chemicals do you use?
  - Where do you store them?
- Pesticides
  - Any pesticides used?
  - Which ones?

Epidemiologic Triangle of Disease

The epidemiological triangle is an excellent tool that professionals use to analyze a complex situation. It identifies three groups of factors that combine to cause an adverse health affect (disease or injury). You might also think of this as the who, what, and where triangle of disease.

Most public and environmental health professionals think of disease in terms of the epidemiological triangle below.

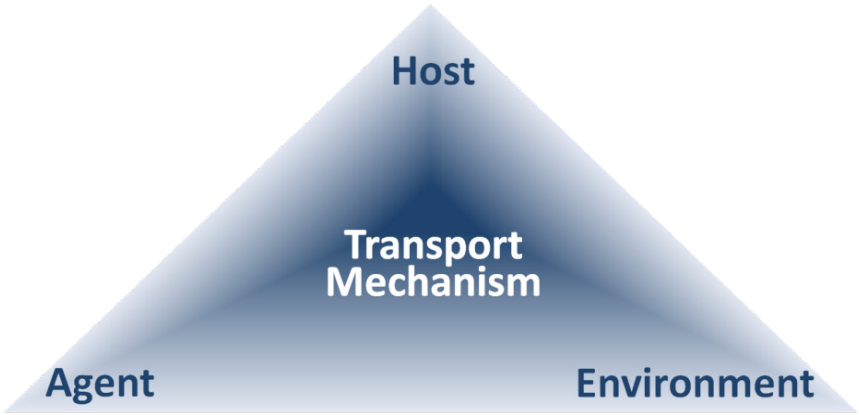
The HOST is the PERSON or the who.

The AGENT is the SOURCE or what, that can bring about changes in a person's health. Agents of disease and injury can be biological, chemical, and physical.

The TRANSPORT MECHANISM is any mechanism, direct or indirect, by which an agent is spread from the environment to the host. Transport mechanisms are either a VECTOR or a FOMITE. A transport mechanism ties the three factors together.

A VECTOR is an insect or any living carrier which transports a pathogenic microorganism from the sick to the well, inoculating the latter. A FOMITE is an inanimate object that transports the agent to the host.

In this course, we do not rely heavily on the epidemiologic triangle because the host is usually the resident and the environment is the home. With two legs established, it is simpler approach.



Learning Objectives

- Explain how to work with people to get important information from them about potential hazards in the home.
- Identify key routes of exposure and their relationship to housing hazards.

House as a System

This module will help you see how the house functions as a system and introduce you to to the critical role of air movement in a home. Make sure to thoroughly understand the points in this module or later information will be difficult. Think of this module as introducing you to the later *Keep It Ventilated* module.

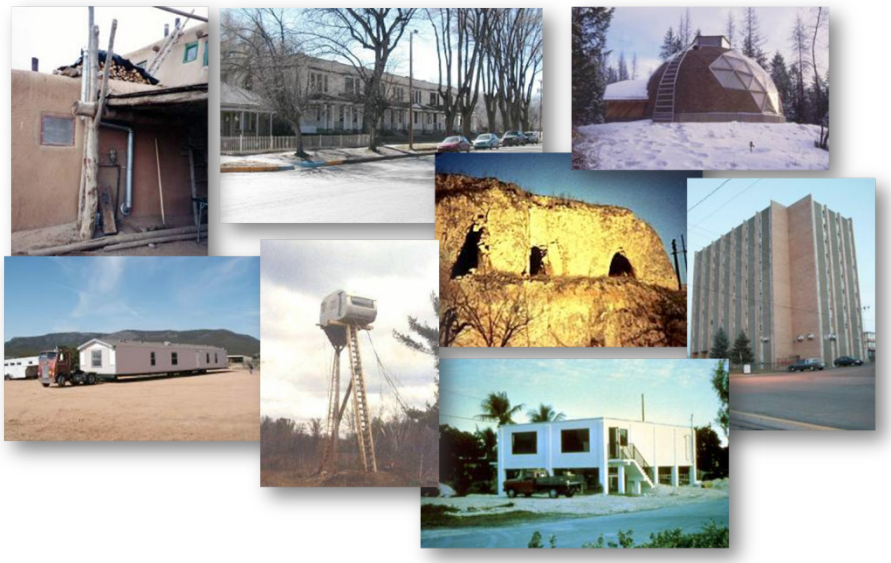
The focus of this discussion is a typical home. One of the three types of homes is probably relevant to where you live.

1. Two-story home with a furnace and water heater in the basement and a crawlspace
2. Two-story row house
3. Two-story home with an open crawlspace and air handler in the attic

What's a House?

Houses can look drastically different, but they all share a common purpose. Think about the differences and the types of housing in your community.

Start with People
House as a System
Keep It:
1. Dry
2. Clean
3. Pest-Free
4. Ventilated
5. Safe
6. Contaminant-Free
7. Maintained
8. Climate Controlled
Making it Work



Learning Objective for this Module

- Identify three important housing systems that contribute to a comfortable living space.

Homes Shelter Us From:

- Animals and Insects
- Wind
- Sun
- Rain (sleet, snow)
- Cold or hot air
- Dust

Houses are a way of transporting a dry Mediterranean climate to every place on Earth. Residences may look a little different, but they must all do the same thing—create a comfortable inside space regardless of what's happening outdoors.

We enclose space with walls, windows, roofs, ceilings, floors and foundations that provide us with shelter from sun, wind and rain and make it possible to heat the space when it is cold out and cool the space when it is hot out. The enclosure is a climatic transition zone whenever outdoor conditions are different than indoor conditions.

Think about the climate in the community where you live and how it may impact a home.

Most of Us Are Comfortable:

Most of us are comfortable with the following conditions:

- Air temperature: 65°F (active) – 80°F (bathing)
- Air relative humidity: 30% –70%
- Air motion: 20– 40 feet per minute
- Surrounding surface temperatures: within 10–15°F of room air.

Most people are comfortable in the ranges of temperature, humidity, air speed and surface temperatures noted above. There are of course times when we are not: we are overdressed or underdressed; we are doing heavy work and generating two or three times more heat than when we are sitting; we have just come in from a cold or hot outdoors and have not acclimated to the new conditions; we are simply bored with paradise conditions (hence steam rooms, saunas, cold dips).

We Have Systems to:

- Add heat
- Remove heat
- Ventilate
- Maybe add or remove humidity

The enclosure of a building provides shelter. The mechanical systems do these things to make it more like a Mediterranean climate. They add or remove heat to balance heat loss or gain from outdoors (sometimes humidity loss or gain as well). Things we do in houses generate heat and water vapor – e.g. a person at rest releases around 240 British Thermal Unit (BTU) of heat and 0.1 pounds water vapor per hour. At higher activity levels this increases. For moderate activity it is more like 800 BTU and 0.2 pounds of water vapor are released per hour. During heavy work these rates may double or triple. In addition to people, any piece of operating equipment releases heat, including lights, refrigerators, freezers, motors, televisions, and computers.

Heating Systems

Heating systems can be can be divided by their fuel source, how they distribute heat to the building, how they vent the combustion by-products, and how they are controlled.

Fuel: gas, oil, wood, electric

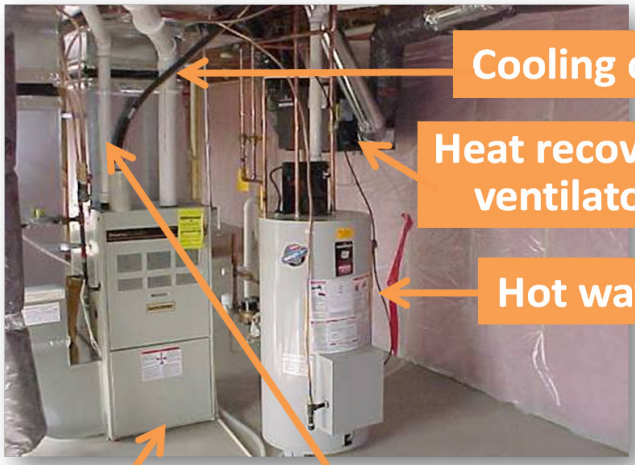
Distribution: hot water, steam, warm air, space heaters; radiators, baseboards, ducts; radiant floors and ceilings

Ventilation: chimneys; sealed combustion; fan powered

Temperature controls

Heat must be added to a building when the outdoor air cools down and the wind blows. How much heat must be added depends on how well the building has been insulated and air-sealed. The heat released by activities in the building helps to heat it when it gets cold out. An ordinary building has to begin adding heat when the outdoor temperature drops to five degrees below the thermostat setpoint. The heating system in a well-insulated and sealed building may not turn on until the outdoor temperature drops by ten or fifteen degrees.

The pictures at the top of the next page show several typical heating and cooling systems and a hot water heater. Pictures of older, less common systems follow.



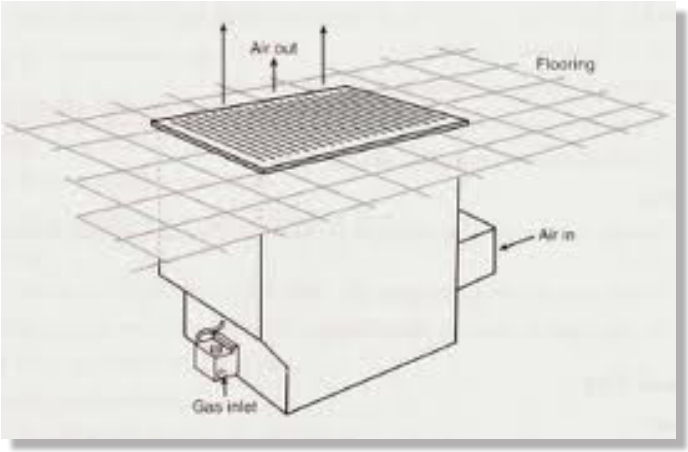
Left picture: A photo of a gas fired sealed combustion warm air furnace and a power vented hot water heater. A DX cooling coil has been installed in the supply side of the air handler so this is a heating and cooling system. There is no way of inspecting and cleaning this otherwise well designed system. Notice the heat recovery ventilator in the background behind the cylindrical water heater.

Right picture: An oil-fired boiler provides hot water to baseboard radiators. This boiler has a dedicated outdoor air supply ducted directly to the burner air intake.

To the right is a picture of an octopus heating system—also known as a "gravity feed" system. They were mostly used between the late 1800's through the mid 1900's.

This antiquated system consists of a natural gas or oil fired burner and heat exchanger with no blower. It looks like an octopus in the basement because with no blower it needs large ducts sloped upwards to allow the heated air to flow upwards to the perimeter of the rooms above, while a centrally located cold air return brings the cooling air back down into the furnace located in the middle of the basement. These systems typically have asbestos wrapped ducts. The older ones may have been coal fired, and the natural gas fired ones may have been retrofitted.

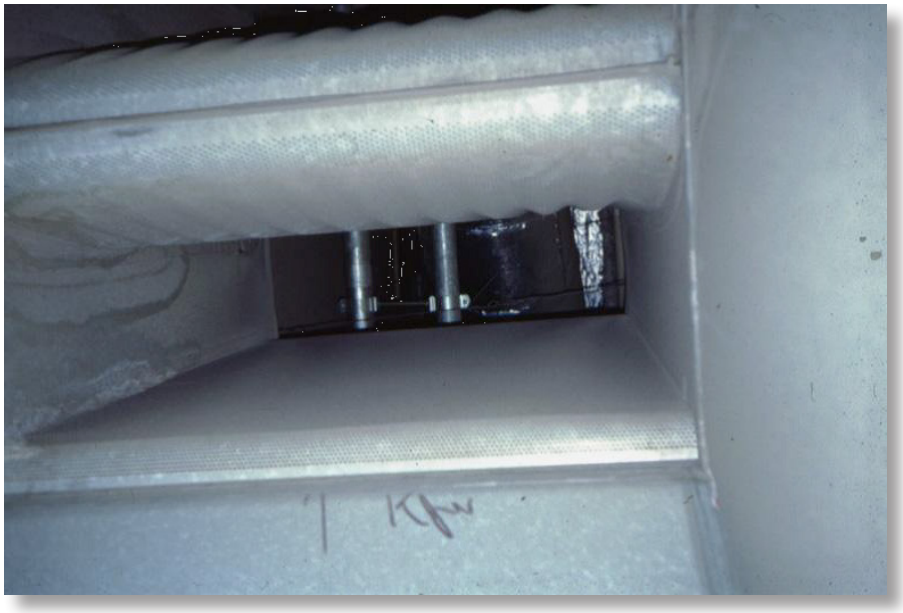
Below are pictures of a floor furnace. These furnaces are like an exposed heat exchanger that is mounted under the floor. Their advantages are that there are no ducts to leak, no fans to push or pull air from unconditioned sources, and they do fairly well if all doors inside the house are kept open. Since heat rises these furnaces can warm up a house with 8 foot walls very well. However, floor furnaces have hot grills and will burn if stepped upon with a bare foot. Carbon monoxide detectors along with smoke detectors are needed in case the units develop a crack in their heating chambers.



Floor furnaces are generally found in houses built in the 1920's up through the 1940's. New ones are still being produced for replacements. They may have been used as early as 1900 when this type of system was first being created. They do have good points, especially where a forced air system installation would destroy the integrity of an older house. They are good systems when properly maintained.[1]

This is an example of a gas-fired wall furnace. Wall furnaces are either installed on the wall as a free-standing unit or recessed within the wall. All currently manufactured models of wall furnaces are gravity-vented (without fan-assisted combustion). Heated air can be furnished either by gravity or fan circulation. Gravity units operate in the same manner as gravity room heaters. Like room heaters, gravity units can be shipped with optional counterflow fans. Fan wall furnaces are equipped with factory-installed air circulation fans. The efficiencies of fan wall units are relatively high, since they are designed to take full advantage of the counterflow air circulation. [2]

Below is a photo of a heat exchanger inside a furnace. This is the side where inside air moves. Inside the metal tube is the flame.



Cooling Systems

- Fuel - almost all are electric
- Windows, fans, and shades
- Distribution
  - Central air
  - Through the wall
  - Duct-less splits
- Dehumidification
  - Air conditioners/part-load
  - Dehumidifiers
- Control thermostat, humidity

Residential cooling systems are nearly all powered by electricity. There may be one or multiple cooling units. The cool air may be distributed using ductwork or cool air may be blown from the unit directly into the room (window air conditioners and ductless split air conditioners).

Although properly sized air conditioners can dehumidify, they are not efficient at it until they run around 20 minutes in each hour. The more oversized an air conditioner is the less it will dehumidify. When this happens people feel cold and clammy—the air cooled to the setpoint but it is humid. The first step is to size the unit correctly. Many ductless split systems have electric resistance reheat in them to improve humidity control and in fact can often be controlled by a humidistat as well as a thermostat.

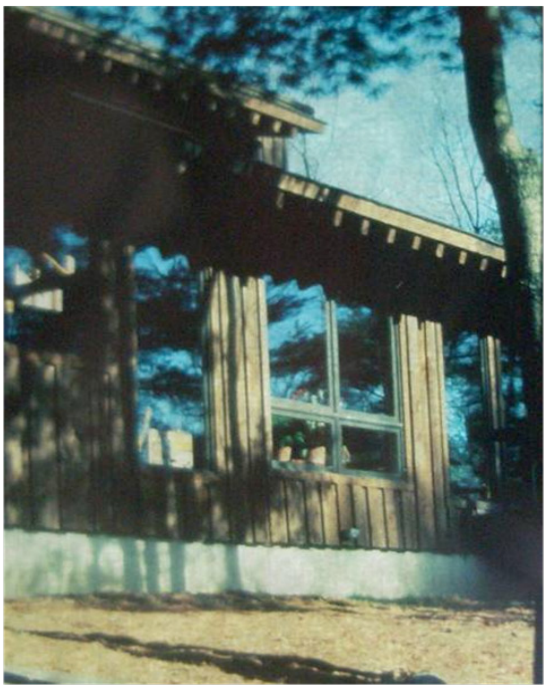
A dehumidifier is an air conditioner that uses the heat it removes from the air to reheat the cold air rather than dumping the heat to the outdoors. A small dehumidifier can be used in combination with an air conditioner to provide both temperature and humidity control.

Left: a picture of a warm air furnace with central air conditioning. There is no way to inspect or clean the coil without opening up the ductwork.

Bottom right: an electric heat pump in a multi-family building.

Upper right: an A-coil in a horizontal DX air conditioner.

A significant amount of cooling can be done by blocking the sun (trees, high performance windows, shades) and providing recirculating fans and venting equipment that produces heat.



Internal and Solar Gains:
Good when cold out; bad when hot out

Heat can come from people (100-150 watts/person), electric and gas appliances, and solar heat in through windows. In the average house in the United States, around 23% of heating is done by these gains and 59% of cooling needs are caused by these gains. Heat from occupants and activities and sunlight shining through the windows can help heat the house when it is cold out, but add to the cooling load when it is hot out.

Other Factors Related to Heating and Cooling

- Water (drinking, cooking, washing, toilets)
- Cooking and storing food
- Ventilation fans
- Lighting
- Computers, stereos, hair dryers, razors

Again the home and the real world are complex. There are other things that are going on in the house that affect temperature and moisture. Once people are in the building they need to cook, wash, groom, work, entertain, and use the bathroom. Somewhere water comes into the building does a number of jobs and leaves through a sewage pipe. How does that happen? Where does it happen? The same is true for electricity and air.

Learning Objectives

- Identify three important housing systems that contribute to a comfortable living space.

Keep it Dry

Start with People
House as a System
Keep It:
1. Dry
2. Clean
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Making it Work

Learning Objectives

- Name three health hazards in the home that are related to excessive moisture.
- Identify four sources of moisture in the home.
- Describe five strategies for controlling moisture in the home.

Excess moisture is associated with increased incidence of respiratory disease. The prevalence of asthma or respiratory symptoms is twice as high for occupants of schools or homes with evidence of dampness problems or molds. In places where there is mold and environmental tobacco smoke there has been a noted 20-40% increase in asthma symptoms or respiratory symptoms.

Molds can trigger asthma attacks in sensitive individuals. They can also adversely affect immune system function.

IOM Report
Mold & Moisture Related Health Effects

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

Moisture Sources

A Keep It Dry example – Does Water Drain Away From the House?
Drainage is the key to rainwater control. The roof, the walls, the windows, the foundation and the site must drain water away from the building. Examine the site to see how rainwater flows. Does the landscape drain water away from the house or towards it? Is there evidence the water table at the site is near the surface? Are there gutters on the house?

Learning Objectives for this module

- Name three health hazards in the home that are related to excessive moisture.
- Identify four sources of moisture in the home.
- Describe five strategies for controlling moisture in the home.

Moisture Sources

Keep things dry. These are the sources of water that have to be controlled to avoid problems.

- 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

Prevalence of Interior Water Leakage in the U.S.

- 8.5% had interior water leakage in 12-month period
  - 2.0% from fixtures
  - 3.9% from leaking pipes
  - 0.9% from broken water heater
  - 2.3% from other or unknown causes
- The problem was worse for:
  - Renters – 10.7%
  - Those living below the poverty line – 10.4%
- Up from 8.4.% in 2011 for interior water leakage

From American Housing Survey – 2015[a]

8.5 % Interior Water Leak	
Source of interior leak	**% among total # of units**
Leaking pipes	3.9%
Fixtures	2.0%
Broken water heater	0.9%
Other or unknown	2.3%

Prevalence of Exterior Water Leakage in the U.S.

- 9.9% had exterior water leakage in 12–month period
  - 5.6% from the roof
  - 2.2% from the basement
  - 2.0% from the walls, closed windows or doors
  - 1.0% from other or unknown source

From American Housing Survey – 2015[a]

11% Exterior Water Leak	
Source of exterior leak	**% among total # of units**
Roof	5.7%
Basement	2.8%
Walls/windows/doors	2.2%
Other/unknown	1.2%

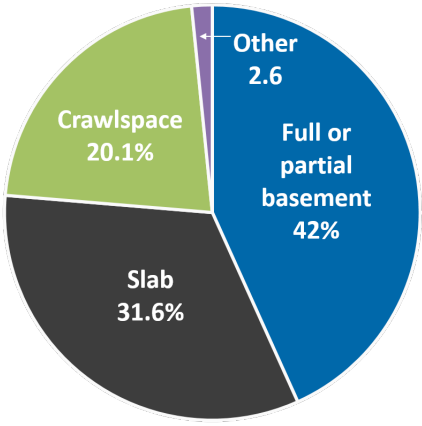
[a] Figures will not sum to total because a unit can have more than one type of leak.

Construction Factors

Of single family homes excluding mobile homes:

- 42% have full or partial basement
- 20.1% have crawlspace
- 31.6% have slab
- 2.6% have "other"

From American Housing Survey – 2015[a]



Exterior physical condition of homes

- 19% of homes have some physical condition contributing to leaks
- 1.8% have sagging roof
- 2.8% have missing roofing material
- 1.3% have hole in roof
- 2.2% are missing bricks siding or other outside wall material
- 1.1% have sloping outside walls
- 1.0% have boarded up windows
- 5.1% have foundation crumbling or has open crack or hole

From American Housing Survey – 2015[b]

19% One or More Exterior Problems	
Exterior condition	**% among total # of units**
Foundation crumbling/open crack/hole	5.1%
Broken windows	3.7%
Missing roofing material	2.8%
Missing outside wall material	2.2%
Sagging roof	1.8%
Hole in roof	1.3%
Sloping outside walls	1.1%
Boarded up windows	1.0%

[b] Note that this excludes multiunit housing and that since conditions are not mutually exclusive (e.g., one can have both broken windows and missing roofing material), the numbers in the table do not sum to 100%.

Comfort Levels

The following ranges are the levels at which most humans feel comfortable in indoor environments:

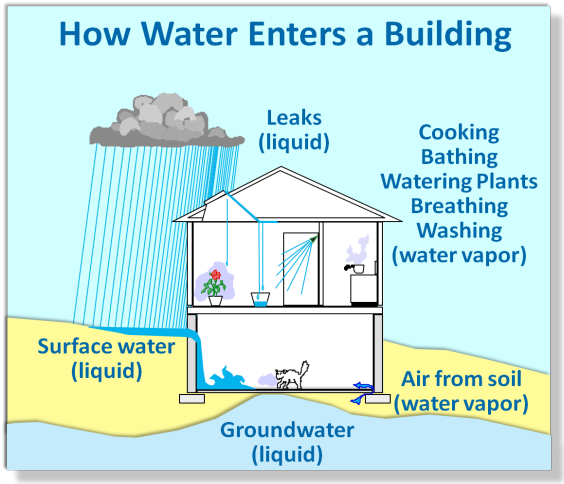
- Air temperatures: 65°F (when active) – 80°F (when bathing)
- Air relative humidity: 30% – 70%
- Air motion: 20 – 40 feet per minute
- Surrounding surface temperatures: within 10 –15°F of room air

Structural building conditions, personal activities, weather conditions, and the adequacy of available heating and cooling systems all affect the ability of individuals to maintain their indoor environments in these "comfortable" ranges.

How Water Enters a Building

Keep out liquid water

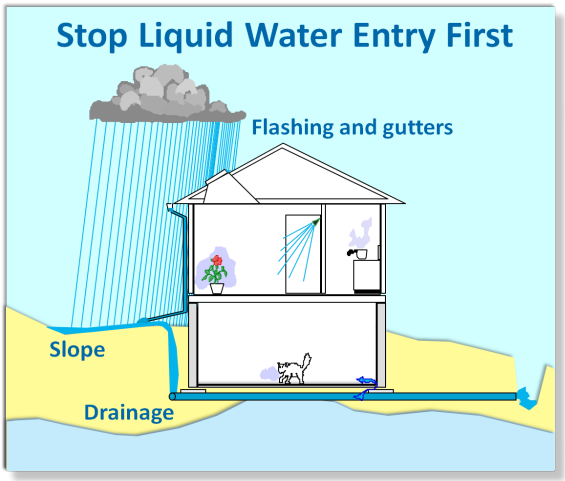
- Trace and repair rain leaks, which occur at places where materials join (e.g. an improper flashing detail at a roof/wall joint, no damp proof course in a parapet wall, skylight or equipment curbs).
- Trace and repair surface water and groundwater leaks, which are usually the result of poor or failed drainage detailing (e.g. no capillary break beneath a slab on grade, poorly designed rain gutters, clogged footing drains, poorly graded site).
- Trace and repair plumbing leaks.



Manage Water Vapor Migration

Outdoor air as a source of water vapor

- During cooling seasons, the outdoor air may be hot and humid. If air conditioning systems are not designed to deal with the latent load, thermal comfort problems and condensation in the supply system may result. If the building or rooms, plenums or cavities are running negative in the cooling season, thermal comfort problems may result or condensation may occur in the walls, ceilings or plenums of the building.



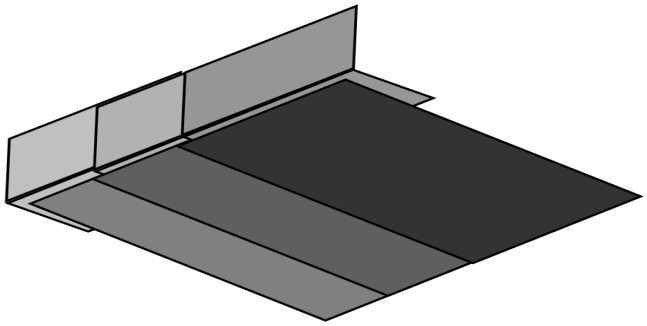
Combination of wind, capillary suction and sun driven rain as source of wall moisture

- A masonry wall which receives direct sun will experience a significant daily temperature swing on the outer surface. If the outer surface of the wall has even a small amount of moisture entering by wind or capillary suction, moisture can accumulate to saturation levels in the masonry if there is an interior layer of low-permeability material (e.g., foil-faced or extruded foam board,

vinyl wallpaper). The warmed outer surface of the wall creates a large partial pressure difference that drives the moisture into the wall, then the moisture has no place to go.

Protect indoor chilled surfaces

- Protect surfaces such as chilled water lines or earth contact foundation materials using insulation and low permeability materials layered to keep water vapor away from chilled surfaces. Locate the materials so that unconditioned outdoor air will not be drawn across them.



Step flashing is layered on top of each course of shingles and flashes the joint between an adjoining wall and the roof. Most importantly it does not rely on sealants.

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Problems with Managing Rainwater

Below left is a picture of a downspout that dumps all the collected water next to the foundation. The discharge has been crushed by people or lawnmowers.

On the right is a solution to the problem. This is a picture of a downspout that goes below grade and extends ten feet from the house with solid pipe where it transitions to another fifteen feet of perforated pipe (protected by filter fabric) creating a leaching system.

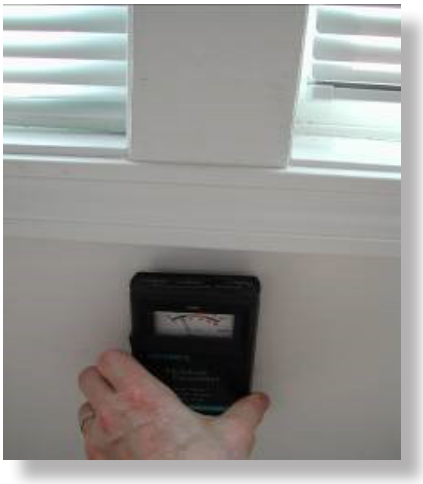
Retrofit rainwater protection

Here is a retrofit method of controlling rainwater from the exterior. EPDM rubber roofing is placed against the foundation wall and extended out below grade. Filter protected drain pipe and porous backfill are used to collect water and drain it away from the foundation.

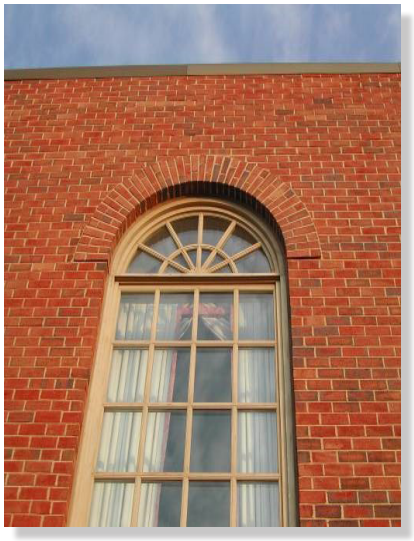
Retrofit rainwater protection

Windows Leak?

Masonry plus rain and sun plus air conditioning plus vinyl wallpaper = mold. You can usually see clues on the outside to shape your indoor inspection. This picture shows severe moisture damage beneath a window. Windows may leak rainwater at mitered corners and where multiple windows are mulled together. They may leak around the edges where they should be flashed into the wall system. The picture below shows the use of a moisture meter to check moisture beneath a window. Contractors and renovators should use window installation methods that prevent such damage.



Sidings that absorb rainwater in combination with air conditioning and an interior vapor barrier can result in condensation and mold growth. The brick absorbs rainwater, the sun heats the water, evaporating it and creating very high vapor pressure in and behind the brick. The vapor pressure drives water vapor into the wall. The vapor passes through the wall until it hits an intentional (polyethylene films) or accidental (vinyl wallpaper, chalkboard, mirror) vapor barrier that is chilled by the air conditioned interior. Then the vapor condenses.



Back venting the brick, using a low perm sheathing and running the building under positive pressure help reduce this problem. Running the building under negative pressure aggravates the problem.

Air conditioner condensate drains into building

Porous material can wick water from outside

The bottom few inches of this wall are damp because water is wicking up through the footing by "capillary suction." It is only wet a few inches from the slab because the moisture evaporates into the basement. In an unfinished basement this is probably not a problem, but if the wall is finished using paper covered gypsum board, paneling and wooden studs or furring strips, a dark, damp place is created. This provides good conditions for mold growth.

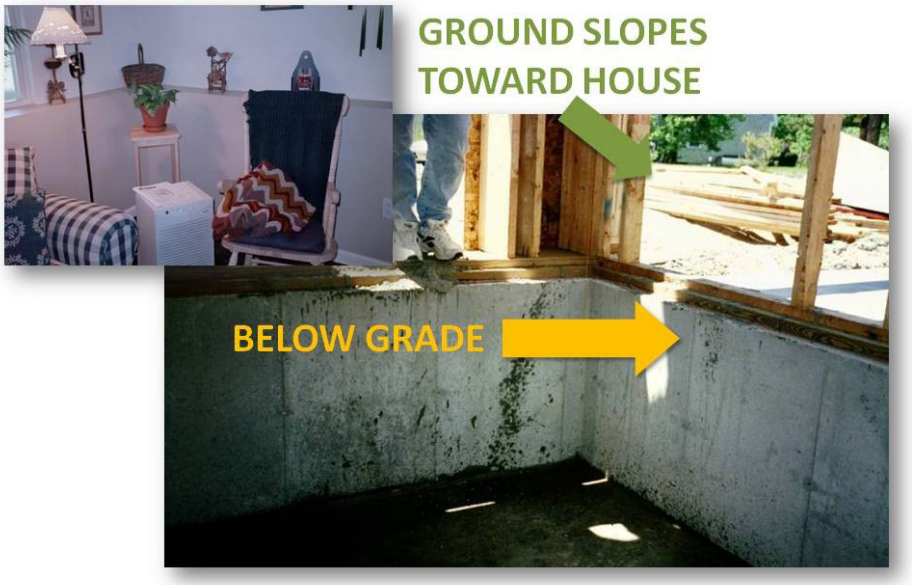
This room smells musty.

What do you think is going on?

Do you see any visual clues?

Hidden mold?

The picture in the upper left corner shows the picture on the previous page. Notice that the room was a finished room with walls that are partially below grade. The room had no visible mold but smelled musty. Removing the furnishings and finishes revealed significant mold growth.



Molds are organisms that colonize surfaces. They produce large numbers of spores that contain DNA and enough food to start growth. Unless extremely diligent efforts are made to keep surfaces clean on a daily basis, there are mold spores on virtually every surface in a building. Ordinary house dust contains tens of thousands of mold spores per gram.

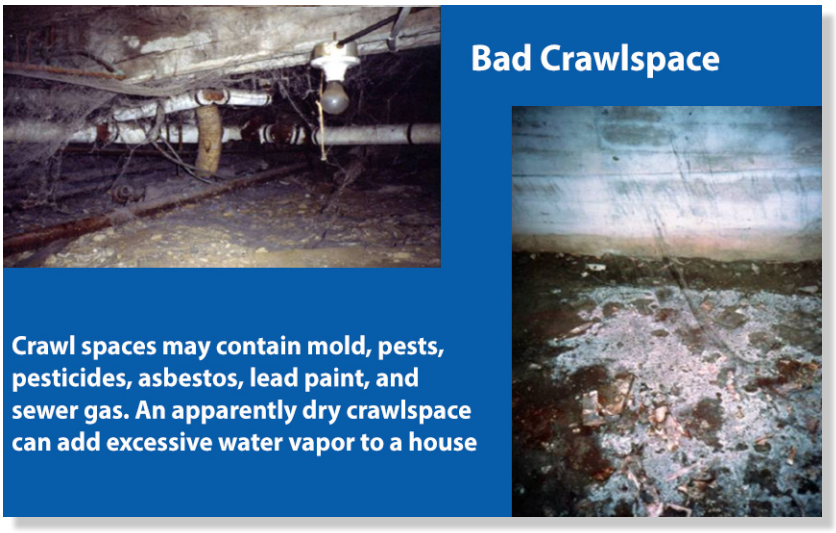
If conditions are right the spore germinates and sends out thread-like hyphae. The hyphae exude enzymes. If there is enough free water available the enzymes go into the solution and digest available food. The nutrient solution is absorbed back into the hyphae, more growth occurs, and spores are produced until the colony runs out of food or water.

In the photo on the right, the wooden flooring seen here is composed of heartwood Douglas fir and sapwood Spruce. The Douglas fir has almost no mold growth on it because there are very few sugars and starches in heartwood. Molds cannot actually digest cellulose and lignin. The sapwood is covered with mold because it is filled with sugars and starches.

Moisture meters are useful in determining whether a material is wet or not and tracing the source of problem water.

Crawlspaces may contain mold, pests, pesticides, asbestos, lead paint and sewer gas and be a conduit for radon. An apparently dry crawlspace can add excessive water vapor to a house.

Crawlspaces are often the source of indoor air contaminants. In many areas the most common problems are the result of moisture. Poorly managed rainwater and warm, humid outdoor air are the two most common sources of moisture in crawlspaces. During times when the outdoor dew point is higher than the temperature of surfaces in the crawlspace, the ventilating outdoor air actually humidifies the crawlspace. In mixed/humid and hot humid climates ventilated crawlspaces are problematic. During cold weather, ventilated crawlspaces containing plumbing run the risk of pipes freezing.



Air from crawlspaces is drawn into the occupied portion of houses by the stack effect during cold weather. When an air handler is running, air can be drawn into the occupied portion of the house. This happens when closed doors separate supply air diffusers from return grilles or when there are leaks on return portions of an air distribution system that are located in the crawlspace.

A study conducted by the EPA in crawlspace houses in Tennessee found that the leakage between the crawlspace and the upper portion of the house averaged 38 square inches for houses without ductwork in the crawlspace and 74 square inches for houses with ductwork in the crawlspace.

Good sealed crawlspace

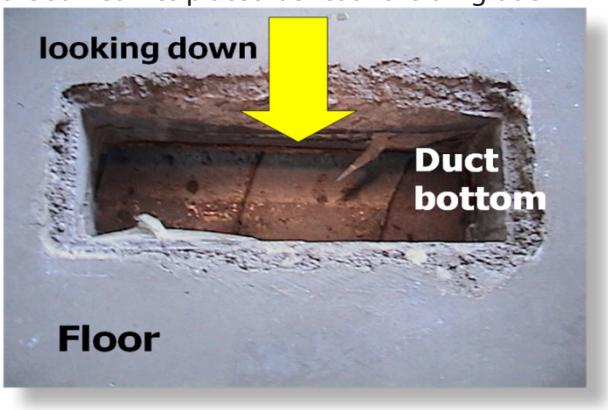
Here is an example of a sealed, insulated crawlspace with good drainage and a vapor barrier covering the soil floor.

Failed Drainage Systems

Sometimes there are drainage systems installed, but they have failed. Drain lines must be protected from clogging with silt. Traditionally they were covered with layers of straw or felt paper. In the last thirty years, synthetic filter fabrics have been developed that last longer and provide better filtration. In the photos on the previous page the sump pump on the left has broken and has not been repaired. The pump on the right would run except the float that turns on the pump is stuck on the plywood cover.

The picture on the right also shows an example of how sometimes our efforts to make things "better" actually create more problems. The plywood cover was put into place to prevent injury to children and pets, but the design was faulty because it prevented the float from working properly. Therefore possible basement flooding could result.

Ductwork beneath the slab is a problem area. Supply or return ducts are sometimes placed beneath the on-grade slab. This is often the lowest point in the building, so the ducts collect any accidental water from plumbing leaks or rainwater leaks. They are not water tight, so water leaks in from outside. If the soil air has high radon levels then they also provide a good transport pathway. When these cause problems it is often best to abandon them and install new heating or cooling distribution systems.



Are there floor drains? A dehumidifer?

A floor drain in the basement is a good idea. It gives water from a big plumbing or rainwater leak a place to go. Notice the dehumidifier. Below grade spaces often can benefit from a dehumidifier.

Steps to Dry Basements

- Drain, drain, drain
- No paper or wooden materials in contact with foundation
- Keep warm, humid air away from earth-chilled surfaces.
- Dehumidify

Plumbing Problems

The next category of problem water is plumbing leaks. When plumbing leaks occur, it is best if they are easy to see, easy to repair and do not wet materials that facilitate mold growth or dry slowly. Wet rooms, such as kitchens, baths and laundry rooms, are the places most likely to have plumbing leaks. Always inspect around toilets, tubs, showers, beneath sinks, clothes washers and dishwashers.

The drain basket and drain trap are vulnerable locations for leaks and vermin entry. Fortunately, they are easily inspected. Put a stopper in the sink and run water to see if the basket leaks. Let the water out to check the trap. Repair by tightening and sealing as needed.

Drain pans are inexpensive ways to reduce the impact of a mechanical leak. They can be used for hot water tanks and for washing machines. Drain pans are not intended to hold the capacity of the appliance. In the picture on the next page, the drain pan actually has a leak (see red circle) and should be replaced. Residents need to know to check the drain pan for water. Indicators such as alarms or lights are helpful for appliances that are not easily accessible (e.g. water heater in the attic).

The condensation pan beneath a refrigerator may overflow and cause mold growth. Often these pans are heated to evaporate condensate. The heating may have failed. Many people do not realize they should be checked and cleaned periodically.

If humidity levels are greater than 95% for three to six weeks . . . the result could be the picture below - a vacuum bag with mold. This vacuum was left in a house that was closed up for 6 weeks without air conditioning. The dust on the vacuum cleaner bag served as a food source while the humidity provided the moisture. Mold spores are ubiquitous but don't usually cause a problem unless you have this type of extended high humidity levels.

Chronically high humidity can result in mold growth. While it is true that mold spores generally need a small amount of liquid water to germinate and hyphae tips certainly need liquid water to exude enzymes and absorb digested nutrient, it does not take a lot of liquid moisture. At 90% relative humidity an ordinary surface only needs to be 6 degrees Fahrenheit cooler than the air to be at dew point. In a building, it is likely that there are surfaces few degrees cooler than house air.

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Mold or Mildew?

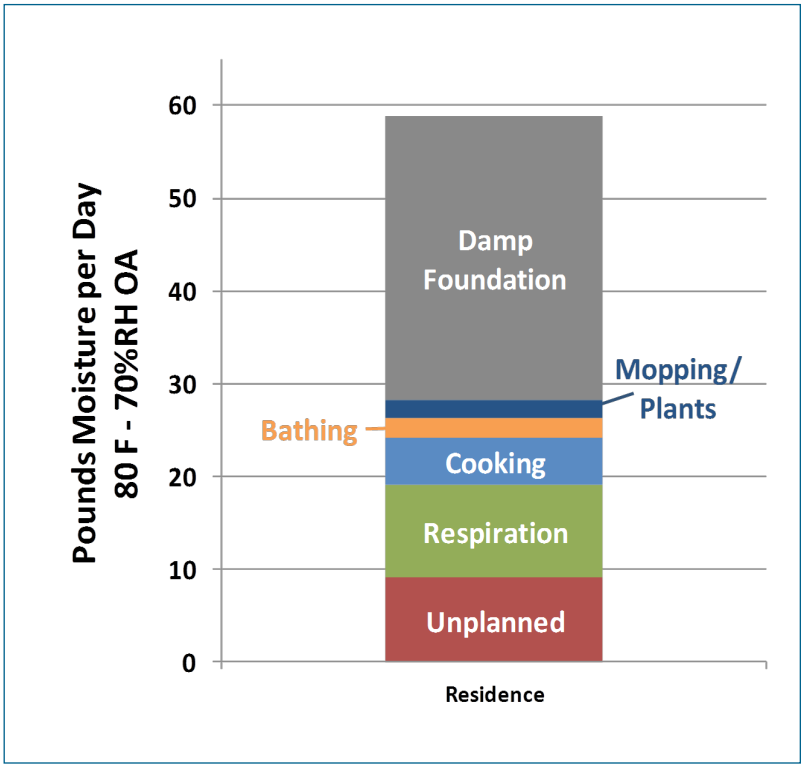
A frequently asked question is

What is the difference between mold and mildew?

According to wisegeek.com, "in common usage, the difference between mold and mildew usually is in their appearance and the surfaces on which they are growing. Mold is often thicker and black, green, red or blue in color, and mildew usually is lighter, powdery and gray or white. Both mold and mildew often grow in moist and warm locations, but mildew is more often found in showers, on paper and on fabrics, and mold is often found on foods and in walls and other permanent structures."

This chart shows sources of humidity for a family of four. For offices and classrooms, the major source of indoor humidity during warm, humid weather is outdoor air. However, as this chart illustrates, for a residence the dominating source could be a damp foundation. If the foundation is dry, the major sources of indoor humidity are respiration, bathing, cooking and outdoor air.

Also, do not overlook the possibility that occupants have introduced a strong humidity source such as multiple aquariums; a constantly boiling stewpot with no ventilation; a humidifier; or an indoor spa.



The picture to the right shows condensation and mold growth on the bottom of a toilet tank. Condensation occurs when there is too much humidity and the surfaces are too cool. The tank is cooled by incoming cold water. The water vapor is from outdoor air during warm humid times of the year and from hot showers. The mold gets nutrient, not from the porcelain, but from paper dust released by tearing toilet tissue.

The problem can be avoided by:

- using an insulated toilet
- air conditioning or dehumidifying the house air
- using a mixing valve to supply warm water to the toilet tank.

Mold can grow where we cannot see it

Mold in the air conditioner?

Air conditioners have cold surfaces such as the cooling coil, the drain pan, the ductwork down stream of the cooling coil and supply diffusers. Mold can grow in all of these locations. Again, there are two parts to fixing the problem. The first is to clean up the mold and the second is to fix the water issue. Cleaning up the mold should be done following guidance from the U.S. Environmental Protection Agency.

Many residential air conditioners do not have access panels that allow inspection or cleaning of the cooling coils. These should be installed so the coils can be inspected and cleaned. It helps to use higher efficiency filters so there is less dust on the coil.

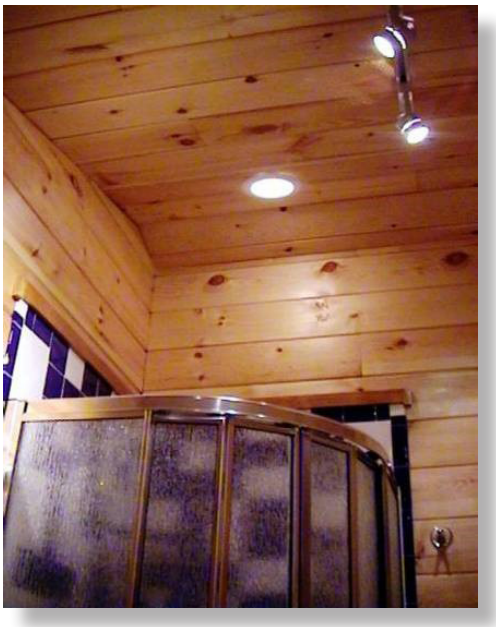
The pictures below show mold growing on a ceiling that is being chilled by wind blowing through the soffit across un-insulated gypsum board and mold growing around a window where there is poor insulation.

Mold due to poor insulation or wind blowing through insulation.

Mold around window where there is no insulation.

This picture shows a cold water line (seen running up the wall in the background), which condenses water above the ceiling. The water drips down onto the gypsum board ceiling resulting in a straight line of mold growth. All things being equal, mold does not grow in straight lines unless it is fed by a straight line water source.

Unsealable recessed light allows warm, moist air into the unheated attic



The recessed light in the photo above right is an opening directly into the attic. When the light is on the heat from the bulb causes a thermal draft to move even more air into the attic. This light is located over the shower in a bathroom that does not have an exhaust fan. As a result the warm, humid shower air is exhausted directly into the attic.

Considerations for Dehumidifers

Dehumidifiers are very useful for managing humidity levels in buildings. High humidity in buildings is either the result of warm humid outdoor air entering the building or a strong source of indoor humidity. In a previous picture, the source of humidity was water migrating through the foundation and evaporating into the basement during cold weather. In warm weather, it was both the damp foundation and outdoor air.

When running at least 35% of each hour, air conditioners dehumidify. During part-load conditions they do little or no dehumidification. Dehumidifiers can be very useful in combination with air conditioners in hot humid climates with extended part-load conditions. Dehumidifiers, however, do not cool the air. They ordinarily have supply air temperatures over 90 degrees F.

Considerations for Dehumidifers

- Wattage (Energy Star rated)
- Water removal rate
- Noise
- Drainage
- Icing
- Filter

Characteristics that are desirable in dehumidifiers are:

- Low energy use – some models are Energy Star rated now;
- Quiet operation – many dehumidifiers are too noisy to use in occupied space;
- A direct drain or a condensate pump (otherwise the tank must be emptied several times a day);
- And freeze protection so they can be used in cool spaces like basements or crawlspaces.

Response to Mold Problems

- IDENTIFY the problem
  - extent of moisture damage and contamination
  - dynamics of moisture sources
  - appropriate containment and worker protection
- DRY the wet areas in the short term
- DESIGN a solution
  - long term intervention in the moisture dynamics
  - fungal clean-up procedures and clearance criteria
- DISCARD or DECONTAMINATE contaminated material
- IMPLEMENT repairs and program changes to prevent future problems
- SEE EPA Guidance

Mold is a contaminant problem and a moisture problem. Both problems must be solved. The solutions are quite different. The mold itself is best removed from the building by cleaning surfaces or by removing contaminated materials. Containment and encapsulation have been used to intervene in exposures. There is no general agreement in the written remediation guidance on the advisability of containment or encapsulation methods.

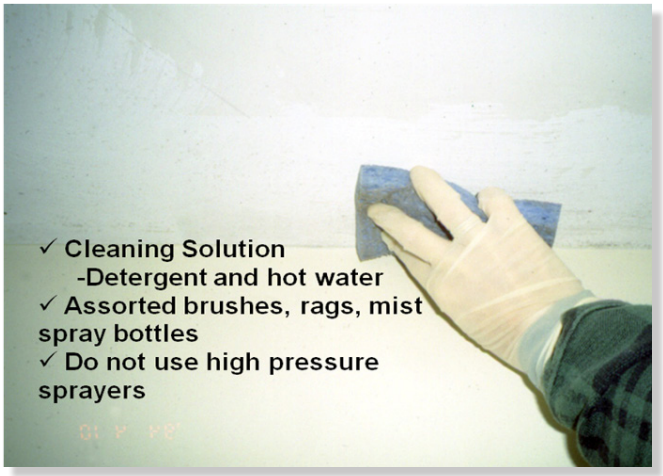
In the picture to the right, the attic above the bathroom has mold growing on some of the roof sheathing. A moisture meter is used to test the moisture content of roof sheathing in cold weather.

The test locations are only one foot apart and yet the moisture content of the sheathing is very different. The south facing sheathing is drier, because it receives more sun than the north facing sheathing. Notice that the south facing sheathing is free of mold and the north facing sheathing is covered with mold. The source of the moisture is water vapor in the house air. Warm house air is leaking into the attic through cracks and holes in the ceiling. The cold roof sheathing is dehumidifying the warm air from the house. During the day, the water that condensed overnight on the south facing roof is evaporated by the solar heat.

This is an oil tank in a stone basement foundation with high humidity. On the right hand side of the tank the bluish-green spots are colonies of aspergillus species. The mold may be getting nutrient from a layer of dust.

On the left hand side the tank has been vacuumed using a HEPA vacuum. A large reduction in spore and hyphae have been made by this simple action. The cleaning was done with the upstairs portion of the house under positive pressure (provided by 1200 cfm window fan). A dehumidifier was installed to maintain humidity at 65% or lower.

Here is a picture of mold growing on painted joint compound in a bathroom. The moisture condenses from the air during showers, in spite of a low volume of exhaust air (around 7 cfm) through the grille. The mold did not grow with one person living in the house, but began shortly after another person moved in.



For aeas less than 10 square feet - clean it up. Vacuum, then clean.

Wiping damp surfaces with water and a small amount of detergent collects any remaining fungal particles. The detergent is needed because the spores of some fungi (e.g. aspergillus and penicillium species) are hydrophobic and pushed off the surface into the air if water without a surfactant is used.

Some experts recommend the use of a pesticide containing borates labeled to kill or prevent mold as a final rinse. Be sure to read the label carefully and follow instructions if you choose this option. Also, check with the state agency regulating the licensing of pesticide applicators. While homeowners are usually permitted to treat their own home, other people may need to be licensed or certified by the state to apply any pesticide.[1]

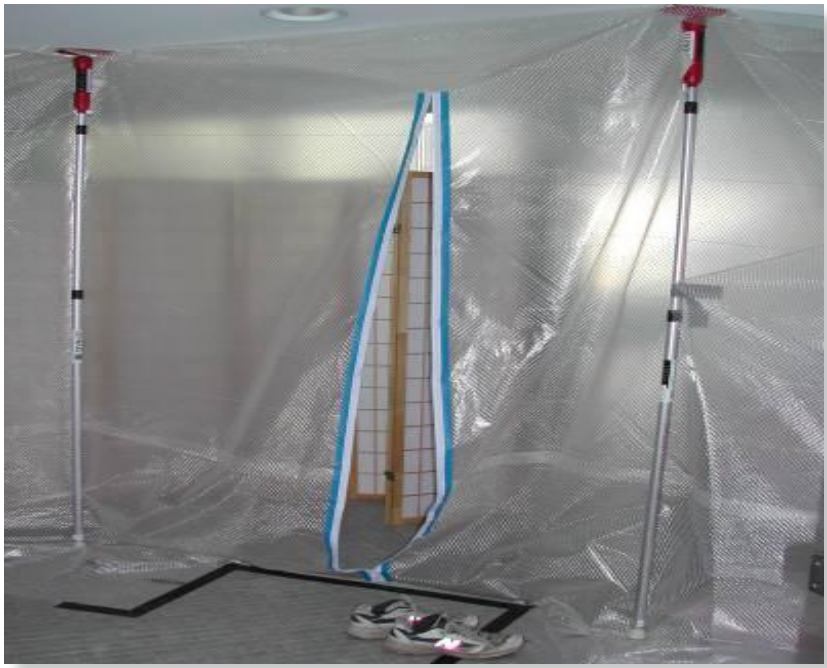
For Bigger Jobs, MUST HAVES are:

- Adequate respirator
- Eye protection
- Rubber gloves
- Coveralls

Make sure you remove and bag all of these items before you leave the work area.

As the size of the area needing remediation increases or if demolition is involved, the chance of larger exposures increases and more worker protection and containment are advised. Quickly drying things out is an important step, because mold will continue to grow as long as there is moisture and nutrient.

This shows fairly simple containment using spring-loaded poles and polyethylene film.



Containment may be needed for bigger jobs. See EPA Guidance.

Code Requirements Related to Moisture

302.2 Grading and drainage

- All premises shall be graded and maintained to prevent the erosion of soil and to prevent the accumulation of stagnant water thereon, or within any structure located thereon.

304.7 Roofs and drainage

- The roof and flashing shall be sound, tight and not have defects that admit rain.
- Roof drainage shall be adequate to prevent dampness or deterioration in the walls or interior portion of the structure.
- Roof drains, gutters and downspouts shall be maintained in good repair and free from obstructions.
- Roofwater shall

304.6 Exterior walls

- All exterior walls shall be free from holes, breaks, and loose or rotting materials; and maintained weatherproof and properly surface coated where required to prevent deterioration.

304.2 Protective treament

- All exterior surfaces, including but not limited to, doors, door and window frames, cornices, porches, trim, balconies, decks and fences shall be maintained in good condition.
- Exterior wood surfaces, other than decay-resistant woods, shall be protected from the elements and decay by painting or other protective covering or treatment.
- All siding and masonry joints as well as those between the building envelope and the perimeter of windows, doors, and skylights shall be maintained weather resistant and water tight.

Key Messages

- Excess moisture creates conditions that can affect health.
- Moisture in the home comes from inside and outside.
- Excess moisture in the home should be prevented through appropriate construction methods and plumbing systems, temperature control, ventilation and proper maintenance.

Learning Objectives

- Name three health hazards in the home that are related to excessive moisture.
- Identify four sources of moisture in the home.
- Describe five strategies for controlling moisture in the home.

Keep it Clean

For a healthy home, not only is cleaning important but so is the consideration of surfaces and materials that are cleanable. Many surfaces are tough to clean, and corners and cubbyholes can be tough to clean, too. The goal is to keep a house clean AND CLEANABLE.

People are not born knowing that they must brush their teeth to prevent decay; they must learn it. So with household hazards, people need to learn how to clean and choose cleanable surfaces and materials.

Why Clean or Easily Cleanable?

- Reduced exposure to:
  - Chemical contaminants
  - Allergens
  - Pest droppings and urine
  - Pesticides and consumer chemicals
  - Heavy metals, such as lead and arsenic
- Reduced harborage for pests

Many of the contaminants above are persistent. They simply will not disappear unless they are cleaned. A house mouse, for example, will leave 3,000 drops of urine wherever it goes. Allergens can get into the home from a variety of sources. Therefore, cleaning is important and surfaces need to be cleanable.

The Pediatric Asthma and Allergy Clinic at the Boston Medical Center identifies the following environmental allergens that can be inhaled and tests for them with antigens.

Animals: Dog, Cat, Cockroach, Feather mix (chicken, duck, goose), Gerbil, Guinea pig, Hamster, Horse, Mouse, Parakeet, Rabbit, Rat

Dust Mites: D farinae, D pter., Dust mite mix, House Dust Mix

Molds: Alternaria, Aspergillus, Cladosporium, Epicoccum, Helminthosporium, Penicillium, Mold mix (AHAP)

Tree Pollen: Birch, Oak, Elm, Maple, Ash, Hickory, Tree mix

Grass Pollen: Grass mix (5-Grass Mix, Hollister-Stier)

Start with People
House as a System
Keep It:
1. Dry
2. Clean
3. Pest-Free
4. Ventilated
5. Safe
6. Contaminant-Free
7. Maintained
8. Climate Controlled
Making it Work

Learning Objectives for this module

- List three contaminants or allergens that are frequently found in house dust and their health effects.
- Describe three ways allergens or contaminants get into house dust.
- Identify three strategies to reduce them.

Weed Pollen*:* Lamb's quarters, Marsh elder, Plantain, Ragweed, Sagebrush, Yellow dock

Other Allergens*:* Latex, Foods (aerosolized)

Other: non-inhalant allergens: Foods, Stinging Insects, Medications

Dust mites are particularly troublesome. Humid buildings may be colonized by dust mites—in dry climates, dust mites are limited to porous materials that get humidified.

Humid buildings may be colonized by dust mites. In dry climates dust mites are limited to porous materials that get humidified.

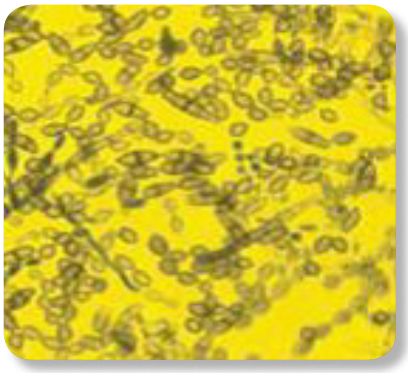
As the 2000 Institute of Medicine Report notes, dust mite allergen can cause asthma and trigger asthma attacks for those who are sensitized to this allergen.

Dust Mite Control

- Keeping humidity at or below 50%
- Washing bedding and blankets
- Using dust mite mattress and pillow encasements
- Freezing soft toys and small items
- If possible, replacing carpets with hard surfaces, and removing draperies and upholstery

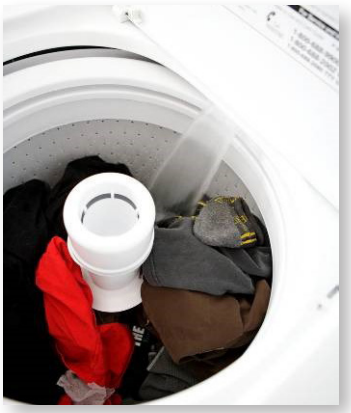
Washing in warm or even cold water will kill a significant percentage of mites and remove much of the allergen.[1]

About two-thirds of the dust in a low-rise building is tracked in from outdoors. The dust can become airborne from people's activities and, in fact, is found at higher levels nearer to people than in the general room air. Most house dust contains known contaminants in the form of heavy metals, pesticides, and fungal spores; therefore controlling dust is a good idea.



Environmental Allergens

- Animals
- Dust Mites
- Molds
- Tree Pollen
- Grass Pollen
- Weed Pollen
- Latex
- Foods
- Stinging Insects
- Medications



Track-off systems are crucial to controlling indoor dust. A good track-off system that is kept clean can collect upwards of 80% of the tracked-in dirt. A useful residential system consists of four parts:

- Hard-surfaced walkways
- A grate-like mat that allows grit to fall through
- A carpet portion to dry and collect fine particles
- An easily damp-mopped hard-surface floor

The photo to the right is an example of a fairly inexpensive track-off grate. However, keep in mind that the mesh must be fine enough to avoid trips in high heels.

Shoes off—less dust enters

Where does house dust come from?

- Brought-in
- Home grown
  - Lead Dust
  - Dust Mites
- Resident-Made
  - Garbage
  - Clutter

Brought-in Dust

Four Steps to Reduce

- Hard Surface Walkways
- Outside Grate-Like Mat
- Inside Carpet Pad
- Hard Surface Floor

How Do We Make Buildings More Cleanable?

- Install dust walk-off systems at entryways
- Keep activities that create dust away from people.
- Provide smooth, cleanable surfaces
- Provide effective storage space (to help avoid clutter)
- Choose flooring that is easy to clean
- Use vacuums that have good filtration and can be emptied quickly and thoroughly

Isolate Problems

Keep pets off beds and out of bedrooms

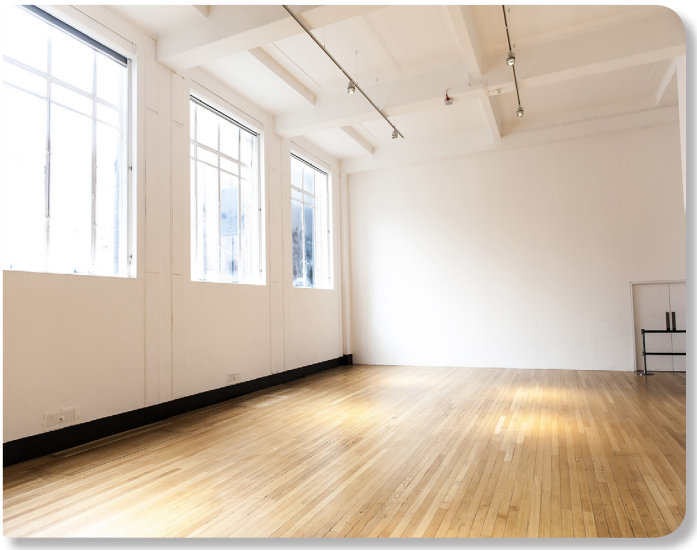
Pets sleeping in bedrooms and on beds can dramatically increase the occupant's exposure to pet dander and other contaminants and pathogens. This may be a special hardship to those with allergies and asthma. For these individuals, pets should be kept off the beds and out of the bedroom.

Beyond asthma, they also present potential risks of ticks and fleas to residents.

Cleanable Flooring

Hard-surface floors show dust more clearly, can be cleaned faster, and can be damp-mopped. Textile floor coverings are more complicated. They can collect and hold dust but often turn into "virtual sources" of airborne particles.

Vacuum cleaners are better than sweeping in terms of lessening the amount of particles they put in the air. This is increasingly the case as improved vacuum filters have become widely available. Vacuums with beater bars do a more thorough job of cleaning.



HEPA is an acronym for "high-efficiency particulate air." A HEPA filter can trap a large amount of very small particles that other vacuum cleaners would simply recirculate back into the air.

It is important to know whether you have vacuumed long enough. The vacuum in the picture at below-right has a sensor that turns from red to green when it has collected some fraction of the dirt.

Central vacuums can have the canister placed in garages or vented to the outdoors so that particles passing through the filters are not released into the house.

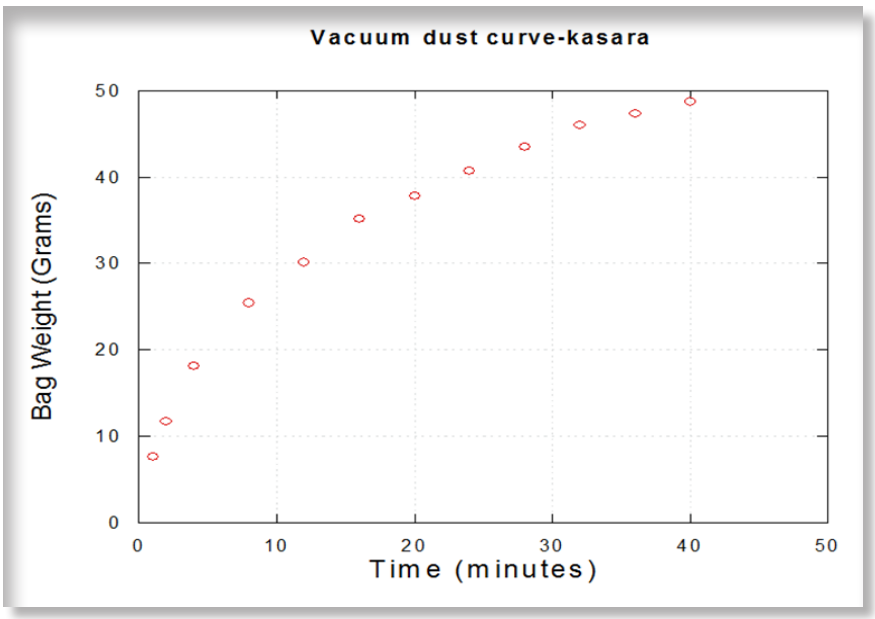
Older Carpets: Difficult to Clean

The graph below shows the weight gain in a vacuum cleaner bag every two minutes as it passes over the same square meter of carpet. The resulting curve is a classic saturation curve. When the bag stops gaining weight, all the recoverable dust has been removed from the carpet. The recoverable dust fraction is high for level loop and plush carpet and low for sculptured and shag carpet.

Notice that the vacuum recovered 50 grams of dust from one square meter of carpet and that it took over 40 minutes to do it. This is the result of not vacuuming quite long enough for an extended period. Once clean, it requires far less time to keep it clean. At this loading, the carpet is acting as a virtual source of airborne particles. When carpet is clean, it actually lowers airborne particle levels. It is not yet known at what point carpet changes from being a sink to a source.

What to look for in a vacuum?

- Beater bar
- Vacuum strength
- Filter type
- Dirt sensor



How Clean is Clean?

Determining if the house is clean is often difficult because there are very few standards for cleaning. However, there are standards for lead dust at 40 CFR Section 765. There are also standards for lead in soil. While not a standard, the federal government established goals to reduce allergens in its Healthy People 2020 program for mice and cockroaches.

- Clearance testing for lead
- 40 micrograms of lead per square foot on floors
- 250 micrograms of lead per square foot on window sills.
- Standards for allergens?
- Standards for dust?

Other Cleaning Methods

Problematic Cleaning Methods

- Carpet cleaning
- Overuse of antimicrobials
- Sanitizers
- Air fresheners

Duct Cleaning

EPA recommends duct cleaning when:

- There is substantial visible mold on hard surface ducts and other ventilation components.
- Ducts are infested with rodents or insects.
- Ducts are clogged with excessive dust and debris.
- Ducts actually release particles from supply registers.

See EPA's *Should You Have the Air Ducts in Your Home Cleaned?*[2]

Wire shelves are a better idea than particle board shelves. They are easier to clean.

Clutter

Clutter can be a problem because it can make it more difficult to keep a house clean and can also provide places for pests to hide. It can also be a source of trips and falls and, in more serious situations, hamper escape from the house if there is a fire or some other type of emergency. Clutter can also block ventilation vents. Typical solutions include using shelves and bins for organizing the home.

Hoarding is an excessive acquisition of possessions (and failure to discard them), even if the items are worthless, hazardous, or unsanitary. Compulsive hoarding may impair mobility and impede necessary access to or escape from the unit, creating a potential health and safety hazard. Hoarders may need assistance from mental health professionals.

If you are an assessor, and your checklist asks, "Is there excessive clutter in a bedroom?" what is your objective criteria for making that determination? Could be: (1) Is there a slip, trip, or fall hazard? (2) Are surfaces cleanable? (3) Are vents blocked? (4) Are there harborages for pests?

Code Requirements Related to Cleanliness

305.1 General.

- The interior of a structure and equipment therein shall be maintained in good repair, structurally sound, and in a sanitary condition.
- Occupants shall keep that part of the structure which they occupy or control in a clean and sanitary condition.
- Every owner of a structure containing a rooming house, housekeeping units, a hotel, a dormitory, two or more dwelling units or two or more nonresidential occupancies, shall maintain, in a clean and sanitary condition, the shared or public areas of the structure and exterior property.

302.1 Sanitation.

- All exterior property and premises shall be maintained in a clean, safe, and sanitary condition.
- The occupant shall keep that part of the exterior property which such occupant occupies or controls in a clean and sanitary condition.

307.1 Accumulation of rubbish or garbage.

- All exterior property and premises, and the interior of every structure, shall be free from any accumulation of rubbish or garbage.

503.4 Floor surface.

- In other than dwelling units, every toilet room floor shall be maintained to be a smooth, hard, nonabsorbent surface to permit such floor to be easily kept in a clean and sanitary condition.
- Section 503.4 is a good example of a standard to make sure surfaces are cleanable. However, the IPMC exempts dwellings. It applies to public and commercial buildings.

Most housing codes require a smooth, hard, nonabsorbent surface in bathrooms. In essence, this would ban carpeting in these areas. One requires it in kitchens. Given activities in bathrooms (and, to some extent, kitchens), hard, smooth, nonabsorbent surfaces are essential. Throw rugs are okay because they can be washed easily.

Key Messages

- Pesticides, allergens, and general chemicals in the home can cause allergic reactions, asthma and asthma exacerbation, and toxic exposure effects.
- Potential sources of allergens and contaminants in the home come from outdoor and indoor sources.
- Keeping a home clean includes controlling the source, creating smooth and cleanable surfaces, reducing clutter, and using effective cleaning methods.

Learning Objectives

- List three contaminants or allergens that are frequently found in house dust and their health effects.
- Describe three ways allergens or contaminants get into house dust.
- Identify three strategies to reduce them.

Keep it Pest-Free

This is a wire chewed by a rodent – estimated to cause up to 20% of all fires of unknown origin, in addition to those positively identified as rodent-caused.

Health Effects of Pests

- Asthma: rate has doubled in 20 years: 10%+
  - Main cause of lost school days
- Pests are main triggers of asthma in urban areas:
  - Dust mites – allergen in feces (Der p 1)
  - Cockroaches – allergens in feces (Blag 1 and 2)
  - Mice – allergen in urine (MUP)
- Spread infectious diseases
- Health effects greater on children

It is the health effects that are the main drivers for our concern about pests, and asthma tops that list. The asthma rate has doubled in the last 20 years, and is now over 10% of school age children nationwide; in many urban areas it is twice the national average. Asthma is the main cause of lost school days, which also means lost work days, since a parent must stay home with the sick child.

Cockroaches and mice have been identified as the major triggers for asthma in urban areas. In addition most homes have dust mites. All excrete potent allergens that can cause allergic effects, and trigger asthma attacks. This means that not only do we have to eliminate the pests, but we have to remove them, and clean up their mess.

Start with People
House as a System
Keep It:
1. Dry
2. Clean
3. Pest-Free
4. Ventilated
5. Safe
6. Contaminant-Free
7. Maintained
8. Climate Controlled
Making it Work

Learning Objectives for this module

- Name three illnesses or injuries associated with pest infestation.
- Identify three clues of pest infestation.
- Identify the three strategies associated with an IPM approach.
- Name two illegal pesticides that may be used in the home.

Pests are capable of spreading infectious disease – both roaches and rodents can carry dozens of infectious bacteria, viruses, and even fungi. Mice are a reservoir for, and can vector, salmonella. Children are the most vulnerable population – they are smaller, so smaller amounts can result in health effects. Children also eat more, drink more, and breathe more, pound for pound, than adults. Additionally, since they are growing, and critical body systems are still developing, "insults" to their bodies may have more profound effects.

What's a Pest?
"Any destructive or troublesome organism"

- Affects health.
- Destroys food or property.
- Creates a nuisance.

Something we don't like, where we don't want it!

More Health Effects of Pests

- Insect Bites – piercing the skin barrier (mosquitoes, ticks, bedbugs, flies)
- Rat bites
  - Up to 500,000 rodent bites per year
  - Mostly sleeping infants
  - Rat Bite Fever (>10% mortality)
- Rabies

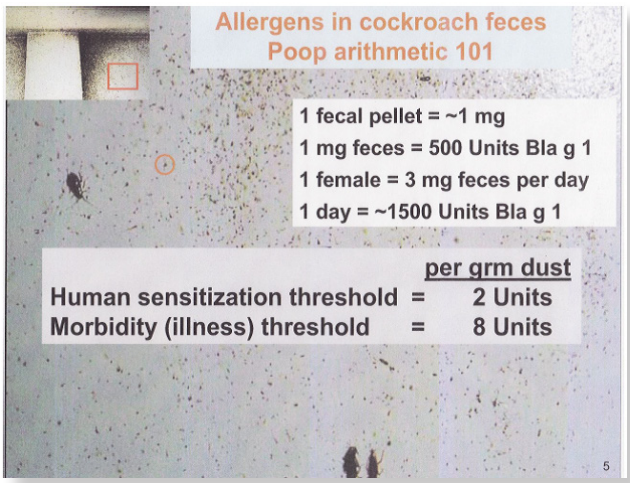
Mosquito bites

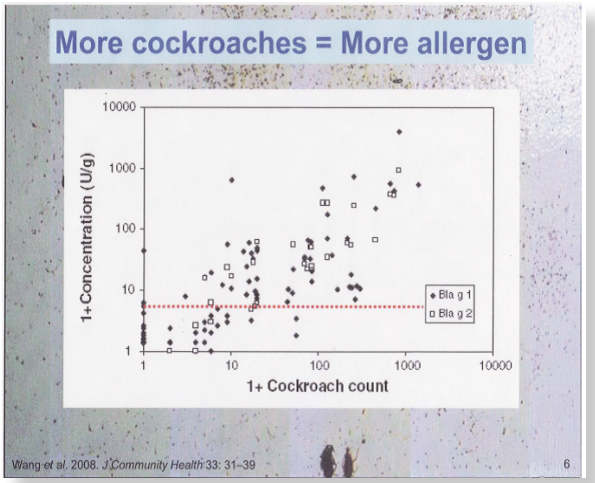
Rat bites, multiple

The photo below is an enlarged detail of the inside back of a cabinet; the 'dots' are "FRASS:" insect poop, specifically cockroach feces.

Bottom line: each female (females are bigger, eat more and poop more, and expression of the allergen is linked to the reproductive cycle), can potentially trigger about 180 asthma attacks.

The photo is from Changlu Wang, a leading urban entomologist now at Rutgers. The relationship between number of bugs (bottom) to concentration of allergen (left) is basically straight–line. The 8-unit morbidity threshold is the red line: IF you have fewer than 10 cockroaches, allergen levels are sub-clinical. Of the residents you know who have roaches, do any of them have fewer than 10?





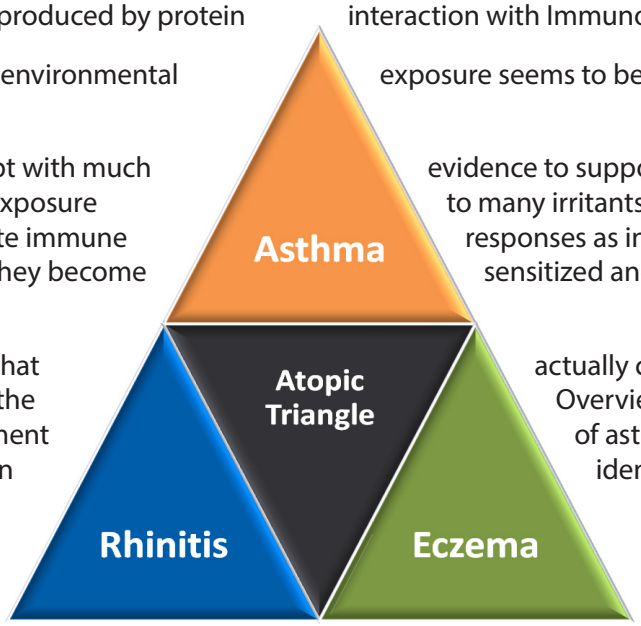
The Atopic Triangle of Asthma, Allergies, and Eczema

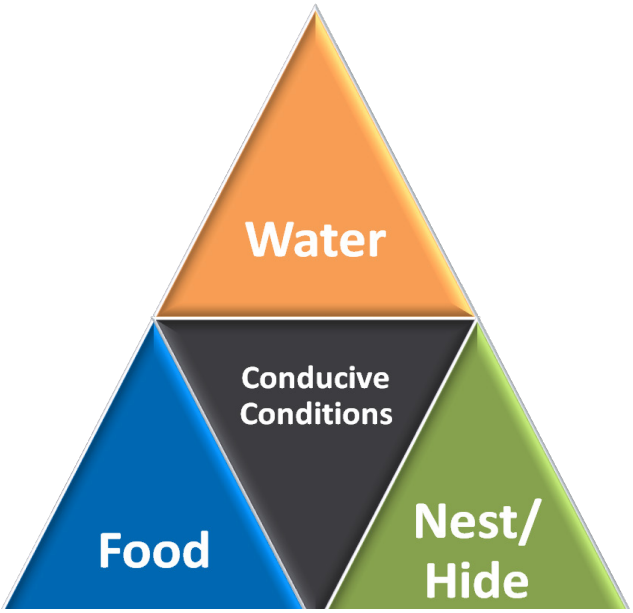
Allergens are part of the "Atopic Triangle," including asthma, rhinitis, and eczema – all three are often (but not always) found together, and can cross-react. They are all produced by protein interaction with Immunoglobulin E (IgE).

Although genetic predisposition is part of atopy, environmental exposure seems to be more important.

The Hygiene Hypothesis is a controversial concept with much evidence to support it: because we have largely eliminated dirt, pathogens and exposure to many irritants in our environment, children do not develop appropriate immune responses as infants. Instead, when they encounter "insults" as older children they become sensitized and develop atopic symptoms.

However, there is not a lot of understanding of what actually causes asthma. As the Institute of Medicine report referred to in the Overview section indicates, factors that contribute to the development of asthma have been identified and many triggers of asthma have been identified BUT the underlying causes of asthma remain unknown.[1]





What Do Pests Want?
Pest Triange

- Food
- Water
- Harborage
  - Some place to hide and nest
  - Ideally warm

ALL pests need three things: food, water and a place to hide (harborage). Preventing, or removing these conditions conducive to infestation will prevent pests – they will go to where food, water and harborage are available. This is the essential concept behind Integrated Pest Management—remove the conditions and you prevent the pests.

How Common are Pests?

American Housing Survey (2015):

- Mice or rats (13.2% below poverty)
- Cockroaches (18.4% below poverty)
- Mice or rats (13.2% all occupied units)
- Cockroaches (11.8% all occupied units)

National Allergy and Asthma Surveys (2002-6):[2,3]

- Mice allergens–63% (95% low-income)
- Cockroach allergens–85%
- Rat allergens–33% of inner-city homes

Rat feces in insulation

Roach frass under sink

Integrated Pest Management (IPM)

Control measures in IPM – beyond prevention – include the factors listed to the right. Proper identification is essential – you need to know what the pest is in order to know if it is a critical pest, and how to control it. For instance, termites require different – and much more extensive controls – than ants. Assuming that ants are "termites" can lead to the unnecessary application of, and exposure to high toxicity pesticides. Know your pest before you start!

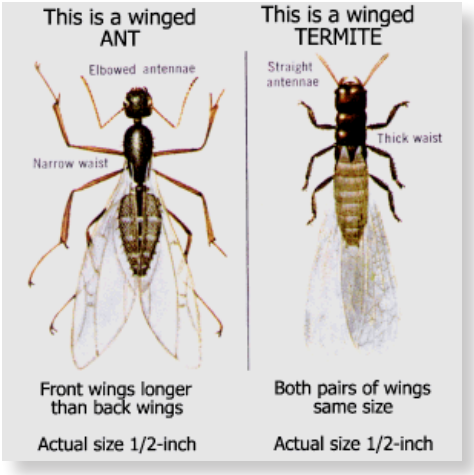
Other basic control principles in IPM are:

- **Exclusion and Denial** – keeping them out of a home, and sealing their harborages
- **Sanitation** – removing all food residues, filth, clutter and other food and protection
- **Water** – most pests need a source of water. Cockroaches, for instance, can live a month without food, but only a week without water. Mice do not need to drink – they get the water they need from their food. They will however, drink free water if it's available. Bedbugs also do not water; they drink blood.
- **Physical controls** – include traps of all sorts – glue traps, pheromone-lures, snap traps, curiosity traps, etc.
- **Chemical controls** – are not the first choice of tool. If necessary, start with low risk pesticides, including cockroach baits and gel, boric acid, and insect growth regulators (IGR). Other pesticides may be used if essential, but rarely.
- **Ongoing monitoring** – is essential after control is established, in order to know if pests are reintroduced, so that new controls can be used before an infestation is reestablished.

How Do We Control Them?

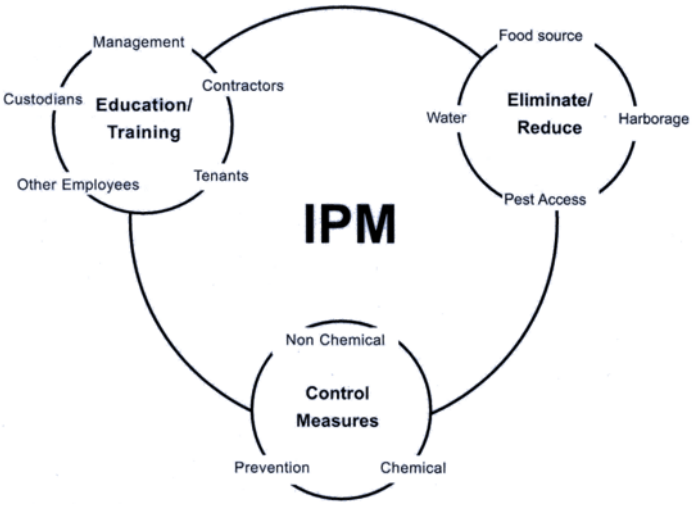
- Prevention
  - Identification
  - Exclusion & denial
- Sanitation
  - Food & water
- Physical controls
  - Chemical controls
- Ongoing monitoring

So—what is IPM? First, it is important to realize that Integrated Pest Management is considered **THE** best practice for pest control by HUD, EPA, CDC, the National Pest Management Association, and most academic researchers. It is not "new," unproven, radical, or trivial. HUD and the Government Services Administration have implemented IPM sine 1995; the National Park Service since the 1980's. IPM should not be considered a "premium" service, marketed at a higher price point to pesticide-adverse residents.



Multiple tactics is one of the key elements of IPM: many tools are available and should be used, rather than reliance on a single method. Pesticides for instance, are one tool in the IPM tool box but they are not the only, or primary tool. However, effective control is the essential goal: methods that do not provide effective control – such as using glue boards as the only method for pest control in a school, are inadequate. At the same time, it is important to not affect "non-target organisms" – children, adults, pets, wildlife, etc.

It's also important that control methods be economically sustainable – controls need to maintained over time, and costs are a significant factor. Further, control measures should have minimal environmental impact for long-term sustainability (for instance, disposable traps should perhaps be paper or wood, not plastic).



Reduce Pesticide Use

Pest pressure can drive people to unsafe use of pesticides and various health problems can be the result. One of the elements of IPM is a reduced used of pesticides. IPM does not exclude the use of pesticides, but the use of the other tactics reduces the need for pesticides. IPM also makes deliberate choices about the types of pesticides when they must be used, and makes least risky choices.

This is in contrast to conventional controls, particularly those most familiar to residents – aerosol sprays and foggers, and baseboard sprays by pest control operators (PCOs). Infestations drive residents to use pesticides in ways and amounts that risk compromising health, particularly that of their children.

Using too much pesticide (a common problem is using multiple foggers in a small apartment) can result in acute exposure – pesticide poisoning. In 2007, Poison Control Centers reported 16,000 pesticide exposures requiring treatment, over half to children under 5 years old. Ninety-three of these exposures occurred in their own home.

Much less understood are chronic exposures: the effects of exposure to small amounts of pesticide over a long period of time. Most pesticides leave residues that persist in homes indefinitely. Studies in Boston and New York City for instance, have found DDT residues still in homes, 30 years after being banned in this country. We simply do not know what effect on children's health these exposures may have.

Insecticide Chalk

High levels of pests may also lead people to use dangerous or illegal pesticides – "Tres pasitos" is common in Latino communities. It is manufactured overseas and illegally imported. Commonly sold in baggies in neighborhood stores or on the street, it is used to poison mice: "Tres pasitos" means "three little steps" – that's as far as the mouse gets after eating it. There is actually a thriving black market for pesticides in this country – many people miss the old, now-banned pesticides – they "worked better" than those now available. However, they have very high risks associated with them. Chinese chalk is another product not registered with the EPA or legal for sale or use in this country. It is chalk impregnated with high-potency pesticide. You draw a line with it – when a bug walks across the line, it dies. But what happens when a kid uses it to draw a hopscotch grid and then puts her fingers in her mouth?

Pesticides and Poisonings

- In 2016, Poison Control Centers reported just under 14,000 pesticide exposures requiring treatment.
- Almost half of all households with children under five stored pesticides within reach of children.
- 95% of all of poisoning of children under age 6 occurred in their own home.

According to the 2016 Annual Report of the American Association of Poison Control Centers' National Poison Data System 34th Annual Report, there were 77,573 pesticide exposures—33,458 involving children five years or younger. A total of 13,905 exposures required treatment in a health–care facility.

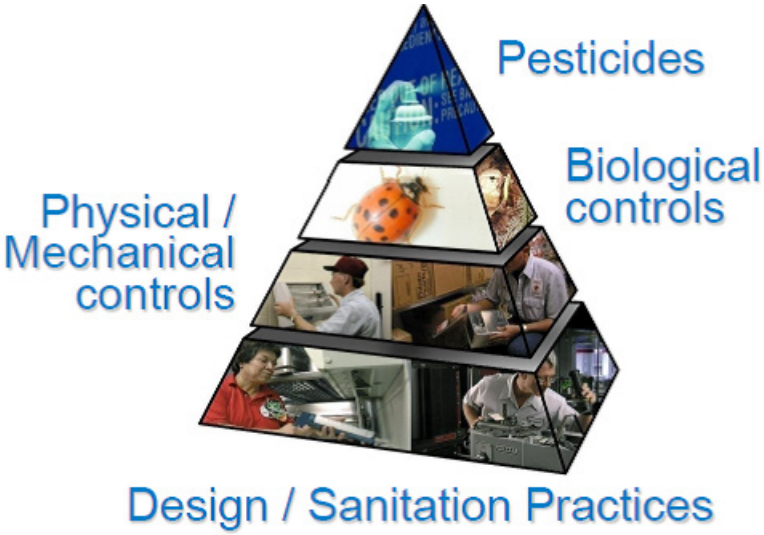
In 1971, Mr. Yuk was created by the Pittsburgh Poison Center at Children's Hospital of Pittsburgh. Since then, Mr. Yuk has been used to educate children and adults about poison prevention and to promote poison center awareness. In addition, Mr. Yuk has raised awareness that poison centers are available 24 hours-a-day, every day of the year to assist in the management of poisoning emergencies.

Other Pesticide Problems

Other possible problems with pesticide use include treating for the wrong pest – for instance, termite treatments for what turn out to be ants. Termiticides tend to be more potent, and are used in much larger quantities than anticides, and significant, and unnecessary exposure may occur. Similarly, people often assume that if "a little is good, more is better," and use inappropriate chemicals, often in excessive amounts.

There is also the problem of resistance—insects can become tolerant of pesticides over time, and the chemicals lose their effect. This is a common and increasing problem, and is one of the factors that makes bed bug control difficult; they are resistant to many common pesticides including all the "old" pesticides that were once successfully used against them. DDT, for instance, was very potent when it was introduced to commerce in 1947. Within two years some bed bugs were exhibiting resistance–that is, surviving DDT applications, and by 1958 DDT was ineffective against them. Bed bugs subsequently developed resistance to Malathion, Diazinon, and each pesticide used when earlier ones lost their potency. The process continues today, with increasing resistance to pyrethroids, the most common currently used pesticide. Using less pesticide means less exposure to humans and other non–target organisms, and can also help preserve their effectiveness for when they must be used.

The IPM Pyramid



IPM is a process that balances the use of design, physical, biological and chemical controls to manage pests. Just like the food pyramid, the primary tools are lower on the pyramid; those higher up are used sparingly. In the IPM pyramid, lower risk interventions are lower down, and higher risks rise towards the top.

The base of the pyramid is building design, sanitation, and communication: building the pests out, and monitoring for their presence. Mechanical controls—traps, such as light traps, mechanical traps, pheromone lures, etc. are preferred control methods. In some cases biological controls may be useful: cats are often used to control mice. However, modern American house cats are too well fed, in most cases, to be effective at rodent control, and will be simply unable to eliminate an extensive infestation; they are better as a deterrent to a "pioneer" seeking new territory.

Finally pesticides are at the top of the pyramid, which may have two layers: "biorational" pesticides, and "conventional." "Biorational" pesticides minimize exposure and may have reduced toxicity (such as cockroach bait "pucks" and gels, or IGR's). Conventional pesticides largely rely on contact with the pest to poison it, and include aerosols, foggers and conventional sprays. They have the highest risk of exposure, and usually higher toxicity.

The best practice is to make decisions that utilize choices low on the pyramid.

IPM vs. Conventional Pest Control

Activities	Conventional	IPM
Program Strategy	Reactive pest control	Preventive pest control
Resident Education	Minimal	Extensive
Spraying & Fogging	Extensive	Rare
Rodent/bird control	Poisons	Exclusion/ Trapping

This table helps draw out the differences between IPM and conventional pest control. Spraying and fogging are discouraged because of the lack of control and potential for greater exposures.

HUD Guidance on IPM (2011)[5]

Here is a summary of the important guidance elements that the U.S. Department of Housing & Urban Development has put out on IPM:

a) Communicate policies and procedures

b) Identify environmental conditions conducive to pests

c) Identify and report pests

d) Establish ongoing monitoring, reporting and tracking systems

e) Determine action levels

f) Improve waste management

g) Select appropriate pesticides; beware of MCS and other sensitivities

h) Ongoing exclusion and denial

i) Educational outreach; use resident educators

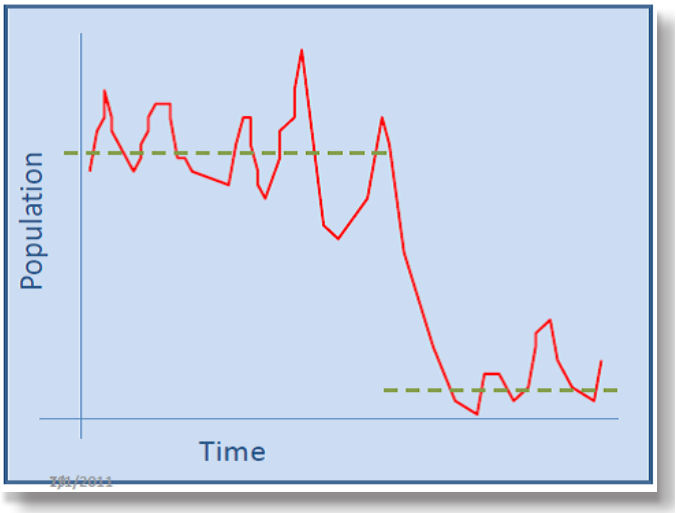
j) Understand state laws on used furnishings

k) Use least-risk pesticides, when necessary

l) Post pesticide-use notification signs

Change the Habit

Think of a building as having a carrying capacity for a given species. Carrying capacity is defined as enough food, shelter and water at the right temperatures to sustain some maximum number. If colonized for long enough, the population will hover around the carrying capacity. If pesticides or trapping alone are used to decrease the population, the numbers will spring back to carrying capacity when the trapping or pesticide use stops. If, however, the entry points to the building, nest sites, food and water locations are sealed, the carrying capacity has been lowered. Removing pest food or storing human food (and food waste) in pest proof containers further lowers the carrying capacity. In a pest proofed building, pesticide use can be drastically reduced.



IPM: Step-by Step

1. Inspection and Identification
2. Exclusion and Denial
3. Education and Action
4. Sanitation
5. Physical control
6. Monitoring

1. Inspection and Identification

- Thorough inspection
  - Exterior
  - Interior
  - Focus Areas
- Identification of pests found
  - Experienced field personnel
  - Field guides
  - Urban entomologist

Applying IPM starts with a thorough inspection; beginning with the exterior of buildings, looking for ways that pests can enter, such as under doors, through unscreened open windows, through pipe penetrations—in fact, through any penetration of walls, especially any hole ¼" in diameter or wider—the minimum size for a mouse to squeeze through.

Interior inspection is looking for the same points of entry, plus harborages (cracks and crevices behind cabinets and baseboards, inside appliances, etc.), food sources (crumbs, litter, garbage, pet food or feces), and water sources (leak, drips – under the kitchen sink, for instance).

Focus areas are areas of concentrated pest activities. In apartments this may be stoves, refrigerators, or trash cans. In multi–unit buildings some units may be the source of infestations in other units. Trash chutes, compactor rooms, or foodservice facilities are other common focus areas.

As noted, correct identification of pests is essential. Cooperative Extension services in each state will identify insects for free; many universities or pest control companies have a Board Certified Entomologist (BCE).

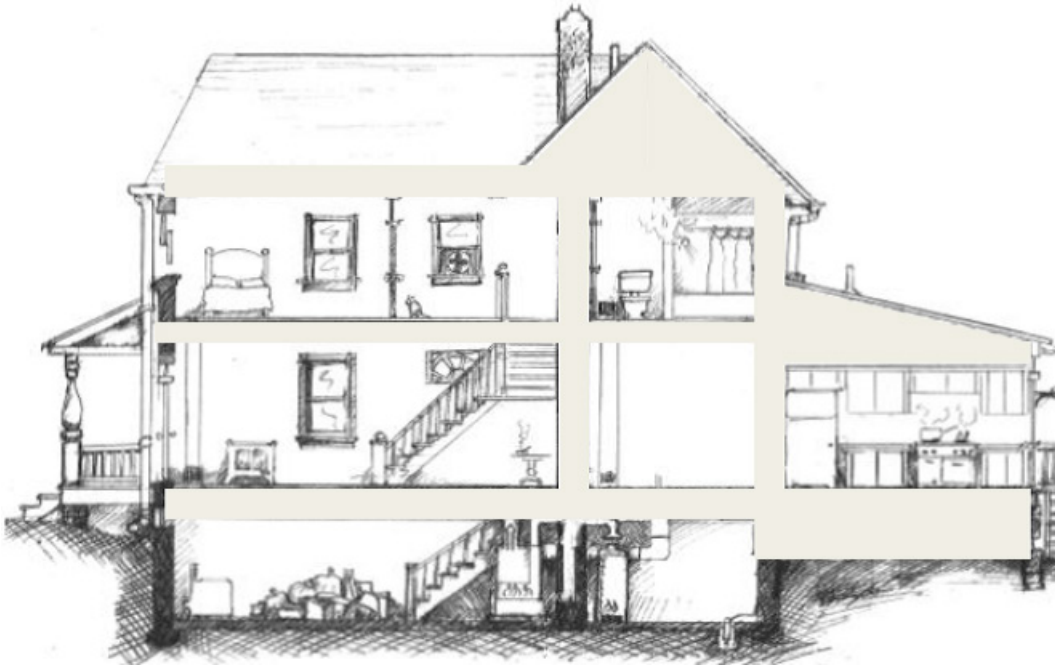
See the Creature, Be the Creature: What to look for and where to look

- The creature
- Creature droppings
- Nests and burrows
- Good food – under sinks, kitchens, trash bins
- Source of water
- Hidden places – inside walls, under/behind cabinets, basements/crawlspaces/attics, waste bins, under baseboards
- Near entry holes (from exterior inspection)
- Warm cavities for insects (inside TV's, computers, smoke alarms)

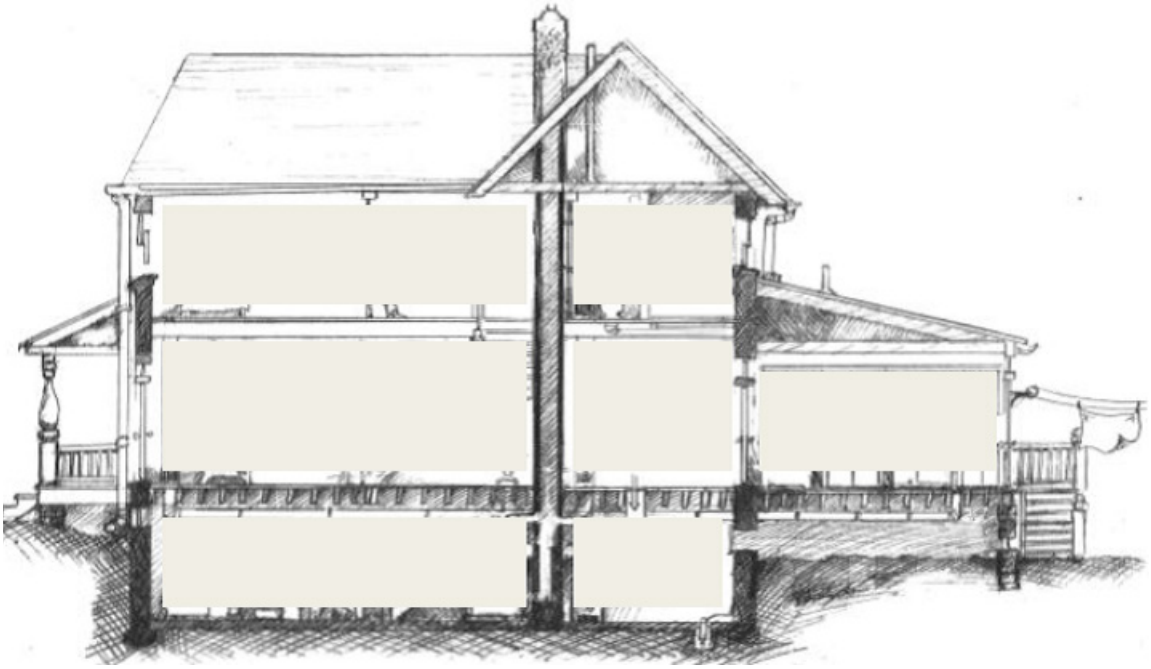
Look for signs that a building is colonized by pest species during an assessment. All of them are looking for food, shelter, water and a date. Most of them are prey species, so they are uncomfortable when out in the open. The more you are able to think like the creature, the more you are able to identify signs that they are present.

"See the creature, be the creature"

A person's View



A Cockroach's View

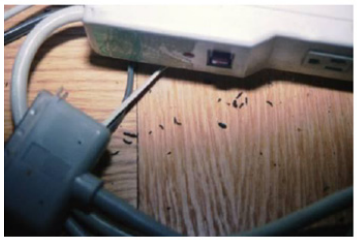


A Cockroach's View

A Rat's View

In this picture, rat proofing did not work. You need to get down on the ground and peer under the pipe to see the rat burrow entrance. Look for evidence of burrows or nests. Notice an ineffective effort to block the original entry point. Burrowing rodents may tunnel downward for several feet.

Look for mouse droppings in the hidden places where they may go. Mouse droppings are allergens. Mice are creatures of habit. You can move furniture and disrupt their patterns to see more of them. Move and bait.



Power cord on desk

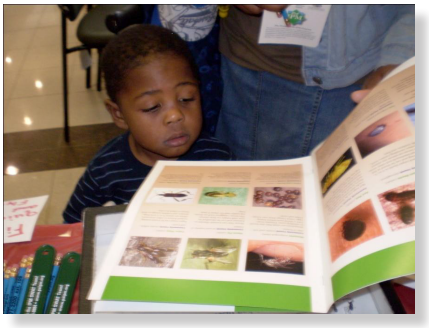
Mouse droppings

2. Exclusion and Denial

Exclusion is addressing penetrations and harborages found during inspection. Door sweeps are an easy fix – without them, mice will squeeze right under doors. They do need periodic replacement. All cracks and crevices should be sealed with silicone caulk (more durable than acrylic or latex, and also water–proof, heat–resistant, and gnaw–resistant). Any crevice more than ¼" wide will need to be packed with copper or stainless steel (rust resistant) mesh before sealing with caulk, spackle, patching concrete, sheet metal, or other material. This helps prevent rodents from gnawing through the patch. Expanding spray foam ("Stuff–It" or other brands) can help fill larger holes, such as in basement walls or behind kitchen cabinets.

For information on designing buildings that are more resistant to common pests, see Pest Prevention by Design Guidelines produced by the San Francisco Department of the Environment in November 2012. (www.sfenvironment.org/sites/default/files/fliers/files/final_ppbd_guidelines_12-5-12.pdf)

We can build them out, but it's what people do that determines whether pest control is successful. Every person is part of the IPM Team. IPM is a team approach, and requires communication and education – of residents, facilities staff, and possibly of PCO's as well. Residents—especially children—can often pinpoint pest runways and nest sites. Everyone should understand what the pests are, how they are being controlled, and why. Uninformed residents may, for instance disturb or even throw out glue boards, strap traps, and other control measures. They may use inappropriate chemicals that interfere with control—for instance spray pesticides act as repellents, and will keep cockroaches from feeding on baits, such as Combat. This can be a major cause in the failure of baits and gels to eliminate cockroaches.



Residents and building staff should understand why IPM methods are being used, and that the safety of their family, pets and home are primary decision factors. They should also understand that the more familiar methods have higher risks, and may interfere with IPM controls. Foggers are a good example of a very high risk product (they both coat the inside of the home with pesticides, and are explosive) that can send people to the hospital, as well as make other controls ineffective.

Education and Action

- Understand pests
- What needs to be controlled, how, when
- Safe control –vs. unsafe practices arborage
- Educating residents
- Choosing PCO's
- Training PCO's

4. Sanitation

Most pests rely on our sloppiness to live. How much food does a cockroach need? A mouse? A drop of grease will feed 20 roaches. A mouse eats only 1/10th of an ounce a day. Potato chip crumbs in front of the TV? Yum.

They eat our crumbs, our pet's food, our garbage. Most require water – dishes left in the sink overnight is their paradise – lots of food and water. Pet food and water left down overnight (when our cats and dogs are mostly sleeping anyway) is a constant source of high quality food. Even feces in uncleaned cat boxes can be food for pests.

Counters and floors must be clean and grease free; grease is a preferred, and superior, food source for cockroaches, mice and rats. Trash cans are another huge food source for pests. In many cases, residents may not have covered kitchen trash cans or even have trash cans at all. Outdoor garbage cans should have tight fitting lids, and ideally should be metal—rats and squirrels easily gnaw though plastic. These are essential items, and providing them to residents who lack proper trash and garbage cans should be a basic element of IPM programs.

Photo: City of Houston Bureau of Children's and Environmental Health

Photo: City of Houston Bureau of Children's and Environmental Health

Again, most pests must have a source of water. Leaving a meat–tray in the sink is not good hygiene. Leaks from plumbing and condensation are major sources of water for pests. Many sinks drip from the drainpipe under the sink—the result of simple condensation. Warm air in the cabinet holds moisture which condenses on the cold pipe, just as water droplets form on a cold drink in summer. These drips can rot the plywood bottom of the cabinet, providing harborage as the plywood buckles, and food —the rotting cellulose and glue of the plywood. This can be fixed simply: cut a piece of pipe insulation (usually black foam, usually used to maintain hot water temperature in pipes) to fit.

Mosquitoes are, of course, dependent on standing water outdoors—eliminate sources, or, if that's not possible, use mosquito "dunks" which are "pucks" or briquettes impregnated with Bacillus thuringis Isrealeness (BtI)—a bacteria that parasitizes mosquito and fly larvae exclusively. Nontoxic to fish, or anything except insects, BtI is a very effective and low–risk control.

Water damage is the biggest threat to the integrity of any structure; leaks must be eliminated and damage repaired. Water damage can attract pests, both for water and shelter. Check roof gutters, ground slope (grade), and other possible sources of moisture.

Water

- Essential for insects & rats
  - Not for mice or bed bugs
- Mosquitoes
  - Standing water
- Structural damage
  - Gutter and roofs
  - Leaks from outside
  - Plumbing and interior leaks
- Sink trap; plumbing entry

5. Physical Control

After basic prevention – that is removal of conditions conducive to pests: food, water and shelter, control efforts begin. The methods used will be specific to the pest. Traps, ranging from glue traps for roaches to snap or "curiosity" traps for mice, are a vital tool.

Cockroach control was transformed in the early 1990's by the availability of baits and gels, which can be 100% effective in two weeks or so, as opposed to conventional spray pesticides which only affect cockroaches in the open—no more than 20% of any given population. Baits and gels are carried back into walls where cockroaches live, and poison all of the roaches through a domino-effect: roaches eat each other's feces, and dead roaches, spreading the poison. When eggs hatch, the babies (nymphs) feed on the dead adults and the colony crashes, usually within two weeks.

Physical Control

- Identify and assess problem
- Same strategy
  - Food, water, horborage
- Different tactics—pest specific
  - Traps
  - Baits for insects (not rodents)
  - Dusts
  - Biorational chemicals: IGR's

Inert dusts are dusts that do not contain an active pesticide, including boric acid and diatomaceous earth (DE) and are also effective control for most bugs. They work by drying out ("desiccating") the insect; DE also scratches the cuticle (skin) of the insects, accelerating desiccation. Dusts are very fine, and although inert dusts have low toxicity to mammals, they can cause respiratory problems, especially for people with asthma or other respiratory problems. Dusts should never be used in exposed piles, lines, cups, or on mattresses; they should instead be puffed into enclosed voids (behind cabinets, into walls, etc), where they will contact the bugs, not us.

Insect Growth Regulators (IGRs) interfere with an insects' ability to shed its skin, which is necessary for it to grow. They therefore cannot mature or reproduce and colony collapse occurs. The immature and affected bugs continue to grow inside their too–small skin, and are crushed by their own growth.

To reduce exposure, choose safer products such as:

- Enclosed, tamper–proof roach baits
- Gels applied in small dabs in cracks
- Some dusts (boric acid)

Remember that baits are attractive when there are no competing food sources.

Watch out for illegal and dangerous pesticides:

- Pesticides that look like candy or mothballs
- "Miraculous" Chinese insecticide chalk
- "Tres Pasitos"

When conducting your assessment, you should also look for illegal pesticides in the home. Illegal pesticides are often much more toxic than registered pesticides (those that EPA has approved).

Tto the right is a picture of illegal naphthalene moth repellent products. Mothballs pose a hazard to young children. Mothballs can be easily mistaken for candy, or simply tempt young children to touch and play with them. Recent studies have linked naphthalene to illnesses, including nasal cancer. Widespread sale and distribution of these products make illegal mothballs a particular concern.

To the left is a picture of an illegal insecticide chalk known as "Miraculous Chalk" or "Chinese Chalk." You may have seen the chalk in a neighborhood store or sold on the street for about $1 a box. It is mostly imported illegally from China and often bears a label in both English and Chinese. Sometimes the manufacturer claims that the chalk is "harmless to human beings and animals" and "safe to use." These claims are untrue and dangerous. Similarly, "Tres Pasitos" is imported illegally from Mexico and other Latin American countries. Its name means "three little steps" in English, because after eating it, this is all mice can muster before dying. The active ingredient (or the chemical that actually kills the pest) in "Tres Pasitos" is a chemical called aldicarb. EPA considers aldicarb to be a very toxic chemical - and one that should never be used in your home. Children are especially vulnerable to poisoning by aldicarb when it is sprinkled around the home to control roaches, mice and rats. Exposure to high amounts of aldicarb can cause weakness, blurred vision, headache, nausea, tearing, sweating, and tremors in people. Very high doses can kill people, because it can paralyze the respiratory system. What "Tres Pasitos" does to pests, it can also do to you.

Federal Pesticide Law

The most important pesticide law is the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) administered by Environmental Protection Agency. Keep in mind that the term pesticide includes anything that kills or repels:

- Insects
- Fungus
- Plants
- Mold
- Rodents
- Microbes

Also keep in mind that no pesticides are safe—some are low–risk but cannot be defined as safe. The label on a pesticide is the law regarding that pesticide.

Pesticide Registration

Here is a summary of important points related to pesticide registration:

- Manufacturer must apply for each formulation
- EPA approval required before sale or distribution
- EPA ensures that if label is followed, there is reasonable certainty of no harm to human health and the product does not pose unreasonable risks to the environment
- "Restricted Use" pesticides are most hazardous
- EPA registration number is key
- Unregistered pesticides have unknown "active ingredients" (AI) and are not safe to use

See http://www.epa.gov/pesticides/about/aboutus.htm for more information.

Are these labels?

No, they provide information about the product but they are not the labels that EPA reviews and approves. Labels should have a signal word such as Caution, Warning, Danger, Poison (usually with skull and crossbones).

This is a label:

And this is a label:

EPA approves the language and layout for the label on every pesticide. Copies of all labels are available on-line at www.epa.gov/pesticides/pestlabels/. For labeling requirements, see www.epa.gov/oppfead1/labeling/lrm/.

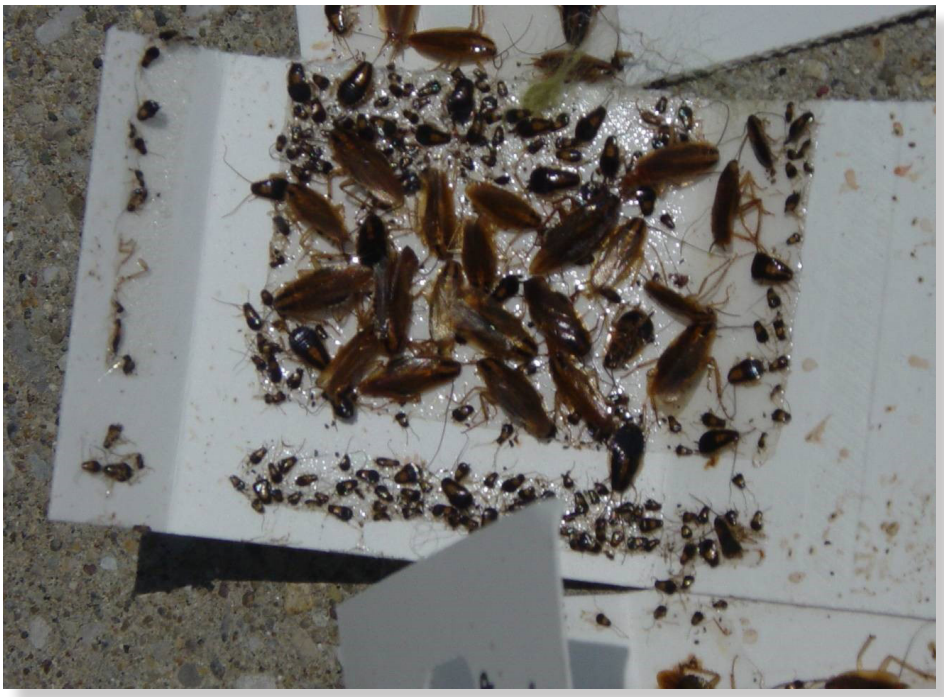
EPA requires that the front panel include the information identified above. Back panel typically includes:

- EPA Registration Number - identifies the manufacturer/formulator and the product.
- Company Name and Address
- Precautionary Statements
- Hazards to Humans and Domestic Animals
- First Aid
- Environmental Hazards
- Physical or Chemical Hazards
- Directions for Use
- Storage and Disposal
- Warranty Statement (voluntary)
- Worker Protection Labeling

Monitoring

Monitors are glue traps that are used to check for pests, to identify pests, and to identify the extent of an infestation. The second photo down to the right shows an example: German cockroaches, in a large breeding population, with a nest near to where the bottom edge of the monitor (or trap) was placed.

Insect monitors come in many styles; most fold up into a covered shape to protect the sticky trap from dust. Monitors should always be dated, and have the trap location marked. They should be placed against walls, in corners, behind & under cabinets, appliances, etc. They should be used at a rate of 3-6 per kitchen, and at least one in each other room, including bedrooms. Check all monitors within 48 hours during initial clean-out operations; replace as needed. When the population is controlled, monitors should be checked monthly to be sure re-infestations are not happening. If new pests are observed on the monitors, control actions should begin again. Do not apply controls unless the monitors show the need.



Monitoring for Rodents

This is a similar process to insect monitoring. You can use snap traps or glue-boards. Remember though, glue-boards do not kill; mice may vocalize or escape. Traps should be placed in corners, along runways, and in tight dark spaces. Traps should be checked daily and increased if monitors indicate activity.

Applicator Licensing

Make sure that you understand requirements for applicator licensing in your state. Many states require pesticide applicators to be licensed if they are:

- Applying pesticide onto another person's property
- Charging a fee
- Using Restricted Use Pesticides (certain high-risk pesticides not available except to licensed professionals)
- Applying onto Public places, including schools, child care facilities, playgrounds and parks, etc.
  - For example, a brochure outlining Pennsylvania's regulations is at: http://extension.psu.edu/pests/pesticide-education/applicators/certification/pennsylvania-pesticide-applicator-certification-brochure

Licensing

The licensing process is regulated by each state, and varies. For specific information on each state see: http://npic.orst.edu/mlr.html. Written testing is always required. There are usually at least two sets of written testing—*General* (basic safety and use information everyone must know) and *Category* (information on specific types of service, e.g. termite, household pests, schools, etc.). Actual tests vary by state. Usually states have some reciprocity with adjacent states, but a license **MUST** be had for each state in which an applicator works (i.e., a NJ applicator cannot go to NY without an NY license).

Insurance

Insurance is required! Costs of cleanup, damage and penalties for misapplication can be substantial.

- A 2014 example from NJ: "TRENTON—The Department of Environmental Protection (DEP) has fined Zapp Termite and Pest Control, a Neptune City pesticide business, and its owner, Vincent K. Taylor, $495,000 for misapplying pesticides at numerous locations in Monmouth and Middlesex counties, including Red Bank Housing Authority properties and various restaurants. The DEP has also revoked the firm's pesticide applicator business license and Taylor's commercial pesticide applicator license." http://www.nj.gov/dep/newsrel/2014/14_0008.htm

Hypersensitivity Registry

A Hypersensitivity Registry is a periodically updated list that identifies people medically sensitive to pesticides. People listed on this registry **MUST** be contacted before any application of pesticides near their registered locations.

- At least two states, Pennsylvania and Louisiana, maintain Pesticide Hypersensitivity Registries

Unlicensed People

Supervision of unlicensed people by licensed applicators is usually allowed:

- Direct—most people may apply pesticides if they are under direct supervision, and within direct sight of a licensed applicator ("Pest Management Professional").
- Indirect—Registered technicians, trained by a licensed applicator, may apply treatment, if they are supervised by the licensed applicator who can be on site with-in a short period of time.

See http://www.epa.gov/pesticides/enforcement/enforcement.htm for more information.

Know Your Pests

Here is some basic information to help you identify pests correctly.

It is important that you are able to identify the four common species of cockroaches, and that you understand their basic life cycle.

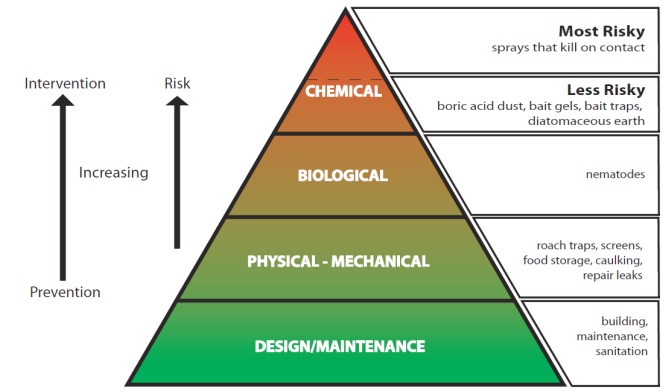
The first roach from the left is an American cockroach. About 1-1/2" long, this roach has wings and files. Often called a "waterbug," or in the South a "palmetto bug", they usually live in sewers and drains, and appear in basements, kitchens and other places where there are drains and it is warm and damp.

The black roach is an Oriental cockroach—also often (and confusingly) called a "waterbug." They live primarily in the ground, and prefer cool and damp places. They surface mostly in crawl spaces and basements, and sometimes in potted plants, especially those brought indoors for winter.

On the far right is the Brown-banded cockroach. They prefer high and dry habitats, often found in common areas, offices, and other areas where carbohydrates are available (usually merely crumbs, or sugar syrup—from sodas, for instance).

The German cockroach (third from left, top picture, and family portrait in the bottom picture) is the basic kitchen cockroach: brown, ¾" long, with "racing stripes" down its back. On the left in the lifecycle picture, is the adult male. The larger female to his right carries her egg case almost until it hatches (it's protruding from her abdomen), at which point she drops it (see the brown, curved object below). Within 48 hours it hatches: up to 40 babies (nymphs) emerge. The nymphs go through five molts in a month or so, depending on food, warmth and other conditions, to reach adulthood. Adults have wings (but do not fly); nymphs do not have wings. German roaches are the most prolific roach, and eat almost anything, although grease is their favorite food.

Handling Roaches – The IPM Way



Pyramid of IPM Tactics for Roaches

PENNSTATE College of Agricultural Sciences

PA IPM

Pennsylvania Department of AGRICULTURE

The basis of effective cockroach control is at the base of the pyramid: making the structure roach-proof, and ensuring sanitation to deny the roaches food. The second stage is eliminating sources of moisture, and keeping up with new repairs, proper food storage, and other standard procedures; "deferred maintenance" should not be practiced.

There are no good biological controls for cockroaches indoors—except in the semi-tropics, where lizards are fond of them. While the pyramid lists nematodes, introducing microscopic parasitic worms into buildings has not been popular in practice.

Biorational controls for cockroaches include the use of inert dusts in enclosed spaces (usually within walls where the insects nest), baits, gels, and insect growth regulators. The conventional kill—on contact sprays, aerosols and foggers in the tip of the pyramid are seldom used in IPM, except for "emergency" applications. An aerosol might be appropriate to eliminate a stinging insect nest over a school door. A liquid spray crevasse application might be used in a boiler room to eliminate a population before the crevasse is sealed. All pesticide applications must be done only by licensed pest control applicators.

Frass

Frass along the top of a door, under a shelf, and on a wall behind where a clock was hung. You have to know where to look to find signs.

Cockroach Control

Cockroach control involves removing their food, their water, and their hiding places, as already discussed. In addition to the dusts, glue boards, baits, gels and IGR's already mentioned, vacuum cleaners are an excellent tool for removing large infestations immediately.

A HEPA (High Efficiency Particulate Air filter) vacuum must be used to prevent the potent cockroach allergen from being blown out of the vacuum and widely dispersed into the living space. A vacuum can suck up thousands of roaches; but be sure to remove, double bag, and dispose of it immediately to prevent infestation of the vacuum.

Rodent Control

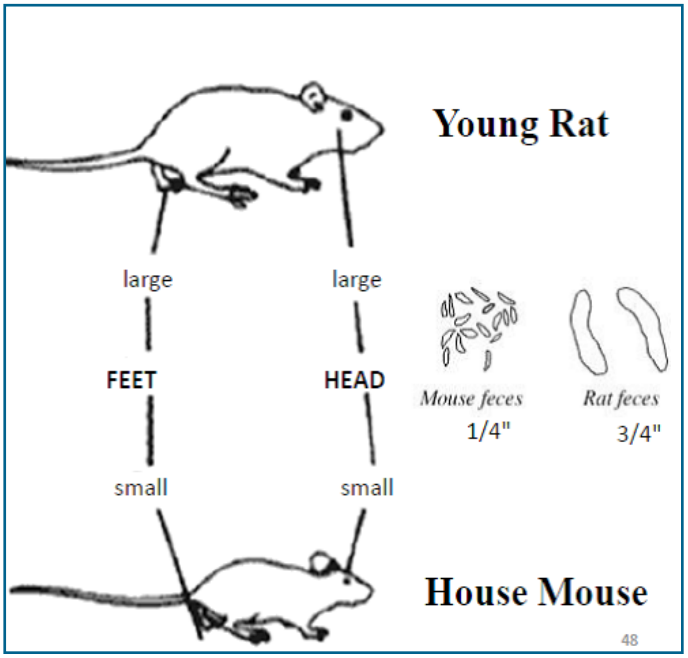
Like us, rodents are mammals; they need the same conditions we do and will eat anything that we do. Rats need water; mice get their water from their food, and don't need, but will drink, free water. Rats and mice have another difference – apart from their size – mice are curious, while rats are extremely cautious.

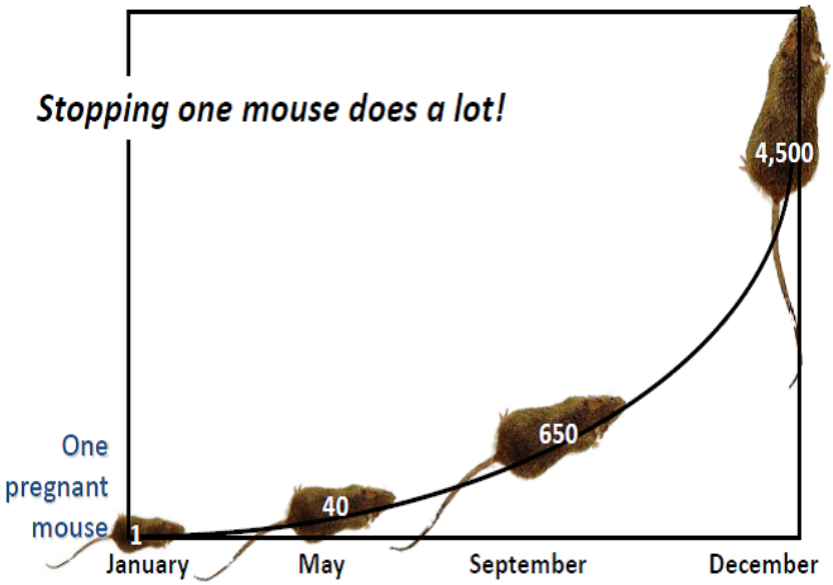
Squirrels are difficult to remove from buildings. However they are rodents, and are attracted to rodent baits: if rodenticides are not properly secured, squirrels are a frequent non-target kill. This can be a public relations problem, particularly in parks or other public areas.

Rodent Identification

The droppings (feces) of mice differ from those of rats. Knowing the difference can help determine if the pest in question is a mouse or rat; control of each will differ.

Droppings can help you find nests or burrows because they are left in areas of high activity. Rodents communicate by smelling chemicals in droppings. Adults can be distinguished by size, but it can be difficult to tell an adult mouse from a baby rat. The feet and head of mice seem in proportion to their bodies and their tails are thin and long, while the rats have hind feet and heads that seem larger than they should be and thick tails that are shorter than their bodies. Mice are not small rats and mice do not become rats when they go outdoors.





Rodent Reproduction, One mouse, one year…

Mice mate at 1 month of age; gestation is 19 days; there are 4 - 7 young per litter; 8 litters per year = 30 - 35 young weaned per female per year.

This is the same as cockroaches. This graph assumes 6 litters of 6 young per year with 50% females in each litter. Gestation takes 1 month. Reproductive maturity is reached at 1 month.

Signs of Rodents

Top left shows rat droppings in a wall cavity. This causes an odor for years. Top right illustrates rat burrows in a clay wall in a basement. The bottom left picture is a stained ceiling tile below a mouse nest. Bottom right is an open, unsecured poison bait for rodents (note mouse droppings nearby). This picture illustrates that there is evidence that there is a pest problem.

Remember that mice explore new things, and are readily trapped, while rats avoid new things in their environment—traps, for instance. Any bait may be used, and in fact, various baits should be tried. While peanut butter is the "standard", almost anything attractive, including bits of bacon, hot dog or cookie, or nesting material, such as cotton balls, can be tied to the trap and can be effective

Rat traps must be pre–baited, that is baited, but not set, allowing the rat to feed freely. It may take several days before he is comfortable with this new addition to his environment. Once fed from, rebait the trap and allow the rat to feed again, at least once. Then rebait and set the trap.

Rodenticides should never be used inside a residential space; the National Pest Management Association concurs with this recommendation. The risk of poisoning, especially of children, is high: 63% of all children's pesticide poisoning reported to the Poison Control Centers are by rodenticides. Rodents who die in the walls also smell for 6–8 weeks. Since January 2009 the use of loose rodent bait in residences has been illegal: rodenticides must be in an enclosed tamper-resistant bait station.

Loose, pesticide-treated seed based baits are effective in treating outdoor rat burrows. The bait should be introduced into the burrow so that it appears natural (use a long funnel or piece of garden hose); do not attempt to collapse burrows until no rat activity is evident for a week.

Things That DON'T Work on Pests

- Contact sprays
- Foggers
- Mothballs
- Ultrasonic devices
- Dryer sheets

Conventional sprays and aerosols must contact insects to kill them. They do not penetrate into the walls where cockroaches live and where about 80% of the population are hiding. The sprays are also ineffective against the eggs. Therefore, the population recovers quickly.

Foggers have the same limitations, and do not penetrate deeply into wall structures, in spite of some marketing claims. They also distribute their toxic contents over all of the surfaces in the home. While most users know to wash their dishes and pots and pans, they do not think about other surfaces. For example, couches become covered with pesticide, and when people sit on the couch they can absorb it into their skin. Think about all the surfaces that you touch in your house: light switches, door knobs, cabinet doors…and what about the floor, where the "fog" eventually settles. Are pets and children exposed because of this?

Ultrasonic devices have no effect on insects. While they do affect rodents in a laboratory, they are not effective in most residences. The signals are too directional, do not provide wide area coverage, and mice quickly become used to them.

Finally, dryer sheets and other similar remedies are not proven, and may in fact result in exposure to chemicals with unknown health effects. These products are not intended for pest control, and may be neither safe nor effective.

Things That May Work, but. . .

- Essential oils and cleaners
- Carbon dioxide traps
- Kerosene
- Homemade traps and gadgets

Essential oils are also not studied for effectiveness or safety. They are indeed potent and may kill insects on contact, but they may have unexpected effects, including triggering allergic or asthma reactions in sensitive people. Many essential oils contain solvents, and may contain other unknown ingredients. While they may be safe in contained uses, the health effects of exposure to essential oils used for pest control are unknown. Anecdotal reports have included damage to property and finishes, as well as triggering choking and wheezing.

Carbon dioxide traps can be effective monitors for bed bugs – but only in unoccupied rooms. Bed bugs are able to distinguish between a live person and a trap, and avoid the traps. They can, however, be very useful for determining that no bed bugs are present in unoccupied space, such as vacant apartments. The trap shown to the right did catch bedbugs, but there are commercial traps available as well.

Kerosene will indeed kill bed bugs, and many other insects and animals. It is both a solvent (that can dissolve the insects' cuticle) and a poison hazardous to most animals, including mammals. It is also highly flammable and is a known carcinogen. Kerosene should never be used indoors.

Bed Bugs–Don't Panic!!

Bed bugs are on the rise, but can be controlled. You can avoid getting them. Not every red mark is a bite, and not every bite is from a bed bug. They are not invisible – you can see them. They do not carry or spread disease, but they are a nuisance, and can seriously affect mental health.

Although control can be challenging, as we'll see, simple heat will kill bed bugs and their eggs.

From an agency perspective, protocols, cooperation and coordination are the most important factors to prevent movement of bed bugs in multi-family housing, and between residents in shelters, foster care, homes and group living.

Bed Bug Basics

- Identify properly – don't assume!
  - Bat bugs and swallow bugs look similar
  - Cockroaches, ticks and lice can be mistaken for bedbugs as well
- Life cycle
  - Must feed to move from nymph to adult
  - Poppy to apple-seed size
  - 6-12 eggs laid @ 2-3 days
  - Eggs are resistant to pesticides

Photo credit: Changlu Wang & John Obermeyer/Rutgers University

While bed bugs are spreading rapidly, they are NOT everywhere and even in beds not every bug will be a bed bug. Careful identification is important to be sure that you are actually treating the correct pest, and to make sure that it won't come back. Closely related species that infest bats and birds may bite humans, and will require treatment of the primary host – bats or birds.

Bed bugs lay 6-12 eggs at a time, every two to three days, gluing them into cracks and holes. About ten days later each group hatches, meaning that new sub–colonies are constantly appearing in different places and new eggs are being laid constantly. This makes control difficult, especially since the eggs are resistant to the chemical pesticides. Even direct contact with most pesticides will not kill the eggs. Heat, on the other hand, kills all stages of bed bugs, including eggs.

How and Why Bed bugs Spread

Bed bugs are mostly hitchhikers; climbing onto clothing and into backpacks and luggage to find new homes. One of the reasons bed bugs spread is because of how they reproduce. Unique in the animal world, the male bed bug engages in "traumatic insemination" and pierces the female's abdomen randomly to inseminate her. This is painful and multiple matings can kill a female – so they leave and hide, going off to start a new colony away from the existing males; someplace accessible down the wiring or plumbing is a ready destination. A single insemination provides all of the sperm she needs for the 200-500 eggs she lays over her life.

Because wild bed bugs have demonstrated resistance to most of the over-the-counter (OTC) pesticides available to residents, these chemicals act as repellents, causing bed bugs to disperse. If foggers are used, they primarily drive the bugs into neighboring units. Residents should not use aerosols or foggers.

Since travel is the main way bed bugs spread, anyone can pick up a bug, at anytime, anywhere. Pest control professionals and others working with residents should be aware, and prevent transfer and infestation.

Protect Yourself When Visiting Clients' Homes

- Only take necessary items into the home. Do not set anything on the floor or on furniture.
- Sit on folding, kitchen, or other hard (un-upholstered) chairs.
- Avoid sitting on couches, beds, stuffed chairs
- If possible, bring your own folding stool
- Wear light colored clothing, shoes and socks that can be thrown in the dryer
- Take along an extra set of clothes and plastic bags so you can change if you suspect infestation

When you visit homes, take in only what you need: clipboard, tool bag, etc. Leave everything else behind. Never sit, or put your belongings on, upholstered furniture: choose hard kitchen chairs; ask if you can meet around the kitchen table rather than on the couch. Some agencies are supplying visiting staff with folding stools. Wear clothing that can be thrown into a dryer—when you get home put all clothes in a hot dryer for 30 min. This will kill bed bugs and their eggs. You may wish to keep a spare set of clothes sealed in your car.

Bedbugs – Outline of Control

- Exclusion
  - Clutter elimination, use bins
- Preparation
  - Wash bedding
  - Seal mattress using encasements
    - **Do not** put pesticide on mattresses
- Use traps that act as interceptors
  - Make the bed an island
  - Monitor
  - Prevention

Getting rid of the bugs means getting rid of the places they hide; this is where clutter is important. Sanitation is not an issue with bed bugs, per se, because they only feed on us, not our garbage. Clutter provides harborage and de-cluttering is a necessary first step.

Pest control operators (PCOs) will provide instruction for unit preparation; some residents may require assistance. Residents should wash and dry bedding and other items on hot water settings, use dissolvable laundry bags, or dispose of "dirty" bags and use new bags or plastic bins to return clothes to home.

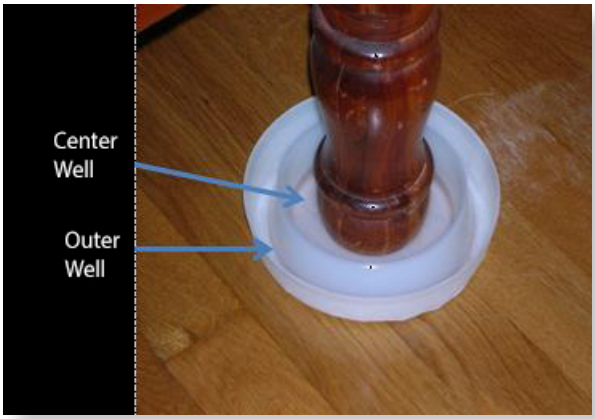
Mattresses should be encased, not discarded or pesticide treated. Discarded mattresses simply pass their bugs along to someone else when the mattress is picked up of the street. While very few pesticide labels may allow application to mattresses, this is not ever recommended, especially on children's mattresses. The possible long term effect of sleeping on a pesticide–treated sponge has never been studied. Instead: use an encasement designed to stop bed bugs. Encasements are designed to prevent bedbugs from getting out of the mattress and prevent bed bugs from being able to live on the mattress. Use only

encasements rated for bedbugs. While bed bug encasements will also contain dust mites and their allergens, allergen-only encasements will not stop bed bugs.

Simple interceptor traps, placed under the legs, can isolate the bed and make it a "safe island" within a still active treatment zone. (Mattress encasement must be used, and the bed must not touch the walls or any other object; bedclothes must not touch the floor). Encasements and interceptors are also excellent prevention – they allow you to monitor for insects, and see and eliminate them before an infestation can be established.

Bed bug – Treatment Outline

- Inspection
  - Crack and crevice
  - Treatment
- Vacuum
- Heat or cold
- Pesticides by PCO only
  - Dusts
  - Crack and crevice treatment
- Re-inspection and retreatment
- Encasements and interceptors



Inspection is the key to bed bug treatment and control. Bedbugs hide and finding them is a challenge. They prefer cracks and crevices as thin as a credit card; their eggs are only 1 millimeter—1/28th of an inch long. Inspection means examining and disassembling, as necessary, the bed and associated systems, bedside furniture, baseboards and carpets, and possibly closets, clothes, etc. Remember that beds are not the only place people sleep—recliners, couches, wheel chairs, and all upholstered furniture will need checking. Inspection– and only inspection–guides treatment.

Vacuuming is very useful for removing lots of bugs quickly. Because the eggs are glued into remote and tiny locations, vacuuming is unlikely to remove all the eggs, and is not effective for total control, but it is very useful.

Heat–or cold–treatments are the current "gold standard." Temperatures below freezing (32 ˚ F) or over 120˚F, for more than twenty minutes will kill bedbugs and their eggs. Remember to consider insulation, and how much time you may need – but anything you can put in a hot dryer for 30 minutes will be fine. Steamers are also effective, but need to be professional-grade, low pressure and low vapor; application rate is 4 feet a minute – or 1 foot every 15 seconds! Bed bug treatment takes time, and labor; that's why it's expensive.

Pesticides, if necessary should be applied only by a licensed pest management professional; aerosols and foggers should never be used. Most control requires at least two, usually three treatments two to three weeks apart: reinspection needs to be part of every treatment plan. Follow through on decluttering, laundering, and other PCO recommendations is essential. While reinfestation is possible at any time, encasements and interceptors are important prevention and monitoring tools and should be left in place.

Code Requirements Related to Pests

EXTERMINATION. The control and elimination of insects, rats or other pests

- by eliminating their harborage places;
- by removing or making inaccessible materials that serve as their food;
- by poison spraying, fumigating, trapping or by any other approved pest elimination methods.

INFESTATION. The presence, within or contiguous to, a structure or premises of insects, rats, vermin or other pests.

308.1 Infestation.

- All structures shall be kept free from insect and rodent infestation.
- All structures in which insects or rodents are found shall be promptly exterminated by approved processes that will not be injurious to human health.
- After extermination, proper precautions shall be taken to prevent reinfestation.

302.5 Rodent harborage.

- All structures and exterior property shall be kept free from rodent harborage and infestation.
- Where rodents are found, they shall be promptly exterminated by approved processes which will not be injurious to human health.
- After extermination, proper precautions shall be taken to eliminate rodent harborage and prevent reinfestation.

304.14 Insect screens.

- During the period from [DATE] to [DATE], every door, window and other outside opening required for ventilation of habitable rooms, food preparation areas, food service areas or any areas where products to be included or utilized in food for human consumption are processed, manufactured, packaged or stored, shall be supplied with approved tightly fitting screens of not less than 16 mesh per inch (16 mesh per 25 mm) and every swinging door shall have a self–closing device in good working condition.

308.2 Owner.

- The owner of any structure shall be responsible for extermination within the structure prior to renting or leasing the structure.

308.3 Single occupant.

- The occupant of a one–family dwelling or of a single-tenant nonresidential structure shall be responsible for extermination on the premises.

308.4 Multiple occupancy.

- The owner of a structure containing two or more dwelling units, a multiple occupancy, a rooming house or a nonresidential structure shall be responsible for extermination in the public or shared areas of the structure and exterior property. If infestation is caused by failure of an occupant to prevent such infestation in the area occupied, the occupant shall be responsible for extermination.

308.5 Occupant.

- The occupant of any structure shall be responsible for the continued rodent and pest-free condition of the structure.
- Exception: Where the infestations are caused by defects in the structure, the owner shall be responsible for extermination.

Resources

- Cooperative Extension Services
- State Pesticide Regulator for Pest Control Applicators/Operators
  - Often at universities
- www.ehw.org
- Go to www.csrees.usda.gov/Extension/ to find your local cooperative extension system office.
- Free online course from Healthy Homes Training Center: http://healthyhousingsolutions.com/training-course/integrated-pest-management-in-multifamily-housing-online-course/
- The Bugman's Bug Book: http://healthyhousingsolutions.com/wp-content/uploads/2014/12/The_Bugmans_Bug_Book.pdf
- Classroom course from Healthy Homes Training Center: http://healthyhousingsolutions.com/training-course/ipm/

Key Messages

- Pests can create allergens and be vectors of disease.
- Control of pests through pesticides can lead to poisonings and other neurological problems.
- Some pesticides found in homes have been banned.
- Make houses less hospitable for pests. Prevent entry, control food, water, and places for shelter.
- Integrated Pest Management is the recommended strategy.

Learning Objectives

- Practitioners are able to restate three key IPM messages:
  - Reduce risk by reducing pesticide use, and choosing pesticides carefully.
  - Use multiple tools to get effective control
  - Clean up food, water and places to hide
- Practitioners understand how cockroaches and mice trigger asthma
- Practitioners can demonstrate how to exclude pests
- Practitioners can explain why not to use aerosols, foggers and rodenticides in homes.

Keep it Ventilated

Why should you keep a house well ventilated? Indoor air quality is important. Pollutants can be found in concentrations **2-5 times higher indoors than outdoors**.

Proper ventilation can reduce hazards of:

- Volatile organic compounds
- Moisture
- Environmental tobacco smoke
- Particulate matter
- Allergens
- Mold
- Carbon monoxide
- Formaldehyde

Proper ventilation can also address sources of combustion contaminants

- Oven as heater
- Spillage from furnace, water heater, fireplace
- Ventless heater or fireplace
- Car exhaust from attached garage

Heating

Information from the American Housing Survey provides a context for the type of fuel that people use for heating as well as other purposes. It also describes the heating equipment that many people have as well as the heating problems they encounter.

Type of Heating Fuel

- Water Heater
  - 50.6% have gas, LP/bottled gas
  - 41.2% have electricity
- Clothes Dryer
  - 21.4% have gas, LP/bottled gas
  - 78.6 % have electricity

Start with People
House as a System
Keep It:
1. Dry
2. Clean
3. Pest-Free
4. Ventilated
5. Safe
6. Contaminant-Free
7. Maintained
8. Climate Controlled
Making it Work

Learning Objective for this Module

- Name five unhealthy conditions associated with poor ventilation.
- List five things (e.g. a room, appliance, mechanical system) in a household that need ventilation.
- Name three things that power airflow in a building.
- List three household contaminants that can be removed by ventilation.
- Describe two ways ventilation reduces air contaminant levels.

Primary Heating Equipment

- 64.5% have warm air furnace
- 9.2% have steam or hot water system
- 11.8% have electric heat pump

But . . .

- 647,000 (0.5%) have room heaters without a flue
- 1.2 million homes (1%) rely on wood-burning stoves
- 68,000 homes (0.1%) rely on cooking stoves

. . . For their primary source of heat.

From American Housing Survey – 2015

Heating Problems

- 8.6% were uncomfortably cold for more than 24 hours
  - 10.1% for renters
  - 11.1% for residents below poverty level
- 1.3% were uncomfortably cold for at least 24 hours due to inadequate heating capacity
  - 1.9% for renters
  - 2.3% for residents below poverty level
- 1.3% were uncomfortably cold for at least 24 hours due to inadequate insulation
  - 2.1% for renters
  - 2.2% for residents below poverty level

From American Housing Survey – 2015

Health Effects from Combustion Contaminants

Combustion contaminants is not an uncommon problem. This problem is popping up all over the country, mostly in new homes. Usually families notice a fine layer of soot appears on plastic surfaces, such as TV and computer screens, inside refrigerators and freezers, on walls and ceiling, on carpets, particularly under doors and at baseboards.

Unvented kerosene or gas heaters are also a problem. In the picture to the right, the kerosene heater in this home was used to provide supplemental heat, but the odor of the combustion products was so annoying that the door behind the heater was cracked open while the heater was in use. If the door was not providing ventilation, dangerous gases could build up. Burning fuel without ventilation can produce nitrogen dioxide, carbon monoxide, and nitrogen oxide, as well as particles. Unvented combustion devices should not be used in occupied spaces.

- Carbon Monoxide (CO)
  - Fatigue, headaches, dizziness, confusion
  - The silent Killer
- Nitrogen Dioxide
  - Eye, nose, and throat irritation
  - Shortness of breath

These are the two major pollutants associated with combustion products. At relatively low levels of carbon monoxide, a healthy person may feel fatigued. As levels increase a person may complain of headaches, dizziness, weakness or confusion. It is important to realize that CO is often referred to as the "Silent Killer" because it is colorless and odorless and death can occur without the person being aware that high levels exist. CDC reports that over 15,000 people each year are treated in emergency rooms for non-fire related carbon monoxide exposures. Additionally, an average of 500 people die each year from non-fire related carbon monoxide exposures.

If a flame is yellow, it is not burning hot enough and it will produce more carbon monoxide. However, the hotter the flame, the more nitrogen dioxide is produced.

Carbon Monoxide Limits[1]

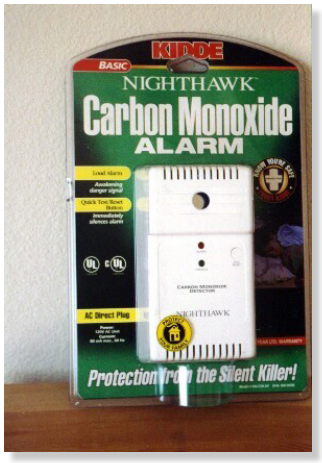
The chart below shows exposure limits for people at work for 8 hours a day or for outside air. What about people who are in their home virtually all the time?

Agency	Situation	Maximum CO Level	Duration
Environmental Protection Agency	Outdoor/Ambient Air	9 ppm	8 hours
		35 ppm	1 hour
Consumer Products Safety Commission/Underwriter Laboratories (UL)	Alarms for Immediate Life Threats in Residential Air	70 ppm	1-4 hours
		150 ppm	10-50 min
		400 ppm	4-15 min
Canadian Department of National Health & Welfare	Air in Residences	11 ppm	8 hours
		25 ppm	1 hour
World Health Organization	Indoor Air	32 ppm	Max.

Consumer Product Safety Commission (CPSC) recommendations for CO Alarms:

- Place near sleeping area
- Put on every level of a home to provide extra protection
- Do not install directly above or beside fuel-burning appliances

Carbon Monoxide Alarms



Proper placement of a carbon monoxide alarm is important. If you are installing only one carbon monoxide alarm, the Consumer Product Safety Commission (CPSC) recommends it be located near the sleeping area, where it can wake you if you are asleep. Additional alarms on every level and in every bedroom of a home provide extra protection. Install a battery-operated CO alarm in your home and check or replace the battery when you change the time on your clocks each spring and fall.

Homeowners should remember not to install carbon monoxide alarms directly above or beside fuel-burning appliances, as appliances may emit a small amount of carbon monoxide upon start-up. An alarm should not be placed within fifteen feet of heating or cooking appliances or in or near very humid areas such as bathrooms.

Carbon Monoxide Alarms should not be thought of as a REPLACEMENT for proper use and maintenance of fuel-burning appliances. It is important for you to know that the technology of CO alarms is still developing, that there are several types on the market, and that they are not generally considered to be as reliable as the smoke alarms found in homes today. Some CO alarms have been laboratory-tested, and their performance varied. Some performed well, others failed to alarm even at very high CO levels, and still others alarmed at very low levels that don't pose any immediate health risk. Further, unlike a smoke alarm, where you can easily confirm the cause of the alarm, CO is invisible and odorless, making it harder to tell if an alarm is false or a real emergency.

Installing a CO Alarm

The vertical placement of a CO alarm or monitor does not influence how it functions so it can be placed at any height. Although CO initially "rides up" on hot air, it dissipates fairly quickly and mixes with other indoor air.[1] However, when placed at knee level there is the possibility of tampering or damage by pets, children or vacuum cleaners, so higher placement avoids this problem.

The location of a CO alarm is very important. CO alarms are to be m[1]ounted outside sleeping areas in close vicinity to the sleeping areas. Homes with sleeping areas on multiple levels will need CO alarms on all levels.

Some alarms have a monitor as well that shows the level of CO. Generally, though, people should not waste their time trying to read a monitor, they should be evacuating immediately. Note that the average cost of a basic CO alarm is $25 and the average cost of a CO alarm/monitor with a digital display is $50.

In the photo to the left, a CO alarm is being placed next to a smoke alarm in the hallway outside of a frequently–occupied bedroom. Check or replace the battery

[1] See Hampson NB, Courtney TG, Holm JR, "Should the placement of carbon monoxide (CO) detectors be influenced by CO's weight relative to air?", Journal of Emergency Medicine, 2012 Apr;42(4):478-82. Epub 2011 May 4.

when you change the time on your clocks each spring and fall. A CO alarm should be tested by pressing the TEST button. A common cause of failure is weak or missing batteries, which should be replaced routinely. Most alarms have a 5–year life span.

There are approximately 500 carbon monoxide deaths plus more than 15,000 non-fire-related carbon monoxide healthcare visits per year.

Why Ventilate: Health Effects

Ventilation plays an important role in maintaining health. Poor ventilation can result in higher rates of respiratory irritation and illness . . .

- Common colds
- Influenza
- Pneumonia
- Bronchitis

. . . and increased rates of absence from school or work

A recent study found the following:

- 70% higher respiratory illness in fan-ventilated classrooms compared to window ventilated rooms;
- Nursing homes had much lower (76%) influenza rates in buildings with 100% supplied outside air
- With improved ventilation in housing and buildings, illnesses could decrease in incidence by 18% and costs to the US economy could be decreased by $6-14 billion.

Well Ventilated?

A Very Short History of Ventilation

Ventilation equipment is the visible evidence of a long history of indoor air quality, heat, and moisture problems. Why else would we have invented it?

This is a photo of a woodcut showing a worker pumping air into a mine shaft to provide ventilation for his fellow workers. The woodcut is from De Re Metallica, a text on mining and metallurgy written in 1556 by Georgius Agricola. Agricola describes many of the ailments suffered by miners and the solutions for them, among which is "stagnant air…which… produces a difficulty in breathing; the remedies for this evil are the ventilating machines."

Agricola's chapter on ventilation shows three types of ventilators – scoops to divert wind into the mine, fans resembling radial blowers powered by men, water turbines or wind mills, and bellows powered by men or horses. Indoor air quality problems are not new and the benefit of ventilation has long been understood.

A Well-Ventilated Building?

Is there a difference between a building with plenty of air flow and one that is well ventilated?

A Well-Ventilated Building 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 airflows can't carry contaminants into and around the house

Ventilation reduces air contaminant levels in two different ways:

- If contaminants are released from a point source, a local exhaust system can be used to collect the contaminants before they spread throughout the building (e.g. chimneys, toilet exhaust, dryers and range hoods).
- Outdoor air with low air contaminant levels can be drawn or blown into the building and mixed with the indoor air through a whole house ventilation system, lowering the concentration by dilution. The contaminant then leaves the building in the exhaust air.

By using ventilation or conditioning air to manage pressure differences, the airflow through a building can be planned to minimize exposures in the most efficient way. Local exhaust ventilation is more efficient than dilution ventilation because it collects the contaminant near the source and intervenes in the transport mechanism. This is why we use local exhaust ventilation for radon removal.

Understanding Ventilation

Key Concepts

- If any portion of air leaves a house the same amount must enter
- Air like water seeks the path of least resistance
- When heated, air rises
- When cooled, air falls
- Air can be hot, cold, wet, dry, or polluted when it enters or exits a house

What Powers Air Flow?

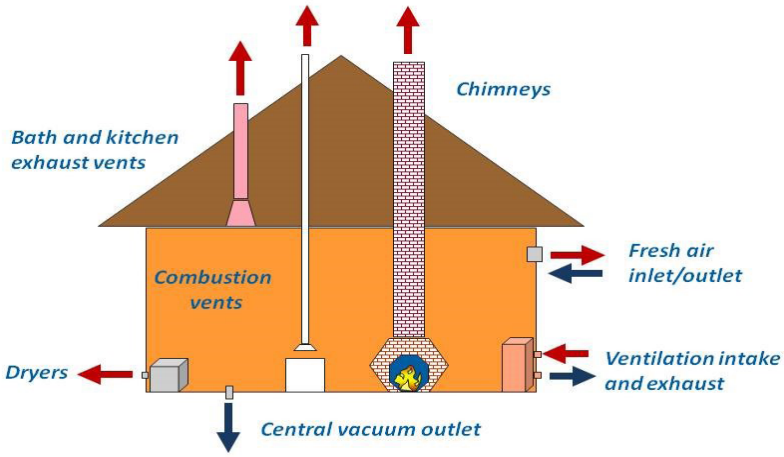
Air moves through buildings, because a force creates differences in air pressure. The source of the force is most frequently some combination of fans, air temperature differences, and wind. It is easy to understand how fans and wind ventilate and cause air to move through buildings.

Temperature differences *Fans* *Wind*

Air Flow in Homes

- Typical homes do not have a planned supply of fresh air
- We depend on leakage such as windows, doors, and cracks
- his is usually not adequate

Air Flow Needs Designed Holes

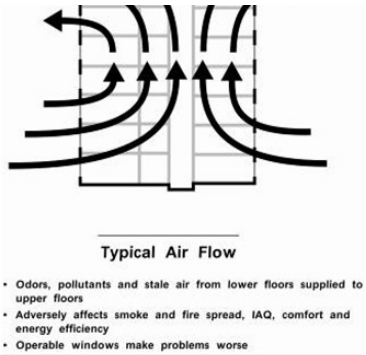


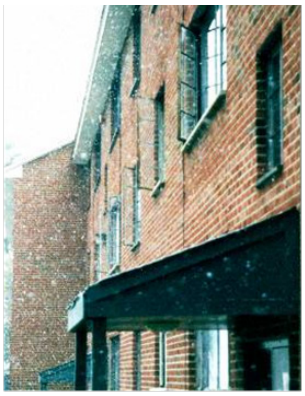
Courtesy of Arnie Katz at Advanced Energy

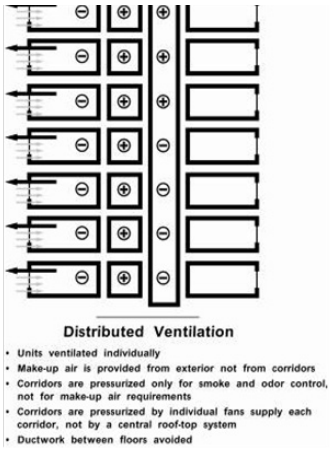
Contaminants in our homes need to have designed pathways to allow the contaminants to exit the building. At the same time we need to bring in ventilation air in a controlled fashion. We don't want the air we breathe to come in through places such as crawl spaces or leak through gaps in moldy walls, for example. Our homes should be air sealed tight and then ventilated right. And the fresh ventilation air needs to come from areas outside that are not near contaminants.

These designed pathways should not be blocked or sealed and the airflow always needs to flow in the direction for which they were designed.

In multifamily buildings with people living so close to each other, planned fresh supply air is very important. In high rise buildings in cold weather, the air from inside the lower apartments can rise and carry contaminants to people in higher apartments. And as the air warms and rises, it creates negative pressure in lower apartments and positive pressure in higher apartments. Now the higher apartments get too warm and the lower ones get colder as cold outside air leaks in. As the lower apartment dwellers turn up the heat to compensate, the higher apartments just get warmer in this vicious cycle. In the middle photo below, you can see an example of this with the upper windows open.







Multifamily Exhaust Only—New Construction

In multifamily high-rise apartments the exhaust ventilation ducts are sometimes commonly connected and may be missing individual dampers. So if the exhaust fans are not running, you can have air from one apartment passing into another, with all the contaminants and odors that may be present. And, as mentioned earlier, the stack effect (warm air rising) just makes this worse. The photo to the right shows rooftop fans providing exhaust ventilation for a six-story multifamily building. Vertical ducts connect the floors. Air may pass from one apartment through the ductwork and into another if the fans are not running, there is a problem with fan flow, the ducts are leaky, or the stack effect overwhelms the system.

Assessing Ventilation: What Are We Looking For?

When assessing a house for ventilation, check to see if the important stationary sources have effective exhaust ventilation and whether there is enough general dilution ventilation.

Local exhausts are easy enough to check—are they there, do they work?

- Bath, dryer, and range exhaust fans?
- Gas stove used as heater?
- Windows work?
- Smoke alarm goes off?
- Unvented gas or kerosene heaters?
- Vented hot water heater?
- Furnaces, boilers, fireplaces vented?
- Rooms without windows?

Because most residential buildings assume that operation of the local exhausts, wind and stack driven air flows, and operable windows provide enough general ventilation, it is more difficult to assess general ventilation. The simplest way to get an idea is to ask the occupant if odors linger, windows fog during cold weather, or the air seems stale?

- Lingering odors?
- Stale air?
- Windows fog?

To go beyond this level requires a fair amount of knowledge and less common test equipment (e.g. blower doors).

Things That Need Exhaust Ventilation

There are two kinds of ventilation needs: ventilation for air quality and ventilation for combustion equipment. Here is a list of rooms and appliances in a home that need exhaust ventilation:

- Bathrooms
- Kitchen ranges
- Clothes dryers
- Boilers, furnaces, hot water heaters
- Fireplaces, wood burning stoves

Bathrooms

Bathrooms are sources of moisture and odors. An exhaust vent should be located in each one. A single fan ducted to the bathrooms is a simple way of doing this. A chemical smoke bottle can quickly answer the question: is it moving air the right way? Chemical smoke allows you to quickly understand how air is moving around a building. It is one of the most powerful tools for solving indoor air quality, condensation and comfort problems. Chemical smoke is a strong irritant and should be used carefully; do not let people in the home keep it.

Placing toilet paper over the fan is another way people sometimes test to see if a fan is working. However, this method only tells you if the fan is actually pulling some air. A large percentage of installed fans don't even pass this test!

Why bother testing exhaust fans? A recent program, in which exhaust fans were tested in over 300 new homes, found that approximately 20% were pulling less than 15 cfm, despite being properly sized (most were 70 cfm fans) and properly ducted. The problem was that the backdraft dampers, either on the unit itself, on the termination, or both, were taped shut to avoid damage while shipping and the installer did not remove the tape.

Damper Work?

Ducted OK?

Local Ventilation: Kitchens

Kitchen ranges and ovens are the source of many contaminants. Since grease tends to collect on kitchen exhaust fans, they need to be cleaned frequently. A buildup of grease can attract cockroaches.

The photo to the right shows a vented range hood. Notice the duct in cabinet. The photo on the left shows a recirculating range hood (not vented) that has no duct in cabinet but has a grille on upper surface of hood—this is not ideal.

Kitchen ventilation should:

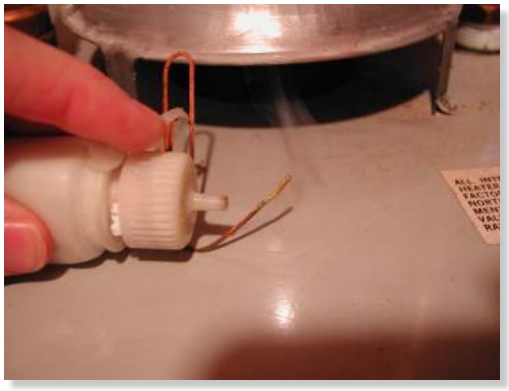
- Remove moisture, odors, grease
- Remove products of combustion (moisture, CO, NO2)I f gas oven or range
- Be vented to the outside
- Be reasonably quiet, otherwise many people will not use it.

Clothes Dryers

Although most people do not think of them in this way, dryers are exhaust vented devices. Dryer exhausts use from 75 to 150 cfm of air to remove heat, lint, the perfumes from fabric softeners, and in the case of gas fired dryers, combustion fumes. The amount of air exhausted by a dryer depends on how heavily it's loaded, the amount of lint on the filter and the resistance of the flex duct used to exhaust the air.

Boilers, Furnaces, Hot Water Heaters

Older boilers, furnaces and water heaters are usually atmospherically vented, which means they rely on the stack effect (warm air rising) to exhaust their combustion gas out of the house. There is no mechanical fan pushing the gas out. So if there is a stronger competing force the combustion gas can sometimes come back into the house. For example, a dryer close to a water heater will exhaust a large amount of air from the area and, in the process, may overwhelm the draft of the water heater gas and suck it back into the room. The photo in the middle on the next page shows someone using a smoke tester on a natural draft water heater to see if the combustion gas is going up the flue as expected. (Please refer to the Building Performance Institute's ANSI standard for protocols.)



Leaks in ductwork can also create pressure difference problems. The leaks in the return side of an air handler can "mine" contaminated air from anywhere the leaks draw air (e.g. crawlspaces, attics, basements). The photo to the right shows an example of a pressure differential. Soot is filtered from the air as it passes beneath the door when it is closed; leaving behind a visible line.

The photo below on the left shows an example of poorly constructed ducts. The photo on the right shows well–sealed ducts.

The photo on the right on the previous page is a good representation of how ducts should be properly sealed: using mastic and mesh. However, this is probably a commercial HVAC system, due to the size of the unit and ducting itself.

The photo on the left on the previous page may cause a fair amount of discussion as many people don't feel this is all that bad, considering that the installation is in an attic. The flexible ducting is well-insulated and it is attached to rigid ducting using zip ties, which is certainly better than having used duct tape. However, this ducting has a number of twists and turns which could reduce airflow to certain registers within the home. In addition, it is corrugated, which again could reduce airflow, because the corrugations disrupt air and do not allow for smooth, laminar flow as would be the case in rigid ducting.

Further, since the unit is in the attic, one can imagine that it would be difficult for the homeowner to routinely check and change filters in the HVAC system. Also, if the condensate line or condensate drip pan becomes clogged, it would almost certainly result in wetting and possible damage to ceiling and wall materials. Lastly, in general attic furnaces are less efficient as they are working against nature by trying to force warm air down into the living space and drawing the cooler return air up. The natural state is that cooler more dense air tends to fall as warmer less dense air rises.

The photo to the right is illustrating how a duct blaster is attached to a residential HVAC system. Once attached, the unit is turned on and pushes air into the ducts at a constant pressure. A manometer (pressure device) can show how much duct leakage is occurring and, if the technician blows chemical smoke into the duct system, leaks can be detected as the smoke leaks through any holes.

Filtration

Filtration serves a number of purposes. It:

- protects coils from clogging with dust.

Further, at high enough efficiencies, it:

- protects coils and ductwork from collecting deposits of fine particles that could support fungal growth if wetted (25% dust spot efficiency);
- begins to collect fine enough particles benefiting the lungs of building occupants (25 % dust spot efficiency).

Poorly sealed filter access panel

MERV – Filter Rating System

MERV, the Minimum Efficiency Reporting Value, is a way to differentiate between filters that have different levels of filtering particles. It is based on the removal efficiency for particles of different sizes. The MERV) rating of a filter describes the size of the holes in the filter that allow air and particles to pass through. The higher the MERV rating, the smaller the holes in the filter, and smaller the particles that will be captured. Remember the size of the particle plays a role in whether or not it can be taken into the lungs.

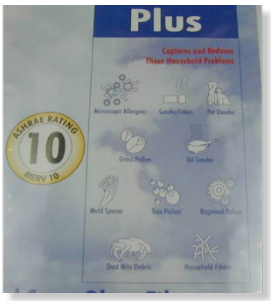
MERV Ratings

MERV	Particle Size	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*

MERV is intended to help simplify the filter selection process for users. It is derived by combining the cleaner's average efficiency at removing three particle size fields. If a high MERV filter is used with a fan designed for something lower there may be inadequate airflow which can lead to appliance problems.

MERV 8 vs. MERV 10

MERV 8 filter media should not promote the growth of bacteria, mold, mildew, or fungi in normal operating environments, and are not chemically treated. MERV 10 filters, on the other hand, can capture particles that are smaller, such as legionella and lead dust.



Other Rating Systems

The High Efficiency Particulate Air (HEPA) filter is designed to capture airborne particulates (solids) down to 0.3 microns in size. The HEPA media looks like blotting paper. It is made of very thin glass fibers fashioned into a sheet much the same way as wood fibers are used to make paper. Air passing through the media must continually change direction in order to pass around the thin glass fibers. Large particles cannot make these sharp turns without colliding into, and becoming captured by, the HEPA media.

To qualify as a HEPA filter, the filter must collect 99.97% of a specific particulate that measures 0.30 microns. Please note that "HEPA-type" filters and filters labeled for allergen control have not been certified that they meet the standard.

And……

Look at the claims on the filter below. Are they accurate? This filter is probably only a MERV 4. These are often used in residential air conditioning and heating units and will capture particles such as pollen, dust mites and carpet fibers, but not finer particles such as mold spores.

This filter is probably only a MERV 4.

Code Requirements Related to Ventilation

403.1 Habitable spaces.

- Every habitable space shall have at least one openable window.
- The total openable area of the window in every room shall be equal to at least 45 percent of the minimum glazed area required in Section 402.1.

- **403.2 Bathrooms and toilet rooms.**

- Every bathroom and toilet room shall comply with the ventilation requirements for habitable spaces as required by Section 403.1, except that a window shall not be required in such spaces equipped with a mechanical ventilation system.
- Air exhausted by a mechanical ventilation system from a bathroom or toilet room shall discharge to the outdoors and shall not be recirculated.

302.6 Exhaust vents.

- Pipes, ducts, conductors, fans or blowers shall not discharge gases, steam, vapor, hot air, grease, smoke, odors or other gaseous or particulate wastes directly upon abutting or adjacent public or private property or that of another tenant.

403.4 Process ventilation.

- Where injurious, toxic, irritating or noxious fumes, gases, dusts or mists are generated, a local exhaust ventilation system shall be provided to remove the contaminating agent at the source. Air shall be exhausted to the exterior and not be recirculated to any space.

403.5 Clothes dryer exhaust.

- Clothes dryer exhaust systems shall be independent of all other systems and shall be exhausted in accordance with the manufacturer's instructions.

603.2 Removal of combustion products.

- All fuel-burning equipment and appliances shall be connected to an approved chimney or vent.
  - Exception: Fuel-burning equipment and appliances which are labeled for unvented operation.

603.5 Combusion Air

- A supply of air for complete combustion of the fuel and for ventilation of the space containing the fuel-burning equipment shall be provided for the fuel-burning equipment.

607.1 General.

- Duct systems shall be maintained free of obstructions and shall be capable of performing the required function.

505.4 Water heating facilities.

- Water heating facilities shall be properly installed, maintained and capable of providing an adequate amount of water to be drawn at every required sink, lavatory, bathtub, shower and laundry facility at a temperature of not less than 110°F (43°C).

- A gas-burning water heater shall not be located in any bathroom, toilet room, bedroom or other occupied room normally kept closed, unless adequate combustion air is provided.
- An approved combination temperature and pressure-relief valve and relief valve discharge pipe shall be properly installed and maintained on water heaters.

603.5 Combustion air.

- A supply of air for complete combustion of the fuel and for ventilation of the space containing the fuel-burning equipment shall be provided for the fuel-burning equipment.

Key Messages

- Ventilation plays an important role in maintaining health.
- Ventilation is necessary to remove humidity and to dilute or remove contaminants.
- Local exhaust ventilation removes contaminants from a point source, while whole house ventilation uses fresh air to dilute contaminants.

Learning Objectives

- Name five unhealthy conditions associated with poor ventilation.
- List five things (e.g. a room, appliance, mechanical system) in a household that need ventilation.
- Name three things that power airflow in a building.
- List three household contaminants that can be removed by ventilation.
- Describe two ways ventilation reduces air contaminant levels.

Keep it Safe

There are many possible ways to be injured in a house. Falls, poisonings, fires, and drowning are just a few examples of common causes of home injuries. Just as people are not born knowing that they must brush their teeth to prevent decay, people must learn steps that they can take to reduce hazards in their homes.

This module will first discuss the differences between injuries and accidents, and then provide information on the most common home injury causes, ways to identify related hazards, and steps intended to prevent injury occurring.

Are Injuries Accidents?

Accidents are events that happen completely by chance, with no planning or deliberate intent. Injuries are preventable: they do not occur at random.

Accidents are things like being hit by a meteor—you cannot plan for such an event. Injuries are a very human experience. We all take chances based on our past experiences. For example, we believe that we will not be injured when using a chair instead of a stepstool or ladder because we were not the last time. Unsafe acts that result in injuries are not accidents. Being more aware helps prevent actions that lead to injuries.

Start with People
House as a System
Keep It:
1. Dry
2. Clean
3. Pest-Free
4. Ventilated
5. Safe
6. Contaminant-Free
7. Maintained
8. Climate Controlled
Making it Work

Injury is the leading cause of death and disability among children and young adults.

Injuries are preventable!

Learning Objective for this Module

- Explain the difference between an injury and an accident.
- Name the three most common home injury related causes of death.
- Name five locations to look for safety hazards in the home.
- Name five ways to prevent home injuries.

Safety-Related Housing Issues

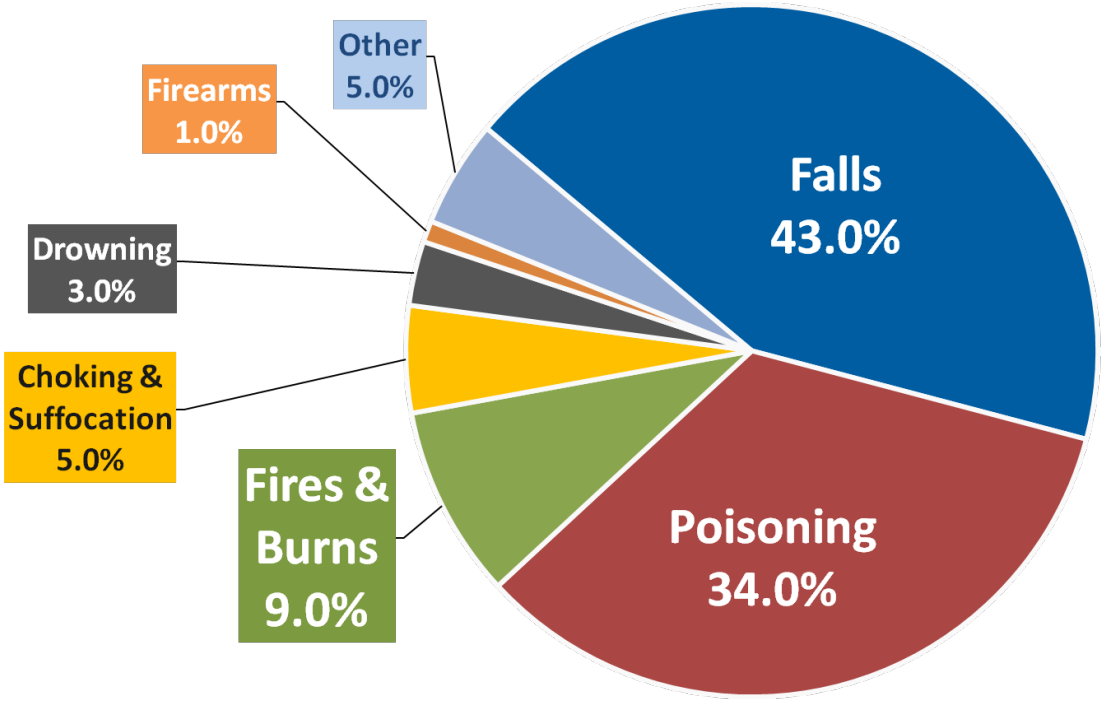
The following are some basic statistics related to examples of safety related housing deficiencies:

- Holes big enough to trip on
  - 1.5% of homes have holes in floors
  - 3.3% for residents below poverty level
- Electrical Wiring
  - 2.6% have exposed wiring
  - 2.3% have rooms without electric outlets
  - 8.5% have blown fuses or breakers in last 3 months
- Alarms
  - 54.9% of homes don't have working CO alarm
  - 5.3% of homes don't have working smoke alarm

Source: American Housing Survey – 2015 execpt Alarms which is from 2011 data since this was not included in the 2015 data.

Common Causes of Home Injury Deaths

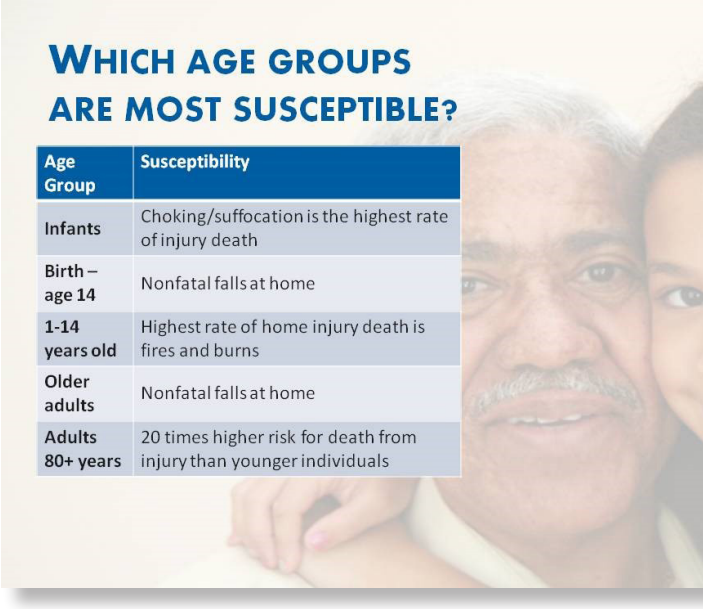
What are the most common causes of home injury deaths? Below is a pie chart showing the most common causes of home injury deaths. As you can see, falls, poisonings and fires/burns, are the top three causes of home injury deaths. Falls account for 43% of all deaths, poisoning 34%, and fires 9%.[1]



Children and older adults (70 and above) tend to be the most susceptible groups for home injuries.

For infants, the highest rate of injury death is from choking and suffocation. The highest rate of home injury death for 1–14 year olds is from fires and burns.

Adults 80+ years of age are at 20 times higher risk of death due to injury (e.g. falls) than younger individuals. When the elderly do survive a fall, they take longer to recover and often do not fully recover.[2] More than 33,000 people died in falls in 2015. Falling is the third leading cause of unintentional-injury-related death over all age groups, but it's the #1 cause of death for those 65 and older, according to Injury Facts 2017



WHICH AGE GROUPS ARE MOST SUSCEPTIBLE?

Age Group	Susceptibility
Infants	Choking/suffocation is the highest rate of injury death
Birth – age 14	Nonfatal falls at home
1-14 years old	Highest rate of home injury death is fires and burns
Older adults	Nonfatal falls at home
Adults 80+ years	20 times higher risk for death from injury than younger individuals

Falls

Falls are a leading cause of nonfatal home injury for children from birth through 14 and for the older population. Areas of concern inside of and around the home include stairs, transitions from one level to another, windows and balconies, thresholds, ladders, and play areas.

Windows

Window falls account for approximately 8 deaths and 3,300 injuries among children ages 5 and under annually.[3] Window guards are easy to install but are window width specific. They are typically installed with four screws that are long enough to get into the framing studs of the window opening.

To prevent other window related injuries, decals or stickers can be positioned on sliding doors to remind persons of glass windows.

Window Safety Guard

Safety Glass?

Grab Bars and Handrails

Do the pictures on the right show handrails and grab bars where needed?

Grab bars are important safety aids in tubs and near toilets, especially for the elderly. In addition to home use, grab bars are becoming increasingly common in hotels. Also of particular concern in bathrooms, residents should avoid using electrical appliances and components in areas with water, unless rated for that use.

Stairs should have secure handrails on both sides as well as good lighting at the top and bottom to help residents see the first step and subsequent ones.

Accessibility ramps are also important.

Healthy homes activities also include improving homes for "vulnerable" populations, like persons with disabilities.

Where Do Kids Play?

There are many potential injury hazards to young children both inside and outside of the home.

An open dug well is an attractive nuisance for children. Let's remember the case of "Baby Jessica." Jessica McClure Morales (born March 26, 1986) became famous at the age of 18 months after falling into an unguarded open well in the backyard of a home in Midland, Texas, on October 14, 1987. Between that day and October 16, rescuers worked for 58 hours to free "Baby Jessica" from the eight-inch-wide well casing 22 feet (6.7 metres) below the ground. The story gained worldwide attention (leading to some criticism as a media circus), and later became the subject of a 1989 ABC TV movie.

So many children are injured on trampolines that many school districts can no longer get insurance for them. In the picture to the right there are a number of potential problems: the trampoline is too close to the building and to the sidewalk and there are too many children on at one time. On a positive note, by covering the springs, the children on this trampoline are protected from injuries related to falls in which limbs become caught in the springs

In this yard, a wheelbarrow is a tempting, easily tipped, unofficial jungle gym. The lumber piled near the wall presents trip, splinter and nail puncture hazards.

If there is water in the wheelbarrow, this could be a drowning hazard or habitat for mosquitoes. What are better storage options for the wheelbarrow and wood?

Sharp-edged bolts are protruding from the swing set in this photo to the right. Protruding hardware pieces are cut hazards and can also catch in clothing, resulting in falls or strangulation. Exposed concrete reinforcing bar and barbed wire are other common puncture and cut hazards found in outdoor play areas.

There may also be chemical hazards in older treated wood with arsenic, chromium, and copper. Newer treated wood is treated with quaternary ammonia compounds.

What Do They Land On?

Soft materials should be present under playground equipment. The photo to the right displays a proper material in use under the playground equipment. However, note the potential for moisture and rodent problems with the soft materials so close to the exterior wall. Also, note the sharpened tips of the surrounding fence. Further, the plastic toys may not be entirely stable and may tip. There also may be lead in the plastic which will be released as it degrades in the heat and ultraviolet rays of the sun.

Poisoning

82% of households keep medicines in unlocked drawers or cabinets

69% of homes with young children store household chemicals in unlocked areas

***Source**: The State of Home Safety in America™, Facts About Unintentional Injuries in the Home, Second Edition, 2004*

Preventing Poisonings: Secure Storage

General purpose cleaners, bleaches, and drain cleaners are among materials commonly used in kitchens that are acutely toxic if ingested or, in the case of chlorine bleach, if mixed with the wrong chemicals.

In the picture to the right, many hazardous products are stored on open shelving, low enough for children to reach. Combining some of these products, like chlorine bleach and window cleaner, produces chlorine gas.

The photos below show better options for the storage of hazardous products and cleaning supplies: guarded cabinets and drawers with over-the-counter medications, prescription medications, vitamins supplements, and tobacco products.

Additional measures include getting rid of unused medicines. In some areas, community drug take–back programs allow the public to bring unused drugs to a central location for proper disposal. If a take-back program is not available in your area, or disposal instructions are not given on the drug label, throw the drugs into the household trash, but first, take them out of their original containers and mix them with an undesirable substance, such as used coffee grounds or kitty litter. The medication will then be less appealing to children and pets, and unrecognizable to people who may intentionally go through trash. Then put them into a sealable bag, empty can, or other container to prevent the medication from leaking or breaking out of the garbage bag.

The poison control number (1-800-222-1222) should be put on or near every phone.

Labels

Three agencies regulate labels for consumer products that may contain hazardous substances: The Food and Drug Administration (FDA), the Environmental Protection Agency (EPA), and the Consumer Products Safety Commission (CPSC).

- Foods, drugs, dietary supplements and cosmetics – regulated by FDA
- Pesticides (fungicide, insecticides, herbicides, rodenticides, etc.) – regulated by EPA
- Consumer products – regulated by CPSC

The Federal Hazardous Substances Act regulates all remaining consumer products. See www.cpsc.gov/BUSINFO/regsumfhsa.pdf and www.cpsc.gov/BUSINFO/pppa/pppa09.pdf

Materials Safety Data Sheets

Materials Safety Data Sheets (MSDSs) are not labels. They are separate documents describing the potential hazards to workers. They are required by the Occupational Safety and Health Administration (OSHA) for hazardous chemicals. Some consumer product manufacturers make MSDSs available to the public.

CPSC Principal Display Panel

The Consumer Product Safety Commission (CPSC) requires consumer products containing hazardous substances to have:[5,6]

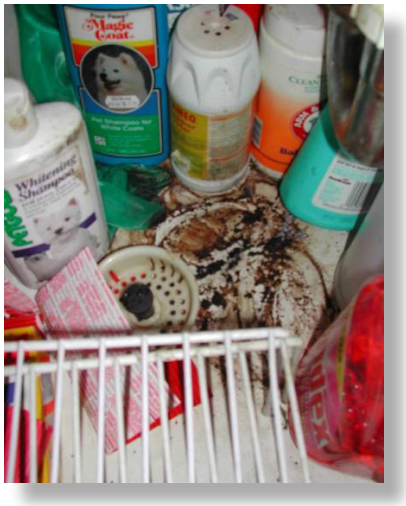
Principal Display Panel containing:

- Signal word – CAUTION is least dangerous, POISON is most dangerous
- Affirmative Statement of Principal Hazard
- If all labeling is not on the principal display panel, then other cautions must be located on another panel.

Other Label Requirements:

- Name and place of business of the manufacturer, packer, distributor or seller
- Common or usual name or chemical name
- Precautionary measures to follow
- Instructions for first aid treatment when appropriate
- Instructions for handling and storage
- "Keep out of the reach of children" or its practical equivalent
- Special labeling for certain chemicals
  - Charcoal
  - Art materials
  - Additional items (fireworks, etc.)

What's Under the Sink?



Do all cleaning product labels have hazard warnings? No, not unless they involve a potential specific hazard. All products are governed by the Federal Hazardous Substances Act that was passed in 1960. This covers household cleaning products that are expected to be stored in the home or garage, but specifically excludes food, drugs and pesticides. These are covered by other legislation.

The signal words *Caution, Warning, Danger* must appear on the main panel of the label with the specific hazard following.4 Additional information such as "*Keep out of Reach of Children*" is also required.

- What products typically have the "Caution" label? Most automatic dishwashing and laundry detergents.
  - Common warnings are: *Eye Irritant, Skin Irritant, Harmful if Swallowed*. These generally are not expected to cause permanent damage, but an inflammation of the affected area might occur. ***Caution*** or ***Warning*** also appears on products that are flammable or apt to explode if heated.
- What products are likely to have *Danger* or *Poison* on the label? Oven cleaners, rust cleaners, clogged-drain openers, or highly flammable products.
  - *Poison* is rarely used, but household lye, antifreeze and some car-care products stored around the house may have this label.
  - The *Danger* signal word is required if the product is highly toxic, corrosive or extremely flammable.

Consumers should avoid products labeled ***Danger***. They should prefer products labeled *Caution*.

Understanding Corrosive v. Irritant

Corrosive and irritant are two important words to know. Corrosives cause irreversible (permanent) damage. Irritants cause reversible damage. That does not mean irritants are completely safe. Most products will cause irritation to the eye if put in the eye as a liquid.

Often consumers can find a product that is labeled irritant instead of corrosive that works equally well. Consumers should avoid corrosives.

- Corrosive: Destroys living tissue such as skin or eyes by chemical action.
- Irritant: Not corrosive and causes a substantial injury to the area of the body that it comes in contact with. Irritation can occur after immediate, prolonged, or repeated contact.

Understanding Flammable v. Combustible

Flammables start fires. Combustibles feed fires once started. If you need to choose, pick a combustible. Flash points are measured by putting a spark or a flame above a liquid as the liquid is warmed. At the flash point, the liquid will release enough vapors that it can support the flame. The lower the flash point, the greater the risk.

An extremely flammable liquid can start a fire under most conditions. Gasoline is extremely flammable. It has a flash point of about –20 degrees F. Flammables require higher temperatures to support combustion but can catch fire on a hot day.

In contrast, combustibles need more than a hot day to catch fire. They need to heat to about 100 F or they need to be sprayed into the air. A spray will increase the surface area of the liquid releasing more vapor. This makes it burn at lower temperatures. As a general rule, flammables start fires and combustible feed fires. Avoid flammables.

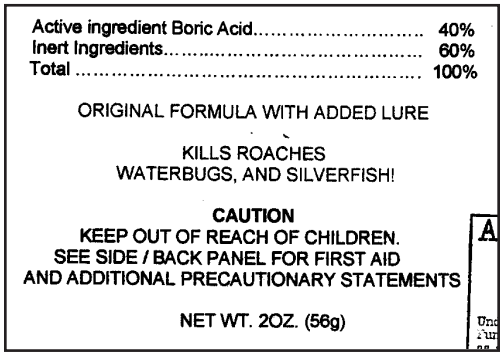
- Flash Point: Temperature where liquid will support a flame
- Extremely Flammable: Flash Point is 20°F or less
- Flammable: Flash point between 20°F and 100°F
- Combustible: Flash point between 100°F and 150°F

EPA Pesticide Product Labels

You may remember the information about EPA Pesticide labels from ***Keep It Pest-Free***. EPA approves the language and layout for the label on every pesticide. Copies of all labels are available on-line at www.epa.gov/pesticides/pestlabels/. For labeling requirements, see www.epa.gov/oppfead1/labeling/lrm/.

EPA Pesticide product labels must have the following information identified on the front panel:

- Product Name
- Ingredients
  - Active
  - Inert / Other
- "Keep Out of Reach of Children"
- Signal Word: Poison / Danger / Warning / Caution
- First Aid
- If Poison, then skull and crossbones
- Net contents


Active ingredient Boric Acid..... 40%
Inert Ingredients..... 60%
Total 100%

ORIGINAL FORMULA WITH ADDED LURE

KILLS ROACHES
WATERBUGS, AND SILVERFISH!

CAUTION
KEEP OUT OF REACH OF CHILDREN.
SEE SIDE / BACK PANEL FOR FIRST AID
AND ADDITIONAL PRECAUTIONARY STATEMENTS

NET WT. 2OZ. (56g)

The back panel typically includes:

- EPA Registration Number - identifies the manufacturer/formulator and the product.
- Company Name and Address
- Precautionary Statements
  - Hazards to Humans and Domestic Animals
  - First Aid
  - Environmental Hazards
  - Physical or Chemical Hazards
- Directions for Use
- Storage and Disposal
- Warranty Statement (voluntary)
- Worker Protection Labeling

Storing Hazardous Materials

Anything kept in a bottle should be correctly labeled and easy to identify. Hazardous materials should be kept in secure locations.

In 1971, Mr. Yuk was created by the Pittsburgh Poison Center at Children's Hospital of Pittsburgh. Since then, Mr. Yuk has been used to educate children and adults about poison prevention and to promote poison center awareness. In addition, Mr. Yuk has raised awareness that poison centers are available 24 hours-a-day, every day of the year to assist in the management of poisoning emergencies.

What about bug spray?

When applying insect repellents to children, read all directions first. Do not apply over cuts, wounds, or irritated skin. Do not apply to eyes, mouth, hands, or directly on the face. Also, use just enough to cover exposed skin or clothing, but do not use under clothing.

Vegetation

Many plants are poisonous and should not be found in houses or yards with small children. Occupants should learn which of their outdoor and indoor plants are poisonous and teach children to not put plants in their mouths.

Art Materials

Many art materials contain hazardous materials. For a given need, there are often nontoxic alternatives that accomplish the same purpose. Products bearing the labels "AP approved product" or "CP certified product" have been reviewed by a special program of the Arts and Crafts Materials Institute and do not present toxicity concerns.

Food Safety

To safely preserve food, keep refrigerators at 40 degrees F. The only way to know is to measure the temperature. Don't measure the temperature after you've just filled it with food because the food will temporarily warm the refrigerator.

Remember to:

- Wash your hands!
- Keep raw & cooked foods separate
- Cook foods using a thermometer
- Store food properly:
  - Fridge: < 41˚F
  - Freezer: < 0˚F

For more information, go to: http://foodsafety.adcouncil.org/Downloadable-Materials/

Fire[7]

- A residential fire claims a life every three hours.
- Fires are the 3rd leading cause of fatal home injury in the US.
- An estimated 365,500 residential building fires are reported to U.S. fire departments each year and cause an estimated 2,560 deaths, 13,000 injuries, and $7.4 billion in property loss.
- Cooking is the leading cause of residential building fires (45 percent). Nearly all residential building cooking fires are small, confined fires (94 percent).
- Residential building fires occur most frequently in the early evening hours, peaking during the dinner hours from 5 to 8 p.m., when cooking fires are high.

- Forty-seven percent of non-confined residential building fires extend beyond the room of origin. The leading causes of these larger fires are electrical malfunctions (16 percent), unintentional or careless actions (16 percent), intentional (12 percent), and open flame (11 percent).
- Smoke alarms were not present in 22 percent of the larger, non-confined fires in occupied residential buildings.

Fire prevention tips[8]

- Never leave food unattended on a stove.
- Keep cooking areas free of flammable objects.
- Avoid wearing clothes with long, loose-fitting sleeves when cooking.
- Never smoke in bed or leave burning cigarettes unattended.
- Do not empty smoldering ashes in a trash can. Keep ashtrays away from upholstered furniture and curtains.
- Never place portable space heaters near flammable materials.
- Keep all matches and lighters out of reach of children.
- Install smoke alarms on every floor of the home.
- Use long-life smoke alarms with lithium-powered batteries. If long-life alarms are not available, use regular alarms, and replace the batteries annually.
- Test all smoke alarms every month to ensure they work properly.
- Devise a family fire escape plan and practice it every six months.
- If possible, install or retrofit fire sprinklers into home.

Fires from Smoking[9]

- An estimated 7,600 smoking-related fires in residential buildings occur each year in the United States.
- While smoking-related fires accounted for only 2 percent of all residential building fires, they were a leading cause of civilian fire deaths, accounting for 14 percent of fire deaths in residential buildings.
- Sixty-seven percent of the non-confined residential building smoking-related fires occurred because of abandoned or discarded smoking materials or products, primarily cigarettes.
- The bedroom was the leading area of fire origin for non-confined residential building smoking-related fires at 24 percent.
- Residential building smoking-related fires occurred most often from noon to 8 p.m., peaking from 2 to 3 p.m. at six percent.

Placing and Maintaining a Smoke and Fire Detector

Smoke and fire alarms are needed to sound an alarm. Place them where hot air from a potential fire will collect so they will sound the alarm at the beginning of a fire, when moments are precious.

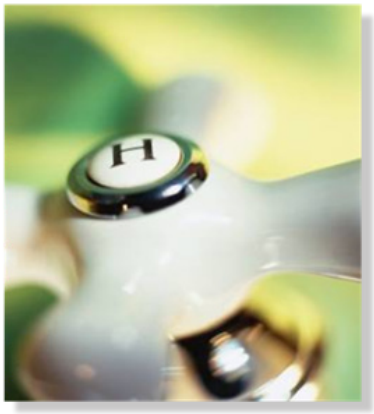
In the photo on the preceding page, a smoke and fire alarm is placed next to a CO alarm in the hallway outside of a frequently occupied bedroom. The alarm is probably being placed too close to a corner where there may not be good airflow. They need to follow manufacturer's instructions.

Regulations vary on whether the alarms must be hard-wired, battery powered or both. These devices should be tested by pressing the TEST button. A common cause of failure is weak or missing batteries, which should be replaced routinely.

Scalding

Burns[7]

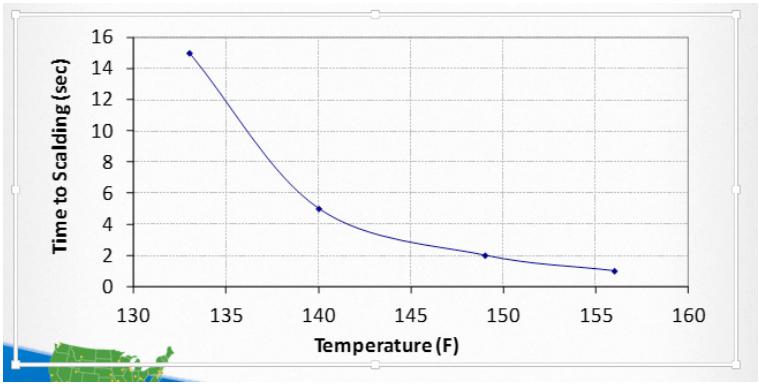
- 75% of households did not know the temperature setting on their water heaters.
- 91% were unaware of the temperature of hot tap water.



Hot water must be warm enough to make soaps effective and kill most environmental bacteria, like Legionella. However, to avoid scalding, hot water should be less than 120°F.

A study published in 2003 concluded that washing clothing and bedding in cold or warm water with detergent or detergent plus bleach removed most allergens and a significant ($P < .05$) portion of live mites. Repeated washing is required to further reduce mite levels.

If water is above 120 degrees Fahrenheit, it can cause scalds and burns especially in a bathtub where a child could have longer exposures. The 2006 International Residential Code requires the use of water mixing devices on showers and bathtubs. These devices blend hot and cold water to keep the temperature less than 120 degrees F.

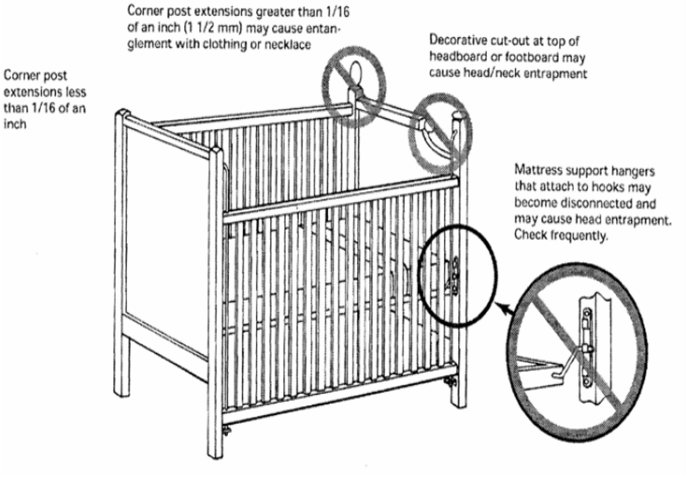


Choking and Suffocation

To prevent falls, uprights on railings should be close enough to prevent a six inch diameter sphere from passing through. The uprights on this railing are close enough together to prevent a child's head fitting through. However, the railing with horizontal bars has one opening wide enough to crawl through and another that is both wide enough to get a head through and narrow enough to create a choke hazard. Children should be properly supervised while in outdoor play areas. Stair and balcony slats should be checked as well.

Crib Safety

The CPSC issued new crib standards in 2011. Some of the new mandatory rules for cribs include: (1) stopping the manufacture and sale of dangerous, traditional drop-side cribs (2) strengthening mattress supports and crib slats (3) requiring crib hardware to be more durable; and (4) making safety testing more rigorous.



To prevent suffocation, never place pillows or thick quilts in a baby's sleep environment. Also, there should be no gaps larger than two fingers between the sides of the crib and the mattress.

Proper assembly of cribs is paramount—follow the instructions provided and make sure that every part is installed correctly. If you are not sure, call the manufacturer for assistance.

Do not use broken or modified cribs. Infants can strangle to death if their bodies pass through gaps between loose components or broken slats while their heads remain entrapped.

Set up play yards properly according to manufacturer directions. Use only the mattress pad provided with the play yard; do not add extra padding. Never place a crib near a window with blind, curtain cords or baby monitor cords; babies can strangle on cords.

Loose Cords for Blinds

In general, cords for blinds should be kept out of reach of small children. A dangling cord attracts the curiosity of a toddler who can become tangled and is not sure enough on his or her feet to escape. Many additional objects can pose choking or suffocation hazards to small children as well. They should be kept out of reach.

Electric Shock

Electrical outlets should be covered. Brightly colored outlets, or worse yet, those with images of popular cartoon figures, draw children to them. Transparent, uninteresting covers are the safest. Outlets should be checked to be certain that the hot, neutral and ground wires are not mixed up.

Drowning

Drowning hazards found in yards and other outdoor areas include swimming and wading pools, wells, streams, and ponds. Even a bucket of water inside or outside is a drowning hazard to a toddler, who can tip into the bucket, but may not be able to get out.

According to the U.S. Consumer Product Safety Commission (CPSC), drowning is the leading cause of unintentional death among children ages one- to four- years-old and it takes only a few inches of water for a young child to drown.

Overall, pools are the leading location where children drown. Pools should have four-sided isolation fencing with a self-latching and self-closing gate. Swimmers should always be supervised by a responsible adult.

After pools, bathtubs are the second leading location where young children drown. A 2012 CPSC report on in home drownings and non-fatal submersions in products such as bathtubs, buckets, bath seats, toilets, and landscaping features indicates that from 2006 to 2010, there were 684 incidents (434 fatalities) involving children younger than five years of age. Eighty-two percent of the victims were younger than the age of two and 81 percent of the incidents involved bathtubs or bath-related products.

Firearms

Firearms should be unloaded, locked, and stored in a secure location. Trigger locks are inexpensive and easy to use. Ammunition should be kept in separate locked storage.

Safety Strategies

As you can see, there are many possible ways to be injured in a house. The following list provides twelve safety strategies:

1. Safety gates at the top and bottom of stairs help prevent falls on stairs and keep children away from dangerous areas. Place smoke detectors on every level of the home and near bedrooms to alert occupants to fires.
2. Safety latches and locks for cabinets and drawers in kitchens, bathrooms, and other areas help prevent poisonings and other injuries. Window guards and safety netting help prevent falls from windows, balconies, decks, and landings.
3. Door knob covers and door locks help prevent children from entering rooms and other areas with possible dangers.
4. Anti-scald devices for faucets and shower heads prevent burns, as does setting the water heater temperature to 120 degrees. Corner and edge bumpers help prevent injuries from falls against sharp edges of furniture and fireplaces.
5. Place smoke detectors on every level of the home and near bedrooms to alert occupants to fires. Outlet covers and outlet plates help prevent electrocution.
6. Window guards and safety netting help prevent falls from windows, balconies, decks, and landings. Carbon monoxide (CO) alarms outside bedrooms help prevent CO poisoning.
7. Corner and edge bumpers help prevent injuries from falls against sharp edges of furniture and fireplaces.
8. Outlet covers and outlet plates help prevent electrocution.
9. Carbon monoxide (CO) alarms outside bedrooms help prevent CO poisoning.
10. Cutting window blind cords and using safety tassels and inner cord stops help prevent children from strangling in blind cord loops.
11. Door stops and door holders help prevent injuries to fingers and hands.
12. Cordless phones make it easier to continuously watch young children, especially when they're in bathtubs, swimming pools, or other potentially dangerous areas.

Code Requirements Related to Safety

304.10 Stairways, decks, porches and balconies. Every exterior stairway, deck, porch and balcony, and all appurtenances attached thereto, shall be maintained structurally sound, in good repair, with proper anchorage and capable of supporting the imposed loads.

304.13 Window, skylight and door frames. Every window, skylight, door and frame shall be kept in sound condition, good repair and weather tight.

304.18 Building security. Doors, windows or hatchways for dwelling units, room units or housekeeping units shall be provided with devices designed to provide security for the occupants and property within.

304.18.2 Windows. Operable windows located in whole or in part within 6 feet (1828 mm) above ground level or a walking surface below that provide access to a dwelling unit, rooming unit or housekeeping unit that is rented, leased or let shall be equipped with window sash locking devices.

305.2 Structural members. All structural members shall be maintained structurally sound, and be capable of supporting the imposed loads.

305.4 Stairs and walking surfaces. Every stair, ramp, landing, balcony, porch, deck or other walking surface shall be maintained in sound condition and good repair.

305.5 Handrails and guards. Every handrail and guard shall be firmly fastened and capable of supporting normally imposed loads and shall be maintained in good condition.

306.1 General. Every exterior and interior flight of stairs having more than four risers shall have a handrail on one side of the stair and every open portion of a stair, landing, balcony, porch, deck, ramp or other walking surface which is more than 30 inches above the floor or grade below shall have guards. Handrails shall not be less than 30 inches high or more than 42 inches high measured vertically above the nosing of the tread or above the finished floor of the landing or walking surfaces. Guards shall not be less than 30 inches high above the floor of the landing, balcony, porch, deck, or ramp or other walking surface.

402.2 Common halls and stairways. Every common hall and stairway in residential occupancies, other than in one- and two family dwellings, shall be lighted at all times with at least a 60-watt standard incandescent light bulb for each 200 square feet of floor area or equivalent illumination, provided that the spacing between lights shall not be greater than 30 feet.

604.2 Service. The size and usage of appliances and equipment shall serve as a basis for determining the need for additional facilities in accordance with the ICC Electrical Code. Dwelling units shall be served by a three-wire, 120/240 volt, singlephase electrical service having a rating of not less than 60 amperes.

604.3 Electrical system hazards. Where it is found that the electrical system in a structure constitutes a hazard to the occupants or the structure by reason of inadequate service, improper fusing, insufficient receptacle and lighting outlets, improper wiring or installation, deterioration or damage, or for similar reasons, the code official shall require the defects to be corrected to eliminate the hazard.

605.2 Receptacles. Every habitable space in a dwelling shall contain at least two separate and remote receptacle outlets. Every laundry area shall contain at least one grounded-type receptacle or a receptacle with a ground fault circuit interrupter. Every bathroom shall contain at least one receptacle. Any new bathroom receptacle outlet shall have ground fault circuit interrupter protection.

605.3 Lighting fixtures. Every public hall, interior stairway, toilet room, kitchen, bathroom, laundry room, boiler room and furnace room shall contain at least one electric lighting fixture.

Key Messages

- Injuries are not accidents. They are preventable.
- There are many simple and inexpensive ways to prevent home injuries.
- Children and older adults are more at risk for injuries in the home.
- Falls, poisoning, and fires/burns are the most common causes of injury deaths.

Learning Objectives

- Explain the difference between an injury and an accident.
- Name the 3 most common home injury related causes of death.
- Name five locations to look for safety hazards in the home.
- Name five ways to prevent home injuries.

Keep it Contaminant-Free

Can you really keep a home contaminant-free? Perhaps not, but you can make significant progress by carefully evaluating your buying decisions. You may be intentionally bringing in contaminants due to the function that the contaminant performs, or the contaminant may be along for the ride.

In this module, we will be focusing on buying decisions. We have already discussed pests and pesticides in *Keep It Pest-Free*. We will talk about asbestos, lead, and mercury in the next section—*Keep It Maintained*—so that we can focus on maintenance for their biggest sources. In this module, we will consider tobacco smoke, volatile organic compounds (VOCs), and Formaldehyde

An Outline of Contaminant Buying Decisions – and Those Along for the Ride

Contaminants We Intentionally Bring In

- Tobacco smoke
- Pesticides
  - Sprays, baits, and powders
- Volatile organic compounds
  - Air fresheners and cleaning products
  - Glues, sprays, and coatings
  - Building materials
- Mercury
  - Thermostats and fluorescent lamps
- Asbestos
  - Building materials
- Meth Labs

Along for the Ride

- Bedbugs and mice
  - Used furniture, mattresses, boxes
- Cockroaches
  - Cardboard boxes and furniture
- Formaldehyde
  - Pressed wood products

Start with People
House as a System
Keep It:
1. Dry
2. Clean
3. Pest-Free
4. Ventilated
5. Safe
6. Contaminant-Free
7. Maintained
8. Climate Controlled
Making it Work

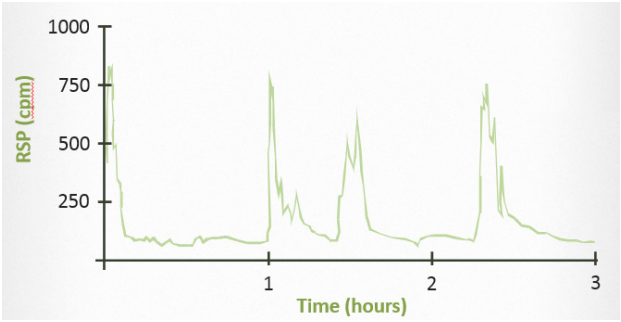
Learning Objectives for this module

- Identify at least four contaminants in the home and strategies to prevent, contain or control them. health effects.
- Describe at least four ways that contaminants get into the home.
- Identify at least three health effects and their associated contaminant.

- Lead
  - Used building supplies

Secondhand Smoke

Tobacco smoke is an important contaminant source in indoor air. Every spike in this time series of airborne particles in a house (graphic to the right), is one person smoking a cigarette. Sixty percent of the U.S. population has biological evidence of exposure to second hand smoke.



Tobacco Spikes in Particle Levels

Source: Indoor Air Quality, Infiltration and Ventilation in Residential Buildings NYSERDA 1985 [5]

Why Avoid Secondhand Smoke: Related Health Effects

The 2014 Surgeon General's Report on secondhand smoke concluded that:

1. Secondhand smoke causes premature death and disease in children and in adults who do not smoke.
2. Children exposed to secondhand smoke are at an increased risk for sudden infant death syndrome (SIDS), acute respiratory infections, ear problems, and more severe asthma. Smoking by parents causes respiratory symptoms and slows lung growth in their children.
3. 2.5 million nonsmokers have died because they breathed secondhand smoke—air that was polluted by other people's cigarette smoke.
4. Exposure of adults to secondhand smoke has immediate adverse effects on the cardiovascular system and causes coronary heart disease and lung cancer.[1]

Additionally, a study published in 2012 found a statistical association between the increasing prevalence of smoke-free home rules among homes with infants and decreasing cases of SIDS.[3]

Adult Health Affects:

- Coronary heart disease
- Lung cancer
- Cardio Pulmonary Obstructive Disorder (CPOD)
- Middle ear infections
- Pneumonia, bronchitis

Further, smoking materials such as cigarettes are the leading cause of home fire death.[2] The following are some interesting statistics from the American Lung Association that focus on problems related to secondhand smoke. Secondhand smoke causes an estimated 3,000 lung cancer deaths in nonsmokers each year.

Smoking materials have historically been the leading cause of home fire deaths. During 2005-2009, smoking materials were the heat source in an annual average of 18,900 reported home structure fires, 660 civilian fire deaths, 1,270 civilian fire injuries, and $492 million in direct property damage. A proportional share of fires with heat sources from unclassified open flame or smoking materials are included in the candle and smoking material estimates.

Only 5% of reported home structure fires were started by smoking materials, but these fires caused 25% of the home fire deaths. These materials also caused 10% of all reported home fire injuries and 7% of the direct property damage.

Smoke-Free Home Rules: State Performance

	1998-1999	2003	2009-2010	% Increase
Total	60%	72%	81%	33%
Max (state range)	81%	89%	93%	15%
Min (state range)	40%	53%	68%	70%

It is interesting how the percentage of children exposed to secondhand smoke varies greatly between states. On average, 22% of U.S. children under the age of 18 are exposed to secondhand smoke at home.

- 11.7% of children in Utah
- 17.7% of children in Washington
- 20.1% of children in Maryland
- 29.8% of children in Ohio
- 34.2% of children in Kentucky

Nonsmokers Exposed to Tobacco Smoke Have Increased Risk of Acute and Chronic Disease

- Respiratory illness (including arrested lung development)
- Asthma attacks and development
- Middle ear effusions
- Irritant effects
- Children affected by smoking caretaker

What Can You Do about Tobacco Smoke in Homes and Cars?

- Quit. If you're ready, there is help
- Do not smoke around children
- Smoke outside
- Exhaust vent the places where people smoke

Smoke-Free Housing Policies

In addition to resident health benefits, smoke-free housing saves property owners money.[4] The following chart shows the differences in rehabilitation costs in nonsmoking, light-smoking, and heavy-smoking units

The Monetary Impact

Cost to Rehabilitate a Unit Where Smoking is Prohibited vs. a Unit Where Smoking is Allowed

	Non-Smoking	Light Smoking	Heavy Smoking
General Cleaning	$240	$500	$720
Paint	$170	$225	$480
Flooring	$50	$950	$1,425
Appliances	$60	$75	$490
Bathroom	$40	$60	$400
TOTAL	$560	$1,810	$3,515

Data reflects surveys from housing authorities and subsidized housing facilities in New England. Collected and reported by Smoke-Free Housing New England, 2009.

Other Benefits of Smoke-Free Housing[5]:

- **Increases Demand**: 81% of prospective tenants in Massachusetts were less interested in a development if they smelled smoke in the building.
- **Decrease Fires/Potential Insurance Discount**: Smoking is the leading cause of fatal household fires. Some insurers offer discounts for owners with smoke-free policies.
- **Reduces Tenant Conflict**: 39% of landlords reported that a smoke-free policy lowered tenant conflict.

Approaches to Smoke-Free Multifamily Rental Buildings:

- **Policy Approaches**: Approaches to eliminating secondhand smoke in multi-unit rental apartments range from voluntary measures adopted by apartment building owners, to governmental incentives, to ordinances and statutes at the state and local level regulating smoke-free policies, to other exposure deterrents.
- **Change Is In The Air:** HUD is mandating for the first time that public housing authorities go smoke-free to "improve indoor air quality, benefit the health of public housing residents and PHA staff, reduce the risk of fires, and lower overall maintenance costs." It is important to understand that HUD is not prohibiting residents from smoking, and admission cannot be denied to applicants solely because they smoke, but any resident, guest, employee, or vendor will no longer be allowed to smoke in or within 25 feet of public housing buildings.
- **Voluntary/Grassroots Efforts**: Local public health agencies and nonprofit organizations have established smoke-free housing programs to encourage rental property owners to adopt some form of smoke-free or

smoking-restricted policies for their buildings. This approach involves meeting with individual landlords, or with landlord associations, tenant organizations, or associations representing property owners.

- **Low-Income Tax Credit**: This program provides federal tax credits to state and local government units to stimulate the development of affordable housing. Local governments can develop criteria for the type of housing they want in their communities. States such as California, Maine, Minnesota and New. Hampshire, as well as cities, such as Minneapolis and St. Paul, have included the adoption of smoke-free policies for proposed building projects as a criterion considered in the awarding of tax credits. Developers do not have to include a smoke-free policy in their development, but their chances in the competitive process are improved if they do.
- **Disclosure:** The cities of Oakland and San Francisco, California, Rockland County, NY, Buffalo, NY, Duluth, MN and the states of Maine and Oregon have passed laws that require the owners of rental apartment buildings to disclose the smoking policies for the buildings, whether the policy is smoking permitted, smoking restricted or smoke-free. The laws do not mandate that units be smoke-free; the laws just require notification to prospective tenants of the smoking policies and location of smoking and nonsmoking units. The Oakland ordinance also requires that sellers of condominiums disclose the smoking policy for the unit and for the complex.

Volatile Organic Compounds

Volatile organic compounds (VOCs) is a broad class of chemicals that we breathe inside our homes. It is tough to make broad generalizations beyond saying that less exposure is better.

If you want to understand whether the chemical is dangerous you need to understand the chemical's hazards and the exposures involved. The risk is the exposure times the hazard. The list below identifies sources of some of the more significant VOCs. You may be able to identify others.

Volatile Organic Compounds	
• Air Fresheners • Cleaning Products • Sprays and Coatings • Formaldehyde • Carpets	• Vinyl Floors • Drywall • Hobbies • Home Maintenance

EPA's Office of Indoor Air Quality found that the concentration of VOC's can be two to five times greater in the home than outdoors. During or immediately after paint-stripping activities, VOC levels can be 1,000 times higher than outdoors. We treat VOCs as a group since there may be cumulative or synergistic effects from breathing a combination of them.

Paints, varnishes, and glues may contain a variety of materials with potential health or nuisance effects.

When painting:

1. Use low-VOC paints with caution or use traditional paints with adequate ventilation.
2. Select durable, easy-to-clean paints that meet these standards:

- Contrast ratio greater than 0.95 on ASTM D2805 (hiding power).
- Number of cycles greater than 1000 on ASTM D2486 (scrubbing durability).
- Greater than 50% stain removal on ASTM D3450 (washability).

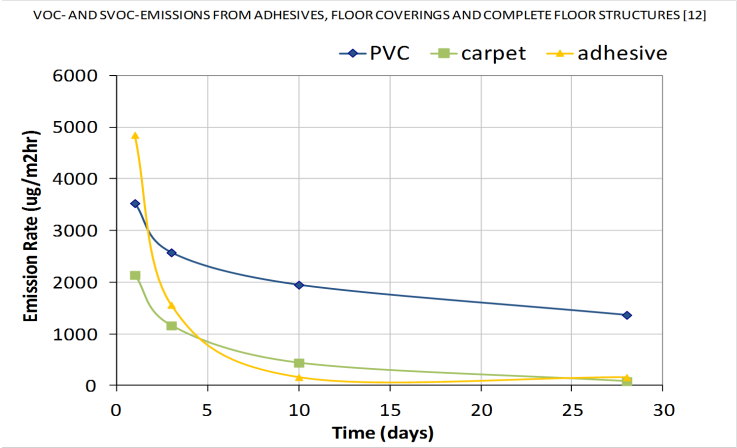
3. Acquire and review information on potential contaminants including Material Safety Data Sheets (MSDS), emission data, and any other information available.
4. Avoid:
   - Terpenes
   - Linseed oil
   - Paints containing ethylene glycol (paints with no glycol are preferable but paints containing propylene glycol are acceptable)
   - Acid cured polyurethane finishes
5. Follow this outdoor air ventilation guidance for paints, varnishes, adhesives and carpeting:
   - Provide 2 – 5 ach (air changes/hour) fan powered ventilation during application and for two days afterwards.

Why Avoid VOCs?

There are several health effects associated with VOCs. These include headaches, nausea, certain types of cancers, and damage to different systems of the body. Again, it varies with each chemical. The picture to the right represents a neuron. Damage to neurons caused by VOCs can affect the functioning of the central nervous system.

Potential health effects of VOCs:

- Eye, nose, throat irritation
- Headaches, nausea, coordination
- Liver, kidney, and brain damage
- Some can cause cancers
- Child development



The chart above shows three different building materials that release gases at different rates. Wet-applied products often start with high emissions but emit very quickly, while solid products take longer.

Reduce Potential Sources

The same principles that were applied to the management of pests, dirt, and moisture can be applied to other sources as well. First, keep it out—don't use it at all. Second, substitute something less likely to cause problems. Consider the risks for contaminants released by the product itself, the use and maintenance of the product, and how badly can things go wrong in the event of an accident.

1. Don't use it if you don't have to.
2. Substitute with a product that has:
   - Low-VOC and particle emission
   - Low toxicity and irritancy characteristics
   - Low risk of chemical reactivity
   - Low risk of fungal contamination
   - Low maintenance requirements

Summary - Steps to Control VOCs

- Control the source
  - Avoid using products that contain VOCs
  - Use lower VOC options (i.e., paints)
- Store materials properly
  - Keep containers sealed
  - Store away from air intake
  - Remove unwanted products from home
- Ventilate
  - Open doors and windows during use

Third-Party Certifications

There are various third-party organizations that evaluate products for health, energy efficiency, and sustainability. For buildings, there are four major national programs mentioned in the Overview module. (See NCHH's comparison of the programs in the references provided for the Essentials course.) For products and (to some extent) services, there are three main programs. Each has its merits; you should explore them all. There are also some programs for specific area, such as GreenShield for pest management.

- Buildings
  - Green Communities – www.greencommunitiesonline.org
  - Energy Star with Indoor Air Package – www.energystar.gov
  - LEED for Homes – www.usgbc.org/LEED/homes/
  - National Green Building Standard (ICC-700-2008) by ICC and NAHB

- Products and Services
  - Green Seal – www.greenseal.org
  - EcoLogo - www.ecologo.org
  - EPA's Design for the Environment –www.epa.gov/dfe
- Areas
  - GreenShield Certified (for pest control) – www.greenshieldcertified.org

Industry Stewardship Programs

Many industries have adopted environmental stewardship programs for their members. There are various third-party organizations that evaluate products for health, energy efficiency, and sustainability. These are valuable programs to bring about positive change in the industry; however, be cautious since there have been different motivations for their creation. Before recommending one, check them out.

Examples of industry stewardship programs:

- QualityPro for Pest Management – www.npmaqualitypro.org
- Green Label for Carpet and Rugs – www.carpet-rug.org
- Environmental Stewardship Program for Kitchen Cabinet www.greencabinetsource.org
- Ingredient Communications for Consumer Chemicals –www.cspa.org/public/media/info/cpici.html

Emerging Issues

Healthyhomes.net is the best way to stay current on emerging issues. Three examples of emerging issues are phthalates from vinyl products, Chinese drywall, and cadmium in jewelry.

- Phthalates are typically used in the production of vinyl products (such as flooring and windows) to increase flexibility. Chemicals may be released from the product when it is initially used and as it eventually degrades. There are concerns about the impacts of these chemicals on the body, especially reproductive effects.
- Drywall imported from China has been found to be releasing a chemical – most likely sulfur dioxide – in the moisture of an air conditioning heat exchanger. The sulfur dioxide converts to sulfuric acid and quickly corrodes the copper. The smell can be offensive. No one is sure of the health effects. The Florida Department of Health is leading the investigation on this issue.
- There have been a few reports of cadmium showing up in jewelry, possibly from nickel cadmium recycling. Cadmium may be a low-value metal replacing lead. Cadmium has serious health effects impacting the kidneys.

And Then We Have Meth Labs . . . .

What Are the Health and Safety Hazards?

- Explosive
  - Lithium metal, sodium, ether
- Flammable
  - Acetone, ethyl alcohol, solvents of all kinds
- Toxic
  - Iodine, red phosphorus, phosphine gas, anhydrous ammonia, methamphetamine
- Caustic
  - Sodium hydroxide, hydrochloric acid, muriatic acid

For additional information, see *EPA's Voluntary Guidelines for Methamphetamine Laboratory Cleanup: Revised Edition* (March, 2013). Available at http://www2.epa.gov/sites/production/files/documents/meth_lab_guidelines.pdf

Key Messages

- It is easier to prevent exposure to contaminants than it is to remove them and treat their effects.
- Should contamination occur: control, contain, and clean up.
- Contaminants are not always detectable by our senses.

Learning Objectives

- Identify at least four contaminants in the home and strategies to prevent, contain, or control them.
- Describe at least four ways that contaminants get into the home.
- Identify at least three health effects and their associated contaminant.

Keep it Maintained

In this module, we will be focusing first on maintenance in general and second on contaminants not previously addressed including those that are associated with maintenance problems such as lead-based paint and asbestos, and others such as radon.

Contaminants and Maintenance

Contaminants associated with maintenance include:

Legacy Toxics

- Lead-Based Paint
- Asbestos
  - Siding
  - Plaster
  - Insulation

Additional contaminants (not covered in this course) include:

- Chromated Copper Arsenate Wood
- Mercury
  - Thermometers & Flourescent Lamps
- Pesticide Residues

Other Problems Associated with Maintenance include:

- Cockroaches
- Mice and Rats
- Mold
- Carbon Monoxide
- Sewer Gas
- **And Then There is Radon…**

Maintenance

Proper, routine maintenance of the items below will prevent substantial moisture sources and associated health hazards.

- Solid waste storage and removal processes
- Water supply system

Start with People
House as a System
Keep It:
1. Dry
2. Clean
3. Pest-Free
4. Ventilated
5. Safe
6. Contaminant-Free
7. Maintained
Making it Work

Learning Objectives for this module

- Identify at least three systems that require ongoing maintenance.
- Identify two maintenance actions that require the use of a professional.
- Name at least two health effects from lead.
- Identify housing targeted by the RRP rule.
- Describe the two ways to mitigate radon in a home.

- Sewer system
- Heating/cooling/dehumidification/humidification systems
- Cooking
- Cooking areas
- Ventilation
- Rainwater control/drainage
- Structural integrity
- Storage / Organization

Maintenance Actions to Remember

- Inspect
- Clean
- Lubricate
- Replace
- Repair
- Organize

Poor maintenance of the downspout in this picture caused rainwater to be deposited next to the foundation.

The first step in maintenance is to inspect systems and appliances regularly to ensure their proper function. Routine cleaning and lubrication are needed for some systems. Repair and replace systems immediately when they fail.

Some systems have items such as filters, which must be routinely replaced (usually every 3 months) to prevent clogged filters from blocking proper air flows.

How's the filter? A clogged low efficiency filter partically sucked out of the frame.

General maintenance activities should be on-going, with seasonal and annual components.

Lead and Lead-Based Paint

To the right are key sources of lead in a home.

Federal EPA standards define lead-based paint hazards to include:

- Deteriorated lead-based paint
- Lead in dust that exceeds certain thresholds. There are standards for lead dust on floors, window sills and window troughs.
- Lead in soil that exceeds certain thresholds.

EPA has also set a level of lead in drinking water that is considered a hazard. Additionally, some pottery, produced in other countries can have lead in the glazes. The Consumer Product Safety Improvement Act (CPSIA) of 2008 set new limits for the lead content in children's products and the amount of lead in the paint used on those products. The standard was phased in over a period of three years. According to the current standards:

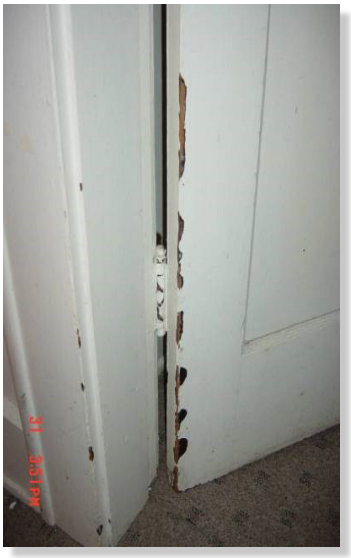
- Products designed or intended primarily for children 12 and younger may not contain more than 100 ppm of lead (effective August 14, 2011).
- Paint and similar surface-coating materials for consumer use must not exceed 90 ppm of lead (effective August 14, 2009).

Lead and Lead-Based Paint

- Peeling, Chipping Paint / Deteriorated Paint
- Dust
- Soil
- Drinking Water
- Consumer Products such as Pottery, Cribs, Jewelry, Candle Wicks
- Cultural Items
- Contaminated Sites

Why Lead?

Lead was added to paint to make it more durable. We therefore find lead-based paint more frequently on exterior surfaces and on windows and doors which require a more durable paint. We are most likely to find leaded paint outside in older homes. The second greatest use of leaded paint is on doors and windows inside older homes. Often windows have deteriorated paint, as windows experience moisture due to variations between inside and outside temperatures, causing causes paint failure.



Why Avoid Lead?

- Reduced IQ
- Learning disabilities
- Impaired hearing
- Reduced attention spans, behavior problems
- Anemia
- Kidney damage
- Damage to central nervous system
- Coma, convulsions, death

We can see deteriorated paint. It can be peeling, flaking, chipping or chalking.

Chalking is when paint leaves a whitish film. You may have walked alongside a building and then noticed a white film on your clothing. This is chalking. The paint was designed to do this and help keep the exterior clean. Unfortunately, the chalking can contain lead.

Lead: Age of Housing Matters

Of all U.S. housing stock, 40% of houses contain lead-based paint because so much of the housing stock is old. Lead was banned from use in residential paint in 1978 in the United States. The lead industry began voluntarily phasing out lead in paint in the mid 1950's. The chart to the left shows this trend. Nearly 9 of 10 homes built before 1940 have lead-based paint somewhere in the building.[1] More than ½ of homes built in the 1950's have some lead-based paint and the use of lead in paint declines sharply in the 1960's.

Year House Was Built	Percent of Houses with Lead-Based Paint
Before 1940	87 percent
1940-1959	69 percent
1960-1978	24 percent
All US Housing Stock	40 percent

Prevelance of Deteriorating Paint

- 2.1% of homes have broken plaster or peeling paint
- Conditions that deteriorate paint - in past twelve months
  - 8.5% of homes had interior water leakage
  - 11% of homes had exterior water leakage
- Source: American Housing Survey - 2011

Source: American Housing Survey - 2011

Available Testing for Lead Hazards

Besides just looking, we have tools to test for lead in paint, dust, soil and drinking water. Testing may be one of the actions recommended after analysis of the interview and inspection. People who are sampling for clearance testing usually need to be licensed.

Paint	Dust - Clearance Testing	Bare Soil	Drinking Water
Paint chip (laboratory test)	Floors: 40 micrograms per square foot (µg/ft^2)	Play areas: 400 parts per million (ppm)	Public water supply: 15 ppb
On-site test kits	Sills: 250 µg/ft^2	Other areas: 1,200 ppm	
	Troughs: 400 µg/ft^2		

EPA's Renovation, Repair, and Painting (RRP) Rule allows Certified Renovators to use an EPA-recognized paint test kit to determine whether paint is lead-based. EPA posts a list of all recognized paint test kits (www.epa.gov/lead/testkit.html#recognized).

As of November 2012, EPA has recognized the following three paint test kits:

- 3MleadCheck
- D-Lead
- State of Massachusetts Lead Kit

EPA Lead Renovation, Repair and Painting (RRP) Rule

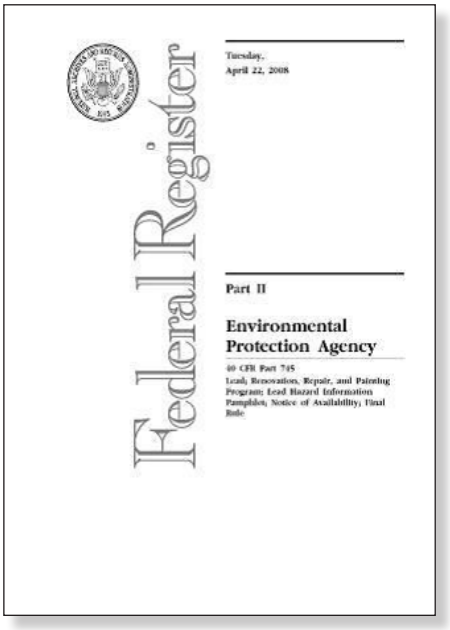
If housing is receiving federal assistance, contractors must comply with HUD's 1012/1013 regulation.

- Effective April 22, 2010
- Applies to pre-1978:
  - Target Housing (same as disclosure rule)
  - Child-occupied facilities
- Triggers:
  - Compensation
  - Paint disturbance (a/k/a renovation)
- 40 CFR 745.80 to 745.91
- April 22, 2008 Federal Register

Authorized States

Twelve states have been authorized to administer and enforce the RRP Rule.

- Alabama
- Delaware
- Georgia
- Iowa
- Kansas
- Massachusetts
- Mississippi
- North Carolina
- Oklahoma
- Oregon
- Rhode Island
- Utah
- Washington
- Wisconsin


Federal Register

Tuesday,
April 22, 2008

Part II

Environmental Protection Agency

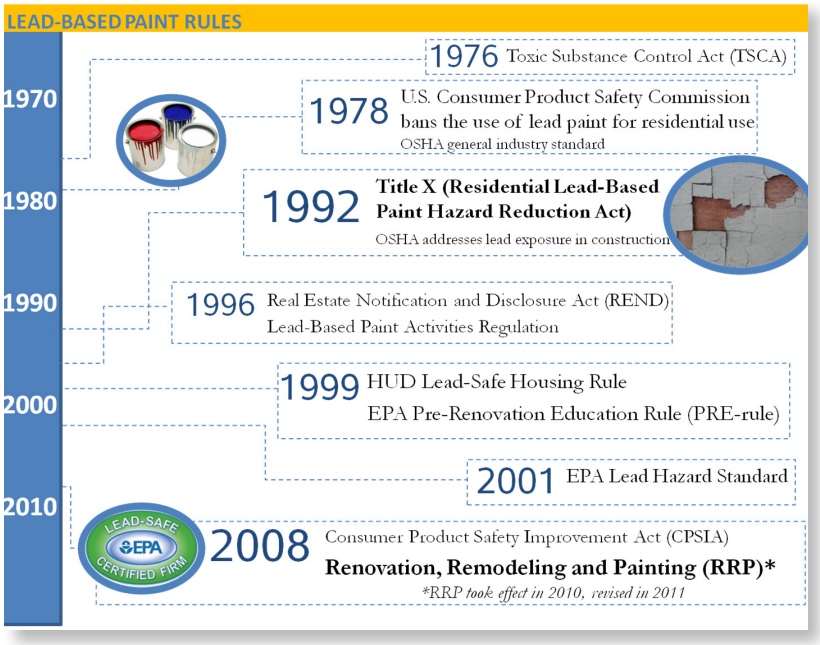
40 CFR Part 745
Lead; Renovations, Repair, and Painting Program; Lead Hazard Information Pamphlet; Notice of Availability; Final Rule

Impacts of RRP Rule

- 8.4 million renovation events annually
  - Impact may drop to 4.4 million events
- Requires certification of:
  - 210,000 renovation firms by EPA after October 22, 2009
  - 235,000 individuals by accredited trainers after April 22, 2009
- Estimated by EPA to add $35 per job

Why Now?

- Final major rule from the Residential Lead-based Hazard Reduction Act of 1992
- Congress required rule to be finalized in 1996
- Still to come:
  - Public buildings built before 1978
  - Commercial buildings that create lead-based paint hazards



Detailed Timeline of Lead-Based Paint Rules

- **1976 — Toxic Substance Control Act (TSCA)**
- **1978 — U.S. Consumer Product Safety Commission** bans the use of lead paint for residential use
- **1978 — OSHA** promulgates a final occupational lead standard for general industry (excluding the construction industry). The 1978 lead standard required that the permissible exposure limit be achieved, to the extent feasible, by engineering and work practice controls and in addition included a number of ancillary provisions requiring employers to provide medical surveillance, medical removal protection (MRP), hygiene facilities, appropriate respirators, and air monitoring, among other things.
- **1992 Title X**. The Residential Lead Based Paint Hazard Reduction Act, better known as Title X (ten) was enacted, amending the Toxic Substances Control Act to add a Title IV on Lead Exposure Reduction. Title X emphasized prevention of lead poisoning via lead-based paint and directed agencies to develop regulations for disclosure and other activities.
- **1992 — OSHA** proposes to amend its existing air contaminants standards to reduce the permissible exposure limit for lead in construction.
- **1996 — *The Real Estate Notification and Disclosure* 1996**
- **1996 — The Lead-Based Paint Activities** regulation (1996) has work practice, training, and certification standards for LBP "activities" which are abatement, risk assessment, and paint inspection. EPA has authorized 35 states to run the program.
- **1999 — HUD Lead-Safe Housing Rule** requires federally assisted housing to notify, evaluate, and reduce lead based paint hazards.
- **1999 — EPA Pre-Renovation Education Rule (PRE-rule)** requires distribution of the lead pamphlet, Protect Your Family from Lead in Your Home, to the owners and occupants before starting renovation work.

- **2001 — EPA Lead Hazard Standard** defined lead-based paint hazards and established limits for lead content in settled house dust and soil including clearance standards.
- **2008 — Consumer Product Safety Improvement Act (CPSIA)** of 2008 set limits for the lead content in children's products and the amount of lead in the paint used on those products and in general
- **2008 — The Renovation, Remodeling and Painting (RRP) regulation** (EPA 2008) proposed rule requires workers and contractors to be certified and follow safe practices when working in pre-1978 housing unless a paint test proves there's no lead paint in the work area.
- **2010 — RRP takes full effect** in April 2010 (superseding the PRE rule). EPA has authorized 12 states to run the program.
- **2011 — RRP updated** to allow certified renovators to collect paint chip samples for analysis by a recognized laboratory (in lieu of lead test kits), add standards for e-learning in accredited programs, articulate minimum enforcement provisions for authorized state and tribal programs and clarify the requirements for vertical containment on exterior renovation projects, the prohibited or restricted work practice provisions, and the requirements for high-efficiency particulate air (HEPA) vacuums. Some minor changes were also made to the training program accreditation and application process.

***Important notes*:**

- Lead abatement projects are designed to permanently eliminate existing lead-based paint hazards, and may be ordered by a state or local government in response to a lead-poisoned child or other reason. Only trained and certified individuals may perform lead abatement.
- Renovation, repair and painting (RRP) projects are typically performed at the option of the property owner for aesthetic or other reasons, or as an interim control to minimize lead issues. It is not designed to permanently address lead-based paint. However, RRP projects can disturb lead-based paint in homes and buildings built before 1978 and cause lead hazards, even when none existed before. Therefore, they are also regulated and require certification. If you are seeking information on EPA's rules requiring lead-safe renovation, repair and painting to prevent lead hazards see EPA's Renovation, Repair and Painting (RRP) Program page.

The above timeline relates primarily to lead paint. EPA and CDC have other important regulations in place governing blood lead levels and lead in the soil, water and air.

Please see the following websites for additional information:

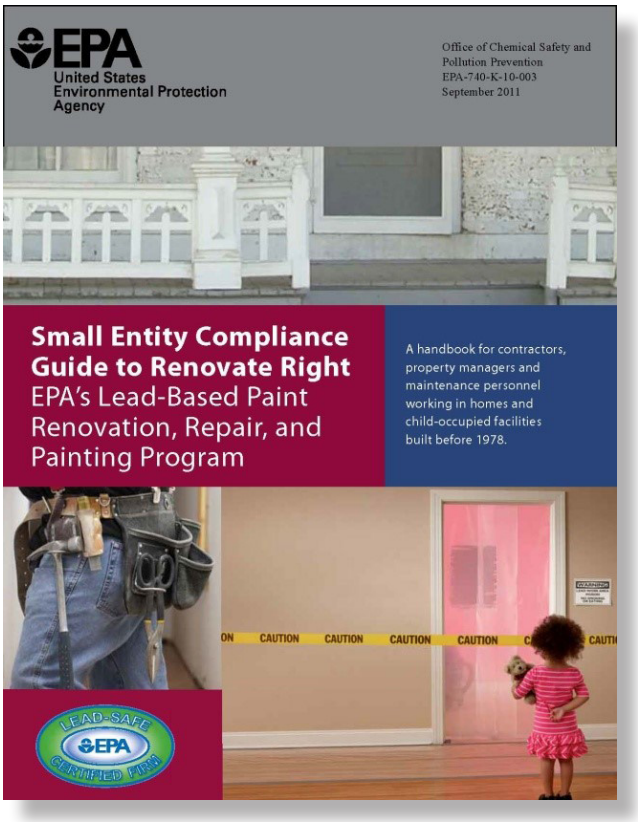
www.epa.gov/lead

www.epa.gov/lead/pubs/renovation.htm

www.hud.gov/lead

So What Will Change?

- Certified Renovation Firm Disturbs Paint
  - EPA or State Certification (after 10/22/09)
  - Fees and five-year renewal
- Certified Renovators Supervise Work
  - One-day training (after 4/22/09)
  - Five-year renewal
- Mandatory Work Practices
  - Isolate work area
  - Contain dust
  - Thoroughly clean-up work area for debris and dust
- Post-renovation Cleaning Verification
- Documentation



Summary of Requirements

- Interior
  - Containment including 6' of plastic in all directions from outer most area of disturbance (horizontal only)
  - Cover and seal to the floor all non-moveable items within plastic work area.
  - Cover and seal all windows, doors, and HVAC vents within work area.
  - Prohibited practices.
- Exterior
  - Containment including 10' of plastic in all directions from outer most area of disturbance (horizontal only).
  - Also 20' critical containment area consisting of physical barrier and posted signs.
  - If work is within 10' of neighboring property line, containment must include vertical plastic.
  - Prohibited practices.

How Clean is Clean?

Determining if the house is clean after renovation is often difficult because there are very few standards for cleaning. However, there are standards for lead dust at 40 CFR Section 765.

- 40 micrograms of lead per square foot on floors.
- 250 micrograms of lead per square foot on window sills.
- 400 micrograms of lead per square foot on window troughs.

There are also standards for lead in soil. A sugar packet of contains one gram of sugar. If the sugar would be all lead, 40 ug/ft^2 would be equivalent to spreading the sugar packet over 25,000 ft^2 —one–third of a football field. Open a packet and sprinkle it on the floor to imagine this distribution.

HUD's clearance dust standards for single–surface wipe samples are 40 ug/ft^2 for floors, 250 ug/ft^2 for interior window sills, and 400 ug/ft^2 for window troughs. The dust–lead level must be less than the applicable standard for the surface to pass clearance.

The EPA has developed a federal course for lead inspection, risk assessment and sampling technicians. Inspectors receive 3 days of training and are taught to test lead in paint using an XRF device, to sample for lead in dust, and to complete a full inspection for lead in paint. They can also do lead dust clearance testing following lead abatement and renovation work. Risk assessors have 5 days of training, which includes the 3 days of inspector training plus 2 additional days learning how to sample lead in soil and conduct a risk assessment looking for lead in paint, soil and dust. They also learn how to recommend solutions for lead hazards. Sampling technicians are the newest discipline and accepted in some but not all states. This one day course teaches students to sample lead in dust. Once they have state certification, they are qualified to perform clearance testing after lead hazard control work but not abatement work. They can also assess lead dust levels in properties to identify lead problems.

Lead Disclosure

- At property transfer, provide buyer/renter:
  - Lead warning statement
  - Summary of information on lead hazards (yes, no, don't know)
  - Documents on specific information about lead-based paint and lead hazards.
  - Tenant signature
- Rentals
  - Common Area results must be disclosed to all tenants.
  - At lease signing
  - Applies to oral leases

Housing Code Provisions Related to Paint

- **304.2 Protective treatment**.
  - All exterior surfaces, including but not limited to, doors, door and window frames, cornices, porches, trim, balconies, decks and fences shall be maintained in good condition.
  - Exterior wood surfaces, other than decay-resistant woods, shall be protected from the elements and decay by painting or other protective covering or treatment.
  - Peeling, flaking and chipped paint shall be eliminated and surfaces repainted.

- **304.6 Exterior walls**.
  - All exterior walls shall be free from holes, breaks, and loose or rotting materials and maintained weatherproof and properly surface coated where required to prevent deterioration.
- **305.3 Interior surfaces**.
  - All interior surfaces, including windows and doors, shall be maintained in good, clean and sanitary condition. Peeling, chipping, flaking or abraded paint shall be repaired, removed or covered. Cracked or loose plaster, decayed wood and other defective surface conditions shall be corrected.

Asbestos

Asbestos was used in building materials from around 1900 to 1978. It can be found in many items, including old floor tiles, siding, roofing materials, and around pipes. Some roofing and siding shingles are made of asbestos cement. Houses built between 1930 and 1950 may have asbestos insulation.

Additional locations for asbestos:

- Asbestos may be present in textured paint and in patching compounds used on wall and ceiling joints. Their use was banned in 1977.
- Artificial ashes and embers sold for use in gas-fired fireplaces may contain asbestos.
- Older products such as stove-top pads may have some asbestos compounds.
- Walls and floors around woodburning stoves may be protected with asbestos paper, millboard, or cement sheets.
- Asbestos is found in some vinyl floor tiles and the backing on vinyl sheet flooring and adhesives.
- Hot water and steam pipes in older houses may be coated with an asbestos material or covered with an asbestos blanket or tape.
- Oil and coal furnaces and door gaskets may have asbestos insulation.

Why avoid asbestos?

From studies of people who were exposed to asbestos in factories and shipyards, we know that breathing high levels of asbestos fibers can lead to an increased risk of:

- lung cancer
- mesothelioma, a cancer of the lining of the chest and the abdominal cavity
- asbestosis, in which the lungs become scarred with fibrous tissue.

The risk of lung cancer and mesothelioma increases with the number of fibers inhaled. The risk of lung cancer from inhaling asbestos fibers is also greater if you smoke. People who get asbestosis have usually been exposed to high levels of asbestos for a long time. The symptoms of these diseases do not usually appear until approximately 20 to 30 years after the first exposure to asbestos.

How to Handle Asbestos

- LEAVE IT ALONE (if in good condition).
- Look for signs of wear or damage such as tears, abrasions, or water damage but avoid touching the material.
- If damaged, or if renovation might disturb it, repair or removal by a licensed professional is needed.

Vermiculite[2]

What is Vermiculite Insulation?

Vermiculite is a naturally occurring mineral that has the unusual property of expanding into worm-like accordion shaped pieces when heated. The expanded vermiculite is a light-weight, fire-resistant, absorbent, and odorless material. These properties allow vermiculite to be used to make numerous products, including attic insulation.

Do I Have Vermiculite Insulation?

Vermiculite can be purchased in various forms for various uses. Sizes of vermiculite products range from very fine particles to large (coarse) pieces nearly an inch long. Vermiculite attic insulation is a pebble-like, pour-in product and is usually lightbrown or gold in color. The pictures above several samples of vermiculite attic insulation.

Is Vermiculite Insulation a Problem?

Prior to its close in 1990, much of the world's supply of vermiculite came from a mine near Libby, Montana. This mine had a natural deposit of asbestos which resulted in the vermiculite being contaminated with asbestos. Attic insulation produced using vermiculite ore, particularly ore that originated from the Libby mine, may contain asbestos fibers. Today, vermiculite is mined at three U.S. facilities and in other countries which have low levels of contamination in the finished material.

How can I Tell if My Vermiculite Insulation Contains Asbestos?

You should assume that vermiculite insulation is from Libby and treat the material as if it contained asbestos by not disturbing it or by using a trained professional if it needs to be removed. Since the Libby mine was estimated to be the source of over 70 percent of all vermiculite sold in the U.S. from 1919 to 1990 and vermiculite from Libby was contaminated with asbestos, further testing is not necessary to take the appropriate precautions. While you can hire a trained professional to test your attic for asbestos, this may be expensive and, depending on the methods used, might give you erroneous results. We do not recommend that you open your walls to check for vermiculite.

Asbestos Regulations

According to the U.S. EPA, asbestos is often present in a wide variety of products and materials. See http://www.epa.gov/asbestos/learn-about-asbestos.html#find. Over 3,000 products contain asbestos, including:

- Attic and wall insulation produced containing vermiculite
- Vinyl floor tiles and the backing on vinyl sheet flooring and adhesives
- Roofing and siding shingles

On April 6, 1973, the EPA prohibited spray application of products containing more than 1% asbestos by weight, and adopted a regulation prohibiting any "visible emissions" in milling and manufacturing operations and during the demolition of buildings.[3] Financial penalties applied. In 1978, the EPA expanded the spray ban to include spray application of such products for "decorative" purposes.[4]

On October 14, 1975, the EPA defined "friable asbestos material" as any material containing more than 1% asbestos by weight that can be crumbled, pulverized, or reduced to powder, when dry, by hand pressure, and required that prior removal of asbestos material occur any time > 206 linear feet of pipe insulation or 160 square feet of friable surface-applied asbestos material was disrupted during building demolition or renovation.[5] The EPA also banned installation of asbestos block insulation on boilers and water tanks in 1975.[6] These regulations remain in effect today. The EPA has a clearance level for determining whether a building is safe to occupy after asbestos removal activities have occurred. This level is currently 0.1 fibers·cm-3 as measured by transmission electron microscopy (TEM), for airborne asbestos fibers > 5 µm in length and with an aspect ratio of > 3:1.

In 1976, the Toxic Substances Control Act (TSCA) was passed, conferring additional authority upon the EPA to regulate asbestos.[7] Under the Act, the EPA was empowered to monitor chemical substances and regulate any chemical determined to pose an "unreasonable risk" to human health and/or to the environment.[7] In 1989, after determining that asbestos posed such a risk, the EPA issued a final rule under the TSCA, prohibiting the manufacture, importation, processing, and distribution of most asbestos-containing products in commerce.[8] The rule contemplated a three-stage process during which certain products would be completely phased out of commerce over a several year period.[8] In 1991, however, the Fifth Circuit Court of Appeals vacated the rule in *Corrosion Proof Fittings v. EPA, 947 F.2d 1201 (5th Cir.1991), concluding that the EPA failed to give sufficient* consideration to its statutory mandate to promulgate regulations which achieve protective purposes in the least-burdensome manner available. The court also determined that the EPA failed to provide the public with proper notice and failed to demonstrate the alleged benefits of the rule by neglecting to assess the harmfulness of likely substitute products.[9] In the aftermath of the Court's decision, the rule continues to ban only new uses of asbestos as well as asbestos containing flooring felt, rollboard, and corrugated, commercial, or specialty paper.[6]

In 1986, the EPA began enforcement of the Asbestos Hazard Emergency Response Act (AHERA), signed into law as Title II of the TSCA. AHERA required that all school buildings in the United States be inspected for asbestos-containing materials, that the location and amount of such materials be documented, and that emissions of fibers from such materials be prevented.

The Asbestos School Hazard Abatement Reauthorization Act (ASHARA), adopted in 1990, amended AHERA to require accreditation for individuals performing asbestos inspections and abatement projects in school, commercial, and public buildings. In addition to administering the contaminant-focused legislation discussed above, the EPA also monitors asbestos within the context of other pieces of legislation.

Congress adopted the Safe Drinking Water Act (SDWA) in 1974, which charges the EPA with identifying safe levels (termed maximum contaminant level goals (MCLG)), of contaminants in drinking water. The asbestos MCLG is 7 MFL (million fibers/L). In 1996, Amendments to the SDWA required the EPA to review the validity of each contaminant level every six years. To date, the EPA has conducted two such six-year reviews, confirming the appropriateness of the 7 MFL asbestos level in both 2003 and 2010.

The EPA also regulates asbestos under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), enacted by Congress in 1980. CERCLA, often referred to as Superfund, provides that the term "hazardous substance," as contemplated by the Act, includes any hazardous pollutant identified in Section 112 of the Clean Air Act, which incorporates asbestos. The Act authorizes the EPA to ensure that entities responsible for releasing hazardous substances into the environment cooperate in short-term removal or long-term remedial response cleanup efforts. To date, several clean-up sites targeted under CERCLA have been contaminated by asbestos. The EPA has developed a resource entitled "Asbestos Compendium of Technical Resources," to guide investigative efforts at asbestos-contaminated superfund sites.

National Emission Standard for Air Hazardous Air Pollutant (NESHAP)

- Applies to buildings with more than 4 units
- Work practices, training and notice to EPA

Model Asbestos Program for States

- Applies to buildings with more than 10 units
- Work practices and training

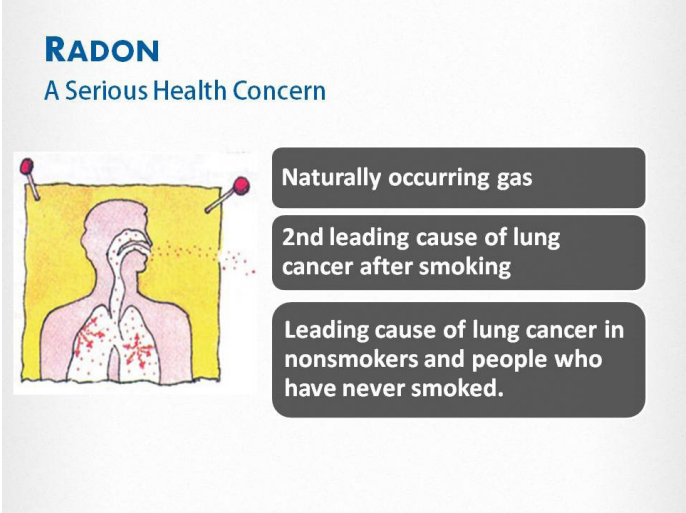
EPA's Ban on Asbestos in Products Reversed in 1992

OSHA Standards for Workers

- http://www.osha.gov/SLTC/asbestos/standards.html

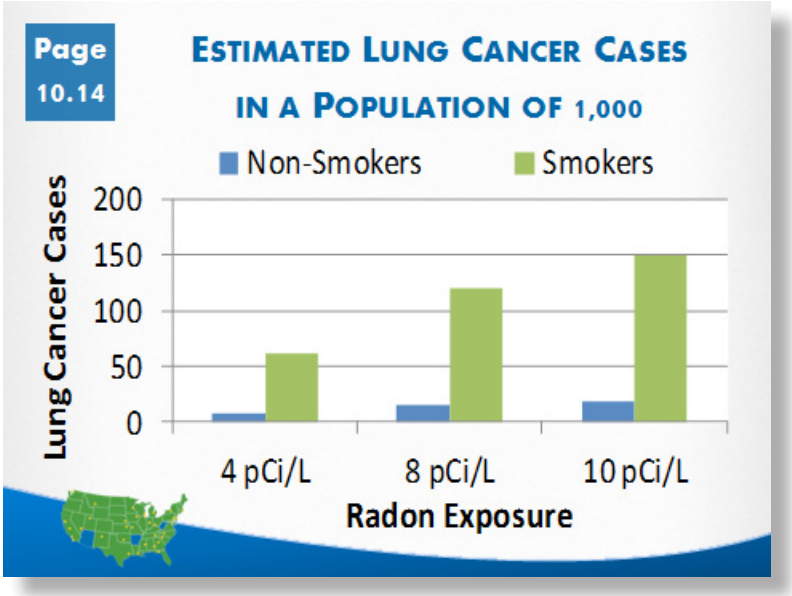
Radon

Radon is a naturally occurring gas produced by the breakdown of uranium and radium in soil, rock, and water. Naturally occurring uranium and radium exist in the ground –especially in granite, shale, phosphate, or pitchblend. Uranium spontaneously breaks down into radium and radium spontaneously breaks down into radon. Radon is a gas that can be carried into the home. Radon spontaneously breaks down into radioactive elements (sometimes called radon decay products) that have a static charge which attracts them to particles such as smoke and dirt. Residents breathe the radioactive elements into their lungs. Residents who smoke breathe in more radioactive elements deep into their lungs. The radioactive elements spontaneously break down to release bursts of energy which damages DNA in the lungs. This can lead to cancer.



Radon is a Class A carcinogen. The National Academy of Sciences (NAS) has determined that radon is the second leading cause of lung cancer overall and the leading cause of lung cancer in non-smokers. In its "Assessment of Risks from Radon in Homes,"[10] EPA estimated that out of a total of 146,600 lung cancer deaths nationally in 1995, 21,100 (14.4%) were radon related. Among non-smokers, an estimated 26% were radon-related.

EPA's reports estimate that there are about 3,000 deaths due to radon from lung cancer in people who have never smoked. EPA reports that this number is three times more than environmental tobacco smoke-related lung cancer deaths in people who have never smoked.[11]



Data for the figure to the left were obtained from EPA's "Home Buyer's and Seller's Guide to Radon".[12]

EPA recommends that action to reduce radon be taken whenever levels are above 4 pCi/L or picoCuries per liter of air; a unit of measure for radon.

For smokers, the risk of lung cancer is even more significant than for non-smokers due to the synergistic effects of radon and smoking. In a population of 1,000 exposed to 4 pCi/L of radon over their lifetimes, EPA estimates that 7.3 people will get lung cancer. The risk is much greater for smokers exposed to the same level of radon. EPA estimates that 41 out of 1,000 smokers exposed to this level of radon over their lifetimes will get cancer.

Put another way, a person who never smoked and is exposed to 1.3 pCi/L of radon has a 2 in 1,000 chance of lung cancer; while a smoker in a similar scenario has a 20 in 1,000 chance of lung cancer. The above chart shows the increased risk of lung cancer for smokers versus non smokers exposed to the same level of radon. At 8 pCi/L the risk to smokers is six times the risk to non-smokers. For non-smokers, EPA estimates that radon and environmental tobacco smoke are the leading causes of lung cancer.

One out of every 15 homes is estimated to have an elevated radon level (above EPA action level of 4 pCi/L). Some regions have higher radon levels; radon is found in every state. A map showing radon levels across the nation is available on-line at www.epa.gov/radon/zonemap.html. Each block is a county (or a parish in Louisiana).

Keep in mind that:

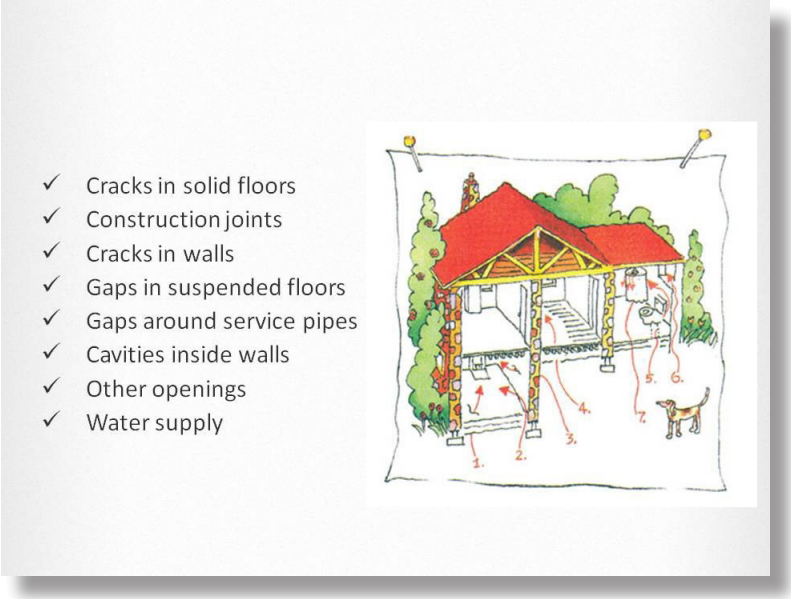
- Some states and EPA regions consider the map to be outdated—some states have better and newer maps. Many states have collected radon data over the past ten years and have more current data than EPA. Some states, such as Florida and New Jersey, have identified their radon high-risk areas.
- The map should be used for radon-resistant new construction only when no local information is available. It should also be used for prioritizing radon outreach activities. The map provides general guidance on anticipated indoor radon levels, i.e., areas of the country where homes are likely to have measurable radon. The map is not an exact predictor of indoor radon levels.
- The only way to know if radon is a problem is to test for it. The map may not be accurate for your specific location. The U.S. Surgeon General recommends testing all homes for radon—not just those in some areas on the map.
- Radon comes from uranium and radium in rock, soil and water. Consequently, the location of radon is not unified in the country. EPA's map of radon zones show trends in radon levels. Although a Zone 1 designation reflects the high risk potential for radon, elevated radon levels are found in all states.

Map Key:

- Red - Zone 1 is where radon is the biggest problem. EPA predicts that red counties have a predicted average indoor radon screening level greater than 4 picocuries per liter (pCi/L).
- Orange - Zone 2 is where EPA predicts that counties have a predicted average indoor radon screening level between 2 and 4 pCi/L.
- Yellow - Zone 3 is where EPA predicts that counties have a predicted average indoor radon screening level less than 2 pCi/L.

How Radon Gets into a Home

This graphic was taken from EPA's "Citizen's Guide to Radon" (EPA 402-K-02-006, May 2004, pg 4).[17]



You cannot see or smell radon. It is an invisible radioactive gas that comes from the natural decay of uranium that is found in nearly all soils. Air pressure inside the home is usually lower than the pressure in the soil around the home's foundation. Because of this difference in pressure, the house can act as a vacuum, drawing air and radon in through foundation cracks, and other openings. It typically moves up through the ground to the air above and into your home through cracks and other holes in the foundation. A home can trap radon inside, where it can build up. Any home may have a radon problem. This means new and old homes, well-sealed and drafty homes, and homes with or without basements.

Radon from soil gas is the main cause of radon problems. Although the ground is the major source of radon for most homes, sometimes radon enters the home through well water. An NAS report (BEIR VI) issued earlier this year confirmed that there are drinking water related cancer deaths primarily due to lung cancer (less than 200 lung-cancer deaths per year).

The NAS report confirms that the estimated risk posed by radon from drinking water is small, relative to exposure to radon in indoor air, but is larger than the risk from other regulated drinking water contaminants. Most of the cancer risk from radon in drinking water arises from the transfer of radon into indoor air, and exposure through inhalation, although there is some risk from ingesting water containing radon. In a small number of homes, the building materials can give off radon, too. However, building materials rarely cause radon problems by themselves.

Testing for Radon

Detector Types: Charcoal canister devices absorb radon or its products on to the charcoal. Alpha track detectors have a plastic film that gets etched by the alpha particles that strike it. Electric ion detectors have a Teflon disc, which is statically charged. When an ion generated from radon decay strikes the Teflon disc, the electrical charge is reduced. The top photo on the next page is a short-term test kit. The bottom photo is a long-term test kit.

How/When to Test: In new construction, test homes after construction is complete but before occupancy. In existing housing, EPA and the US Surgeon General recommend testing all homes below the third floor. Be sure to test before and after renovation, at purchase, or at new occupancy.

Essentials for Healthy Homes Practitioners

Short Term

- Minimum 48 hours
- $10-$20
- Useful results (home sales, rental, occupancy)

Long Term

- 91 days to 1 yr
- $20-$30
- Better indicator of need to mitigate

If result is 4 pCi/L or higher take a follow-up test OR fix the home

As summarized in EPA's "Citizen's Guide to Radon" (EPA-402-K-02-006, May, 2004, pg. 6)17 and "Home Buyers and Sellers Guide to Radon (pg. 15)15, EPA recommends these testing steps:

1. Take a short-term test (or take 2 short-term tests at the same time). If your result is 4 pCi/L or higher take a follow-up test (Step 2).
2. Follow up with either a long-term test or a second short-term test. For a better understanding of year-round average radon level, take a long-term test. If you need results quickly, take a second short-term test. The higher your initial short-term test result, the more certain you can be that you should take a short-term rather than a long-term follow up test. If your first short-term test result is more than twice EPA's 4 pCi/L action level, you should take a second short-term test immediately.
3. If you followed up with a long-term test: Fix your home if your long-term test result is 4 pCi/L or more. If you followed up with a second short-term test: The higher your short-term results, the more certain you can be that you should fix your home. Consider fixing your home if the average of your first and second test (or the 2 simultaneous tests) is 4 pCi/L or higher.

You can purchase radon test kits in the local hardware store, via the Internet or from the National Safety Council. You can also hire a radon professional.

If you use a home test kit, it will likely contain at least one radon testing device, a mailing bag and label, and a sheet or card to record the key data. Follow the sampling instructions.

Testing Options:

- **For kits call 1-800-SOS-RADON, purchase retail, or from certified company**
- **Hire a professional**

The photos on the right on the previous page show examples of a radon data card and form. The person completing the sampling fills out the radon data card and form to tell the lab the property address, location of the sample, test start and completion date, the serial number for the testing device, building type, whether the home was closed during testing, and the location/address where the result should be mailed. Be sure to promptly send the testing device to the lab.

The photo on the bottom left on previous page shows radon testing canisters in a basement area that is not livable. Consumers should place test kits in the lowest lived-in level of their home (according to the EPA Citizen's Guide to Radon[17]). Please note that in some states, radon professionals who do testing may be required to test areas that are suitable for occupancy but are not the lowest lived-in level (according to EPA Home Buyers and Sellers Guide[15]).

Conduct the test in a room to be used regularly (e.g., family room, living room, playroom, den, bedroom); do not test in a kitchen, bathroom, laundry room or hallway. Put the test kit at least 20 inches off the ground, in an area where it will not be disturbed during the sampling period. Shut off all exhaust fans and keep doors and windows closed during testing (except for normal entry and exit).

Interpreting Radon Results

This information was taken from EPA's from "Citizen's Guide to Radon" (EPA-402-K-02-006, May 2004, pg 7).[17]

- Short term test > 4 pCi/L
  - Take second short term test or long term test
- Short term average or long term test >4 pCi/L
  - Fix home for radon

What Your Test Results Mean:

The average indoor radon level is estimated to be about 1.3 pCi/L, and about 0.4 pCi/L of radon is normally found in the outside air. The U.S. Congress has set a long-term goal that indoor radon levels be no more than outdoor levels. While this goal is not yet technologically achievable in all cases, most homes today can be reduced to 2 pCi/L or below.

Sometimes short-term tests are less definitive about whether or not your home is above 4 pCi/L. This can happen when your results are close to 4 pCi/L. For example, if the average of your two short-term test results is 4.1 pCi/L, there is about a 50% chance that your year-round average is somewhat below 4 pCi/L. However, EPA believes that any radon exposure carries some risks - no level of radon is safe. Even radon levels below 4 pCi/L pose some risk, and you can reduce your risk of lung cancer by lowering your radon level.

If your living patterns change and you begin occupying a lower level of your home (such as a basement) you should retest your home on that level. Even if your test result is below 4 pCi/L, you may want to test again sometime in the future.

Radon Reduction Systems

You cannot prevent exposure to radon, but you can minimize the exposure.

- New Construction
  - Passive Sub-Slab Depressurization System
  - Active Sub-Slab Depressurization System
- Existing Housing
  - Active Sub-Slab Depressurization System

Passive System: Has no fan. Radon passively moves from below slab up through pipe to vent outside through the roof.

Active System: Has fan to actively pull radon gas from below the slab through a pipe and outside through the roof.

Other mitigation methods exist, and not all houses have slabs; however, these two methods are the most common.

Passive vs. Active

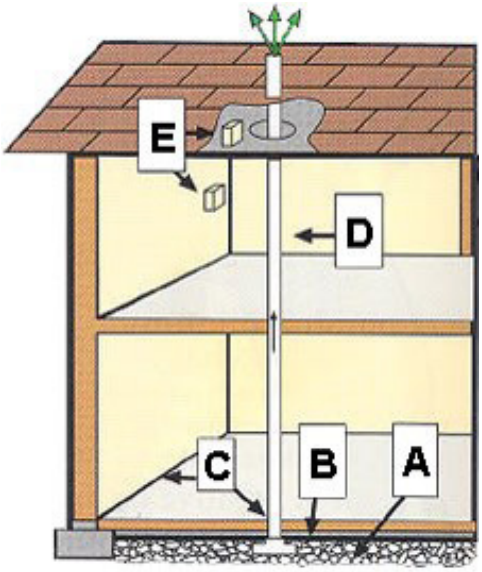
In Zone 1, EPA recommends building passive radon systems into all new construction or substantial renovation jobs where a slab or crawl space is being created. This gives the property owner the option of converting to an active system if test results show radon levels above 4 pCi/L.

In Zones 2 and 3, a given property may still experience high radon levels and hence testing post construction (before occupancy) is appropriate. If levels exceed 4 pCi/L the contractor can then add a fan to an existing passive system or add an active system to suck radon gas out from below the slab through the venting.

Radon Fixes: New Construction

Passive Sub-Slab Depressurization System (New Construction)

A.	• Gas-Permeable Layer
B.	• Plastic Sheeting
C.	• Seal and Caulk
D.	• Vent Pipe
E.	• Junction Boxes



This picture is taken from EPA's webpage at www.epa.gov/radon/construc.html18. This system should be used for new construction. EPA does not recommend a passive system for existing sub-slab construction.

Five important steps in a passive system:

1. Put a gas permeable layer beneath the slab or flooring system to allow soil gas to move freely underneath the house.
2. On top of the gas permeable layer, put plastic sheeting to help prevent the soil gas from entering the home.
3. Seal and caulk all below grade openings in the foundation and walls to reduce soil gas entry into the **home.**
4. Install vent pipe – 4 inches preferred – from gas permeable layer to roof to safely vent radon and other soil gases to the outside.
5. Install junction boxes to make wiring and installation of a vent fan for an active system easier.

For passive systems installation in crawl spaces, cover the floor with poly sheeting, lay a perforated collection pipe below the poly sheeting and connect the pipe to a radon vent riser. It is also important to close openings between the crawl space and basement or crawl space and the living areas. The recommended installation is a T- joint at the bottom of the stack with corrugated pipe running in both directions.

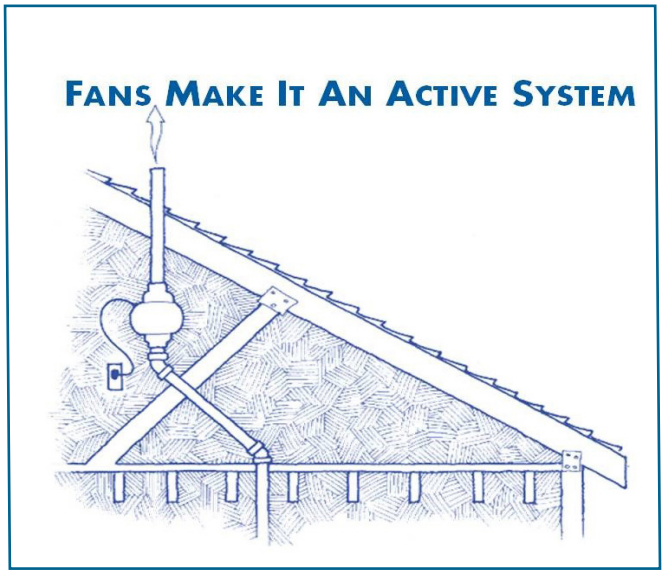
Please note that the pipe (stub up) must be connected to a vent pipe that goes through the interior of the house and vents to the outside. Otherwise, it is not a passive system and radon is vented in the house instead of outside or creates a situation where the pipe (stub up) could be misused for something else such as a commode. Vent pipes passing through the house are required to be labeled.

Active System

The drawing to the right was taken from EPA's "Building Radon Out" (EPA-402-K-01-002, April 2001, pg 62) and shows an in-line fan in the attic.[19]

An active system adds a fan to a passive system to pull radon from the ground and exhaust it outside through the roof, avoiding radon exposure in the home.

EPA recommends that if a radon fan is used that it be installed in an unoccupied space to avoid radon exposures if the fan leaks or fails. In the case displayed above, the fan is in the attic and we see a gable vent to the right.



Radon Fixes: Existing Housing

- ✓ Seal floor and cracks
- ✓ Vent radon gas from below slab
- ✓ Fan sucks air from below slab –active system
- ✓ Sump suction reduces radon gas entry

This information is taken from EPA's "Consumer's Guide to Radon Reduction" (EPA-402-K-03-002, February 2003, pg 9-12).[20] There are several proven methods to reduce radon in your home, but the one primarily used is "subslab suction," a vent pipe system and fan, which pulls radon from beneath the house and vents it to the outside. This system, known as a soil suction radon reduction system, does not require major changes to your home. Sealing foundation cracks and other openings makes this kind of system more effective and cost-efficient. Similar systems can also be installed in houses with crawl spaces. Radon contractors can use other methods that may also work in your home. The right system depends on the design of your home and other factors.

Active Subslab Suction (also called subslab depressurization) is the most common and usually the most reliable radon reduction method. One or more suction pipes are inserted through the floor slab into the crushed rock or soil underneath. They also may be inserted below the concrete slab from outside the house. The number and location of suction pipes that

are needed depends on how easily air can move in the crushed rock or soil under the slab, and on the strength of the radon source. Often, only a single suction point is needed. A contractor usually gets this information from visual inspection, diagnostic tests, and/or experience. A radon vent fan connected to the suction pipe(s) draws the radon gas from below the house and releases it into the outdoor air while simultaneously creating a negative pressure (vacuum) beneath the slab. Common fan locations include attics, garages and the exterior of the house.

Passive Subslab Suction is the same as active subslab suction except it relies on natural pressure differentials and air currents instead of a fan to draw radon up from below the house. Passive subslab suction is usually associated with radon-resistant features installed in newly constructed homes. Passive subslab is generally not as effective in reducing high radon levels as active subslab suction.

Some houses have drain tiles or perforated pipe to direct water away from the foundation of the house. Suction on these tiles or pipes is often effective in reducing radon levels.

All radon systems should be labeled to alert the owners, occupants and contractors about the purpose of various pipes and tubing. The picture to the right shows labeling of the radon control pipes by the contractor clearly showing the purpose of the pipe. This photo also shows potential mistakes. Why is duct tape used? And the pressure tube to ensure there is a vacuum is too high for more people. Also, it appears that there are holes in the walls. This is not good for many reasons.

Label Radon Systems

Radon Mitigation Costs

The chart below shows average costs to mitigate radon in the U.S. Actual costs to mitigate radon may be lower or higher in different regions of the US. For example, costs for radon-resistant new construction vary with local code requirements, such as those which require gravel for drainage. Such costs would not be included as part of RRNC costs, although they are necessary to complete the mitigation activities.

Radon Mitigation Costs	
	Average Costs
New Construction	
Passive only	$350 - $500
Active system	$650 - $800
Existing Homes	$800-$2,500

It is more cost-effective to do radon-resistant new construction than it is to fix a home once it is built. However, remember that even in new homes, testing is needed upon home occupation even if radon-resistant new construction is done. All existing homes should have pre- and post-mitigation testing performed.

Source: This information is taken from EPA's "Home Buyer's and Seller's Guide to Radon" (EPA-402-K-05-005, May 2005, pg. 9) [15].

Finding a Qualified Contractor

EPA recommends that you use a state-certified and/or qualified radon mitigation contractor trained to fix radon problems. You can determine a service provider's qualifications to perform radon measurements or to mitigate your home in several ways. First, check with your state radon office.

Many states require radon professionals to be licensed, certified, or registered, and to install radon mitigation systems that meet state requirements. Most states can provide you with a list of knowledgeable radon service providers doing business in the state. In states that do not regulate radon services, ask the contractor if they hold a professional proficiency or certification credential, and if they follow industry consensus standards such as the American Society for Testing and Materials (ASTM) Standard Practice for Installing Radon Mitigation Systems in Existing Low-Rise Residential Buildings21, or the U.S. EPA's "Radon Mitigation Standards" (EPA-402-R-93-078, April, 1994).

You can contact private proficiency programs for lists of privately-certified professionals in your area. Such programs usually provide members with a photo-ID, which indicates their qualification(s) and the ID-card's expiration date. For more information on private proficiency programs contact:

- State radon offices
- EPA's web site www.epa.gov/radon/proficiency.html
- National Environmental Health Association (NEHA)www.neha-nrpp.org/
- National Radon Safety Board (NRSB) www.nrsb.org

Resources

Additional resources for radon information include:

- State Radon Contacts: (www.epa.gov/iaq/whereyoulive.html)
- Radon Mitigation: 800-644-6999

EPA supports these hotlines to best serve consumers with radon-related questions and concerns:

- 1-800-SOS-RADON (767-7236). Radon Hotline, operated by the National Safety Council (NSC) in partnership with EPA. Obtain coupons for radon test kits (for consumers, individual kits, not in bulk). ($10 for short-term kit; $20 for long-term kit).
- 1-800-55RADON (557-2366). For live help with your radon questions. Operated by the National Safety Council (NSC) in partnership with EPA.
- 1-800-438-4318. The Indoor Air Quality (IAQ) Information Clearinghouse is privately operated under contract to EPA. You can order copies of EPA consumer-oriented radon publications and get general information on radon and indoor air quality issues.
- 1-800-426-4791. Safe Drinking Water Hotline, privately operated under contract to EPA. For general information on drinking water, radon in water, testing and treatment, and radon drinking water standards.

Sewer Gas

The term sewer gas refers to a mixture of gases generated by bacteria and fungi while they are digesting wastes. Sewer gas often contains methane, hydrogen sulfide, ammonia, carbon dioxide, and carbon monoxide. Sewer gas comes from dried out traps in drains, especially in floor drains or homes that have been vacant for awhile. Make sure that there is water in the P trap to help prevent build-up.

Key Messages

- Systems should be inspected regularly to ensure proper function.
- Some maintenance activities require the use of professionals.
- Lead causes a variety of serious health effects.
- Contractors doing renovation should be certified to work on houses with lead paint.
- Deteriorating products or areas with asbestos need to be addressed by a certified professional.
- There are two ways to address high radon levels in a home.

Learning Objectives

- Name at least three systems that require ongoing maintenance.
- Identify two maintenance actions that require the use of a professional.
- Name at least two health effects from lead.
- Identify housing targeted by the RRP rule.
- Describe the two ways to mitigate radon in a home.

Making it Work

Start with People
House as a System
Keep It:
1. Dry
2. Clean
3. Pest-Free
4. Ventilated
5. Safe
6. Contaminant-Free
7. Maintained
Making it Work

Creating a Healthy Homes Program in Your Community

For Healthy Homes projects or initiatives to be successful, the following components need to be in place:

- *Established objectives* – Specific programmatic objectives should be established.
- *Administrative infrastructure* - An administrative infrastructure is needed so that you can get things done (pay bills, etc.).
- *Identified and committed partners* - Partners should be identified and committed to the program. This includes having community based organizations participate in the initial programmatic design, agreeing to share programmatic responsibility, and negotiating a compensation rate. Other partners should include relevant municipal agencies involved in housing, health, and environmental health. These agencies also need to commit their share of resources.
- *Secured funding* - Funding needs to be obtained. This should include securing funds for healthy homes treatment (usually from HUD), for other needed repairs (i.e. for roofs and HVAC systems), for organizing by the community, and for the dissemination information to the community.
- *Sustainability plan* - A plan should be developed to sustain the program beyond the period of time covered by the initial funding source.

If all of these items are in place, it is easier to bring the people who are doing the "on the ground work" into the project. Ideally some of these individuals who are doing the "ground work" will have participated in the initial design and project set-up work and others will assist in fine-tuning some of the items as the project moves forward.

Learning Objectives for this module

- Name two provisions of a code that could be used to cite a hazard in the home.
- Explain why partnership with the community is essential.
- Identify five important players involved in healthy homes issues.
- Explain why data collection and analysis are important in delivering healthy housing services.
- Identify three sources of data and where to find them.
- List two things that you might observe that must be reported and two that are discretionary.

Essentials for Healthy Homes Practitioners

While most individuals working with families will not participate in all of the items listed here, it is critical that healthy homes project managers who are in direct contact with the administration, the family, and other involved partners, are aware of all of these components.

Implementing a Healthy Homes Program

Issues to Consider as Part of Start-Up

Once you decide on your program it is important to ask key start-up questions.

- Will this require a job description and change in responsibilities?
- What sort of training program is needed and for whom?
- How will this alter the way we currently do business (extra time for a home assessment or code inspection)?

Funding Sources for Healthy Homes Activities or Programs

Each year, the U.S. Department of Housing and Urban Development sets aside approximately $6-10 million for healthy homes demonstration and research grants. This funding, awarded on a competitive basis, is described at www.hud.gov/offices/lead. Information about other federal funding can be found through their respective websites.

- HUD – annual NOFA for Healthy Homes demonstration grants
- Other HUD funding - CDBG or HOME funds
- Rental licensing fees or taxes
- EPA – environmental justice, regional funds, lead funds
- State and City – code enforcement fines, health funds (e.g., lead)

Other Funding

- Public agencies can provide "seed" money
  - Develop small grant program for organizing
  - Fund city-wide meeting for community groups
  - Include community outreach in grant proposals
- Involve private sector foundations
  - Know how interests coincide with your mission
  - Ask for their input
  - Involve them in development and evaluation of your work

Benefits to Health and Housing Collaboration

Typically, several local agencies enter homes. How might we improve agency efficiency and the quality of services? Should one agency take on all healthy housing functions? Or should it be a collaboration? The solution will vary based on your local capacity, resources, and needs. Regardless, it is important that health and housing professionals COLLABORATE to develop a solution that meets your community's needs.

- Collaboration is a process in which each participant develops full commitment to a common mission.
- A health and housing collaboration can:
  - Promote long-term success
  - Build long-term community capacity
  - Empower members
  - Produce concrete and measurable change

Important Players

- Agencies
- Community-Based Organizations
- Property Owners
- Contractors and Trades People
- Families
- Others?

Agencies

Many city or county programs already have established home intervention points through other programs. A healthy homes assessment could be done at these times, as a piggy back onto existing programs. Also, this may help to conserve resources. There are a variety of opportunity points in which to intervene. Some will maximize prevention, others may focus on an established disease or health problem.

Examples of Opportunity Points:

- Unit turnover-housing department inspections
- Pregnant women/new baby home visit (health department/WIC)
- General code enforcement visit
- Occupant complaint (pests, leaks, maintenance visits, safety hazards)
- Weatherization assessment and work
- CDBG or HOME funded rehab

Community-Based Organizations

Building and maintaining relationships is very important part of this work. Soliciting input can include talking with key members of community organizations, organizing a meeting explicitly for input, or convening a focus group.

- Solicit input on issues of concern
- Attend community functions and benefits
- Consider their interests and priorities
- Involve community members you work with on boards, commissions and advisory panels

Property Owners

- *Involve property owners in the initial program plan*. As a program is being developed, participation from property owners is critical. They will be far more cooperative during the implementation phase if they have had input into the program's design. Their experience at maintaining low-income homes will provide valuable input.
- *Secure participation from cooperative owner*s: establish positive standards. Even if the percentage of cooperative rental property owners in the target neighborhood is small, the property owners that do participate will help set a positive standard for the program. It will be far easier to do the initial work with cooperative rental property owners. They can inform the program of turnovers so work can be done before children occupy the space.
- *Conduct property work at turnover.* It will be much easier, cheaper, safer, and more efficient for property owners to do work at turnover when the unit is vacant because the family has not yet moved in.
- *Require prerequisite work*. Implementing lead paint stabilization or mold remediation in a house with a leaky roof is futile. Property owners must be responsible for doing pre-requisite work such as roof repair, structural repair, or furnace replacement.
- *Offer training*. Maintenance crews for larger properties can be trained to incorporate healthy house work into maintenance and turnover treatments. A rental property owner can decrease his/her liability by following lead safe work practices and creating healthier housing. Plus they can use healthy homes as a marketing opportunity.
- *Stress the importance of maintenance*. The success of any intervention is only as good as long as property owners and the occupants maintain the dwelling. Helping rental property owners and occupants implement a long term maintenance plan will greatly enhance the program's success.

Contractors & Trades People

The participation of contractors from within the targeted communities helps re-circulate funds within that community, maintains the program's affordability, and increases the program's sustainability. This offers increased practicality and decreased cost and resistance.

- *Involve contractors in developing work protocol*s. The committee that developed lead paint regulations for the exterior of San Francisco houses included two painting contractors. Their participation helped develop regulations that were practical to implement thus lowering the painting contractors' resistance to the new rules and greatly increasing the trade's compliance.
- *Offer to train and equip their crews*. Classroom seminars that merely review restrictions, rules, and consequences isn't enough and frequently create resistance and resentment among contractors. A more useful training model uses hands-on demonstrations to present simple, cost-effective work protocols, tools, and material options.
- *Encourage quality of work standards*. When Baltimore passed a law requiring contractors to capture all the lead paint removed from masonry facades, contractors doing the work to the new standards reported that there were contractors underbidding them by ignoring the regulations. Municipal enforcement alone is an ineffective way of maintaining industry work quality. The trades must integrate these protocols into their standard work procedures.
- *Meet regularly to address problems and concerns*. It is vital that people directing a program get continual feedback from the people implementing their work orders. This is particularly important where poor communication or a breakdown in effective work protocols can put both the workers and the family's health in jeopardy. This feedback needs to come from both the participating contractors as well as representatives from the crews doing the on-site work.

- *Help contractors market Healthy Homes interventions to the private market*. Helping participating contractors, particularly community-based contractors, market to the private sector greatly amplifies benefits from the resources invested in the program. Where HUD funds are being used, increasing the participation of community-based contractors and workers is a Section 3 requirement. New and expanding markets are available to contractors who are certified, trained, and equipped to do healthy homes work.

Families

Always have avenues for the family to become involved.

- Provide program materials.
  - Make sure materials are readily available in neighborhood.
  - Consider libraries, community centers, clinics.
  - Consider taking flyers door to door for discussions with residents, where possible.
- Educate at organizational meetings or "kitchen meetings."
  - Present your program at meetings of existing community organizations.
  - Conduct tenant meetings, where feasible.
  - Hold "kitchen meetings."

Challenges of a Health and Housing Collaboration

- Different visions
- May speak "different languages"
- Many players
- Agency culture
- Power inequities
- Bad" history
- Competition for funding
- Lack of resources, or unbalanced distribution of resources

Using Information to Build & Improve Program

Why Collect Information?

- Determine the magnitude of the problem & community characteristics.
  - Health: who is at risk
  - Housing conditions: where and what are the problems
  - Demographics

Data can help you determine the magnitude of the problem and what is known about it. For example, it can help you:

- *Learn more about the community*: Demographics, educational levels, languages, community resources, where people get their news, who speaks for the community, barriers to working with the community.

- *Describe what is known about the problem*:
  - Person: Who is affected? Specific high-risk populations such as children, elderly, pregnant and nursing women, people with existing health conditions.
  - Place: Where is effect seen? Specific geographic areas, such as low-income or underserved neighborhoods, neighborhoods with low owner occupancy, or areas with known housing or environmental problems
  - Time: When does the problem occur? Are there times of the year, or any special conditions (weather, etc.), which affect the problem?
- *Place the problem in context:* This problem affects X number or X% of: people in a population of XX, children, a specific community, elderly. This problem is preventable, treatable, etc… in % of cases.
- *Describe what data exist:* Are there data to help answer the question?
  - Identify programs that already exist but may be housed in other parts of the agency, department, or in another department.
  - Are resources available from another agency?
  - Are there data available to fit your needs?
- *Identify gaps*:
  - Are there gaps in the data which cannot be filled? Do data exist outside the agency? Can other data be used to help fill gaps?

Why Collect Information?

- Establish a baseline to mark changes
- Evaluate your program
  - Monitor trends over time
  - Track progress toward meeting objectives
  - Determine success – meet objectives
- Make decisions about future program direction and strategies

Baseline information: This is the starting point that describes existing conditions. Baseline data can be used to compare data collected at later points for a comparison, and to measure the results of healthy housing activities. Baseline data may relate to a specific problem. For example, does our target area have a rodent infestation problem? Or it might be used to evaluate whether you have achieved your program goals more broadly.

Program evaluation: The data you collect are a key component of program evaluation, which can help you monitor trends over time. For example, data enable:

- Identification of housing associated health risks
- Determination of healthy housing needs
- Identification of community assets and resources that support the local healthy housing activities in promoting healthy housing and improving quality of life

Data helps you track progress by providing a basis for decision-making (help set priorities and refine program based on current needs and resources) and serves as a roadmap to tell you where you are going and when you have arrived.

By measuring progress against baseline information, you can determine your success, which will help build financial and political support for your program by informing and convincing decision-makers.

Gathering Data

Data are available from many sources, both public and private.

- *Demographic data*: are helpful in describing the people and communities you serve, i.e., population size, live births, age, death, gender, net migration, and race. Socioeconomic data describe social aspects of the population and include: education, income, labor force participation, healthcare, and children.
- *Housing data include*: location of housing, housing assistance information (e.g. public and section 8), age of housing, housing complaints, cost of housing, and typical rents / purchase prices.
- *Health data include*: Births, deaths, and illnesses.
- *Environmental data include*: Rodent activity, water and sewer, radon, "nuisance" complaints, pesticide use, community pesticide use, community garden projects, lead in housing, Superfund / brownsfield data, toxic release inventory data, testing data from healthy homes demonstration and/or research projects.

Visual Survey Report

Resident:
Alternate Contact:
Address:
Unit # Unique ID
Resident Phone:

Visual Conducted by:
Date:

Make a checkmark (✓) if the problem appears in the room or area. For deteriorated paint and water damage, indicate the extent of the problem (see instructions) Use the extra rows to identify any other hazards you notice. Put an asterisk (*) above any room(s) where a child sleeps or plays. Circle (◯) where you photograph a problem.

ROOM OR AREA

PROBLEM		Exterior	Porch	Entryway	Living Room	Dining Room	Kitchen	Bedroom 1	Bedroom 2	Bedroom 3	Bathroom 1	Bathroom 2	Basement		
Deteriorated paint	Walls														
	Windows, door, or trim														
	Paint chips on floor														
Soil with no grass or mulch															
Cockroaches															
Rodents															
Holes in wall															
Mold/ Mildew	Obvious source of moisture														
	No obvious source of moisture														
Water Damage: walls wet/newly stained															
Strong musty smell															
Natural gas/sewer gas smell															
Unvented gas oven/dryer/heater															
Worn-out carpeting															
Other:															
Other:															
Other:															
Other:															
Other:															

If renting, received lead hazard disclosure information from landlord? Yes No

Follow-up visit scheduled for: Date _____ Time: _____

CEHRC: Community Environmental Health Resource Center www.cehrc.org
Revised 3/04

Visual Assessment Tools

- Local Tools
  - Lead Poisoning
  - Healthy Homes
  - Code Inspection
- CDC/HUD Housing Inspection Manual
- Community Environmental Health Resource Center (CEHRC) Visual Survey

HUD Housing Quality Standards are required per 24 CFR 582.401 for federal housing. In hard copy, the HUD Housing Quality Standards consist of a 13-page form that considers a wide variety of hazards to residents including safety and environmental. HUD has also developed tools for electronic entry of the information.

The CEHRC Visual Survey is discussed in more detail below.

The Community Environmental Health Resource Center (CEHRC) used to be a resource for grassroots groups working for social justice in low-income communities around the country. While CEHRC (pronounced "search") no longer exists, the forms, instructions, checklists and decision guides for a visual survey that were created are still very useful tools.

Conducting the Visual Survey is the first step in the CEHRC hazard assessment process. The Visual Survey gives Hazard Investigators an initial opportunity to talk to residents about things they have noticed about their home. Looking around the outside and inside of the home, Hazard Investigators can begin to understand the general condition of the home, and target sampling as appropriate. Some hazards will only be assessed through the Visual Survey as visual evidence of a hazard might be sufficient to trigger control measures or other action.

Sampling Results Report

Record of Contact	First Visit	Second Visit	Meeting to Discuss Results
Hazard Investigator			
Resident or Designee			
Date & time			

Resident:
Address:
Unit #: Unique ID
Resident Phone:
Notes:

Hazard		Hazard Checked	Number of Samples	Results of Sampling		Guideline or Standard	Unit of Measure
				Location	Result		
Average Lead Dust	Floor					≥ 40	Micrograms of lead per square foot of sample area (µg/ft²); home-wide average
	Window Sill					≥ 250	
Maximum Lead Dust	Floor					≥ 40	Micrograms of lead per square foot (µg/ft²); highest level found in the home
	Window Sill					≥ 250	
Lead in Paint						≥ 0.5% by weight	Percentage of lead in paint; maximum level found in the home
Lead in Soil	Play Area					≥ 400	Parts per million of lead in soil (ppm); maximum level in a play area
	Drip Line					≥ 1200	Parts per million of lead in soil; average for drip line and other non-play areas
	Other Area						
Cockroaches						None	Highest infestation category
							Cockroaches per trap per night
Radon						≥ 4	Picocuries of radon per liter of air

Prepared by: Signature: Date:
Name (printed)

Test results noted on this report do not necessarily show all possible health hazards in this home. For example, lead test results are from samples collected in some areas, not the inspection of all painted surfaces.

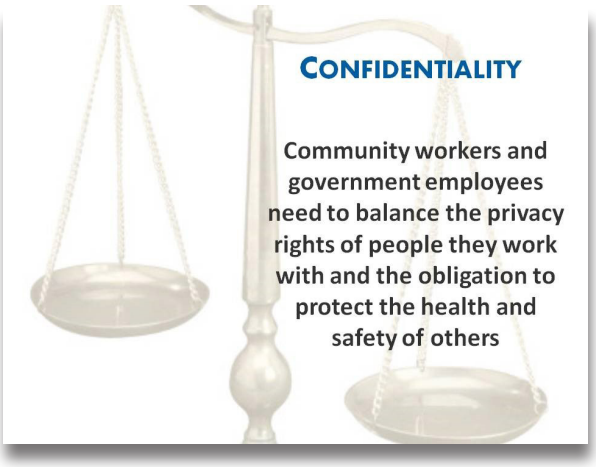
CEHRC: Community Environmental Health Resource Center
Revised 3/04
www.cehrc.org

Instructions for the Visual Survey Report, a Visual Survey Report to be filled out, and Floor Plan and Site Plan models to use when conducting the Visual Survey are available at http://healthyhousingsolutions.com/wp-content/uploads/2014/12/Essentials_Combined_References_Jan2014.pdf. Go to pages 118-125. In many cases, Hazard Investigators will want to take photographs of the home or certain hazards found, to supplement the written report. You should be familiar with how to use the IPMC to relate the identified hazards on the Visual Survey Report form to code violations.

Practitioners can use the CEHRC Visual Survey Report as a trigger for sampling. The CEHRC Sampling Results Report is the report that Hazard Investigators will give to the resident whose home was assessed, along with official lab reports and possibly photographs. The Sampling Results Report contains the results of all hazards that were tested for in the home. It's at-a-glance format allows residents and Hazard Investigators alike to get a sense of the condition of the home as compared to federal and state standards for housing conditions. The Instructions explain, step-by-step, how to fill out the Sampling Results Report.

When giving this report or other results to the resident, Hazard Investigators should take the time to read the results with the resident, explain what they mean, and discuss what future options the resident has for getting identified hazards corrected in a safe manner.

Legal Issues: Confidentiality, Disclosure, and Liability



Confidentiality is both an ethical and legal concern. It can also be a liability issue if you breech the confidentiality of protected information.

What kinds of data must you disclose?
When there is a compelling need to protect the health and safety of others, you may be required to disclose confidential data, including personal identifiers.

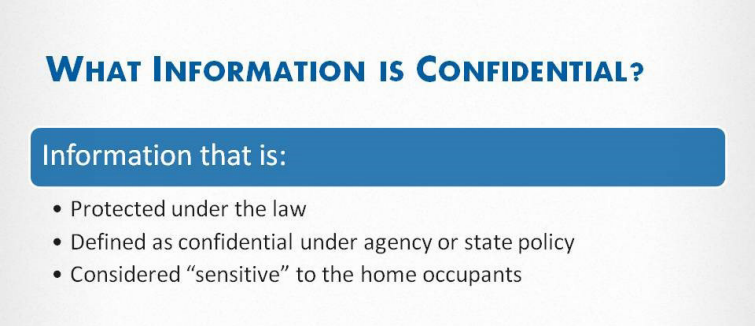
How many of you are required to disclose certain information that we normally consider confidential?
In Maryland for example, health practitioners (including nurses, social workers, doctors, educators, police officers and human services workers) are required to report conditions that endanger children. Community health workers may be mandated by state law to report conditions that endanger children. Check with your agency for their policy. If you are a public health or housing employee, you may have additional local requirements and internal policy on disclosable information. Workers who are not mandated to report child endangerment should discuss situations of concern with their public health/social service agency.

What kinds of data should be kept confidential?

Federal and state law defines what personal information is considered "private" and should be kept as confidential. This is often based on your agency type, job function, and what purpose sharing information would serve. Each law defines this in its own terms. It may a "personal identifier," "personal health information" or "protected health information."

Often, public agencies go above and beyond the law and develop their own privacy policies for confidential information. This may be to reduce negative publicity and/or liability.

Sensitive information is information shared with you by a person or family because of your professional relationship and their trust that you will not divulge this information. This information should, of course, be kept confidential.



Often, there is an overlap in what a resident considers sensitive and what is legally protected.

Information usually thought of as sensitive includes use of addictive products, illegal conduct, mental health, sexual practices or personal hygiene.

Most people consider release of such information an invasion of privacy. Information usually not considered sensitive includes occupation, birth date/age, gender or race ethnicity. Home address and citizenship may be considered sensitive information in some contexts.

Mandated Reporting to Child Protective Services

In some cases, you may be mandated BY LAW to report sensitive information and not keep it confidential. You won't have a choice. A "mandated reporter" – usually defined under state law – is a person that is in contact with children as part of their normal job duties. Mandated reporters are required to report suspected child mistreatment immediately when they have "reasonable" cause to believe that a child is being abused or neglected. The take home lesson - have a policy to address this internally, receive training, and keep up to date on changes to the law.

Conditions that endanger children include:

- Young children home alone
- Active physical abuse, or evidence of such
- Drug activity may **not** be considered a condition that endangers

If you are not a mandated reporter, bring these conditions to the attention of your supervisor. Each agency needs to develop policies to respond to these situations.

Discretionary Reporting

Some information is discretionary or not required to be reported by law. As part of the home assessment you will report all of your findings to the occupant of the home so that they can make decisions about improving the conditions. Most importantly, the occupant needs to know if there are immediate hazards that should be corrected as soon as possible.

- To whom do you report?
- What do you report?
- When?

If the occupant is a tenant, reporting to the property owner can be a little tricky. This is where you must make professional decisions about what to report. Potential consequences could include violating the tenant's trust, threatening your ability to get back in the house to finish an assessment or intervention, and in a worst-case scenario—lead to an eviction. If the issue is a safety issue—and only the landlord can fix the problem—you must report it.

Reporting

If there are immediate hazards or potential code violations, both the tenant and the property owner need to know. Also, there may be some conditions that only the owner can fix. Tenants don't always have the financial resources, or the ability under the lease to perform painting or other interventions.

Investigate state and local laws, and be aware of internal policy as well. If there is not an internal policy, encourage your administrators to develop one.

After this, there is information that does not need to be reported to the owner. For example, maybe the occupant's personal habits or hygiene is contributing to unhealthy conditions. Or, they are overcrowding electrical outlets. This information may be SENSITIVE, thus a good rule is to keep if confidential.

Reporting

Conditions to report to both property owner and tenant

- Lack of smoke alarms
- Sewage intrusion
- Vermin infestation
- Structural defects that may cause an injury
- Peeling/ deteriorated paint in homes older than 1978
- Sample results, if taken (lead, radon)
- Lack of window guards in high rise
- Any other immediate hazards found
- Hot water heater temperature, especially if multifamily

If you do not need sensitive information to carry out

your work – DON'T ASK (e.g. citizenship).

Consider keeping health and housing data separate.

Consider partnerships with other agencies that may already collect sensitive information that could be kept confidential. You will benefit from their control systems, training, and legal authority to keep and store certain information.

Not all laws designed to protect sensitive information apply to all agencies and "transactions." HIPAA, while used to justify numerous data controls, does not apply to all health-related entities. Check with counsel or the relevant governing agencies.

"Rules of Thumb"
Information collection and reporting

- Only collect what you need to know for the work
- Partnerships between health, housing and environmental departments may be beneficial
- Make sure you know which laws actually apply to your work and data collection and follow them
- Don't jeopardize an occupant's well-being by not disclosing code violations to the owner
- Don't jeopardize the occupant's trust by disclosing sensitive information

"Rules of Thumb"
Legal issues and liability

- Follow all laws
- Exercise caution when making recommendations for home treatments; never "wing it"
- Recommend professionals when needed
- Use applicable standards when available

There is a limited amount of research and data for many of the exposure sources seen in residential homes. In some cases, we still do not clearly understand the relationship between exposure and disease, allergic reaction or other etiology or the treatment that addresses the problem.

Liability Exposures for Healthy Homes Practitioners

Expanding the scope of your work to perform healthy homes assessments and interventions may expose you to new risks. You may consider updating your job description, and carrying your own insurance. Healthy housing practitioners may be responsible for assessing and treating various residential environmental health and safety hazards. These include lead-based paint hazards, mold, mildew, pests, vermin, pesticides, radon and physical injury sources.

Again, except for lead and radon, we have few nationally recognized standards or guidelines for achieving safe or acceptable levels of remediation for a number of environmental health and some safety exposures. A lack of standards and accepted guidelines means that there is often no clear legal standard of reasonable care owed to residents and others who might be exposed to the hazards.

Efforts are underway to develop effective testing methods and remediation controls. However, these methods and strategies are still being evaluated to determine how effective they are in eliminating or temporarily controlling the hazards. So practitioners will have to carefully select their approaches to testing and remediating.

Essentials for Healthy Homes Practitioners

Key Messages

- The community must be engaged in achieving HH goals.
- The holistic approach requires coordination and collaboration among all programs sending staff in the home.
- Data are essential to identify the problem, determine the magnitude, develop an intervention and measure success.
- Healthy homes practitioners need to be aware of legal and ethical issues in their own communities.

Learning Objectives

- Name two provisions of a code that could be used to cite a hazard in the home
- Explain why partnership with the community is essential.
- Identify five important players involved in healthy homes issues
- Explain why data collection and analysis are important in delivering healthy housing services.
- Identify three sources of data and where to find them.
- List two things that you might observe that must be reported and two that are discretionary.

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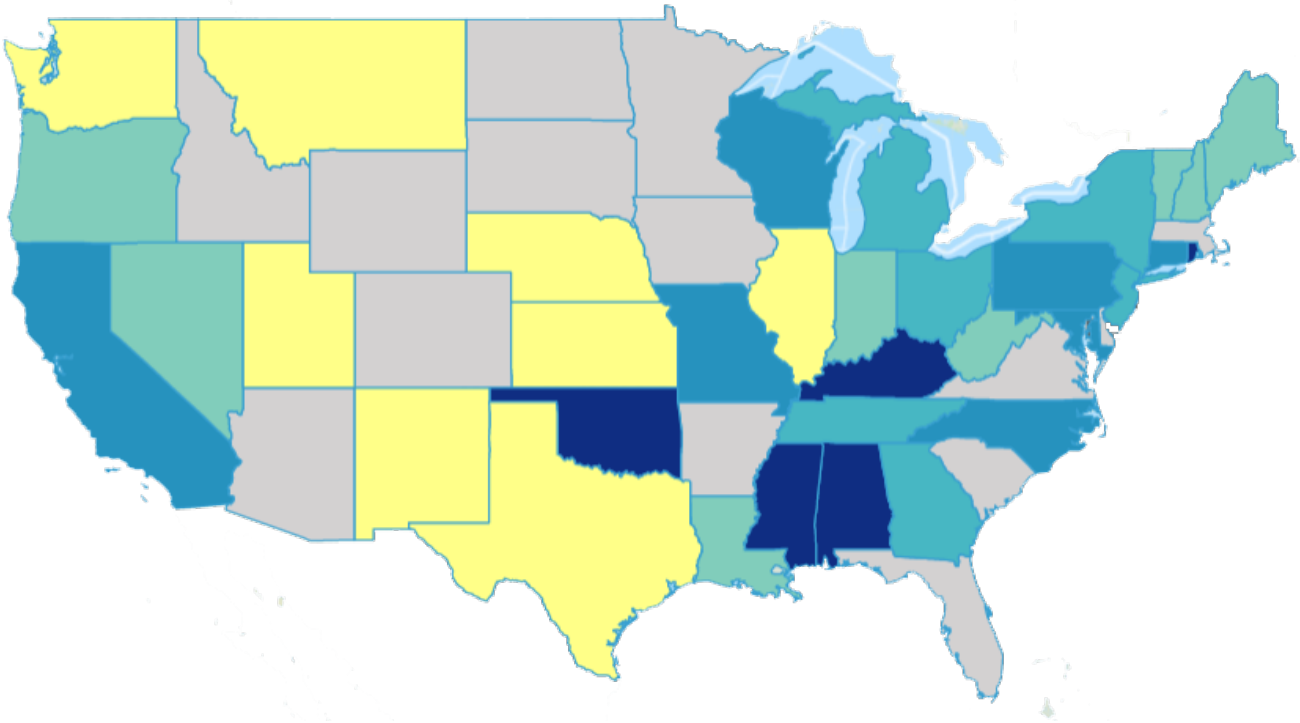
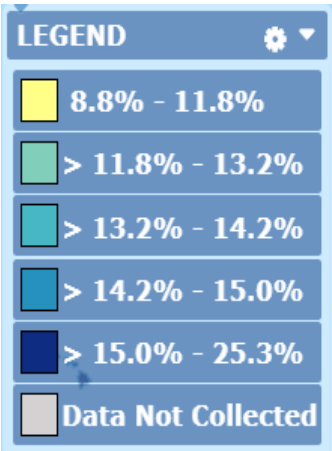
Childhood Asthma

Asthma Prevalence Among Children 2014 - BRFSS data

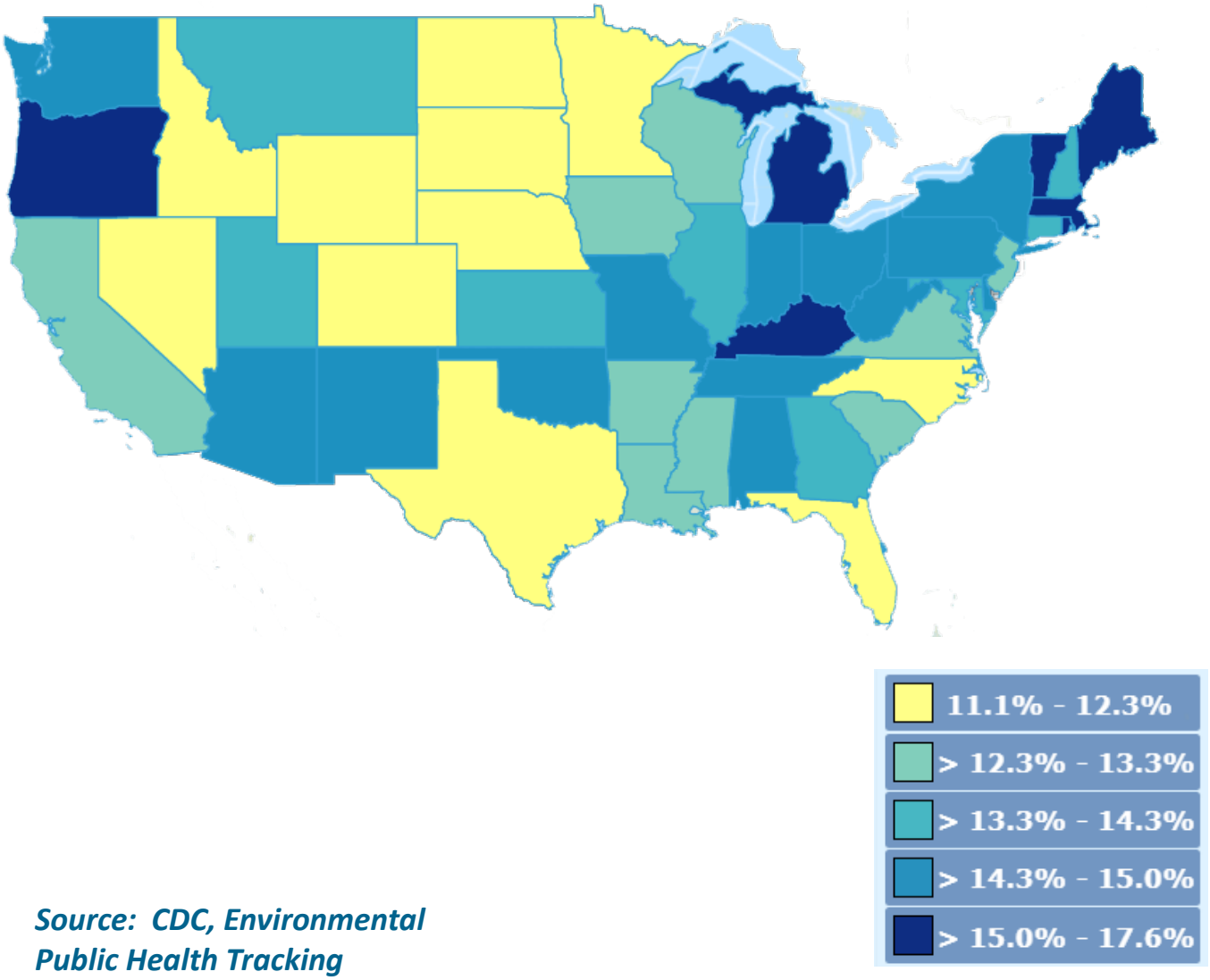




Source: CDC, Environmental Public Health Tracking (www.cdc.gov/ephtracking)

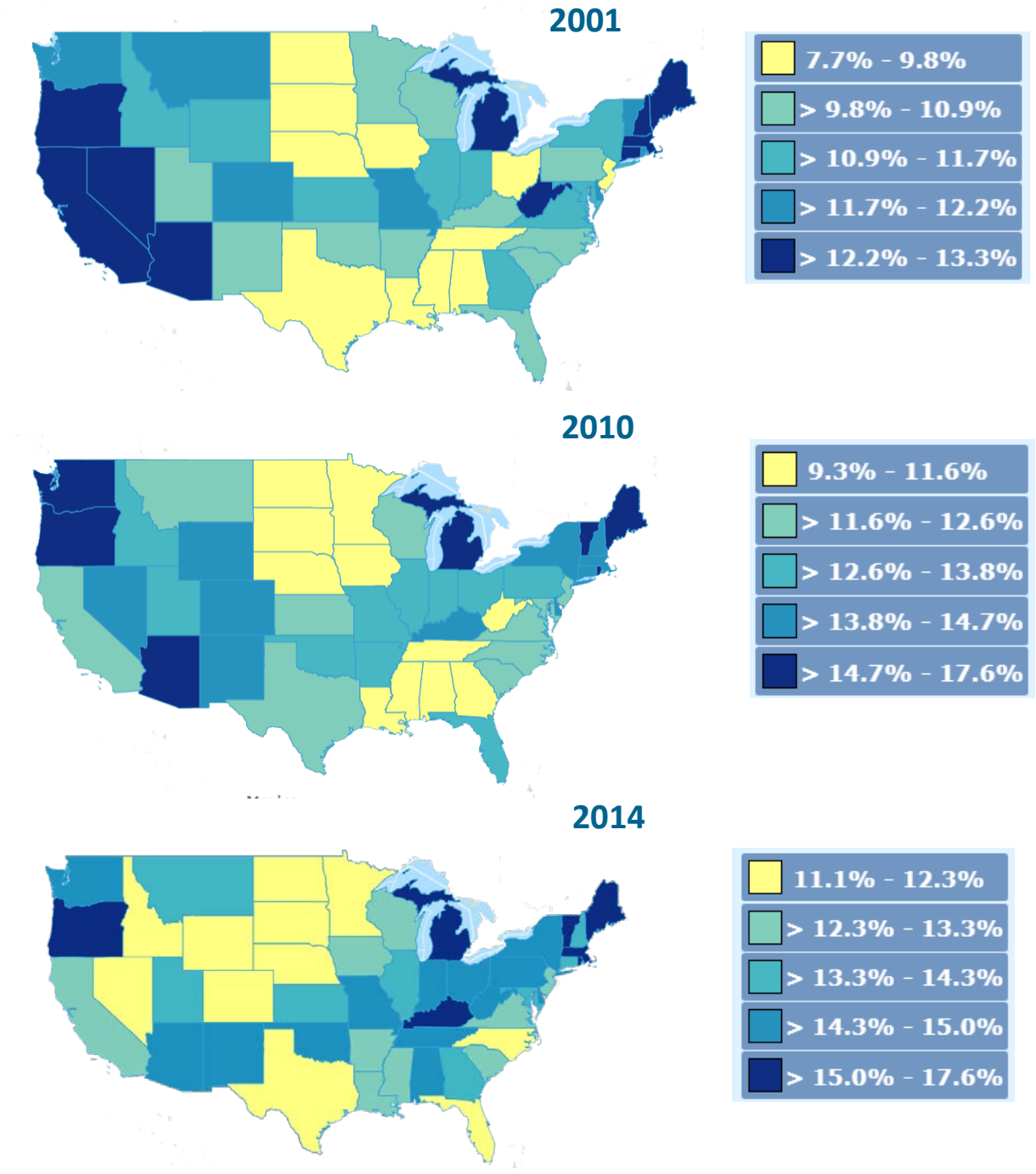
Adult Asthma

Current Prevalence, 2014 - BRFSS data

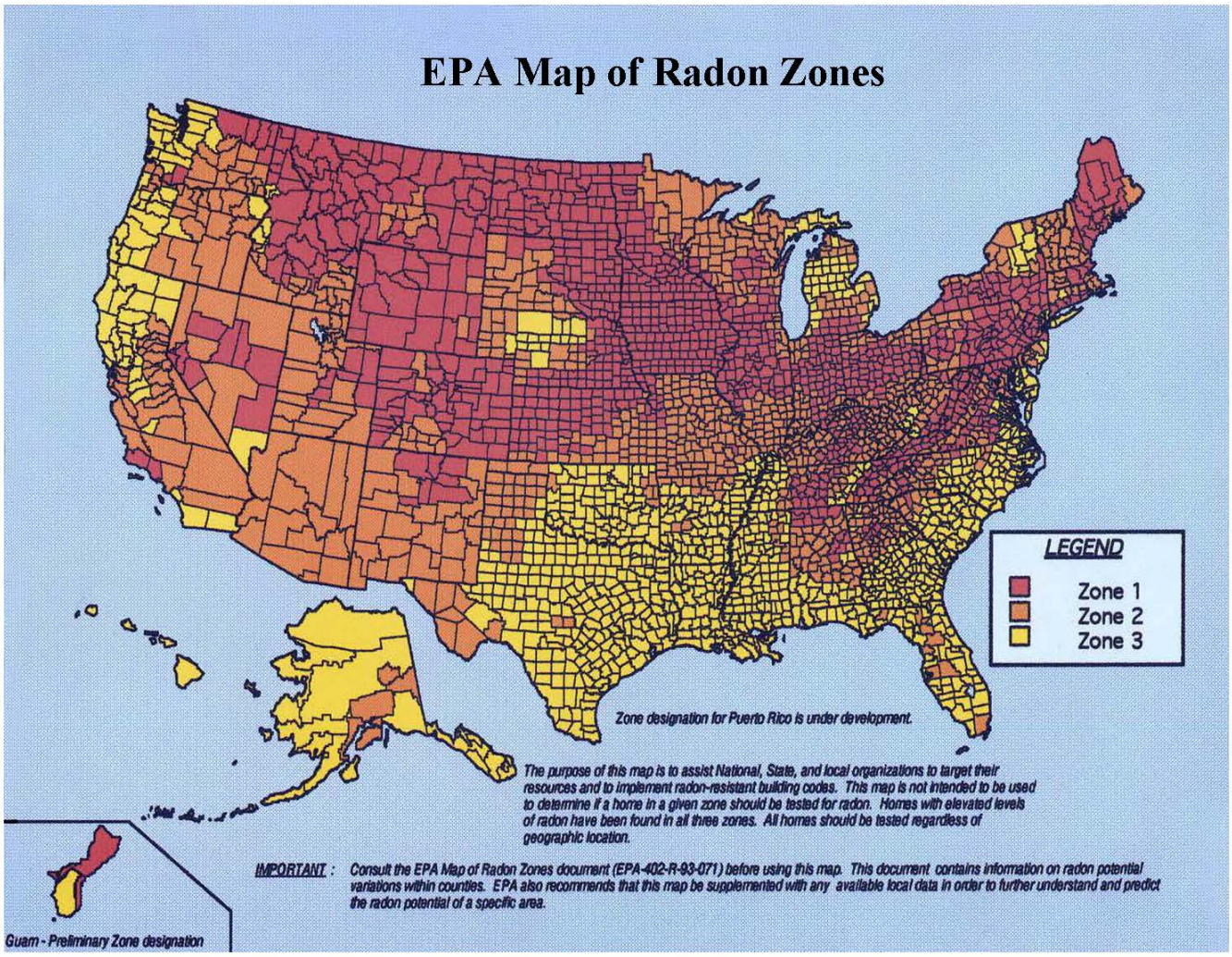


Source: CDC, Environmental Public Health Tracking (www.cdc.gov/ephtracking)

Adult asthma – current prevalence over time



Current asthma prevalence among adults varies across states.


EPA Map of Radon Zones
LEGEND
Zone 1
Zone 2
Zone 3
Zone designation for Puerto Rico is under development.
The purpose of this map is to assist National, State, and local organizations to target their resources and to implement radon-resistant building codes. This map is not intended to be used to determine if a home in a given zone should be tested for radon. Homes with elevated levels of radon have been found in all three zones. All homes should be tested regardless of geographic location.
IMPORTANT : Consult the EPA Map of Radon Zones document (EPA-402-R-93-071) before using this map. This document contains information on radon potential variations within counties. EPA also recommends that this map be supplemented with any available local data in order to further understand and predict the radon potential of a specific area.
Guam - Preliminary Zone designation

National Healthy Homes Training Center and Network

Laws, Rules, and Codes for Healthier Homes: Review of Approaches Affecting Existing Homes

The National Center for Healthy Housing has identified five different, complementary regulatory approaches used to make existing homes healthier and safer. This analysis focuses on regulatory approaches that address current conditions in existing homes. It does not address new construction or how rehabilitation must be conducted in existing homes.

1. Housing/Property Maintenance Code:
The U.S. Department of Housing and Urban Development (HUD) sets standards for housing receiving federal assistance. For example, housing funded through Housing Choice Vouchers (formerly known as Tenant-Based Section 8 Voucher) must comply with Housing Quality Standards (HQS). See Part A (following) for more information on HQS. HUD also sets general standards for housing covered by mortgage insurance. For all other housing, there are no national codes for existing housing or property maintenance. HUD sets standards for the design and construction of manufactured housing and housing receiving federal assistance but does not regulate the maintenance of that housing.

While all states have a code for new construction or major rehabilitation projects, few states have adopted standards mandating minimum conditions in or requiring maintenance of existing housing. In the absence of state standards, most urban and many suburban local jurisdictions adopted a housing or property maintenance code. The nation's model housing or property maintenance code is the International Property Maintenance Code (IPMC), which is managed by the International Code Council (ICC). Two states – New York and Virginia – and more than 600 local jurisdictions have adopted the IPMC with modifications. See Part B (following) for more information on the IPMC.

2. Health/Sanitation Code:
There is no national health code for housing. State and local agencies, mostly in the Northeast, have adopted health or sanitation codes that address health and safety hazards in housing. Many urban areas have also adopted vector control programs generally focused on rodents and mosquito harborage. The leading example of a state health or sanitation code is the State Sanitary Code for the State of Massachusetts. The only model health or sanitation code was adopted by the American Public Health Association (APHA) in 1938 and has not been updated. The U.S. Centers for Disease Control and Prevention (CDC) used this model code as the foundation for its Healthy Homes Reference Manual. See Part C (following) for more information on the APHA model health/sanitation code.

3. Landlord-Tenant Law:
There is no national landlord-tenant law for rental housing. The Federal Lead Hazard Disclosure adopted by both the U.S. Environmental Protection Agency (EPA) and HUD requires landlords, sellers and their agents to disclose potential and known lead hazards in housing built before 1978. HUD also enforces the Fair Housing Law, which requires reasonable accommodations for people with disabilities. Most states and, in the absence of state action, many urban jurisdictions have adopted laws establishing minimum roles and responsibilities for landlords and tenants in rental housing. These codes typically require both parties to comply with the applicable health or housing code. The parties can enforce this requirement through the courts in a private civil suit. The nation's model landlord-tenant law is the Uniform Residential Landlord and Tenant Act (URLTA) managed by the Uniform Law Commission. Twenty-five states have adopted URLTA. See Part D (following) for more information on the URLTA.

4. Product Standards:
The federal government is primarily responsible for setting standards for products in commerce that may impact health and safety. These standards reduce the dangers posed by these products by banning their use in housing, requiring safer designs, or specifying label requirements.
EPA regulates pesticides and does not allow them to be sold or used with prior approval. The Consumer Product Safety Commission (CPSC) regulates most other consumer products related to housing but requires only compliance with general requirements. In response to specific problems, CPSC adopts specific standards to address the problem such as banning lead containing paint. HUD sets standards for formaldehyde in wood in manufactured housing. The HUD label has been widely used as a voluntary standard beyond manufactured housing.
In addition, several national associations including the Underwriters Laboratories (UL), International Standards Organization (ISO), National Fire Protection Association (NFPA), and the American National Standards Institute (ANSI) adopt voluntary industry consensus standards. States and local jurisdictions can set standards only when there are no federal standards or when their actions are consistent with or the same as federal standards. See Part E (following) for more information on these federal product standards.

5. Hazard Management Laws:
The federal, state, and local government set a wide mix of requirements for the management of specific hazards in existing housing. EPA sets standards for asbestos, lead-based paint, and pesticides and has the authority to set standards for radon. HUD sets standards for lead-based paint in federally assisted housing. States and local jurisdictions set standards similar to or more stringent than the federal government. They also act in the absence of federal action such as requiring carbon monoxide alarms, requiring treatment of arsenic-treated lumber, or licensing mold or radon assessors or remediators. See Part F (following) for more information on federal hazard management laws. See Part G (following) for more information on EPA's Renovation, Repair, and Painting Rule.

Table 1
Comparison of Regulatory Approaches to Healthy Homes

	Housing/Property Maintenance Code	**Health/ Sanitation Code**	**Landlord-Tenant Law**	**Product Standards**	**Hazard Management Law**
National Requirements	Yes, for federally assisted housing. No, for other housing.	No.	Lead disclosure and fair housing.	Yes, for specific products and general standards.	Yes, for specific hazards such as lead, asbestos, and pesticides.
State Requirements	Several states.	Several states.	Most states.	Yes, for pesticides. All must be consistent with federal.	Generally yes for specific hazards in addition to federal , such as carbon monoxide and radon.
Local Requirements	Common, except in rural areas.	Common, but limited in scope.	Common in large urban areas.	Uncommon.	Larger community for specific hazards in addition to federal and state.
Current National Models	Yes, International Property Maintenance Code (IPMC).	No.	Yes, Uniform Residential Landlord and Tenant Act (URLTA).	Industry Consensus Standards.	Federal government and some associations issue guidelines to address specific hazards.
For More Information	Part A: Housing Quality Standards Part B: IPMC	Part C: For American Public Health (APHA) Association 1938 Principles	Part D: URLTA	Part E	Part F Part G: EPA's Renovation, Repair, and Painting Rule

A. HUD Housing Quality Standards

I. Overview

The U.S. Department of Housing and Urban Development (HUD) sets standards for housing receiving federal assistance. The primary standards are the Housing Quality Standards (HQS) at 24 CFR 982.401. The HQS were adopted in 1995 and last revised in 1999. All housing funded through HUD's Housing Choice Vouchers (formerly known as Tenant-Based Section 8 Voucher) must comply HQS as a condition of receiving funding. Local public housing authorities conduct initial and annual inspections to ensure compliance with the HQS.[1]

The HQS form the basis for HUD's Uniform Physical Condition Standards and it Public Housing Assessment System that applies to public housing and to Project-Based Section 8 Housing (also known as Housing Assistance Payment Program).[2]

II. HQS's Provisions

(a) Performance and acceptability requirements

(1) This section states the housing quality standards (HQS) for housing assisted in the programs.

(2)

(i) The HQS consist of:

(A) Performance requirements; and

(B) Acceptability criteria or HUD approved variations in the acceptability criteria.

(ii) This section states performance and acceptability criteria for these key aspects of housing quality:

(A) Sanitary facilities;

(B) Food preparation and refuse disposal;

(C) Space and security;

(D) Thermal environment;

(E) Illumination and electricity;

(F) Structure and materials;

(G) Interior air quality;

(H) Water supply;

(I) Lead-based paint;

(J) Access;

(K) Site and neighborhood;

(L) Sanitary condition; and

(M) Smoke detectors.

(3) All program housing must meet the HQS performance requirements both at commencement of assisted occupancy, and throughout the assisted tenancy.

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[1] See www.hud.gov/offices/pih/programs/hcv/about/fact_sheet.cfm for more information on the Housing Choice Voucher program.

[2] See www.hud.gov/offices/pih/programs/hcv/semap/semap.cfm for HUD's Section 8 Management Assessment Program.

(4)

(i) In addition to meeting HQS performance requirements, the housing must meet the acceptability criteria stated in this section, unless variations are approved by HUD.

(ii) HUD may approve acceptability criteria variations for the following purposes:

(A) Variations which apply standards in local housing codes or other codes adopted by the PHA; or

(B) Variations because of local climatic or geographic conditions.

(iii) Acceptability criteria variations may only be approved by HUD pursuant to paragraph (a)(4)(ii) of this section if such variations either:

(A) Meet or exceed the performance requirements; or

(B) Significantly expand affordable housing opportunities for families assisted under the program.

(iv) HUD will not approve any acceptability criteria variation if HUD believes that such variation is likely to adversely affect the health or safety of participant families, or severely restrict housing choice.

(b) Sanitary facilities

(1) *Performance requirements.* The dwelling unit must include sanitary facilities located in the unit. The sanitary facilities must be in proper operating condition, and adequate for personal cleanliness and the disposal of human waste. The sanitary facilities must be usable in privacy.

(2) *Acceptability criteria.*

(i) The bathroom must be located in a separate private room and have a flush toilet in proper operating condition.

(ii) The dwelling unit must have a fixed basin in proper operating condition, with a sink trap and hot and cold running water.

(iii) The dwelling unit must have a shower or a tub in proper operating condition with hot and cold running water.

(iv) The facilities must utilize an approvable public or private disposal system (including a locally approvable septic system).

(c) Food preparation and refuse disposal

(1) *Performance requirement.*

(i) The dwelling unit must have suitable space and equipment to store, prepare, and serve foods in a sanitary manner.

(ii) There must be adequate facilities and services for the sanitary disposal of food wastes and refuse, including facilities for temporary storage where necessary (e.g, garbage cans).

(2) *Acceptability criteria.*

(i) The dwelling unit must have an oven, and a stove or range, and a refrigerator of appropriate size for the family. All of the equipment must be in proper operating condition. The equipment may be supplied by either the owner or the family. A microwave oven may be substituted for a tenant-supplied oven and stove or range. A microwave oven may be substituted for an owner-supplied oven and stove or range if the tenant agrees and microwave ovens are furnished instead of an oven and stove or range to both subsidized and unsubsidized tenants in the building or premises.

(ii) The dwelling unit must have a kitchen sink in proper operating condition, with a sink trap and hot and cold running water. The sink must drain into an approvable public or private system.

(iii) The dwelling unit must have space for the storage, preparation, and serving of food.

(iv) There must be facilities and services for the sanitary disposal of food waste and refuse, including temporary storage facilities where necessary (e.g., garbage cans).

(d) Space and security

(1) *Performance requirement.* The dwelling unit must provide adequate space and security for the family.

(2) *Acceptability criteria.*

(i) At a minimum, the dwelling unit must have a living room, a kitchen area, and a bathroom.

(ii) The dwelling unit must have at least one bedroom or living/sleeping room for each two persons. Children of opposite sex, other than very young children, may not be required to occupy the same bedroom or living/sleeping room.

(iii) Dwelling unit windows that are accessible from the outside, such as basement, first floor, and fire escape windows, must be lockable (such as window units with sash pins or sash locks, and combination windows with latches). Windows that are nailed shut are acceptable only if these windows are not needed for ventilation or as an alternate exit in case of fire.

(iv) The exterior doors of the dwelling unit must be lockable. Exterior doors are doors by which someone can enter or exit the dwelling unit.

(e) Thermal environment

(1) *Performance requirement.* The dwelling unit must have and be capable of maintaining a thermal environment healthy for the human body.

(2) *Acceptability criteria.*

(i) There must be a safe system for heating the dwelling unit (and a safe cooling system, where present). The system must be in proper operating condition. The system must be able to provide adequate heat (and cooling, if applicable), either directly or indirectly, to each room, in order to assure a healthy living environment appropriate to the climate.

(ii) The dwelling unit must not contain unvented room heaters that burn gas, oil, or kerosene. Electric heaters are acceptable.

(f) Illumination and electricity

(1) *Performance requirement.* Each room must have adequate natural or artificial illumination to permit normal indoor activities and to support the health and safety of occupants. The dwelling unit must have sufficient electrical sources so occupants can use essential electrical appliances. The electrical fixtures and wiring must ensure safety from fire.

(2) *Acceptability criteria.*

(i) There must be at least one window in the living room and in each sleeping room.

(ii) The kitchen area and the bathroom must have a permanent ceiling or wall light fixture in proper operating condition. The kitchen area must also have at least one electrical outlet in proper operating condition.

(iii) The living room and each bedroom must have at least two electrical outlets in proper operating condition. Permanent overhead or wall-mounted light fixtures may count as one of the required electrical outlets.

(g) Structure and materials

(1) *Performance requirement.* The dwelling unit must be structurally sound. The structure must not present any threat to the health and safety of the occupants and must protect the occupants from the environment.

(2) *Acceptability criteria.*

(i) Ceilings, walls, and floors must not have any serious defects such as severe bulging or leaning, large holes, loose surface materials, severe buckling, missing parts, or other serious damage.

(ii) The roof must be structurally sound and weathertight.

(iii) The exterior wall structure and surface must not have any serious defects such as serious leaning, buckling, sagging, large holes, or defects that may result in air infiltration or vermin infestation.

(iv) The condition and equipment of interior and exterior stairs, halls, porches, walkways, etc., must not present a danger of tripping and falling. For example, broken or missing steps or loose boards are unacceptable.

(v) Elevators must be working and safe.

(h) Interior air quality

(1) *Performance requirement.* The dwelling unit must be free of pollutants in the air at levels that threaten the health of the occupants.

(2) *Acceptability criteria.*

(i) The dwelling unit must be free from dangerous levels of air pollution from carbon monoxide, sewer gas, fuel gas, dust, and other harmful pollutants.

(ii) There must be adequate air circulation in the dwelling unit.

(iii) Bathroom areas must have one openable window or other adequate exhaust ventilation.

(iv) Any room used for sleeping must have at least one window. If the window is designed to be openable, the window must work.

(i) Water supply

(1) *Performance requirement.* The water supply must be free from contamination.

(2) *Acceptability criteria.* The dwelling unit must be served by an approvable public or private water supply that is sanitary and free from contamination.

(j) Lead-based paint performance requirement

The Lead-Based Paint Poisoning Prevention Act (42 U.S.C. 4821–4846), the Residential Lead-Based Paint Hazard Reduction Act of 1992 (42 U.S.C. 4851–4856), and implementing regulations at part 35, subparts A, B, M, and R of this title apply to units assisted under this part.

(k) Access performance requirement

The dwelling unit must be able to be used and maintained without unauthorized use of other private properties. The building must provide an alternate means of exit in case of fire (such as fire stairs or egress through windows).

(l) Site and Neighborhood

(1) *Performance requirement.* The site and neighborhood must be reasonably free from disturbing noises and reverberations and other dangers to the health, safety, and general welfare of the occupants.

(2) *Acceptability criteria.* The site and neighborhood may not be subject to serious adverse environmental conditions, natural or manmade, such as dangerous walks or steps; instability; flooding, poor drainage, septic tank back-ups or sewage hazards; mudslides; abnormal air pollution, smoke or dust; excessive noise, vibration or vehicular traffic; excessive accumulations of trash; vermin or rodent infestation; or fire hazards.

(m) Sanitary condition—

(1) *Performance requirement.* The dwelling unit and its equipment must be in sanitary condition.

(2) *Acceptability criteria.* The dwelling unit and its equipment must be free of vermin and rodent infestation.

(n) Smoke detectors performance requirement—

(1) Except as provided in paragraph (n)(2) of this section, each dwelling unit must have at least one battery-operated or hard-wired smoke detector, in proper operating condition, on each level of the dwelling unit, including basements but excepting crawl spaces and unfinished attics. Smoke detectors must be installed in accordance with and meet the requirements of the National Fire Protection Association Standard (NFPA) 74 (or its successor standards). If the dwelling unit is occupied by any hearing-impaired person, smoke detectors must have an alarm system, designed for hearing-impaired persons as specified in NFPA 74 (or successor standards).

(2) For units assisted prior to April 24, 1993, owners who installed battery-operated or hard-wired smoke detectors prior to April 24, 1993 in compliance with HUD's smoke detector requirements, including the regulations published on July 30, 1992, (57 FR 33846), will not be required subsequently to comply with any additional requirements mandated by NFPA 74 (i.e., the owner would not be required to install a smoke detector in a basement not used for living purposes, nor would the owner be required to change the location of the smoke detectors that have already been installed on the other floors of the unit).

B. International Property Maintenance Code

I. Overview

The International Code Council[3] (ICC) published the first edition of the *International Property Maintenance Code* in 1998. ICC's three charter members of the International Code Council – Building Officials and Code Administrators International, Inc. (BOCA), International Conference of Building Officials (ICBO) and Southern Building Code Congress International (SBCCI) – developed the IPMC as a comprehensive set of regulations for existing buildings that was consistent with the existing model property maintenance codes at the time.. A new edition is promulgated every three years.

The *International Property Maintenance Code* is founded on principles that the IPMC must:

1. Adequately protect public health, safety and welfare;
2. Not unnecessarily increase construction costs;
3. Not restrict the use of new materials, productions or methods of construction; and
4. Not give preferential treatment to particular types or classes of materials, products or methods of construction.

Adoption

The *International Property Maintenance Code* is available for adoption and use by jurisdictions internationally. Its use within a governmental jurisdiction is intended to be accomplished through adoption by reference. At the time of adoption, jurisdictions should insert the appropriate information in provisions requiring specific local information, such as the name of the adopting jurisdiction. These locations are shown in bracketed words in small capital letters in the code and in the sample ordinance.

To find out whether the *International Property Maintenance Code* or any of the other ICC Codes have been adopted in your community, go to www.iccsafe.org/government/adoption.html.

Maintenance

The *International Property Maintenance Code* is kept up to date through the reviewof proposed changes submitted by code enforcing officials, industry representatives, design professionals and other interested parties. Proposed changes are carefully considered through an open code development process in which all interested and affected parties may participate. The contents of the code are subject to change both through the Code Development Cycles and the governmental body that enacts the code into law. For more information regarding the code development process, contact the Code and Standard Development Department of the International Code Council.

While the development procedure of the *International Property Maintenance Code* assures the highest degree of care, ICC and the founding members of ICC—BOCA, ICBO, SBCCI—their members and those participating in the development of the code do not accept any liability resulting from compliance or noncompliance with the provisions because ICC and its founding members do not have the power or authority to police or enforce compliance with the contents of the code. Only the governmental body that enacts the code into law has such authority.

[3] www.iccsafe.org.

Relationship to Other ICC Codes

The *International Property Maintenance Code* is complements and is fully compatible with all the *International Codes* ("I-Codes") published by the International Code Council (ICC), including the:

1. International Building Code;
2. ICC Electrical Code;
3. International Energy Conservation Code;
4. International Existing Building Code;
5. International Fire Code;
6. International Fuel Gas Code;
7. International Mechanical Code;
8. ICC Performance Code;
9. International Plumbing Code;
10. International Private Sewage Disposal Code;
11. International Residential Code;
12. International Urban-Wildland Interface Code; and
13. International Zoning Code.

All but three other states have adopted one or more of these model codes – most likely the International Building Code.

II. IPMC's Provisions Related to Healthy Homes

EXTERMINATION. The control and elimination of insects, rats or other pests by eliminating their harborage places; by removing or making inaccessible materials that serve as their food; by poison spraying, fumigating, trapping or by any other approved pest elimination methods.

HABITABLE SPACE. Space in a structure for living, sleeping, eating or cooking. Bathrooms, toilet rooms, closets, halls, storage or utility spaces, and similar areas are not considered habitable spaces.

INFESTATION. The presence, within or contiguous to, a structure or premises of insects, rats, vermin or other pests.

302.1 Sanitation. All exterior property and premises shall be maintained in a clean, safe and sanitary condition. The occupant shall keep that part of the exterior property which such occupant occupies or controls in a clean and sanitary condition.

302.2 Grading and drainage. All premises shall be graded and maintained to prevent the erosion of soil and to prevent the accumulation of stagnant water thereon, or within any structure located thereon.

302.5 Rodent harborage. All structures and exterior property shall be kept free from rodent harborage and infestation. Where rodents are found, they shall be promptly exterminated by approved processes which will not be injurious to human health. After extermination, proper precautions shall be taken to eliminate rodent harborage and prevent reinfestation.

304.2 Protective treatment. All exterior surfaces, including but not limited to, doors, door and window frames, cornices, porches, trim, balconies, decks and fences shall be maintained in good condition. Exterior wood surfaces, other than decay-resistant woods, shall be protected from the elements and decay by painting or other protective covering or treatment. Peeling, flaking and chipped paint shall be eliminated and surfaces repainted. All siding and masonry joints as well as those between the building envelope and the perimeter of windows, doors, and skylights shall be maintained weather resistant and water tight. All metal surfaces subject to rust or corrosion shall be coated to inhibit such rust and corrosion and all surfaces with rust or corrosion shall be stabilized and coated to inhibit future rust and corrosion. Oxidation stains shall be removed from exterior surfaces. Surfaces designed for stabilization by oxidation are exempt from this requirement.

304.5 Foundation walls. All foundation walls shall be maintained plumb and free from open cracks and breaks and shall be kept in such condition so as to prevent the entry of rodents and other pests.

304.6 Exterior walls. All exterior walls shall be free from holes, breaks, and loose or rotting materials; and maintained weatherproof and properly surface coated where required to prevent deterioration.

304.7 Roofs and drainage. The roof and flashing shall be sound, tight and not have defects that admit rain. Roof drainage shall be adequate to prevent dampness or deterioration in the walls or interior portion of the structure. Roof drains, gutters and downspouts shall be maintained in good repair and free from obstructions. Roofwater shall not be discharged in a manner that creates a public nuisance.

304.14 Insect screens. During the period from [DATE] to [DATE], every door, window and other outside opening required for ventilation of habitable rooms, food preparation areas, food service areas or any areas where products to be included or utilized in food for human consumption are processed, manufactured, packaged or stored, shall be supplied with approved tightly fitting screens of not less than 16 mesh per inch (16 mesh per 25 mm) and every swinging door shall have a self-closing device in good working condition.

> **Exception:** Screens shall not be required where other approved means, such as air curtains or insect repellent fans, are employed.

304.17 Guards for basement windows. Every basement window that is openable shall be supplied with rodent shields, storm windows or other approved protection against the entry of rodents.

305.1 General. The interior of a structure and equipment therein shall be maintained in good repair, structurally sound and in a sanitary condition. Occupants shall keep that part of the structure which they occupy or control in a clean and sanitary condition. Every owner of a structure containing a rooming house, housekeeping units, a hotel, a dormitory, two or more dwelling units or two or more nonresidential occupancies, shall maintain, in a clean and sanitary condition, the shared or public areas of the structure and exterior property.

305.3 Interior surfaces. All interior surfaces, including windows and doors, shall be maintained in good, clean and sanitary condition. Peeling, chipping, flaking or abraded paint shall be repaired, removed or covered. Cracked or loose plaster, decayed wood and other defective surface conditions shall be corrected.

307.1 Accumulation of rubbish or garbage. All exterior property and premises, and the interior of every structure, shall be free from any accumulation of rubbish or garbage.

308.1 Infestation. All structures shall be kept free from insect and rodent infestation. All structures in which insects or rodents are found shall be promptly exterminated by approved processes that will not be injurious to human health. After extermination, proper precautions shall be taken to prevent reinfestation.

308.2 Owner. The owner of any structure shall be responsible for extermination within the structure prior to renting or leasing the structure.

308.3 Single occupant. The occupant of a one-family dwelling or of a single-tenant nonresidential structure shall be responsible for extermination on the premises.

308.4 Multiple occupancy. The owner of a structure containing two or more dwelling units, a multiple occupancy, a rooming house or a nonresidential structure shall be responsible for extermination in the public or shared areas of the structure and exterior property. If infestation is caused by failure of an occupant to prevent such infestation in the area occupied, the occupant shall be responsible for extermination.

308.5 Occupant. The occupant of any structure shall be responsible for the continued rodent and pest-free condition of the structure.

> **Exception:** Where the infestations are caused by defects in the structure, the owner shall be responsible for extermination.

403.1 Habitable spaces. Every habitable space shall have at least one openable window. The total openable area of the window in every room shall be equal to at least 45 percent of the minimum glazed area required in Section 402.1.

> **Exception:** Where rooms and spaces without openings to the outdoors are ventilated through an adjoining room, the unobstructed opening to the adjoining room shall be at least 8 percent of the floor area of the interior room or space, but not less than 25 square feet (2.33m2). The ventilation openings to the outdoors shall be based on a total floor area being ventilated.

403.2 Bathrooms and toilet rooms. Every bathroom and toilet room shall comply with the ventilation requirements for habitable spaces as required by Section 403.1, except that a window shall not be required in such spaces equipped with a mechanical ventilation system. Air exhausted by a mechanical ventilation system from a bathroom or toilet room shall discharge to the outdoors and shall not be recirculated.

403.4 Process ventilation. Where injurious, toxic, irritating or noxious fumes, gases, dusts or mists are generated, a local exhaust ventilation system shall be provided to remove the contaminating agent at the source. Air shall be exhausted to the exterior and not be recirculated to any space.

403.5 Clothes dryer exhaust. Clothes dryer exhaust systems shall be independent of all other systems and shall be exhausted in accordance with the manufacturer’s instructions.

503.4 Floor surface. In other than dwelling units, every toilet room floor shall be maintained to be a smooth, hard, nonabsorbent surface to permit such floor to be easily kept in a clean and sanitary condition.

505.4 Water heating facilities. Water heating facilities shall be properly installed, maintained and capable of providing an adequate amount of water to be drawn at every required sink, lavatory, bathtub, shower and laundry facility at a temperature of not less than 110ºF (43ºC). A gas-burning water heater shall not be located in any bathroom, toilet room, bedroom or other occupied room normally kept closed, unless adequate combustion air is provided. An approved combination temperature and pressure-relief valve and relief valve discharge pipe shall be properly installed and maintained on water heaters.

602.2 Residential occupancies. Dwellings shall be provided with heating facilities capable of maintaining a room temperature of 68ºF (20ºC) in all habitable rooms, bathrooms and toilet rooms based on the winter outdoor design temperature for the locality indicated in Appendix D of the *International Plumbing Code*. Cooking appliances shall not be used to provide space heating to meet the requirements of this section.

> **Exception:** In areas where the average monthly temperature is above 30°F (-1°C), a minimum temperature of 65°F (18°C) shall be maintained.

602.3 Heat supply. Every owner and operator of any building who rents, leases or lets one or more dwelling unit, rooming unit, dormitory or guestroom on terms, either expressed or implied, to furnish heat to the occupants thereof shall supply heat during the period from [DATE] to [DATE] to maintain a temperature of not less than 68ºF (20ºC) in all habitable rooms, bathrooms, and toilet rooms.

> **Exceptions:**
> 1. When the outdoor temperature is below the winter outdoor design temperature for the locality, maintenance of the minimum room temperature shall not be required provided that the heating system is operating at its full design capacity. The winter outdoor design temperature for the locality shall be as indicated in Appendix D of the *International Plumbing Code*.
> 2. In areas where the average monthly temperature is above 30ºF (-1ºC) a minimum temperature of 65ºF (18ºC) shall be maintained.

603.2 Removal of combustion products. All fuel-burning equipment and appliances shall be connected to an approved chimney or vent.

> **Exception:** Fuel-burning equipment and appliances which are labeled for unvented operation.

603.5 Combustion air. A supply of air for complete combustion of the fuel and for ventilation of the space containing the fuel-burning equipment shall be provided for the fuel-burning equipment.

603.6 Energy conservation devices. Devices intended to reduce fuel consumption by attachment to a fuel-burning appliance, to the fuel supply line thereto, or to the vent outlet or vent piping therefrom, shall not be installed unless labeled for such purpose and the installation is specifically approved.

607.1 General. Duct systems shall be maintained free of obstructions and shall be capable of performing the required function.

C. APHA's Basic Principles of Healthful Housing

I. Overview

In 1938, the American Public Health Association[4] (APHA) formulated Basic Principles of Healthful Housing (Principles),[5] to promote the "physical, mental and social health" essential in housing. For each of the 30 Principles, APHA also identified Specific Requirements, and the Methods of Attainment considered at that time to be the "more important means" by which to achieve the Principle's objectives.

II. How The Principles Have Been Applied

The Principles continue to inform the dialogue about, and development of policies to promote, healthy housing. For example, U.S. federal agencies endorse the Principles in the *Healthy Housing Reference Manual* (*HH Manual*).[6] The CDC also modeled its original basic housing inspection manual after the Principles. In the U.K., the University of Warwick used the Principles as a foundational document in the development of the Health and Housing Rating System, the nation's housing inspection system. The Principles comport with modern tenets of healthy housing, *i.e.*: keep housing dry, clean, ventilated, and pest free; avoid contaminants; and properly maintain housing.

III. APHA's Principles

The 30 Principles fall into four categories:

a. **Fundamental Physiological Needs** (e.g., for illumination, heat, cooling, space, chemical purity, quiet);

b. **Fundamental Psychological Needs** (e.g., for privacy, adequate space, cleanliness, peace-of-mind, normal family and household activity);

c. **Protection Against Contagion** (e.g., from disease, vermin, sewage, contaminated water, over-crowding, food decay); and

d. **Protection Against Accidents** (e.g., from falls, fire, burns, gas, mechanical injuries, electrical shock, building collapse, traffic).

The Principles are summarized below, along with analysis excerpted from the *HH Manual*. The number of each Principle as identified in APHA's 1938 report is indicated by "P#."

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[4] www.apha.org.

[5] APHA, Committee on the Hygiene of Housing, *Basic Principles of Healthful Housing*, (Preliminary Report, March 1938). www.pubmedcentral.nih.gov/articlerender.fcgi?artid=1529239 or www.ajph.org/cgi/reprint/28/3/351

[6] The manual is published by the U.S. Department of Health and Human Services and U.S. Department of Housing and Urban Development. www.cdc.gov/nceh/publications/books/housing/cha02.htm

Fundamental Physiological Needs (8 Principles[7])

1. A thermal environment to *avoid undue* heat loss (P1) -- and *permit adequate* heat loss (P2).

   The lack of adequate heating and cooling systems in homes can contribute to respiratory illnesses or even lead to death from extreme temperatures. . . . . [A] majority of today's homes [can] maintain healthy temperatures, although many houses still lack adequate insulation.

2. An atmosphere of "reasonable chemical purity" (P3).

3. Provision of:
   a. adequate *daylight* illumination and avoidance of undue daylight glare (P4);
   b. direct sunlight (P5); and
   c. adequate *artificia*l illumination and avoidance of glare (P6).

   Research has revealed a strong relationship between light and human physiology. . . . . one of the physiologic responses . . . is the production of vitamin D. . . . It affects body rhythms and psychologic health. . . . . Adequate lighting is important . . . to see unsanitary conditions and to prevent injury . . . Improper indoor lighting can also contribute to eyestrain . . . .

4. Protection against excessive noise (P7).

   Noise has physiologic impacts aside from the potential to reduce hearing ability. . . . elevated blood pressure; negative cardiovascular effects; increased breathing rates, digestion, and stomach disturbances; ulcers; negative effects on developing fetuses; difficulty sleeping after the noise stops; plus the intensification of the effects of drugs, alcohol, aging, and carbon monoxide. . . . [and cause other adverse effects].

5. Provision of adequate space for exercise and for the play of children (P8).

   Healthful housing should include the provision of safe play and exercise areas. Many American neighborhoods are severely deficient, with no area for children to safely play. . . . [no] sidewalks or street lighting, nor are essential services available by foot . . . .

Fundamental Psychological Needs (7 Principles)

6. Provision of:
   a. adequate privacy for the individual (P9);
   b. opportunities for normal family life (P10) – and normal community life (P11);
   c. facilities to make performing household tasks possible without undue physical and mental fatigue (P12);
   d. facilities for "the maintenance of cleanliness of the dwelling and the person" (P13); and
   e. "possibilities for reasonable esthetic satisfaction in the home and its surroundings" (P14).

7. "Concordance with prevailing social standards of the local community" (P15).

[7] The *HH Manual* adds a new Principle #1, "protection from the elements"; and does not discuss APHA Principle #3, "reasonable chemical purity."

Privacy is a necessity to most people . . . . Ideally, everyone would have their own rooms . . . excepting married couples and small children. . . . Bedrooms and bathrooms should be accessible directly from halls or living rooms . . . . crowding can lead to poor school performance in children."

A wholesome atmosphere requires adequate living room space and adequate space for withdrawal. . . . This . . . . includes easy communication with centers of culture and business . . . ."

Protection Against Contagion (8 Principles)

8. Provision of:
   a. A safe and sanitary water supply (P16);
   b. protection of the water supply system against pollution (P17); and
   c. toilet facilities that minimize the danger of transmitting disease (P18).

   [Approximately] 42 million Americans (mostly in rural America) get their water from private wells or other small, unregulated water systems. The presence of adequate water, sewer, and plumbing facilities is central to the prevention, reduction, and possible elimination of water-related diseases. . . . Water-related diseases can be organized into four categories:
   - Water*borne* diseases [*i.e.*, those caused by contamination from chemical, human, and animal wastes, such as cholera, typhoid, shigella, polio, meningitis, and hepatitis A and E].
   - Water-*based* diseases [*i.e.*, from aquatic organisms that become parasites. These are rare in the U.S.]
   - Water-*related vecto*r diseases [*i.e.*,, those linked to vectors that breed and live in/near water; primarily mosquitoes that carry malaria, yellow fever, *etc*. The West Nile virus is a vectorborne disease. In the U.S. in 2003, there were 9,862 human cases of West Nile virus, with 264 deaths.]
   - Water-*scarce* diseases [*i.e.*, diseases that flourish where sanitation is poor due to a scarcity of fresh water, including diphtheria, leprosy, tuberculosis. These conditions are essentially absent from the U.S.]

9. Protection against sewage contamination of interior surfaces (P19) – and avoidance of unsanitary conditions near the dwelling (P20).

   In 2000 . . . 1.4% of U.S. homes lacked plumbing facilities. . . . The containment of household sewage is instrumental in protecting the public from waterborne and vectorborne diseases. . . . .

   Nationally, 74.8% of homes are served by a public sewer, with 24.1% served by a septic tank or cesspool, and the remaining 1.1% using other means."

10. Exclusion of vermin which may play a part in the transmission of disease (P21).

    Vermin, such as rodents, have long been linked to property destruction and disease. Integrated pest management, along with proper housing construction, has played a significant role in reducing vermin around the modern home. Proper food storage, rat-proofing construction, and ensuring good sanitation outside the home have served to eliminate or reduce rodent problems in the 21st century home.

11. Provision of facilities for keeping milk and food fresh ("undecomposed")(P22).

Facilities to properly store milk and food [has] been instrumental in reducing . . . foodborne diseases . . . .

12. Provision of sufficient space in sleeping rooms to minimize the danger of infection (P23).

    Much improvement has been made in the adequacy of living space for the U.S. family over the last 30 years. . . . Excessive crowding in homes has the potential to increase. . . communicable disease transmission [and] the stress level of occupants . . . .

Protection Against Accidents (7 Principles)[8]

13. Erection of the dwelling with materials and methods to minimize danger of accidents due to collapse of any part of the structure (P24).

14. Control of conditions likely to *cause* fires or promote their spread (P25).

    Between 1992 and 2001, an average of 4,266 Americans died annually in fires and nearly 25,000 were injured. . . . . The [US] has one of the highest fire death rates in the industrialized world, with 13.4 deaths per million people. At least 80% of all fire deaths occur in residences. . . . . Apartment fires most often start in the kitchen . . . .

    Cooking is the leading cause of home fires, usually a result of unattended cooking and human error rather than mechanical failure of the cooking units. The leading cause of fire deaths in homes is careless smoking, which can be significantly deterred by smoke alarms and smolder-resistant bedding and upholstered furniture. . . .

    Manufactured homes can be susceptible to fires. More than one-fifth of residential fires in these facilities are related to the use of supplemental room heaters, such as wood- and coal-burning stoves, kerosene heaters, gas space-heaters, and electrical heaters. Most fires related to supplemental heating equipment "result from improper installation, maintenance, or use of the appliance."

15. Provision of adequate facilities for *escape* in the case of fire (P26).

    Three key elements can contribute to a safe exit from a home during the threat of fire. The first . . . is a working smoke alarm system. . . . By 1995, 93% of all single-family and multifamily homes, apartments, nursing homes, and dormitories were equipped with alarms. . . . .

    A second element . . . is a properly installed fire-suppression system. . . . . Currently, few homes are protected by residential sprinkler systems. . . . Sprinkler systems can be installed for a reasonable price. These systems can be retrofitted to existing construction . . .

    The final element in escaping from a residential fire is having a fire [escape] plan."

[8] The *HH Manual* does not discuss Principle # 24, dwelling construction, or # 30, traffic.

16. Protection against danger of electrical shocks and burns (P27).

    Electrical distribution equipment was the third-leading cause of home fires and the second-leading cause of fire deaths in the [U.S.] between 1994 and 1998. . . . . 38,300 home electrical fires occurred in 1998, which resulted in 284 deaths, [and] 1,184 injuries . . . .

    Electrical fires are one of the leading types of home fires in manufactured homes. . . . . [M]any electrical fires in homes are associated with improper installation of electrical devices by do-it-yourselfers."

17. Protection against gas poisonings (P28).

    In 2001 an estimated 130 deaths occurred as a result of CO poisoning from residential sources; this decrease in deaths [down from about 600 in 1998] is related to the increased use of CO detectors. In addition, approximately 10,000 cases of CO-related injuries occur each year.

18. Protection against falls and other mechanical injuries in the home (P29).

    The leading causes of home injury deaths in 1998 were falls and poisonings, which accounted for 6,756 and 5,758 deaths, respectively. . . . . Overall, falls were the leading cause of nonfatal, unintentional injuries occurring at home and accounted for 5.6 million injuries. . . . 48% of households have windows on the second floor or above, but only 25% have window locks or bars to prevent children from falling out. . . .

19. Protection of the neighborhood against automobile traffic hazards (P30).

D. Uniform Residential Landlord and Tenant Act

I. Overview

The Uniform Residential Landlord and Tenant Act (URLTA) was completed by the Uniform Law Commission (ULC) in 1972.[9]

The ULC Drafting Process
A "uniform" state law is one in which uniformity of the provisions of the act among the various jurisdictions is a principal and compelling objective. To draft an act, ULC appoints a drafting committee from among the ULC membership (attorneys from diverse practice areas). Each draft receives at least two years consideration. The drafting process draws on the expertise of state-appointed commissioners, legal experts, and advisors and observers representing the views of other legal organizations or interests that will be subject to the proposed laws.

Draft acts are submitted for initial debate of the entire ULC at an annual meeting. Each act must be considered section-by-section, at no less than two annual meetings, by all commissioners. Once approved, the final step is a vote by states. A majority of the states present, and no less than 20 states, must approve an act before it can be officially adopted.[10]

URLTA
URLTA establishes the landlord and tenant relationship on the basis of contract (rather than property law) and, thus, gives the parties contractual rights and remedies. As of 2012, URLTA has been adopted by 25 states[11]:

Alabama
Alaska
Arizona
Arkansas
Connecticut
Delaware
Hawaii
Indiana
Iowa Kansas
Kentucky
Mississippi
Montana
Nebraska
New Mexico
North Carolina
Ohio
Oklahoma
Oregon
Rhode Island
South Carolina
Tennessee
Virginia
Washington
West Virginia

[9] *See* National Conference of Commissioners on Uniform State Laws (NCCUSL) at www.nccusl.org/Update/. NCCUSL's electronic archives is maintained by the University of Pennsylvania Law School at www.law.upenn.edu/bll/archives/ulc/ulc_final.htm#final.
[10] *See* www.nccusl.org/Update/DesktopDefault.aspx?tabindex=5&tabid=61.
[11] *See* *http://www.ncsl.org/documents/Environ/STUniformLandlord-tenantActs.pdf*

II. URLTA's Property Maintenance Obligations

URLTA is intended to "encourage landlords and tenants to maintain and improve the quality of housing," and clarify the "rights and obligations of landlords and tenants." URLTA § 1.102.

Landlord Obligations

Generally, URLTA requires that a landlord:

- comply with applicable building and housing codes affecting health and safety;
- "make all repairs and do whatever is necessary to put and keep the premises in a fit and habitable condition";
- keep all common areas in a clean and safe condition;
- maintain electrical, plumbing, sanitary, heating, ventilating, air-conditioning, and other facilities and appliances in "good and safe working order and condition";
- provide and maintain appropriate receptacles for removal of garbage and other waste, and arrange for their removal; and
- supply running water and reasonable amounts of hot water at all times and reasonable heat (between October 1 and May 1), except where the law does not require the building be so equipped, or heat or hot water is generated by an installation controlled by the tenant.

Under certain circumstances, a landlord and tenant may agree to have the tenant perform repairs and maintenance. URLTA § 2.104.

URLTA prohibits rental agreements that allow landlords to receive rent free of the obligation to comply with the code's maintenance obligations. URLTA § 1.404; § 2.104(a).

Tenant Obligations

Also, URLTA requires that a tenant:

- comply with all obligations primarily imposed upon tenants by applicable building and housing codes;
- keep the tenant's premises "as clean and safe as the condition of the premises permit";
- dispose of garbage, rubbish and other wastes from the dwelling unit "in a clean and safe manner";
- keep plumbing fixtures in the tenant's dwelling unit "as clear as their condition permits"; and
- use "in a reasonable manner" all electrical, plumbing, sanitary, heating, ventilating, air-conditioning, and other facilities and appliances. URLTA § 3.101.

III. URLTA Provisions Related to Property Maintenance[12]

§ 1.102. [Purposes; Rules of Construction]

(a) This Act shall be liberally construed and applied to promote its underlying purposes and policies.

(b) Underlying purposes and policies of this Act are

(1) to simplify, clarify, modernize, and revise the law governing the rental of dwelling units and the rights and obligations of landlords and tenants;

(2) to encourage landlords and tenants to maintain and improve the quality of housing; and

(3) to make uniform the law with respect to the subject of this Act among those states which enact it.

§ 1.404. [Separation of Rents and Obligations to Maintain Property Forbidden]

A rental agreement, assignment, conveyance, trust deed, or security instrument may not permit the receipt of rent free of the obligation to comply with Section 2.104(a).

§ 2.104. [Landlord to Maintain Premises]

(a) A landlord shall:

(1) Comply with the requirements of applicable building and housing codes materially affecting health and safety;

(2) Make all repairs and do whatever is necessary to put and keep the premises in a fit and habitable condition;

(3) Keep all common areas of the premises in a clean and safe condition;

(4) Maintain in good and safe working order and condition all electrical, plumbing, sanitary, heating, ventilating, air-conditioning, and other facilities and appliances, including elevators, supplied or required to be supplied by him;

(5) Provide and maintain appropriate receptacles and conveniences for the removal of ashes, garbage, rubbish, and other waste incidental to the occupancy of the dwelling unit and arrange for their removal; and

(6) Supply running water and reasonable amounts of hot water at all times and reasonable heat [between [October 1] and [May 1]] except where the building that includes the dwelling unit is not required by law to be equipped for that purpose, or the dwelling unit is so constructed that heat or hot water is generated by an installation within the exclusive control of the tenant and supplied by a direct public utility connection.

(b) If the duty imposed by paragraph (1) of subsection (a) is greater than any duty imposed by any other paragraph of that subsection, the landlord's duty shall be determined by reference to paragraph (1) of subsection (a).

(c) The landlord and tenant of a single family residence may agree in writing that the tenant perform the landlord's duties specified in paragraphs (5) and (6) of subsection (a) and also specified repairs, maintenance tasks, alterations, and remodeling, but only if the transaction is entered into in good faith.

(d) The landlord and tenant of any dwelling unit other than a single family residence may agree that the tenant is to perform specified repairs, maintenance tasks, alterations, or remodeling only if

[12] See www.law.upenn.edu/bll/archives/ulc/fnact99/1970s/urlta72.htm or www.law.upenn.edu/bll/archives/ulc/ulc_final.htm#final.

(1) The agreement of the parties is entered into in good faith and is set forth in a separate writing signed by the parties and supported by adequate consideration;
(2) The work is not necessary to cure noncompliance with subsection (a)(1) of this section; and
(3) The agreement does not diminish or affect the obligation of the landlord to other tenants in the premises.

(e) The landlord may not treat performance of the separate agreement described in subsection (d) as a condition to any obligation or performance of any rental agreement.

§ 3.101. [Tenant to Maintain Dwelling Unit]

A tenant shall:

(1) Comply with all obligations primarily imposed upon tenants by applicable provisions of building and housing codes materially affecting health and safety;
(2) Keep that part of the premises that he occupies and uses as clean and safe as the condition of the premises permit;
(3) Dispose from his dwelling unit all ashes, garbage, rubbish, and other waste in a clean and safe manner;
(4) Keep all plumbing fixtures in the dwelling unit or used by the tenant as clear as their condition permits;
(5) Use in a reasonable manner all electrical, plumbing, sanitary, heating, ventilating, air-conditioning, and other facilities and appliances including elevators in the premises;
(6) Not deliberately or negligently destroy, deface, damage, impair, or remove any part of the premises or knowingly permit any person to do so; and
(7) Conduct himself and require other persons on the premises with his consent to conduct themselves in a manner that will not disturb his neighbors' peaceful enjoyment of the premises.

E. Product Standards

I. Overview

The federal government is primarily responsible for setting standards for products in commerce that may impact health and safety. These standards reduce the dangers posed by these products by banning their use in housing, requiring safer designs, or specifying label requirements.

EPA regulates pesticides and does not allow them to be sold or used with prior approval. The Consumer Product Safety Commission (CPSC) regulates most other consumer products related to housing but requires only compliance with general requirements. In response to specific problems, CPSC adopts specific standards to address the problem such as banning lead containing paint. HUD sets standards for formaldehyde in wood in manufactured housing. The HUD label has been widely used as a voluntary standard beyond manufactured housing.

II. EPA Pesticide Registration

The U.S. Environmental Protection Agency sets product standards for pesticides.[13] A pesticide is broadly defined as any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest. Pests are living organisms that occur where they are not wanted or that cause damage to crops or humans or other animals. Therefore, a pesticide includes herbicides, insecticides, and fungicides. Products which contain certain low-risk ingredients, such as garlic and mint oil, have been exempted from Federal registration requirements, although State regulatory requirements may still apply.

No pesticide can be sold without first being registered by EPA pursuant to the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). For a pesticide to be registered, EPA must affirmatively determine that the product does not pose an unreasonable risk to human health and the environment when used consistent with the label. The label becomes the law that must be followed when used the pesticide. Anyone, even a consumer, who does not follow the product label are violating the law.

Through the registration process, EPA can restrict the sale or use of a pesticide including its use in housing. It can require that only licensed pest control operators use the pesticides by classifying it as a "restricted use" pesticide. During the past few years, EPA has removed once common pesticides such as chlorpyrifos[14] and diazinon[15] from consumer use and restricted access to the products.

In May 2008, EPA took the unusual step of limiting the use and sale of rodenticides because of pervasive misuse.[16] More than 3000 children required treatment for accidental exposure to a type of rodenticide that acts as an anticoagulant in mammals. These second generation anticoagulants kill rodents with just one feeding and persist in body tissues. EPA required that all rodenticide bait products be sold to consumers only in tamper resistant bait stations. Loose bait such as pellets would be prohibited.

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[13] See www.epa.gov/pesticides.
[14] See www.epa.gov/pesticides/reregistration/REDs/factsheets/chlorpyrifos_fs.htm
[15] See www.epa.gov/pesticides/reregistration/diazinon/
[16] See www.epa.gov/opp00001/reregistration/rodenticides/

See www.epa.gov/pesticides for more information.

III. CPSC Hazardous Substances Laws

The Consumer Product Safety Commission sets product standards pursuant to the Consumer Product Safety Act and the Federal Hazardous Substance Act.[17] The CPSC has adopted mandatory products standards for the following items related to housing, furniture, and appliances:

- Safety standard for walk-behind power lawn mowers: 16 CFR Part 1205
- Safety standard for swimming pool slides: 16 CFR Part 1207
- Safety standard for automatic residential garage door operators: 16 CFR Part 1211
- Safety standard for entrapment hazards in bunk beds: 16 CFR Part 1213
- Ban of unstable refuse bins: 16 CFR Part 1301
- Ban of extremely flammable contact adhesives: 16 CFR Part 1302
- Ban of lead-containing paint and certain consumer products bearing lead-containing paint: 16 CFR Part 1303
- Ban of consumer patching compounds containing respirable free-form asbestos: 16 CFR Part 1304
- Ban of artificial emberizing materials (ash and embers) containing respirable free-form asbestos: 16 CFR Part 1305
- Self pressurized consumer products containing chlorofluorocarbons: 16 CFR Part 1401
- CB base station antennas, TV antennas, and supporting structures: 16 CFR Part 1402
- Cellulose insulation: 16 CFR Part 1404
- Coal and wood burning appliances--notification of performance and technical data: 16 CFR Part 1406
- Requirements for full-size baby cribs: 16 CFR Part 1508
- Requirements for non-full-size baby cribs: 16 CFR Part 1509
- Requirements for bunk beds: 16 CFR Part 1513
- Standard for the flammability of vinyl plastic film 16 CFR Part 1611
- Standard for the surface flammability of carpets and rugs (FF 1-70) 16 CFR Part 1631
- Standard for the surface flammability of small carpets and rugs (FF 2-70) 16 CFR Part 1631
- Standard for the flammability of mattresses and mattress pads (FF 4-72, amended) 16 CFR Part 1632
- Standard for the flammability (open flame) of mattress sets (Eff. 7-1-07) 16 CFR Part 1633
- Standard for devices to permit the opening of household refrigerator doors from the inside16 CFR Part 1750

For a complete list sorted by product, go to www.cpsc.gov/businfo/reg1.html.

It also requires labeling of products and bans products containing hazardous substances if they could injure a child.

See www.cpsc.gov for more information.

[17] See www.cpsc.gov.

F. Hazard Management Laws

The U.S. Environmental Protection Agency (EPA) has promulgated regulations to govern asbestos, lead-based paint (LBP), and pesticide use (as well as manufacture and sale). EPA also possesses, but has not exercised, rulemaking authority for radon.

I. Asbestos National Emission Standards for Hazardous Air Pollutants (NESHAP)[18]

The asbestos NESHAP[19] applies to residential buildings with more than four dwelling units (and to other buildings), and imposes requirements for handling Regulated Asbestos-Containing Material (RACM) during demolition and renovation projects. RACM includes *friable* asbestos material; and *non*-friable material that has, or likely will become, friable (*e.g.*, will be subject to sanding or grinding, or likely will be crumbled or pulverized).

The NESHAP requires that:

- Prior to demolition or renovation, a certified inspector must inspect all affected areas; and EPA must be notified ten (10) days prior to the start of work for:
  - any "demolition" (*i.e.*, removal of load bearing member or structure), *even if asbestos may not be present*, and
  - any "renovation" that involves removal or disturbance of >260 linear feet or 160 ft^2 of RACM.
- Certified workers remove all RACM, a certified supervisor be present, and required work practices be followed (*e.g.*, wet methods, and no visible emissions).
- The collection, transport, and disposal of waste comport with regulatory requirements.

II. Lead-based Paint (LBP)

The federal government has several legal authorities pertaining to LBP and LBP hazards:

- The Disclosure Rule[20,21];
- The Lead Safe Housing Rule (LSH Rule)[22];
- The Toxic Substances Control Act (TSCA), and regulations thereunder:
  - The Pre-renovation Education Rule (PRE Rule);
  - The Renovation, Repair and Painting Rule (RRP Rule) (issued by EPA on April 22, 2008 and fully effective on April 22, 2010); and
  - The Lead-based Paint Activities, Certification and Training Rule (LBP Activities Rule);[23] and
- The Resource Conservation and Recovery Act (RCRA) Section 7003.[24]

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[18] *NESHAP Fact Sheet for Renovation and Demolition Projects*. http://yosemite.epa.gov/R10/OWCM.NSF/webpage/Asbestos+in+Demolition+and+Renovation.
[19] 40 C.F.R. Part 61, Subpart M.
[20] 24 C.F.R. Part 35, Subpart A (HUD) and 40 C.F.R. Part 745, Subpart F (EPA).
[21] 42 U.S.C. §§ 4851-4853a (known also as the Residential Lead-based Paint Hazard Reduction Act of 1992).
[22] 24 C.F.R. Part 35, Subparts B-R. The U.S. Department of Housing and Urban Development (HUD) administers and enforces the LSH Rule.
[23] 15 U.S.C. §§ 2601-2692; 40 C.F.R. Part 745, Subparts E and L.
[24] 42 U.S.C. § 6973.

Generally, these laws establish disclosure obligations, and performance standards for activities that disturb LBP – but do *not* impose an affirmative obligation to perform LBP risk reduction work and do *not* empower federal authorities to demand such work. There are two exceptions:

- The LSH Rule applies to federally owned or assisted pre-1978 housing (approximately 3 percent of pre-1978 housing). The rule requires disclosure, and various evaluation and risk reduction measures based upon the classification of the housing, as determined by the level of federal assistance, age of housing, ownership, and other factors.
- RCRA Section 7003 empowers EPA to order a responsible person to take action "as may be necessary" to protect human health and the environment when a "solid waste," including a LBP hazard, presents an "imminent and substantial endangerment."

See Part G for more information on EPA's Renovation, Repair and Painting Rule.

III. Pesticide Use

Integrated Pest Management (IPM)[25]

EPA promotes the use of IPM in residential settings, through outreach and education, and its Pesticide Environmental Stewardship Program (PESP). [26]

IPM is a *series* of pest management evaluations, decisions and controls, generally using a four-tiered approach in the following sequence:

- Set Action Thresholds, *i.e.*, decide the point at which pest populations or environmental conditions indicate that pest control action is required;
- Monitor and Identify Pests, *i.e.*, ensure that pesticides are really needed, and that the correct pesticide will be used;
- Prevention, *i.e.*, manage the indoor space to prevent pests from becoming a threat; and
- Control, *i.e.*, use less risky pest controls first (*e.g.*, highly targeted chemicals, such as pheromones) or mechanical control (*e.g.*, trapping); use additional methods if necessary (*e.g.*,, targeted spraying); use broadcast spraying of non-specific pesticides as a last resort.

Pesticide Labeling[27]

Pesticide labels constitute the law concerning the proper use of a pesticide. Failure to use a pesticide by a professional or by a consumer in accordance with the label requirements and prohibitions is a violation of the law and may be grounds for an enforcement action. To promote proper pesticide use by consumers, EPA employs outreach and education, and voluntary programs.[28]

The "Directions for Use" section of a label reflects EPA's "determination that the use of the product in such a manner does not cause unreasonable adverse effects on the environment." (Other sections explain the ingredients, effects, and other facts.) Generally, the Directions for Use section states the:

- Pest(s) the product may be used to control,
- Sites where the product may be used;

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[25] *Integrated Pest Management (IPM) Principles*. www.epa.gov/pesticides/factsheets/ipm.htm
[26] *See* www.epa.gov/pesp.
[27] *See Label Review Manual*, Directions for Use. www.epa.gov/oppfead1/labeling/lrm/chap-11.htm
[28] *See e.g., Read the Label First* and *Consumer Labeling Initiative*. www.epa.gov/pesticides/label/index.html.

- Required or preferred application methods, and prohibited methods;
- Proper application of the pesticide and the rate of application;
- Restrictions on use for factors such as weather, season, contamination of sensitive areas;
- Limits on how often the pesticide should or may be applied;
- Maximum applicable rates; and
- Any other requirements as necessary

IV. Radon[29]

The 1988 Indoor Radon Abatement Act (IRAA)[30] established the national goal that air within buildings in the U.S. "should be as free of radon as the ambient air outside." IRAA does not explicitly *require* EPA to promulgate regulations, but Section 310 *authorizes* EPA to issue "regulations as may be necessary" to carry out the statute. IRAA also authorizes EPA to provide grants to states to support testing and reducing radon in homes.

EPA relies on voluntary programs to promote radon awareness, testing, and reduction. The program sets an "Action Level" of 4 picocuries per liter (pCi/l) of air for indoor radon. This level "is *not* the maximum safe level for radon in the home" but, rather, is the point at which EPA has deemed the cost to the homeowner to fix the problem is warranted by the risk. EPA works with homeowners, home builders, building code organizations, and others to promote awareness, make new homes more radon resistant, and encourage radon testing when existing homes are sold.

In June 2008, EPA's Inspector General (IG) announced that radon exposure has increased since 1988, and that EPA's voluntary program has not achieved the IRAA's national goal.[31] The IG recommended that EPA:

- "Develop a strategy" for achieving IRAA's goal using the rulemaking authority of section 310 – or "explain its alternative strategy";
- "Identify limitations" in its statutory authority, and report these to Congress;
- Provide "metrics that will better measure the magnitude of the potential radon problem in relation to the number of homes at risk"; and
- Revise how EPA reports Indoor Radon Program results in its accountability reports.

[29] Source: www.epa.gov/radiation/radionuclides/radon.html#epadoing
[30] Title III of the Toxic Substances Control Act, 15 U.S.C. §§ 2661-2671.
[31] EPA Office of the Inspector General, *More Action Needed to Protect Public from Indoor Radon Risks*. www.epa.gov/oig/

G. EPA's New Renovation, Repair, and Painting Rule

When is Compliance with the EPA Renovation, Repair, and Painting Rule Required?

Scope of Rule: Renovation, repair, and painting activities on *target housing* or any *child-occupied facility* built before 1978 performed for compensation after April 22, 2010. *Renovation* is any modification of any existing structure or portion of an existing structure that results in disturbance of painted surfaces.

☐ **Target Housing:** Housing constructed prior to 1978, except:
- Housing for the elderly or persons with disabilities (unless one or more children less than six years of age resides, spends significant amount of time, or is expected to reside in such housing for the elderly or persons with disabilities); or
- Any zero-bedroom dwelling.

☐ **Child-Occupied Facility:** Building, or portion of a building, constructed prior to 1978, visited regularly by the same child, under six years of age, on at least two different days within any week (Sunday through Saturday period), provided that each day's visit lasts at least three hours and the combined weekly visits last at least six hours; and that the combined annual visits last at least 60 hours. It also encompasses:
- Only those common areas that are routinely used by children under age 6, such as restrooms and cafeterias, not simply passed through.
- Exteriors sides of the building immediately adjacent to the child-occupied facility or the common areas routinely used by children under age six.

Activities that are exempt from compliance with the requirements:

☐ **Abatement**: Activities conducted under abatement rules by certified abatement contractor. Abatement involves work where the *primary intent* of the job is to remove lead hazards.

☐ **Minor Repair or Maintenance Activities:** Activities that will disturb less than the following square feet of paint surfaces in 30 calendar days (counting all paint on a removed component):
- 6 square feet per room for interior activities; or
- 20 square feet for exterior activities.

However, this exemption does *not* apply to the following:
- Window replacement.
- Demolition of painted surface areas.
- Using any of the following:
  - Open-flame burning or torching;
  - Machines to remove paint through high-speed operation without HEPA exhaust control; or
  - Operating a heat gun at temperatures at or above 1100 degrees Fahrenheit.

☐ **No Lead-Based Paint Will Be Disturbed:** If one of the following methods is used to determine that the paint on the component to be disturbed was <u>not</u> lead-based paint:
- Written determination by certified lead inspector or risk assessor; or
- Paint chip sampling by a certified renovator (unless specifically excluded by State regulation); or
- Proper use of EPA-recognized test kit by certified renovator (unless specifically excluded by State regulation). There are currently three test kits approved by the EPA for use (one of which is only permitted for use in Massachusetts).

G. EPA's New Renovation, Repair, and Painting Rule

Note that when either of the last two methods is utilized, the person contracting for renovation and tenant, when applicable, must be informed of the following by certified renovator within 30 days after renovation complete, or delivery of invoice. This information must be provided to both parties free of charge.

- Manufacturer and model of test kit
- Description of component tested, including location
- Results of testing
- Laboratory where samples were sent for analysis (paint chip sampling only)
- Dimensions of sample area (paint chip sampling only)

☐ **Do-It-Yourself:** Work performed by owners themselves in dwellings in which they personally reside.

EPA's RRP RULE DOES NOT PREEMPT OTHER RULES INCLUDING HUD, STATE, AND LOCAL REQUIREMENTS

☐ **Twelve states have been authorized to administer and enforce the provisions of the RRP rule.** The authorized states are Alabama, Georgia, Iowa, Kansas, Massachusetts, Mississippi, North Carolina, Oregon, Rhode Island, Utah, Washington, and Wisconsin. These states may have additional restrictions and requirements under their own RRP Legislation. For more information visit the following websites:

- Alabama: www.adph.org/lead/
- Georgia: www.gaepd.org/Documents/lpb_leadpaint.html#lbprtg
- Iowa: http://idph.iowa.gov/lpp
- Kansas: www.kshealthyhomes.org/lead_regulations.htm
- Massachusetts: www.mass.gov/lwd/labor-standards/lead-program/
- Mississippi: www.deq.state.ms.us/MDEQ.nsf/page/Air_Lead-BasedPaint
- North Carolina: http://epi.publichealth.nc.gov/lead/lhmp.html
- Oregon: public.health.oregon.gov/Pages/Home.aspx
- Rhode Island: www.health.ri.gov/healthrisks/poisoning/lead/index.php
- Utah: www.airquality.utah.gov/HAPs/lead/index.htm
- Washington: http://www.commerce.wa.gov/
- Wisconsin: www.dhs.wisconsin.gov/lead/

☐ **A few states have laws pre-dating the RRP Rule and therefore have additional training requirements.** These states include New Jersey, Illinois, Ohio, and California.

☐ **The RRP Rule requires certain documentation to be completed, filed, and in some cases presented to the client.** The following documents must be kept for three years after the completion of the job:

- Proof of pre-renovation education
- Non-certified renovator training and skills reviewed
- EPA test kit and/or paint chip sampling documentation
- Post renovation report

- Certificates for both the renovator assigned to the job and the commissioned firm (which must be kept at the work site during renovation activities)

Limits on Scope of Rule:

☐ **Emergency Renovations Not Due to Elevated Blood Level:** Exempt from information distribution, warning signs, containment, waste handling, training, and certification requirements to extent necessary to respond to emergency. However, cleaning requirements, cleaning verification, and recordkeeping are still required. The nature of the emergency must be documented in the post renovation report. An emergency renovation is one that:

- Is a sudden, unexpected event, and,+
- If not immediately attended to:
  - Presents a safety or public health hazard; or
  - Threatens equipment and/or property with significant damage.

☐ **Emergency Renovations in Response to Elevated Blood Lead in Resident Child:** Interim controls are exempt from advance information distribution requirements.

Milestones in EPA's Renovation, Repair, and Painting Rule

Deadlines	Training Firms	Renovation Firms	Certified Renovators (Individuals)	*Renovate Right* pamphlet	EPA-Recognized Test Kits
6/21/2008			Stop claims of training for EPA certification as renovator or dust sampling technician without accreditation.		EPA recognizes negative tests.
12/22/2008				New *Renovate Right* pamphlet must be used.	
4/22/2009	May apply for EPA accreditation.				
10/22/2009		May apply for EPA certification.			
4/22/2010	**Compliance with Work Practices Required; training and certification not required.**				
7/6/2010			Opt-out rule removed for all non-authorized states and those authorized states that adopt the rule by reference.		
10/4/2011	Changes in training requirements listed.		Paint chip sampling permitted for Certified Renovator; requirements for vertical containment listed.	Page 10 of pamphlet changed, explaining option for dust clearance testing.	
Possible Future Revisions			RRP for commercial units.		

G. EPA's New Renovation, Repair, and Painting Rule

Advance Information Distribution Requirements
40 CFR 745.84

	Inside Dwelling Units in Target Housing	In Common Areas of Multi-Unit Target Housing	In Child-Occupied Facilities (including in target housing)
When to Notify?	No more than 60 days before beginning work (7 days if mailing).		
What to Deliver?	EPA Pamphlet[1]	Either: 1. Written notice to each affected unit;[4] or 2. Post informational signs[6] and EPA Pamphlet.[1,5].	EPA Pamphlet[1]
Documentation of Delivery to Owner	Owner's signature on acknowledgment[2] or certificate of mailing.		
Documentation of Delivery to Adult Occupant	Same as above (for owner) or certify in writing that attempt made but was unsuccessful.[3]	*See Additional Documentation Below.*	If facility is not owner, then same as above or certify in writing that attempt made but was unsuccessful.[3]
Notice to Parents or Guardians	*No additional notice required.*	*No additional notice required.*	Provide EPA pamphlet and renovation information to parents and guardians by either: 1. Mail; 2. Hand delivery; or 3. Post informational signs[6] and EPA Pamphlet.[1,5]
Notice of Changes to Scope, Locations and Dates of Work	*None Required*	If notice given to each affected unit, update notice before initiating work.	*None required*
Additional Documentation	*None Required*	Signed and dated statement of steps performed to notify all occupants and provide them with EPA pamphlet.	Signed and dated statement of steps performed to notify parents and guardians and provide them with EPA pamphlet.
Post-Renovation 30-Day Notice to Person Contracting for Renovation.	☐ If EPA-recognized test kits were used, provide manufacturer and model of test kit used, description and location of components tested, and test kit results. ☐ If dust clearance sampling is performed in lieu of cleaning verification, provide copy of the dust sampling report.		

[1] EPA's new *Renovate Right: Important Lead Hazard Information for Families, Child Care Providers, and Schools*. The existing *Protect Your Family from Lead in Your Home* pamphlet may be used before 12/22/2008.
[2] Must acknowledge receipt of the EPA pamphlet prior to start of renovation and contain the address of unit undergoing renovation, name and signature of owner or occupant, and the date of signature. It must be in same language as contract for renovation for owner and for lease for occupant of non-owner occupied target housing.
[3] Certification requires address of unit, date and method of delivery, names of person making delivery, reason for acknowledgement, signature of certified renovator; and date of signature.
[4] Notice must describe the general nature and locations of the planned renovation activities, the expected starting and completion dates, and a statement of how occupant can get pamphlet at no charge from renovation firm.
[5] If pamphlet is not posted, then provide information on how interested occupants can review a copy of the pamphlet or obtain a copy from renovation firm at no cost.
[6] Signs must describe general nature and locations of the renovation and the anticipated completion date.

G. EPA's New Renovation, Repair, and Painting Rule

Required Work Practices for Renovations
40 CFR 745.85

	Interior Renovations	Exterior Renovations
Information Distribution 40 CFR 745.84	*See Previous Table*	
Work Area Identification	Physical area that the Certified Renovator establishes to contain the dust and debris generated by renovation.	
Occupant Protection		
☐Where to post signs?	Entrance way to the room(s) where renovation is occurring.	Perimeter of work area.
☐What to say on signs?	Warn occupants and others not involved in renovation to remain outside the work area. OSHA Lead Warning Sign is acceptable.	
☐What language?	Primary language of occupants to extent practicable.	
☐When to post signs?	Before beginning renovation until after post-renovation cleaning verification is completed or results from clearance testing have been received..	
Containing the Work Area		
☐Isolate work area.	Take steps necessary to ensure no dust or debris leaves work area while renovation is under way.	
☐Maintain integrity of containment.	Ensure plastic and other impermeable materials are not torn or displaced.	
☐Emergency exit	Ensure containment installed so that it does not interfere with occupant and worker egress in an emergency.	
Preparing the Work Area		
☐Objects in Work Area	Remove or cover with impermeable material with all seams and edges sealed.	*Not Required*
☐Ducts Opening in Work Area	Close and cover all ducts with impermeable material.	*Not Required*
☐Windows and Doors in Work Area	Close windows and doors. Cover doors with impermeable material.	Close doors and windows within 20', and, on multi-story buildings, all below renovation.
☐Access Doors	If door is used while job is being performed, allow workers to pass through while confining dust and debris to work area.	
☐Floors / Ground	Cover with taped-down impermeable material 6' beyond the perimeter of surfaces undergoing renovation or a sufficient distance to contain the dust, whichever is greater.	Cover with disposable impermeable material extending 10' beyond perimeter of surfaces undergoing renovation or a sufficient distance to collect falling paint debris, whichever is greater, unless the property line prevents 10' of such ground covering.
☐Vertical Containment	May be used to decrease the distance of horizontal containment.	Required whenever renovation activites are within 10' of neighboring property line.
☐Tools	Ensure all personnel, tools, waste containers, and other items are free of dust and debris before leaving the work area.	
Prohibited and Restricted Work Practices	The following must not be used in the work area: ☐ Open-flame burning or torching; ☐ Machines to remove paint through high-speed operation without HEPA exhaust control; or ☐ Operating a heat gun at temperatures at or above 1100 degrees Fahrenheit.	
Waste from Renovations		
☐During Work	Contain waste to prevent release of dust and debris before the waste is removed from the work area for storage or disposal. If a chute is used to remove waste from work area, it must be covered.	
☐End of Day and End of Work	Collected waste must be stored under containment, in an enclosure, or behind a barrier that prevents release of dust and debris out of work area and prevents access to dust and debris.	
☐Transporting Waste	Contain waste to prevent release of dust and debris.	

G. EPA's New Renovation, Repair, and Painting Rule

Required Work Practices for Renovations

40 CFR 745.85

	Interior Renovations	Exterior Renovations
Cleaning the Work Area		
☐Paint Chips and Debris	Collect and, without dispersing any of it, seal this material in a heavy-duty bag.	
☐Plastic Sheeting	Leave sheeting to isolate contaminated rooms in place under after cleaning and removal of other sheeting. Mist protective sheeting before folding it. Fold the dirty side inward. Tape shut to seal or seal in heavy-duty bags.	
☐General	Clean all objects and surfaces in work area and 2' outside work area cleaning from higher to lower	
☐Walls	Use HEPA vacuum[1] or wipe with a damp cloth	
☐Carpets and Rugs	Thoroughly vacuum with a HEPA vacuum[1] equipped with a beater bar.	
☐Remaining Surfaces	Thoroughly vacuum remaining surfaces and objects with a HEPA vacuum.[1]	
☐Final Cleaning – Other Than Floors	Wipe remaining surfaces and objects, except for carpeted or upholstered surfaces, with a damp cloth.	
☐Final Cleaning – Uncarpeted Floors	Mop floors thoroughly using a mopping method that keeps wash water separate from the rinse water or using a wet mopping system.[2]	
Post Cleaning Verification	*See Next Table*	

[1] "HEPA vacuum" is a vacuum cleaner designed with a high-efficiency particulate (HEPA) filter as the last filtration stage. A HEPA filter is capable of capturing particles of 0.3 microns with 99.97% efficiency. The vacuum cleaner must be designed so that all the air drawn into the machine is expelled through the HEPA filter with none of the air leaking past it.

[2] "Wet mopping system" means a device with the following: a long-handle, a mop head designed to be used with disposable absorbent cleaning pads, a reservoir for cleaning solution, and a built-in mechanism for distributing or spraying the cleaning solution onto a floor, or a method of equivalent efficacy.

Post-Renovation Cleaning Verification
40 CFR 745.85(b)

Activities	Windowsills	Uncarpeted Floors and Countertops in Work Area
Dust clearance testing is an option if contract or other rules require it.	*Optional.*	
Certified Renovator must personally perform all cleaning verification except recleaning.[1]	Required.	
Step 1: Visually inspect work area for dust, debris, and residue.		
Step 2: If failed visual, have it recleaned.[1]		
Step 3: Wipe with wet disposable cleaning cloth.[2]	Required. Cloth must be damp to touch. One cloth per window sill.	Required. Cloth must be damp when used. One cloth per 40 square feet.
Step 4: Compare to cleaning verification card.[3] Passes if lighter than card.	Required.	
Step 5: If failed, have it recleaned.[1]	Required if failed first wipe.	
Step 6: Wipe surface again with new wet disposable cleaning cloth.[2]	Required if failed first wipe. Can use clean surface of used wipe.	Required if failed first wipe.
Step 7: Compare to card. Passes if lighter than card.	Required if failed first wipe.	
Step 8: If failed, wait one hour or until dried completely whichever is longer.	Required if failed second wipe.	
Step 9: Wipe with dry, disposable cleaning cloth.[4]	Required if failed second wipe. Passes even if darker than card.	
Notice to owner or occupant.	Results must be recorded in post renovation report.	

[1] *Recleaning* means:
a. Thoroughly vacuum surfaces and objects in the work area with a HEPA vacuum. HEPA vacuum must have a beater bar when vacuuming carpets and rugs.
b. Wipe all remaining surfaces and objects in the work area, except for carpeted or upholstered surfaces, with a damp cloth.
c. Mop uncarpeted floors thoroughly using a mopping method that keeps wash water separate from the rinse water or using a wet mopping system (using disposable absorbent cleaning pads).

[2] *Wet disposable cleaning cloth* means a commercially available, premoistened, white disposable cloth designed to be used for cleaning hard surfaces.

[3] *Cleaning verification card* means a card developed and distributed or otherwise approved by EPA for the purposes of determining whether post-renovation cleaning has been properly completed.

[4] *Dry disposable cleaning cloth* means a commercially-available, dry, electrostatically-charged, white disposable cloth designed to be used for cleaning hard surfaces.

G. EPA's New Renovation, Repair, and Painting Rule

Recordkeeping and Reporting Requirements
(40 CFR 745.86)

Firms performing renovations must retain and, if requested, make available to EPA all records necessary to demonstrate compliance with this subpart for a period of three years following completion of the renovation. This three-year retention requirement does not supersede longer obligations required by other provisions for retaining the same documentation, including any applicable State or Tribal laws or regulations.

Records that must be retained shall include (where applicable):

1. **Exemptions**:
   a. Reports certifying that a determination had been made by a lead inspector or risk assessor that lead-based paint is not present on the components affected by the renovation, as described in § 745.82(b)(1).
   b. Any signed and dated statements received from owner-occupants documenting that the requirements of § 745.85 do not apply. These statements must include a declaration that the renovation will occur in the owner's residence, a declaration that no children under age six reside there, a declaration that no pregnant woman resides there, a declaration that the housing is not a child-occupied facility, the address of the unit undergoing renovation, the owner's name, an acknowledgment by the owner that the work practices to be used during the renovation will not necessarily include all of the lead-safe work practices contained in EPA's Renovation, Repair, and Painting rule, the signature of the owner, and the date of signature. These statements must be written in the same language as the text of the renovation contract, if any. (This applies to work performed between 4/22/2010 and 7/6/2010 only).

2. **Information Distribution:**
   a. Signed and dated acknowledgments of receipt as described in § 745.84(a)(1)(i), (a)(2)(i), (b)(1)(i), (c)(1)(i)(A), and (c)(1)(ii)(A);
   b. Certifications of attempted delivery as described in § 745.84(a)(2)(i) and (c)(1)(ii)(A);
   c. Certificates of mailing as described in § 745.84(a)(1)(ii), (a)(2)(ii), (b)(1)(ii), (c)(1)(i)(B), and (c)(1)(ii)(B); and
   d. Records of notification activities performed regarding common area renovations, as described in § 745.84(b)(3) and (4), and renovations child-occupied facilities, as described in § 745.84(c)(2).

3. **Certified Renovator:** Documentation of compliance with the requirements of § 745.85, including documentation that certified renovator:
   a. Was assigned to the project;
   b. Provided on-the-job training for workers used on the project;
   c. Performed or directed workers who performed all of the tasks described in § 745.85(a);
   d. Performed the post-renovation cleaning verification described in § 745.85(b); and
   e. Carries or has on premises the certified renovator's training certificate.

4. **Work Practices:** Certification by the certified renovator assigned to the project that:
   a. Training was provided to workers (topics must be identified for each worker);
   b. Warning signs were posted at the entrances to the work area;

c. If test kits were used, that the specified brand of kits was used at the specified locations and that the results were as specified;
d. If paint chip samples were collected, the samples were sent to a NLLAP-accredited laboratory, and that the name of laboratory and specified locations/dimensions of samples and results were as recorded;
e. The work area was contained by:
   1. Removing or covering all objects in the work area (interiors);
   2. Closing and covering all HVAC ducts in the work area (interiors).
   3. Closing all windows in the work area (interiors) or closing all windows in and within 20 feet of the work area (exteriors).
   4. Closing and sealing all doors in the work area (interiors) or closing and sealing all doors in and within 20 feet of the work area (exteriors).
   5. Covering doors in the work area that were being used to allow passage but prevent spread of dust.
   6. Covering the floor surface, including installed carpet, with taped-down plastic sheeting or other impermeable material in the work area six feet beyond the perimeter of surfaces undergoing renovation or a sufficient distance to contain the dust, whichever is greater (interiors); or covering the ground with plastic sheeting or other disposable impermeable material anchored to the building extending 10 feet beyond the perimeter of surfaces undergoing renovation or a sufficient distance to collect falling paint debris, whichever is greater, unless the property line prevents 10 feet of such ground covering, weighted by heavy objects (exteriors).
   7. Installing vertical containment if renovation work is performed within 10' of neighboring property line, or if work area is less than required amount.
f. Waste was contained onsite and while being transported offsite.
g. The work area was properly cleaned after the renovation by:
   1. Picking up all chips and debris, misting protective sheeting, folding it dirty side inward, and taping it for removal.
   2. Cleaning the work area surfaces and objects using a HEPA vacuum and/or wet cloths or mops (interiors).
h. The certified renovator performed the post-renovation cleaning verification (the results of which must be briefly described, including the number of wet and dry cloths used).

5. **Emergency Renovations:** If the renovation firm was unable to comply with all of the requirements of this rule due to an emergency as defined in § 745.82, the firm must document the nature of the emergency and the provisions of the rule that were *not* followed.

U.S. Department of Housing and Urban Development
Office of Public and Indian Housing

SPECIAL ATTENTION OF:
Regional Directors; State and Area Coordinators; Public Housing Hub Directors; Program Center Coordinators; Troubled Agency Recovery Center Directors; Special Applications Center Director; Administrators; Offices of Native American Programs; Public Housing Agencies; Public Housing; Housing Choice Voucher/Section 8; Tribally Designated Housing Entities; Indian Tribes; Resident Management Corporations

NOTICE: PIH-2011-22

Issued: April 26, 2011

Cross Reference:
24 CFR 903.7(e) (2)
24 CFR 990.165
7 U.S.C. 136r-1 Integrated Pest Management

This Notice Supersedes
PIH Notice 2009-15, PIH Notice 2008-24, PIH Notice 2007-12

Subject: Promotion of Integrated Pest Management (IPM) as an environmentally-sound, economical and effective means to address a major resident concern.

1. **Purpose.** The purpose of this Notice is to promote and encourage the use of IPM by Public Housing Authorities (PHAs), Indian tribes, Tribal Designated Housing Entities (TDHEs), and owner/agents providing assistance through the HCV program. This notice provides guidance to Public Housing Authorities (PHAs) on the benefits of IPM, additional technical assistance and training opportunities for PHAs. Pest management is integral to the provision of safe and sanitary housing. In accordance with 24 CFR 903.7 (e) (2), PHAs must include in their PHA plans a description of any measures necessary for the prevention or eradication of pest infestations. IPM is an ecological approach using an array of methods to prevent and control pests with reduced reliance on pesticides. Procedures contained within this notice remain in effect until superseded by subsequent HUD Directive or guidance.

2. **Applicability.** This notice applies to PHAs administering the public housing and project based Section 8 program, and may be of interest to Indian tribes/TDHEs as well as owners/agents providing assisted housing through the Housing Choice Voucher (HCV) Program. The decision to use IPM techniques in their ongoing pest control effort is under PHA, Indian tribes/TDHE discretion. 24 CFR 990.165(a) covers cost associated with Project Expense Level (PEL) such as maintenance expenses. IPM is a maintenance expense.

3. **Background.** The goal of IPM as defined by the Environmental Protection Agency (EPA) is to control pests by the most economical long term means, and with the least possible hazard to people, property, and the environment. To undertake IPM, project managers should be committed to ongoing or continuous monitoring and record keeping, educational outreach to residents and staff as well as implementing good communication strategies between residents and building managers. IPM methods include: restricted pest access to

food/water; vigilant sanitation and waste management; mechanical control; physical barriers; structural maintenance; and, where necessary, the judicious use of pesticides.

4. **Fundamentals of IPM.** IPM efforts must involve PHA staff, contractors, residents, and include:

    a. Communicating the PHA's IPM policies and procedures to be provided in the appropriate format to meet the needs of all residents including persons with limited English proficiency and in formats that may be needed for persons who are visually or hearing impaired. This applies to administrative staff, maintenance personnel, and contractors as well.
    b. Identifying the environmental conditions that lead to pests and educating residents.
    c. Identifying pests and immediately reporting the presence of pests.
    d. Establishing an ongoing monitoring and record keeping system for regular sampling and assessment of pests, surveillance techniques, and remedial actions taken, include establishing the assessment criteria for program effectiveness. This is a highly effective preventative measure that can help reduce the possibility of a pest infestation outbreak.
    e. Determining, with the involvement of residents, the pest population levels – by species – that will be tolerated, and setting thresholds at which pest populations warrant action.
    f. Improving waste management and pest management methods.
    g. Selecting the appropriate pesticides and insecticides to use. Some residents may suffer from Multiple Chemical Sensitivity or other Environmental Illnesses.
    h. Ongoing efforts to monitor and maintain structures and grounds (e.g., sealing cracks, eliminating moisture intrusion/accumulation) and adding physical barriers to pest entry and movement.
    i. Developing an outreach/educational program to ensure that leases reflect residents' responsibilities for: (1) proper housekeeping, which includes sanitation upkeep and the reduction of clutter, trash removal and storage, (2) immediately reporting the presence of pests, leaks, and mold, (3) cooperating with PHA specific IPM requirements such as obtaining permission of PHA management before purchasing or applying any pesticides, and (4) avoiding introduction of bed bugs and other pests into buildings on used mattresses and other recycled furniture. See "Preventing and Getting Rid of Bed Bugs Safely," New York City Department of Health and Mental Hygiene https://www1.nyc.gov/assets/doh/downloads/pdf/vector/bed-bug-guide.pdf
    j. Check with local health department to determine if your state has laws for re-used furnishings.
    k. The judicious use of pesticides when necessary, with preference for products that, while producing the desired level of effectiveness, pose the least harm to human health and the environment. Residents should notify PHA management before pesticides are applied.
    l. Providing and posting "Pesticide Use Notification" signs or other warnings.

5. **Health Concerns.** Pests may adversely impact the health of residents and contribute to worsening some diseases, such as allergies and asthma. Cockroaches can cause asthma in children and can transfer disease-causing organisms to food and surfaces they contaminate. Rodents, such as mice and rats, carry disease, can trigger asthma attacks and even cause fires by gnawing through electrical wires. Although bed bugs are not known to transmit infectious diseases, their bites can lead to secondary infections. Bed bugs can cause

emotional distress and sleep deprivation for residents as well. Bed bug infestations can spread quickly and must be treated aggressively. All pest control methods are targeted to protecting the health of residents and staff. Although applying pesticides may be effective in eliminating pest populations, many of these chemicals are associated with health and/or environmental risks, and their use should be minimized if alternative methods exist. This is especially important in buildings housing vulnerable age groups such as children or the elderly and in buildings housing residents with compromised immune systems or who may suffer from Multiple Chemical Sensitivity and other environmental illnesses. Therefore, IPM offers the potential to ensure efficacy of pest elimination while protecting the health of residents, staff and the environment.

6. **Building.** Most of the effective methods of pest elimination, including ongoing repairs, erection of barriers, and monitoring, will extend the useful life of a building and as a result generate significant savings that could offset the costs of the pest control. Many of these non-application methods, including structural maintenance, and inspecting for and repairing leaking pipes and cracks in roofs, walls, and windows are effective in preventing moisture intrusion and accumulation. Additionally, IPM-conscious PHAs assess the need to install physical barriers to both pest entry and pest movement within every structure thereby reducing the spread of pest infestations.

7. **Implementation.** HUD promotes IPM as a pest control method. IPM effectively eliminates pests in safer and long term cost-effective ways than traditional pesticide treatments. IPM frequently has proven to be more effective in reducing pest populations than relying solely on broadcast pesticides. The Boston Housing Authority (BHA) experienced approximately one-third reduction in pest related work orders over multiple years in multiple sites. BHA has maintained this reduction and now uses IPM in all its BHA maintained properties. Continuation of the IPM program after initial development cost is considered preventative maintenance expense and is an eligible program activity under the Public Housing Operating Subsidy as codified at 24 CFR 990.165. Successful IPM requires resident participation through proper housekeeping, reporting of pest infestations, and trash removal. Residents can monitor pest populations and assist in identifying how to eliminate access to food and water for pests. Resident organizations must be prepared to assist residents who need help to follow the IPM policy. HUD encourages PHAs to partner with local pest management organizations.

8. **Procurement of IPM Services.** If a PHA uses an outside contractor for pest control, the PHA's pest control/IPM policies and procedures should be incorporated into the specifications or statement of work for the pest management contract. PHAs using an outside contractor are encouraged to use companies that are trained and certified to provide IPM services either through Green Shield certified (http://www.greenshieldcertified.org/) or Green Pro (http://www.whatisgreenpro.org/). The PHA should also consider training for maintenance staff, residents, Resident Councils as well as PHA administrative staff who oversee housing developments or administer occupancy and rental duties such as unit housekeeping inspections.

9. **PHA Maintenance Staff.** If a PHA uses its own maintenance staff for pest management, proper training in the PHA's IPM procedures is essential. It is especially critical to be trained in the proper treatments methods PHAs can use when treating for bed bugs. The contract administrator for any pest management contract should be trained as well. Successful results rely upon proper implementation; training is therefore of critical

importance. IPM training is available at: http://www.stoppests.org/ and http://healthyhousingsolutions.com/training-course/ipm.

10. **Area of High Concern, Bed bugs.** As the number of bed bug infestations rise throughout the country, HUD is in the process of developing protocols to address this growing problem. HUD is addressing the unit inspection process as well as developing the tools necessary for PHAs to identify, treat and monitor the effectiveness of bed bug treatments in its portfolio. Identifying, reporting, treating and monitoring pest infestations are all critical components of IPM and are effective in addressing the bed bug problem.

11. **Reference Materials for Implementing IPM.** The below list of IPM practices does not constitute a HUD endorsement of any specific practice, but provides IPM ideas and practices that have been used to improve pest management while reducing unnecessary dependence on pesticides. HUD encourages PHAs, Indian tribes/TDHEs to share their policies, procedures, resident leases, and written case studies so that these may be published on the HUD website for others to read.

    a. Healthy Housing Solutions, Inc.: http://www.healthyhomestraining.org/ipm
    b. Bed Bugs: "What's Working for Bed Bug Control in Multifamily Housing" http://healthyhousingsolutions.com/wp-content/uploads/2014/12/NCHH_2010-Bed_Bug_Control.pdf http://pestworld.org/pest-world-blog/the-bed-bug-hub-one-stop-shop-for-bed-bug-information
    c. National Pesticide Information Center: http://www.npic.orst.edu/
    d. Integrated Pest Management (IPM), A Guide for Managers and Owners of Affordable Housing, Boston Public Health Commission: http://asthmaregionalcouncil.org/uploads/IPM/asthma_ipm_guide.pdf.
    e. U.S. Environmental Protection Agency:
        i. General IPM information http://www.epa.gov/opp00001/contolling/index.htm housing): http://www.epa.gov/pesticides/ipm
        ii. EPA staff contacts: http://www.epa.gov/pesticides/about/contacts.htm#ipm
        iii. List of EPA IPM publications and instructions for ordering documents: http://www.epa.gov/oppfead1/Publications/catalog/subpage3.htm
    f. Massachusetts Department Agriculture Resources – Building Managers and Landlords: http://www.mass.gov/agr/pesticides/docs/CIB_Building_Managers.pdf
    g. HUD funded "Healthy Public Housing Project" conducted by the Harvard School of Public Health In Boston Public Housing, https://www.hsph.harvard.edu/hphi/
    h. Bed Bug Fact Sheets in English and Spanish produced by Dr. Dini Miller, http://www.vdacs.virginia.gov/pdf/bb-millerbasics.pdf

12. **PHA Case Studies On IPM Application.**
    i. Cuyahoga Housing Authority: http://www.nchh.org/Portals/0/Contents/Case_Study_Cuyahoga_10-20-07.pdf
    ii. Boston Housing Authority: http://www.nchh.org/Portals/0/Contents/Case_Study_Boston_HA_11-13-07.pdf
    iii. New York City Department of Health, Columbia University and the New York City Housing Authority: http://www.beyondpesticides.org/dailynewsblog/?p=1604

13. For further information contact Leroy Ferguson at (202) 402-2411 or email at Leroy.Ferguson@hud.gov or you can contact the nearest HUD Field Office of Public Housing

within your state. Indian tribes and TDHEs should contact the nearest HUD Office of Native American Programs. Locations of these offices are available on HUD's website at http://www.hud.gov.

/s/

Sandra B. Henriquez, Assistant Secretary for
Public and Indian Housing

U.S. Department of Housing and Urban Development
Office of Public and Indian Housing

SPECIAL ATTENTION OF:	NOTICE: PIH-2012-17
Regional Directors; State and Area Coordinators; Public Housing Hub Directors; Program Center Coordinators; Troubled Agency Recovery Center Directors; Special Applications Center Director; Administrators; Offices of Native American Programs; Public Housing Agencies;	Issued: February 28, 2012 Expired: This Notice remains in effect until amended, superseded, or rescinded
Housing; Housing Choice Voucher/Section 8; Tribally Designated Housing Entities; Indian Tribes; Resident Management Corporations	Cross References:

SUBJECT: Guidelines on Bedbug Control and Prevention in Public Housing

I. Purpose

Bedbug infestations have become a serious problem in housing throughout the country. Public Housing properties are not immune to infestations. This Notice provides information and references to best practices regarding the prevention and control of bedbug infestations. It also provides guidance on the rights and responsibilities of HUD, Public Housing Agencies (PHAs) and tenants with regard to bedbug infestations.

II. Background

After a long absence, bedbug infestations are a growing problem in the United States today. According to the United States Environmental Protection Agency (EPA), bedbug populations have increased dramatically. Bedbugs are considered a pest of significant public health importance by the EPA and the Centers for Disease Control and Prevention (CDC). Although the insects are not known to transmit disease, bites may itch and cause an allergic reaction in some people, which may lead to secondary infections. The presence of bedbugs may also contribute to stress or anxiety.

Experts suspect the resurgence is associated with greater international and domestic travel, lack of knowledge regarding the complex measures needed to prevent and control bedbugs, changes in pesticide availability and technology, and increased resistance of bedbugs to available pesticides. Bedbugs are not an indicator of poor sanitation, but excess clutter can provide them more places to hide, making early detection and targeted control

difficult.

HUD has received numerous reports of bedbug infestations in Public Housing properties in various regions. HUD is working closely with other federal agencies to develop and share best practices for preventing and controlling bedbugs.

III. Applicability

This notice applies to PHAs administering the public housing and project based Section 8 program. It may also be of interest to Indian tribes/TDHEs as well as owners/agents providing assisted housing through the Housing Choice Voucher (HCV) Program.

IV. Prevention of Bedbug Infestations

The best approach to bedbug management is to prevent an infestation from occurring in the first place. Federal agencies, such as EPA and HUD, are working in tandem to develop and share recommendations to prevent bedbug infestations.

PHAs are strongly encouraged to develop an Integrated Pest Management (IPM) Plan. Such plans describe the ongoing efforts the property management will take to prevent and respond to pests. For more details on IPM, please see the online guide at http://www.stoppests.org. According to the EPA, principles of IPM for bedbugs include:

- ☐ Raising awareness through education on prevention of bedbugs;
- ☐ Inspecting infested areas, plus surrounding living spaces;
- ☐ Checking for bedbugs in luggage and clothes when returning home from a trip;
- ☐ Looking for bedbugs or signs of infestation on secondhand items before bringing the items home;
- ☐ Correctly identifying the pest;
- ☐ Keeping records – including dates and locations where pests are found;
- ☐ Cleaning all items within a bedbug infested living area;
- ☐ Reducing clutter where bedbugs can hide;
- ☐ Eliminating bedbug habitats;
- ☐ Physically removing bedbugs through cleaning;
- ☐ Using pesticides carefully according to the label directions; and,
- ☐ Following up on inspections and possible treatments.

In addition or as part of an IPM plan, PHAs are strongly encouraged to take the following preventive steps:

- ☐ Provide training for staff to identify bedbugs, and to perform ongoing prevention actions as outlined in the IPM. When a community is at high risk for bedbugs (for example, if the community has experienced prior infestations), periodic building inspections are recommended.

- ☐ Actively engage residents in efforts to prevent bedbugs. Education and involvement of tenants is a critical component of IPM for bedbugs. Bedbugs may often go undetected and unreported and because they are active at night tenants may not be aware of their presence. PHAs may wish to hold workshops for tenants to learn to identify bedbugs, to create unfriendly environments for pests, and to report suspicions of bedbugs as soon as possible.

- ☐ Provide orientation for new tenants and staff, and post signs and handouts regarding bedbug prevention.

More information on bedbug prevention may be found by accessing the following websites:[1]

- ☐ **Healthy Homes Training:** *What's Working for Bedbug Control in Multifamily Housing?: Reconciling best practices with research and the realities of implementation*. http://healthyhousingsolutions.com/wp-content/uploads/2014/12/NCHH_2010-Bed_Bug_Control.pdf

- ☐ **National Pest Management Association Bedbug Hub**: http://pestworld.org/pest-world-blog/the-bed-bug-hub-one-stop-shop-for-bed-bug-information

- ☐ **National Pest Management Association Best Practices Website**: http://www.bedbugbmps.org

- ☐ **Environmental Protection Agency**: http://www.epa.gov/pesticides/bedbugs/

- ☐ **Public Housing Environmental Conservation Clearinghouse (PHECC)** http://www.hud.gov/offices/pih/programs/ph/phecc/pestmang.cfm

V. Addressing Infestations

The PHA should respond with urgency to any tenant report of bedbugs. Within 24 hours of the tenant report, the PHA should make contact with the tenant, provide the tenant with information about control and prevention of bedbugs and discuss measures the tenant may be able to take in the unit before the inspection is performed. However, a bedbug inspection and, if necessary, treatment, may take time to schedule. The PHA should endeavor to take appropriate action within a reasonable time period using the guidelines provided below.

[1] An additional resource for interested parties is the *Bedbug Handbook*. L.J. Pinto, R. Cooper, and S.K. Kraft, *Bedbug Handbook: The Complete Guide to Bedbugs and Their Control* (Mechanicsville, MD: S.K. Pinto & Associates, 2007).

Following a report of bedbugs, the PHA or a qualified third party trained in bedbug detection should inspect the dwelling unit to determine if bedbugs are present. It is critical that inspections be conducted by trained staff or third party professionals. Low level inspections may escape visual detection. For this reason, multiple detection tools are recommended. Recent research indicates that "active" bedbug monitors containing attractants can be effective tools for detecting early infestations. Some licensed pest control applicators use canine detection to verify the presence of bedbugs. The inspection should cover the unit reporting the infestation and no less than surrounding apartments consisting of the units above, below, left and right, and should be completed within three business days of a tenant complaint if possible. If reputable, licensed pest control companies are unattainable within three calendar days, the PHA is required to retain documentation of the efforts to obtain qualified services. If an infestation is suspected but cannot be verified using the methods described above, the PHA should re-inspect the unit(s) periodically over the next several months.

When an infestation is identified, the unit and surrounding units should be treated for bedbugs according to the IPM Plan. Chemical treatments are necessary, but not reliable. Therefore, encasement, interception devices, vacuuming, steaming, freezing and commodity or building heat treatments may be utilized as part of the bedbug control effort. Infestations are rarely controlled in one visit. Effective treatment may require two to three visits, and possibly more. The length, method and extent of the treatment will depend on the severity and complexity of the infestation, and the level of cooperation of the residents.

VI. Additional Considerations

PHAs may offer protective tools to residents to help safeguard properties from infestation and recurrences. For example, the PHA may offer residents bed covers, climb-up interceptors, or other detection or protection devices that may become available. PHAs may voluntarily offer to inspect tenants' furniture before move-in. PHAs may also offer tenants a service of non-chemical treatment of household items upon tenant move-in, non-chemical treatment or inspection of used furniture and/or non-chemical treatment of luggage before it is unpacked when a tenant returns from a trip. Tenants may voluntarily use such services, but PHAs may not require tenants to do so. These services or products are to be offered at the PHAs expense.

A PHA may not deny tenancy to a potential resident on the basis of the tenant having experienced a prior bedbug infestation, nor may give residential preference to any tenant based on a response to a question regarding prior exposure to bedbugs. A PHA may not charge a tenant to cover the cost of bedbug treatment; such costs should be covered by the PHA. HUD reserves the right to approve Lease Addenda. Lease Addenda may not conflict with this Notice.

VII. Tenant Rights and Responsibilities

Tenants are strongly encouraged to immediately report the suspicion of possible bedbugs in a housing unit or other areas of the property. Early reporting allows the pests to be identified and treated before the infestation spreads. Tenants are the first line of defense against bedbug infestations and should be encouraged to create living environments that deter bedbugs. This includes reducing unreasonable amounts of clutter that create hiding places for bedbugs, and regular checking of beds and laundering of linens.

Bedbug infestations can cause health concerns, including physical discomfort and may contribute to stress and anxiety on the part of the residents. Tenants should be advised of the following:

- ☐ A PHA may not deny tenancy to a potential resident on the basis of the tenant having experienced a prior bedbug infestation, nor may an owner give residential preference to any tenant based on a response to a question regarding prior exposure to bedbugs.

- ☐ A tenant reporting bedbugs may expect expeditious response and attention by the PHA, but should be advised that inspection and, if necessary, treatment of bedbugs may take time to schedule. The inspections should occur within three calendar days of the tenant report when possible.

- ☐ Following a report of bedbugs, the PHA or a qualified third party trained in bedbug detection should inspect the dwelling unit to determine if bedbugs are present. It is critical that inspections be conducted by trained staff or third party professionals. The PHA may enter the unit to perform these activities, in accordance with the lease.

- ☐ If bedbug infestation is found in the unit, the tenant may expect treatment to begin within five days of the inspection, though depending on the form of treatment, this may not be possible. Tenants should be advised that treatment may take several weeks.

- ☐ Tenants are expected to cooperate with the treatment efforts by allowing for heat treatment of clothing and furniture and refraining from placement of infested furniture or other items in common areas such as hallways. Tenant cooperation is shown to expedite the control of bedbugs and to prevent spreading of infestations.

- ☐ Management may make staff available to help with moving and cleaning of furniture to accomplish the treatment effort.

- ☐ The tenant will not be expected to contribute to the cost of the treatment effort.

☐ The tenant will not be reimbursed the cost of any additional expense to the household, such as purchase of new furniture, clothing or cleaning services.

VIII. REAC Inspections

Bedbugs should be addressed when reported by staff, tenants or the Real Estate Assessment Center (REAC), regardless of the score of the REAC physical inspection. Inspectors ask the PHA to identify any units and/or buildings that are infested before the inspection begins. When bedbugs are reported or observed, the inspector will record the units and/or buildings affected in the comment section of the Physical Inspection report, noting that bedbugs were reported. The inspector will then select an alternate unit to inspect to replace any unit with observed or reported bedbugs.

REAC sends a "Bedbugs Reported" email to the local PIH field office with a copy to the PIH Regional director when bedbugs are noted in the comments section of a Physical Inspection Report. The PHA will see the information about bedbugs in the comment section of the Physical Inspection Report which provides PHAs with the necessary information to address the situation.

/s/

Sandra B. Henriquez, Assistant Secretary for Public and Indian Housing

Attachment

Prevention and Safe Removal of Bedbugs

Bedbug infestations have become a serious problem in housing throughout the country. Public Housing properties are not immune to infestations, anyone or any home can get bedbugs. Bedbugs live on human and animal blood and typically hide and live in cracks and crevices in dark and undisturbed locations close to their hosts. They can live for long periods of time and although visible to the naked eye, they may be difficult to detect.

Bedbug Prevention Action Plan

- ☐ Inspect in and around sleeping and resting areas at home once a month.
- ☐ Look for signs of bedbug activity, active infestations will have fecal spotting, live or dead bedbugs, shed skins and bedbug eggs.
- ☐ Avoid used furniture and mattresses, especially discarded furniture and mattresses. Used furniture and refurbished mattresses may have bedbugs and bedbug eggs that are difficult to see.
- ☐ Inspect for the signs of bedbugs when traveling away from home. Look for live or dead bedbugs, shed bedbug skins or bedbug eggs and fecal spots on mattresses, clothing or dark cracks and crevices. Wood, metal or plastic furniture, sofas, chairs, tables and many other items may be infested with bedbugs.
- ☐ If contact with an active bedbug infestation is suspected away from home, segregate and isolate in sealed plastic bags any exposed luggage, clothing and personal effects until inspection and decontamination can be completed.
- ☐ Bedbugs prefer to live in cracks and crevices in areas like baseboards, moldings, window/door frames, and cracks/seams in walls and furniture, especially headboards and bed frames and screw holes.
- ☐ Seal baseboards, cracks, crevices, heat, plumbing and electrical services shared between apartments with pest-proofing sealants.
- ☐ Encase mattresses and box springs. Seal box springs in an appropriate zippered encasement to prevent bedbugs hiding inside from escaping; this location is commonly affected in bedbug infestations and yet difficult to inspect.
- ☐ Thoroughly vacuum apartment, furniture and all belongings and use crevice tools and other attachments where feasible. Place the contents of the vacuum in a tightly sealed disposable bag and remove.

EARLY DETECTION IS CRITICAL Early identification and reporting of infestations by residents to building management and neighbors limits the spread of bedbugs. As soon as possible contact Property Manager and/or pest management company. Report the suspected activity as soon as possible. The longer you wait the more likely the problem is to spread and the more difficult and costly it will be to control.

Bedbug Removal Action Plan

The following sequence of steps has been outlined by the Armed Forces Pest Management Board in order to facilitate control of bedbugs in housing.

- ☐ Using a vacuum cleaner (preferably HEPA-filtered), remove the bugs and their cast skins from all observed and suspected harborage sites during the initial inspection, and periodically afterward (once weekly is a suggested self-help action). The vacuum bag should

be removed immediately afterward, sealed tightly inside a larger plastic bag, and that bag incinerated or placed in the next normal trash collection.

- ☐ Launder all infested cloth items in hot water, 120 degrees Fahrenheit or hotter for at least 10 minutes, with soap or detergent, then dry in a warm or hot dryer of at least 140 degrees for at least 20 minutes, or dry clean to kill all bedbug life stages present.
- ☐ Enclose each mattress and box spring in a sealed plastic cover, like those sold commercially. These types of encasements should be of high quality and bedbug puncture proof to limit exposure to house dust mites or bedbugs.
- ☐ Place and seal all recently laundered cloth items (*e.g.*, bed linens, clothing) inside new large plastic bags or tightly closed bins to prevent any bedbugs from re-infesting them.
- ☐ Seal shut all cracks, crevices, and entry points to wall voids, using a high-quality silicone-based sealant, especially within a 20 foot radius of any spot where bedbug bites have been reported, or where the bugs have actually been collected.
- ☐ Additional or alternative physical control measures against bedbugs may include: heat, cold, steam, physical mashing and sticky insect monitors.
- ☐ A residual insecticide should be applied, according to label directions, to each infested site and preferably to a small area around each site. Such applications often involve treating cracks and crevices. When planning and conducting any such treatments, consider examining, if not treating, the opposite side of any involved wall, floor or ceiling.
- ☐ Electrical outlet boxes, and similar voids that cannot be readily sealed, should be treated with an appropriately labeled insecticidal dust.
- ☐ Consider including some type of insect growth regulator (IGR) as a concurrent or adjunctive treatment (*e.g.*, as a tank mix).
- ☐ Limited use of an aerosol or ULV pyrethroid may facilitate the detection of hidden bedbugs by causing them to move around more, and may also potentially increase their exposure to any previously applied residual insecticide. DO NOT use any over-the-counter “foggers.” They are not very effective and may cause bedbugs to scatter.
- ☐ Fumigation or heat (or cold) treatment of batches of furniture, clothing or other items within chambers may be warranted and affordable in specific cases, but whole-structure fumigation to control bedbugs is seldom practical or economically feasible. And such treatments provide no residual effects at all.
- ☐ Re-inspection of infested structures and sites should be done about 10-21 days after any initial treatment, and (if needed) again about 10-21 days later, to detect, and to precisely target the treatment (if needed) of any continued infestation.[1]

Carefully reintroduce cleaned items. Isolate and contain items that have been properly cleaned, laundered or heat treated. Heavy duty plastic bags or air tight containers may be used for this purpose. Clear bags and containers are preferable.

NEVER USE THE FOLLOWING PRODUCTS FOR BEDBUG TREATMENT:

- ☐ **Insecticide “bombs”, total release foggers, camphor, kerosene, diesel, gasoline, alcohol or other similar products. These products can cause serious health problems. They are dangerous if misused and can cause fires and explosions. These products are not appropriate for bedbug management.**

Prevention and Safe Removal of Bedbugs

Additional information about bedbug prevention and treatment may be found by accessing the following resources:

- ☐ **Armed Forces Pest Management Board:** *Bedbugs - Importance, Biology and Control Strategies*
  http://www.afpmb.org/sites/default/files/pubs/techguides/tg44.pdf

- ☐ **Environmental Protection Agency**:
  http://www.epa.gov/pesticides/bedbugs/

- ☐ **Healthy Homes Training:** *What's Working for Bedbug Control in Multifamily Housing?: Reconciling best practices with research and the realities of implementation*.
  http://healthyhousingsolutions.com/wp-content/uploads/2014/12/NCHH_2010-Bed_Bug_Control.pdf

- ☐ **National Pest Management Association Bedbug Hub**:
  http://pestworld.org/pest-world-blog/the-bed-bug-hub-one-stop-shop-for-bed-bug-information

- ☐ **National Pest Management Association Best Practices Website**:
  http://www.bedbugbmps.org

- ☐ **New York City Health Department:**
  http://www1.nyc.gov/assets/doh/downloads/pdf/vector/bed-bug-guide.pdf

- ☐ **Public Housing Environmental Conservation Clearinghouse (PHECC)**
  http://www.hud.gov/offices/pih/programs/ph/phecc/pestmang.cfm

- ☐ http://www.stoppests.org

- ☐ **The Bug Man's Bug Book:**
  http://healthyhousingsolutions.com/wp-content/uploads/2014/12/The_Bugmans_Bug_Book.pdf

- ☐ *Bedbug Handbook*. L.J. Pinto, R. Cooper, and S.K. Kraft

- ☐ *Bedbug Handbook: The Complete Guide to Bedbugs and Their Control* (Mechanicsville, MD: S.K. Pinto & Associates, 2007).

U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
WASHINGTON, DC 20410-8000

ASSISTANT SECRETARY FOR HOUSING-
FEDERAL HOUSING COMMISSIONER

As Special Attention of

All Multifamily Hub Directors
All Multifamily Program Center Directors
All Multifamily Operations Officers
All Directors of Project Management
All Field Counsel

Notice H 2012-5

Issued: April 23, 2012

Expires: This notice remains in effect until amended, revoked, or superseded

Cross References: Housing Notice 2011-20

SUBJECT: Guidelines on Addressing Infestations in HUD-insured and Assisted Multifamily Housing

I. Purpose

This Notice supersedes Housing Notice 2011-20, ―Guidelines on Bed Bug Control and Prevention in HUD Insured and Assisted Multifamily Housing.‖ Readers seeking guidance on the subject of bed bug infestations should instead refer to this Notice, which provides updated information to prevent and address infestations, including but not limited to bed bugs, insects, and all manner of vermin. HUD is providing guidance to Owners, Management Agents (O/As) and residents of HUD Multifamily insured and assisted properties to remind all parties of the importance of prevention, identification, and treatment of infestations in HUD-assisted and HUD-insured rental housing. The Department has received numerous inquiries and comments from the industry and HUD residents seeking clarification and information on appropriate steps to address infestations in Multifamily properties. This Notice provides information and references to best practices regarding the prevention and control of infestations. It also reaffirms existing program requirements with regard to infestations.

II. Background

Pursuant to 24 CFR Part 5, Subpart G, HUD housing must be decent, safe, sanitary and in good repair. Owners of HUD-insured or assisted housing must maintain such housing in a manner that meets physical condition standards. In accordance with project Regulatory Agreements and Section 8 HAP Contracts, the housing must have no evidence of infestation. HUD monitors Owners and Agents (O/As) to ensure that housing meets physical condition standards enumerated in 24 CFR 5.703. This includes providing guidance aimed at preventing and addressing infestations.

Many residents and O/As have contacted HUD to seek guidance on infestations. Of particular concern is the growing problem of bed bugs. According to the United States Environmental Protection Agency (EPA), bed bug populations have recently increased dramatically. HUD is working closely with other federal agencies to develop and share best practices for preventing, identifying and controlling bed bugs.

III. Applicability

This Notice provides guidance to the following types of projects:

A. Properties assisted with Section 8 Project Based Rental Assistance, Rent Supplement or Rental Assistance Payment (RAP) contracts.

B. Properties with active Section 202 Direct Loans, Section 202/162, Section 202 and 811 Capital Advances, and Section 202 Senior Preservation Rental Assistance Contracts or Section 811 Project Rental Assistance demonstration funding.

C. Properties with active FHA insured first mortgages under Sections 207 pursuant to 223(f), 221(d)(3), 221(d)(4), 221(d)(5), 231, 213 or 236.

Certain provisions of this Notice are applicable only to assisted properties, as specified in various sections of the Notice below. The Notice does not supersede existing lease provisions that comply with state and/or local landlord/tenant laws and that have been approved by HUD (where such approval is required).[1] All parties should refer to the property lease executed between the tenant and the O/A, and the property House Rules, for details on Owner and resident rights and responsibilities related to infestations and housing physical condition standards. Certain assisted properties[2] are also subject to provisions of the HUD Model Lease for Subsidized Programs (Family Model Lease) (Form HUD-90105-A, HUD-90105-B, HUD 90105-C and HUD-90105-D) in HUD Handbook 4350.3, *Occupancy Requirements of Subsidized Multifamily Housing Programs*.

IV. Prevention of Bed Bug Infestations

Of particular concern for Multifamily O/As, as well as project residents, is the resurgence of bed bugs, which can cause discomfort and anxiety for residents and which can spread quickly. The ideal approach to bed bug infestations is to prevent them from occurring in the first place. Federal agencies, such as EPA and HUD, are working in tandem to develop and share recommendations to prevent infestations.

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[1] For unassisted O/As, this Notice does not supersede state and local landlord/tenant law related to lease enforcement, housing habitability, and cure rights or damages.

[2] Section 221(d)(3) BMIR, Section 236, Section 8 New Construction, Section 8 Substantial Rehabilitation, Section 8 State Agency, RHS 515 with Section 8, Section 8 Loan Management Set-Aside (LMSA), Section 8 Property Disposition Set-Aside (PDSA), Rental Assistant Payment (RAP), and Rent Supplement projects are subject to the provisions of the Family Model Lease.

HUD encourages Multifamily O/As to develop an Integrated Pest Management Plan (IPM) to focus on preventing infestations. Such plans describe the ongoing efforts the property management will take to prevent and respond to pests. For more detail on IPMs generally, please see the online guide at http://www.stoppests.org. The information below pertains specifically to bed bug infestations.

According to the EPA, principles of IPM for bed bugs include:

Raising awareness through education on prevention of bed bugs;
Inspecting infested areas, plus surrounding living spaces;
Checking for infestations on luggage and clothes when returning home from a trip;
Reducing the number of secondhand items brought into units and looking for bed bugs or signs of infestation on secondhand items before bringing the items home;
Correctly identifying the pest;
Keeping records – including dates when and locations where pests are found;
Cleaning all items within a bed bug infested living area;
Reducing clutter where bed bugs can hide;
Eliminating bed bug habitats;
Physically removing bed bugs through cleaning;
Using pesticides carefully according to the label directions; and,
Following up on inspections and possible treatments.

In addition to or as part of an IPM program, Multifamily O/As are strongly encouraged to take the following steps to prevent bed bugs:

Provide training for staff to identify bed bugs, and to perform ongoing prevention actions as outlined in the IPM. When a community is at high risk for bed bugs (for example, if the community has experienced prior infestations), periodic building inspections are recommended.

Actively engage residents in efforts to prevent bed bugs. Education and involvement of project residents is a critical component of IPM for bed bugs. Bed bugs may often go undetected and unreported, because they are active at night, and tenants may not be aware of their presence. O/As may wish to hold workshops for tenants to teach them to identify bed bugs, to create unfriendly environments for pests, and to report suspicions of bed bugs as soon as possible.

Provide orientation for new tenants and staff, and post signs and handouts.

In addition, tenants should immediately report the suspicion of infestations in housing units or other areas of the property. Early reporting allows the pests to be identified and treated before the infestation spreads. Tenants are the first line of defense against infestations and should cooperate to create living environments that deter pests. This includes reducing unreasonable amounts of clutter that create hiding places for pests and deter treatment.

More information on bed bug prevention may be found by accessing the following websites:[3]

Healthy Homes Training: *What's Working for Bed Bug Control in Multifamily Housing?: Reconciling best practices with research and the realities of implementation*. http://healthyhousingsolutions.com/wp-content/uploads/2014/12/NCHH_2010-Bed_Bug_Control.pdf

National Pest Management Association Bed Bug Hub: http://pestworld.org/pest-world-blog/the-bed-bug-hub-one-stop-shop-for-bed-bug-information

National Pest Management Association Best Practices Website: http://www.bed bugbmps.org

IPM Curriculum and Blog: http://www.stoppests.org

Environmental Protection Agency: http://www.epa.gov/pesticides/bed bugs/

V. Addressing Infestations

The O/A should respond with urgency to tenant reports of infestations. The O/A should endeavor to take appropriate action within a reasonable time period. However, tenants are advised that pest inspections and, if necessary, treatment, may take time to schedule, particularly for recently resurgent pests such as bed bugs, for which it may be difficult to find trained specialists to perform inspections and conduct treatments.

Residents should fully cooperate with the O/A's efforts to identify and address infestations. This tenant cooperation is shown to expedite the control of infestations. Cooperation includes allowing the O/A to enter the unit to perform inspections and treatments, allowing pest treatments to occur, following the pest treatment protocol, and removing infested furniture or other items from common areas such as hallways or community rooms.

Residents are advised that some infestations, including bed bugs, require multiple treatments over the course of several weeks. Generally, relocation from units is not necessary for effective pest treatment. However, if reasonable temporary relocation is necessary, the O/A may request withdrawals from available project funds (which may include Reserve for Replacement, project income, or Residual Receipts, if authorized by HUD), as described below in Section VI, for those days when treatment is actively occurring that may render the unit uninhabitable. All withdrawals of this type must be approved by the Hub/PC Director or designee. Any temporary relocation must be carried out in accordance with applicable civil rights laws, including, but not limited to, Title VI

[3] An additional resource for interested parties is the *Bed Bug Handbook*. L.J. Pinto, R. Cooper, and S.K. Kraft, *Bed Bug Handbook: The Complete Guide to Bed Bugs and Their Control* (Mechanicsville, MD: S.K. Pinto & Associates, 2007).

of the Civil Right Act of 1964 and Section 504 of the Rehabilitation Act of 1973. For example, when persons with disabilities are temporarily relocated, they must be placed in housing that provides, at a minimum, the same accessibility features as the housing in which they currently reside. Additionally, the O/A must ensure the right of return for tenants who have had to be temporarily relocated while the treatment is being performed.

VI. Project Resources

An O/A may contact HUD to request project resources for control of infestations. An O/A may use available operating funds to pay for activities to prevent and/or treat infestations. When other sources of funds are not available or sufficient, the Hub/PC Director may honor requests to reimburse Owners for infestation treatment from the Reserve for Replacement account, or, if authorized, the Residual Receipts account. The releases should follow the processes outlined in HUD Handbook 4350.1, *Multifamily Project Servicing*, Chapters 4 and 25. Owners may make advances (loan without interest) when no reserves are available. With prior HUD approval, Owners may repay the advances from project resources as discussed in HUD Handbook 4350.1.

For assisted housing projects, HUD may consider use of rental assistance to pay reasonable and necessary project expenses, such as an increased pest control line item in the project's operating budget, if the Section 8 Housing Assistance Payments (HAP) contract allows for budget-based rent setting in accordance with the *Section 8 Renewal Policy Guide*.

Owners of assisted properties are advised that any rental assistance received under Section 8, Rent Supplement or RAP cannot be used to reimburse residents for the cost of any additional expense to the household, such as purchase of new furniture, clothing or cleaning services. Assisted project Owners' requests for tenants to pay the costs of infestation treatment must be in accordance with the provision for tenant payment of damages or noncompliance as required in the Family Model Lease.

VII. Recurring Infestations

Many properties face recurring infestations. O/As may take initiative to offer protective tools to residents to help safeguard properties from recurrences. To prevent pests from entering a Multifamily property, O/As may voluntarily offer to inspect tenants' furniture before move-in. Where there is an approved (for Assisted Owners) lease provision that complies with state and/or local landlord/tenant law, O/As may require appropriate treatment of furniture upon tenant move-in, or when a tenant moves furniture into the apartment. These services or products are to be offered at the Owner's expense, or may be paid from project operating funds if available.

All Owners (of assisted and unassisted properties) may pursue remedies provided in the lease agreement and in accordance with state and local rental law. Assisted Owners must follow additional guidelines including occupancy requirements for assisted housing, and must adhere to all HUD and state and local landlord/tenant laws before taking action to deny tenancy or remove residents for causes related to infestations. For O/As of assisted properties, the Family Model Lease provides remedies related to damages or noncompliance. Many O/As have proposed lease addenda

related to infestations. As detailed in HUD Handbook 4350.3, Section 6-9, Lease Addenda in assisted properties may not conflict with the Family Model Lease. HUD reserves the right to review and approve Lease Addenda for assisted properties, for example to ensure that tenant payment provisions in proposed Addenda do not exceed the remedies for damages or noncompliance provided in the Family Model Lease.

VIII. Responding to Inspection Findings

Infestations should be addressed when reported by staff, tenants or the Real Estate Assessment Center (REAC), or if an audit by the HUD Office of the Inspector General identifies possible infestation.

Presently, REAC inspectors will only deduct points if there is the ―presence of rats, or severe infestation by mice or insects such as roaches or termites. The following deficiencies can be noted: 1) Insects and 2) Rats/Mice/Vermin.‖[4] If there is no evidence of infestation (i.e. there are baits, traps, and sticky boards with no presence of insects or vermin) inspectors are instructed not to record this as a deficiency. If evidence is identified, the infestation may be cited as a deficiency.

As per Inspector Notice No. 2010-01, ―the presence and/or treatment of bed bugs will not be scored in the UPCS inspection.‖ However, inspectors now ask the O/A to identify any units and/or buildings that are infested before the inspection begins. If bed bugs are reported, the inspector will record the units and/or buildings affected in the comment section of the Physical Inspection report.

Because bed bug infestations are on the rise, HUD staff will take additional steps to monitor and track reports of bed bug infestation and treatments of such infestations. When bed bugs are reported by the Owner/Agent at the time of inspection or if the Inspector notes the presence of bed bugs, REAC sends a ―Bed Bugs Reported‖ email to the Hub/Program Center Director. HUD staff must take the following steps upon receipt of the ―Bed Bugs Reported‖ email from REAC (regardless of the PASS score the property receives) or if bed bugs are cited as a deficiency within the REAC report, or if bed bugs are reported by the O/A, project residents, the Performance Based Contract Administrator, or an OIG audit:

> Enter the bed bug information on the Problem Statement screen in the Integrated Real Estate Management System (iREMS).
>
> If bed bugs were identified by REAC, send the attached letter (Attachment 1) to the Owner regardless of the score of the REAC Physical Inspection.
>
> Advise the Owner to describe what actions were taken or will be taken to eradicate the infestation.
>
> Advise the Owner to inform HUD of the response to the infestation, and to inform HUD if and when the problem has been completely eradicated.

[4] HUD Physical Inspection Program—Chapter 3: UPCS Definitions Training—Health & Safety

Release funds from Reserve for Replacement or Residual Receipts accounts if requested and if such funds are available and authorized.

Continue to enter all related information into the Problem Statement screen in iREMS; and,

Report any significant developments or problems regarding a bed bug infestation to Headquarters, Office of Asset Management.

If you have questions, please contact your Desk Officer in the Office of Asset Management.

Carol J. Galante
Acting Assistant Secretary for Housing –
Federal Housing Commissioner

Enclosures

ATTACHMENT

Property Owner
Address

SUBJECT: Bed Bugs
Property Name: _____

Dear Owner:

The [Hub Name] Multifamily Hub has received notification from the Real Estate Assessment Center (REAC) that during the physical inspection of your property performed on [Date], the inspector indicated that bed bugs were reported present at the property. The units/buildings below were identified as being infested with bed bugs:

Within 5 days of the date of this letter, please inform your Project Manager of the actions you are taking for bed bug control. This information should include the method of treatment used (or to be used), the timing for treatment(s), and your proposed plan for monitoring and preventing the possibility of future infestation.

If you have any questions, please contact your Project Manager, [Project Manager's Name], at [Project Manager's Telephone Number] ext. [Extension]

Sincerely,

_____
Supervisory Project Manager
Project Management Division

Joint Statement on Bed Bug Control in the United States from the U.S. Centers for Disease Control and Prevention (CDC) and the U.S. Environmental Protection Agency (EPA)

Introduction and Purpose

The Centers for Disease Control and Prevention (CDC) and the U.S. Environmental Protection Agency (EPA) developed this document to highlight emerging public health issues associated with bed bugs (*Cimex lectularius*) in communities throughout the United States.

Photo 1. Bed Bug. Photo courtesy of Dr. Harold Harlan, Armed Forces Pest Management Board Image Library

Bed bugs (**Photo 1**) have been common in U.S. history. Although bed bug populations dropped dramatically during the mid-20th century (1), the United States is one of many countries now experiencing an alarming resurgence in the population of bed bugs. Though the exact cause is not known, experts suspect the resurgence is associated with increased resistance of bed bugs to available pesticides, greater international and domestic travel, lack of knowledge regarding control of bed bugs due to their prolonged absence, and the continuing decline or elimination of effective vector/pest control programs at state and local public health agencies.

In recent years, public health agencies across the country have been overwhelmed by complaints about bed bugs. An integrated approach to bed bug control involving federal, state, tribal and local public health professionals, together with pest management professionals, housing authorities and private citizens, will promote development and understanding of the best methods for managing and controlling bed bugs and preventing future infestations. Research, training and public education are critical to an effective strategy for reducing public health issues associated with the resurgence of bed bug populations.

Impact of Bed Bugs on Public Health

Although bed bugs are not known to transmit disease, they are a pest of significant public health importance. Bed bugs fit into a category of blood-sucking ectoparasites (external parasites) similar to head lice (*Pediculus humanus capitis*). Bed bugs, like head lice, feed on the blood of humans but are not believed to transmit disease. Other ectoparasites, such as body lice (*Pediculus humanus corporis*), are known to transmit several serious diseases. Differences in the biology of similar species of pests, such as body lice and head lice (or bed bugs) can greatly impact the ability of pests to transmit disease.

Bed bugs cause a variety of negative physical health, mental health and economic consequences. Many people have mild to severe allergic reaction to the bites with effects ranging from no reaction to a small bite mark to, in rare cases, anaphylaxis (severe, whole-body reaction) (2). These bites (**Photo 2**) can also lead to secondary infections of the skin such as impetigo, ecthyma, and lymphanigitis (3,4). Bed bugs may also affect the mental health of people living in infested homes. Reported effects include anxiety, insomnia and systemic reactions (1).

Photo 2. Skin Reaction to Bed Bug bites. Photo courtesy of Dr. Harold Harlan

Research on the public health effects of bed bugs has been very limited over the past several decades, largely due to the noted decline in bed bug populations in the latter half of the 20th century. Now that bed bug populations are rapidly increasing, additional research is needed to determine the reasons for the resurgence, the potential for bed bugs to transmit disease and their impact on public health.

Economically, bed bug infestations are also a burden on society. Although the exact dollar amount is not known, the economic losses from health care, lost wages, lost revenue and reduced productivity can be substantial. The cost of effectively eliminating bed bugs may be significantly more than the cost of eliminating other pests because bed bug control usually requires multiple visits by a licensed pest control operator and diligence on the part of those who are experiencing the infestation. Control in multi-family homes is much more difficult than in single family homes because bed bugs frequently travel between units, either by direct transport by humans or through voids in the walls. There are additional costs and complexities associated with coordinating and encouraging participation from multiple residents.

When a community starts to experience bed bug infestations, control is often more challenging because:

- Local public health departments have very limited resources to combat this problem and bed bugs frequently are not seen as a priority.
- Municipal codes struggle to identify those responsible for control of bed bug infestations. Tenants and landlords often dispute who is ultimately responsible for the cost of control and treatment. Treatment costs are high and transient populations make it difficult or impossible to assign responsibility.
- Pesticide resistance and limited control choices make treatment even more difficult. Some bed bug populations are resistant to almost all pesticides registered to treat them. Residents may use over-the-counter or homemade preparations that are ineffective (or even dangerous) and may promote further resistance.
- Pesticide misuse is also a potential public health concern. Because bed bug infestations are so difficult to control and are such a challenge to mental and economic health, residents may resort to using pesticides that are not intended for indoor residential use and may face serious health risks as a result. Additionally, residents may be tempted to apply pesticides registered for indoor use, but at greater application rates than the label allows. This results in a much greater risk of pesticide exposure for those living in the home. Pesticides must

always be used in strict accordance with their labeling to ensure that the residents and applicators are not exposed to unsafe levels of pesticide residues.

Bed Bug Biology

Bed bugs are small, flat insects that feed on the blood of sleeping people and animals. They are reddish-brown in color, wingless, and range from 1 to 7 millimeters in length. They can live several months without a blood meal.

Infestations of these insects usually occur around or near the areas where people sleep or spend a significant period of time. These areas include apartments, shelters, rooming houses, hotels, nursing homes, hospitals, cruise ships, buses, trains, and dorm rooms.

Bed bugs are experts at hiding. They hide during the day in places such as seams of mattresses, box springs, bed frames, headboards, dresser tables, cracks or crevices, behind wallpaper, and under any clutter or objects around a bed. Their small flat bodies allow them to fit into the smallest of spaces and they can remain in place for long periods of time, even without a blood meal. Bed bugs can travel over 100 feet in one night, but they tend to live within 8 feet of where people sleep.

Bed bugs are usually transported from place to place as people travel. Bed bugs travel in the seams and folds of luggage, overnight bags, folded clothes, bedding, furniture, and anywhere else where they can hide. Most people do not realize they can transport stow-away bed bugs as they travel potentially infesting new areas, including their homes, as they relocate.

One of the easiest ways to identify a bed bug infestation is by bite marks that appear on the face, neck, arms, hands, and any other body parts. However, these bite marks may take as long as 14 days to develop in some people so it is important to look for other clues when determining if bed bugs have infested an area. These signs may include the exoskeletons (**Photo 3**) of bed bugs after molting, bed bugs in the fold of mattresses and sheets, a sweet musty odor, and rusty-colored blood spots from their blood-filled fecal material that is often excreted on the mattress or nearby furniture.

Photo 3. Bed Bug Exoskeletons. Photo courtesy of Dr. Harold Harlan, Armed Forces Pest Management Board Image Library

When bed bugs bite, they inject an anesthetic and an anticoagulant that prevents a person from feeling the bite. Because bites usually occur while people are sleeping, most people do not realize they have been bitten until marks appear. The bite marks are similar to that of a mosquito or a flea - a slightly swollen and red area that may itch and be irritating. The bite marks may be random or appear in a straight line. Other symptoms of bed bug bites include insomnia, anxiety, and skin problems that arise from profuse scratching of the bites.

Everyone is at risk for bed bugs bites when visiting an infested area. However, anyone who travels frequently and shares living and sleeping quarters where other people have previously slept has an increased risk for being bitten and for spreading a bed bug infestation.

Integrated Pest Management for Bed Bugs

The current national problem with bed bugs is likely due to the convergence of three human behaviors: lack of awareness of the historical and biological link humans have with bed bugs, increased international travel, and past over-reliance on pesticides. Bed bugs are a "nest parasite" that resides in the human nest – the bedroom. Over time, bed bugs have evolved to develop resistance to many of the chemical pesticides currently used. In fact, bed bugs were widely resistant to DDT by the mid-1950s (5).

Integrated pest management (IPM) is an effective and environmentally sensitive approach to pest management that relies on a combination of common-sense practices. IPM programs use current, comprehensive information on the life cycles of pests and their interaction with people and the environment. This information, in combination with available pest control methods, is used to manage pest damage by the most economical means, and with the least possible hazard to people, property, and the environment.

Bed bug control is most effective when an IPM approach is implemented with diligent participation by the residents. In multi-family housing, diligent participation is also required of the building management. IPM takes advantage of all appropriate pest management options, including the judicious use of pesticides. Although bed bugs may sometimes be controlled by non-chemical means alone, this approach is often very difficult, potentially less effective, and usually more resource intensive. A comprehensive IPM program to control bed bugs may include a number of methods such as:

- using monitoring devices,
- removing clutter where bed bugs can hide,
- applying heat treatment,
- vacuuming,
- sealing cracks and crevices to remove hiding places,
- using non-chemical pesticides (such as diatomaceous earth) and
- judicious use of effective chemical pesticides

A coordinated community IPM program can alleviate both the discomfort and cost of managing bed bugs. The underlying philosophy of bed bug IPM is based on the fact that bed bug infestations will not go away without intervention. Intervention is most effective when populations are low. Such a coordinated effort could create a partnership among government, property managers, citizens, and pest management professionals to ensure an effective intervention facilitated by environmental health professionals. EPA and CDC recommend that pest management and environmental health professionals throughout the U.S. continue to use IPM strategies as they address the bed bug issue.

The Role of Government Agencies and the Public in Bed Bug Control

CDC, EPA, and other federal agencies are working closely with state, tribal and local health departments, academia and private industries to monitor and better understand the recent resurgence of bed bugs in communities throughout the United States. CDC and EPA are facilitating communications and working to expand the knowledge base among agencies and programs that may have a role in reducing bed bug populations. The two agencies are also fostering cooperation with the private sector and the public to encourage their help with this endeavor.

CDC is partnering with experts in the areas of medicine, entomology, epidemiology and environmental toxicology to better understand the resurgence of bed bugs and the methods and tools that are needed for effective bed bug control. CDC will provide timely information on emerging trends in bed bug control with the goal of developing national strategies to reduce bed bug populations. CDC recognizes that very limited research has been conducted on bed bugs during the past several decades and encourages increased bed bug research to determine the causes of the resurgence, the most effective methods of control and the potential for bed bugs to transmit disease.

EPA's primary responsibility is the dual statutory charges to ensure that the pesticides with public health uses are (1) safe and (2) effective against the pests on their labels. EPA carries out this responsibility by conducting rigorous scientific screening of pesticides and imposing limits through registration of pesticides to ensure that when used to control pests, they do not harm people or the environment.

EPA is working to ensure that pest management professionals and the public have access to the latest information on effective bed bug control tools. EPA realizes that certain bed bug populations in communities across the nation are becoming increasingly resistant to many of the existing pesticides. EPA is actively working with industry and researchers to identify new compounds (or new uses of existing compounds) to control bed bugs. In addition, EPA is working to educate the general public, pest professionals, and public health officials about bed bug biology and IPM, which is critical to long-term bed bug control.

Other federal agencies are also involved in research and education about bed bugs. For example, the U.S. Department of Housing and Urban Development (HUD) is funding research on bed bug monitoring and control in low-income, multi-family housing, along with educating public housing authorities and other housing industry groups about bed bug identification and control. Health departments can use local HUD field office personnel or local housing officials as resources when addressing bed bug issues in multi-family housing.

State, tribal, and local government agencies and health departments play a critical role in protecting the public from bed bugs. Public health departments serve on the front lines, providing information on prevention and control of bed bugs through various programs to the public and private sector.

The public, together with their local health agencies, must be involved in the control and management of bed bug populations and must be provided with the knowledge of best practices to prevent and control bed bug infestations. In some cases, a coordinated community control program may be necessary to reduce or eliminate bed bug populations.

Additional Information

For additional information about bed bugs and their control, please see the following print references:

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For additional information about bed bugs and their control, please see the following Web sites:

- U.S. Environmental Protection Agency: http://epa.gov/pesticides/controlling/bedbugs.html
- Centers for Disease Control and Prevention: http://www.cdc.gov/nceh/ehs/Topics/bedbugs.htm
- Bed Bug Hotel Safety: http://www.oregon.gov/DHS/ph/pl/docs/bedbughotel.pdf
- Central Ohio Bed Bug Task Force Information: http://centralohiobedbugs.org/
- Cornell Bed Bug Guide: http://www.nysipm.cornell.edu/publications/bb_guidelines/
- Harvard School Public Health Bed Bug Management: http://www.hsph.harvard.edu/bedbugs/
- National Pest Management Association: http://www.pestworld.org/for-consumers/pest-frequently-asked-questions/bedbug-faq
- National Pesticides Information Center: http://npic.orst.edu/pest/bedbug.html
- New Jersey Bed Bug Fact Sheet: http://www.nj.gov/health/eoh/phss/documents/bedbugfactsheet.pdf
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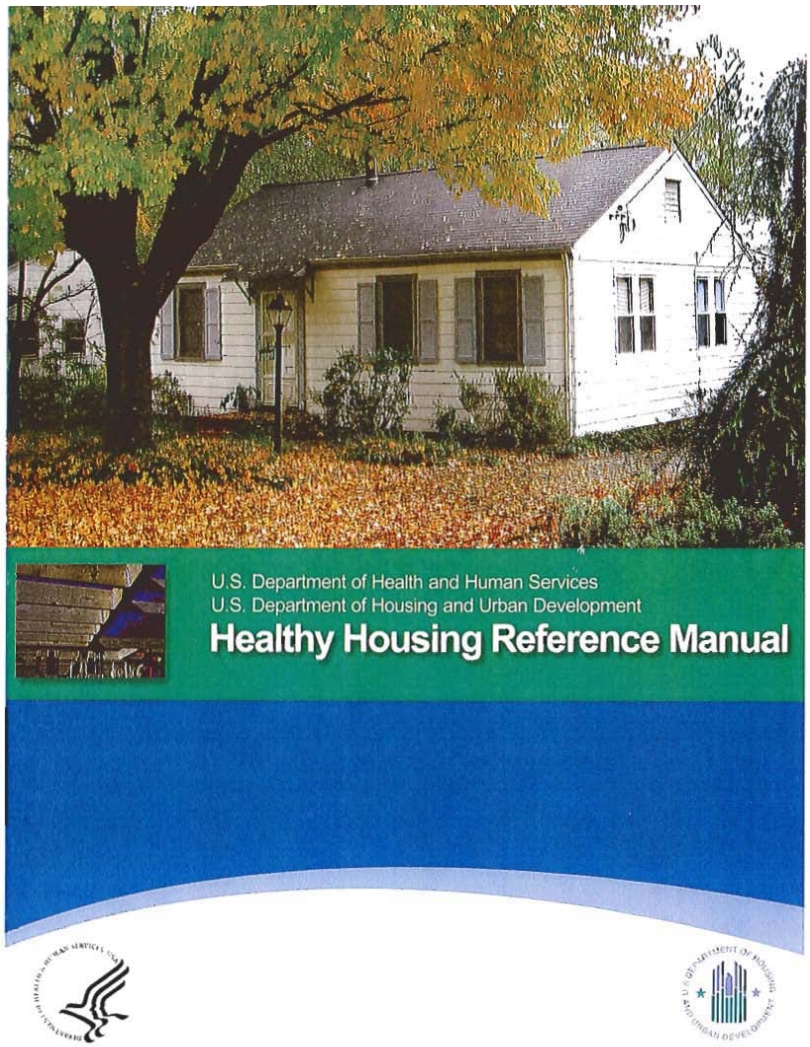

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MAKING IT WORK

No references

Index to Exercises

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Exercise #2	Healthy Homes Statistics	Pages 2-3
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Exercise 1: Make the Connections - See the Big Picture

Health Impacts	Housing Hazards	Corrective Action	Resources

Exercise 2: Get a Handle on Healthy Homes Statistics

Instructions

From the References tab in your binder, take out the "American Housing Survey – National 2011" packet. If you have a separate packet on a specific Metropolitan Statistical Area (MSA), take that out too. Then answer the following questions using the national data or MSA data as assigned by the instructor. The instructor may assign you or your group specific questions to answer.

***NOTE**: Review your answers to this exercise in preparation for the Healthy Homes Specialist Credential test.*

About the 2011 American Housing Survey National Data Packet: The packet is twelve pages long and consists of two parts:

- **Selected Elements Related to Healthy Homes – Seven Pages**
  - General Information: Occupancy, Units in Structure, Year Structure Built, and Foundation
  - Exterior Information: External Building Conditions and Water Leakage During Last 12 Months
  - Interior Information: Damage, Water Leakage During Last 12 Months, Rodents, and Electrical
  - Sanitation & Water Information: Lack of Facilities, Drinking Water Safety; and Sewage Disposal /Safety Equipment
  - Heating & Fuel Information: Main Heating Equipment, Water Heating Fuel, Clothes Dryer Fuel, and Heating Problems
  - Selected Physical Problems: Severe Physical Problems, Moderate Physical Problems, and Overall Opinion of Structure

- **About the American Housing Survey – Five Pages**
  - Overview
  - Key Definitions Related to Healthy Homes
  - AHS's Rating System for Physical Problems
  - Potential Errors in American Housing Survey

About the 2011 American Housing Survey MSA Data Packet: The packet for a specific MSA is similar to the 2011 AHS National Data with the following changes:

- The MSA Data information is compared to next closest National Data. For example, 2004 MSA data is compared to the 2005 National Data.
- National data is only listed when the MSA percentages has at least 20% relative difference from the national percentage and an absolute difference of at least 0.25% from national percentage.

Write the number for each characteristic.

_____ # of homes with severe physical problems (note that units are thousands of homes)

_____ # of homes with moderate physical problems

_____ # of homes with either severe or moderate problems

_____ % of homes with exterior water leakage in past 12 months

_____ % of homes with interior water leakage in past 12 months

_____ % of homes with signs of mice in past 3 months

_____ % of rental homes built before 1980

_____ % of homes with warm-air furnaces

_____ % of homes with a clothes dryer fueled by gas (piped or LP)

_____ % of renters rating their home a 1 or 2 (where 1 as worst possible and 10 as best possible)

Checkmark the most common cause of each type of problem.

Exterior water leakage	Interior water leakage	Moderate physical problems
☐ Walls or window problems	☐ Leaking pipes	☐ Plumbing
☐ Basement problems	☐ Broken fixtures	☐ Heating
☐ Roof problems	☐ Broken water heater	☐ Upkeep
☐ Other/unknown	☐ Other/unknown	☐ Kitchen

Exercise 3: Get a Handle on a Model Housing Code

Instructions

From the References tab in your binder, take out:

1. International Property Maintenance Code (IPMC)
2. HUD Housing Quality Standards (HQS)

The instructor may assign you or your group specific questions to answer.

Questions:

1. If rats are found, is simply killing them sufficient to comply with the code?

a. Yes b. No c. Maybe

2. Is a crack in an exterior brick wall a violation of the code?

a. Yes b. No c. Maybe

3. Is a disconnected downspout a violation of the code?

a. Yes b. No c. Maybe

4. What must be done to repair flaking interior paint?

a. Fix cause of peeling b. Remove all paint whether peeling or not

c. Test for lead dust hazards d. Correct defective surface condition

5. Which room is not allowed to have carpeting?

a. Kitchen b. Bathroom c. Child's Bedroom

6. Does the exhaust of an electric clothes dryer have to be vented outside?

a. Yes b. No c. Maybe

7. Must a bathroom have an exhaust fan that vents outside?

a. Yes b. No c. Maybe

8. Can a landlord let the air temperature go below 60ºF under any circumstances?

a. Yes b. No.

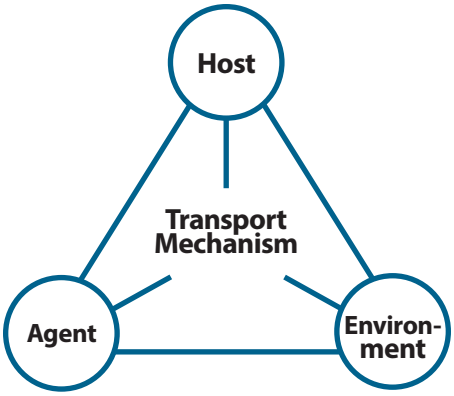
What other model codes apply to existing buildings that are not being reconstructed?

a. International Residential Code
b. International Fire Code
c. International Existing Building Code
d. All of the above.

10. What is the minimum temperature for hot water at the tap?

a. 43º F
b. 110 º F
c. 125 º F
d. 68 º F

Exercise 4: The Epidemiologic Triangle



The purpose of this exercise is to help you better understand the epidemiologic triangle and how it can be used for addressing healthy housing issues.

The Epidemiological Triangle can be used whether the disease or illness is acute (causes symptoms that are immediately recognizable) or chronic (symptoms develop over time and for that reason may not be readily identified with the exposure). The triangle can also be useful to understand the process involved with unhealthful conditions, such as those that cause physical injury.

Instructions

For each of the scenarios described below draw an epidemiological triangle. Identify the host (as well as any factors that make the host susceptible), environment, agent, and vector. Fill in the corners of the triangle.

Scenarios

1. Acute Disease

An adult visits the home of a friend and quickly develops a severe allergic reaction. The patient is allergic to animals, but the friend has never had a pet of any type in his home. However, the friend does state that he frequently has problems with mice in the home.

2. Chronic Disease

While her parents are finishing remodeling their 1950's home, a young child falls and incurs severe trauma on her arm. An x-ray is taken at the hospital and while no breaks have occurred, the doctor sees strong lines on the x-ray outlining the bones. This can be an indication the child has been exposed to the metal lead.

3. Physical Condition

In a newly opened senior high rise living facility, there are reports of an alarming number of falls. Concerned that something in the construction of the apartments may be causing or contributing to the falls, the manager visits the residents to ask for details concerning the circumstances of each fall. The conditions in common are as follows: all the falls occurred at night or in the late afternoon after sundown; all apartments are fully carpeted except for the kitchen and bathroom; there is a raised marble threshold at the entrance to the kitchen and bathroom that separates the ceramic tiles of these two rooms from the carpeting on the other side of the threshold; and the majority of the falls occurred when entering or leaving either or both of these rooms.

Exercise 4: The Epidemiologic Triangle (continued)

Scenario	Host	Agent	Environment	Transport Mechanism
1. Acute Disease				
2. Chronic Disease				
3. Physical Condition				

Exercise 5: Identify Moisture Problems

Instructions

Break up into small groups according to instructor's directions. Each group gets a set of photos. Identify moisture problems and their potential source. Avoid writing on the photos. After 15 minutes, the instructor will review the photos and the answers with the class.

Photo	Potential Moisture Problems	Proposed Correction
#1		
#2		
#3		
#4		
#5		
#6		
#7		
#8		
#9		
#10		

Exercise 6: Identify Pest Problems

Instructions

Break up into small groups according to instructor's directions. Each group gets a set of photos. Identify pest and pesticide problems and their potential source. Avoid writing on the photos. After 15 minutes, the instructor will review the photos and the answers with the class.

Photo	Potential Pest and Pesticide Problems	Proposed Correction
#1		
#2		
#3		
#4		
#5		
#6		
#7		
#8		
#9		
#10		
#11		

Exercise 7: Identify Ventilation Problems

Instructions

Break up into small groups according to instructor's directions. Each group gets a set of photos. Identify ventilation problems and their potential source. Avoid writing on the photos. After 15 minutes, the instructor will review the photos and the answers with the class.

Photo	Potential Ventilation Problems	Proposed Correction
#1		
#2		
#3		
#4		
#5		
#6		
#7		
#8		
#9		
#10		

Exercise 8: Find the Child Safety Devices or Practices

Instructions: *Below is a cross-section of a home. By each number is a safety precaution families can use to reduce the chances of injury. For each number, identify the safety device and the injury that it is designed to protect against.*

Safety Device Number	Description of the Safety Device or Practice	Injury that Safety Device or Practice is Designed to Avoid
#1		
#2		
#3		
#4		
#5		
#6		
#7		
#8		
#9		
#10		
#11		
#12		

Exercise 9: Practice Visual Assessment & Identify Potential Violations

Instructions: *The purpose of this exercise is to familiarize you with a common visual assessment tool and help you understand its strengths and weaknesses so you may better evaluate the tools that will fit your program.*

Step 1: *Take the packet from the References section of the binder labeled "CEHRC Visual Survey Report and Instructions". Look through the instructions. The trainer will review key elements of the instructions and then show you a series of photos. Based on the photos complete the visual assessment form. You do not need to complete the floor plan or site plan.*

Step 2: *Using the International Property Maintenance Code or your local housing or other code as directed by the instructor, identify which rooms had potential violations of the law. Indicate the code sections, which problems are clearly violations and which ones require more investigation. If something requires more investigation, then identify what investigation is needed.*

Step 3: *Identify three strengths and three weaknesses of the CEHRC Visual Survey.*

About the Packet:

Healthy homes programs have developed many tools to conduct a visual assessment for healthy homes issues. Most of the healthy homes visual assessments are tailored to the particular needs of the program. Many community-based organizations used the CEHRC Visual Survey developed by the Alliance for Healthy Homes. It stands for the Community Environmental Health Resource Center.

The Visual Survey is the first step in the CEHRC hazard assessment process. The Visual Survey gives hazard investigators an initial opportunity to talk to residents about things they have noticed about their home. Looking around the outside and inside of the home, hazard investigators can begin to understand the general condition of the home, and target sampling as appropriate. Some hazards will only be assessed through the Visual Survey as visual evidence of a hazard might be sufficient to trigger control measures or other action. Others require more sampling to quantify the particular hazard.

The CEHRC's Visual Survey consists of:

- Instructions;
- Visual Survey Report;
- Floor Plan; and
- Site Plan.

The materials are available in Spanish and English.

For this exercise, we will use the Visual Survey Report.

Step 2: Identify the Potential Code Violations in Photos

Area of Home	Nature of Violation/ Code Sections Potentially Violated	Nature of Violation		Responsible Person	
		Definite	Potential	Owner	Occupant
Exterior					
Porch					
Entryway					
Living Room					
Dining Room					
Kitchen					
Bedroom 1					
Bedroom 2					
Bedroom 3					
Bathroom 1					
Bathroom 2					
Basement					
Other: _____					
Other: _____					

Step 3: Evaluate CEHRC Visual Survey

Three Strengths:

1.

2.

3.

Three Weaknesses:

1.

2.

3.