

Seven Principles of Healthy Homes



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The Link Between Housing & Health



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

Florence Nightingale

Cited in Lowry, S. BMI, 1991, 303, 838-840



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Maslow's Hierarchy of Need



A green pyramid diagram on a blue background. The pyramid is divided into five horizontal sections. From top to bottom, the sections are labeled: 'Self-Actualization', 'Ego', 'Belonging', 'Safety and Security', and 'Physiological Needs'. The text 'Safety and Security' is highlighted in yellow.

Self-Actualization
Ego
Belonging
Safety and Security
Physiological Needs



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Why Do We Care About Healthy Homes?



Young children spend **nearly 80%-90%** of their time inside.

Housing affects health both directly and indirectly:

- Physical, chemical, biological exposures
- Psychological



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Start with People

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



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Special Communication Issues

- Cultural
 - Shoes in the Home
 - Men and Women
 - Other
- Responding to Problems
 - Hoarding
 - Tolerance for Clutter and Pests



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No Place Like Home!

Resident Overall Opinion of Structure

American Housing Survey – National 2005

Worst ← → Best

Type of Resident	1	2 to 4	5 to 7	8	9	10
All	0.4%	1.8%	24%	28%	16%	28%
Renters	1.0%	4.1%	37%	27%	11%	19%
Severe Problems	3.4%	6.2%	35%	21%	12%	20%
Below Poverty	13.3%	3.6%	27%	23%	12%	28%



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Home is where the heart is.
 Pliny

The strength of a nation derives from the integrity of the home.
 Confucius

One of our deepest needs is to be at home.
 Timothy Radcliffe

Where thou art, that is home.
 Emily Dickinson

It may be frail; its roof may shake; the wind may blow through it; the storms may enter; the rain may enter – but the King of England cannot enter; all his forces dare not cross the threshold of the ruined tenement.

William Pitt

Home is the place where, when you have to go there, They have to take you in.
 Robert Frost

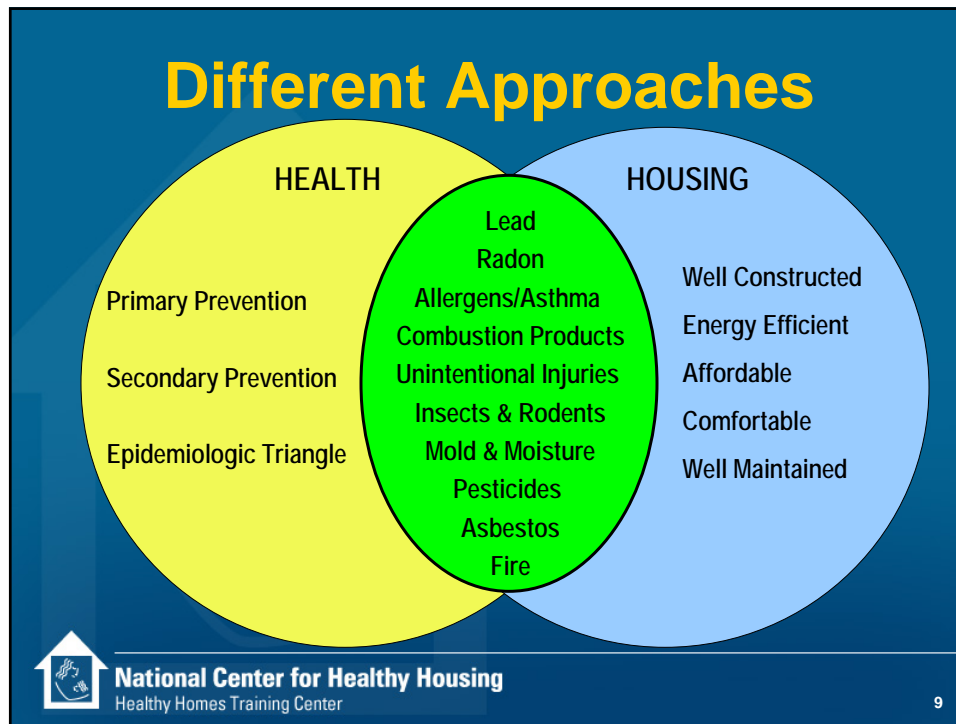
There's no place like home.
 Dorothy, Wizard of Oz

He is happiest, be he king or peasant, who finds peace in his home.
 Johann Wolfgang von Goethe



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What is Healthy Housing?

Healthy Housing is

- Designed,
- Constructed,
- Maintained, and
- Rehabilitated

in a manner that is conducive to good occupant health.



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The Real World is Complex

- Current knowledge
- Economic factors
 - Community
 - Family
- Social and cultural
- Affordability
- Political and legal factors
- “Do No Harm”
- Precautionary principles



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But . . .

- 6.2 million homes had severe or moderate physical problems in the U.S. in 2005
- Total does not consider cockroaches, mold, dampness and other problems linked to health.



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Moisture / Water Intrusion

Mold

Asthma Exacerbation


Why a Holistic Approach?

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Moisture / Water Intrusion

Structural Damage

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Structural Damage



Pests



Lead Poisoning



Fire



Injuries






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Asthma and Allergy Exacerbation




Pests



Pesticide



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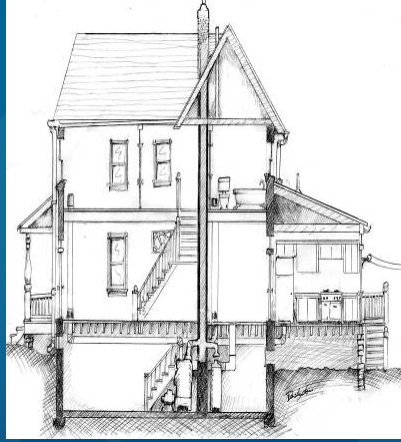
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7 Healthy Homes Principles



Keep It:

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



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Keep It Dry



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Keep It Dry

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



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Exterior Water Leakage

- About 12 million homes (10.7%) had exterior water leakage in 12 month period
 - 5.8 million - roof
 - 3.6 million - basement
 - 2.4 million - walls, closed windows or doors
 - 1.3 million - other or unknown source
- 6.4% of homes constructed since 2000 had problem.

From American Housing Survey – 2005



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Interior Water Leakage

- More than 9 million homes (8.3%) had interior water leakage in 12 month period
 - Leaking pipes and fixtures key sources
- 5.5% of homes constructed since 2000 had problem.

From American Housing Survey – 2005



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Overhangs Work

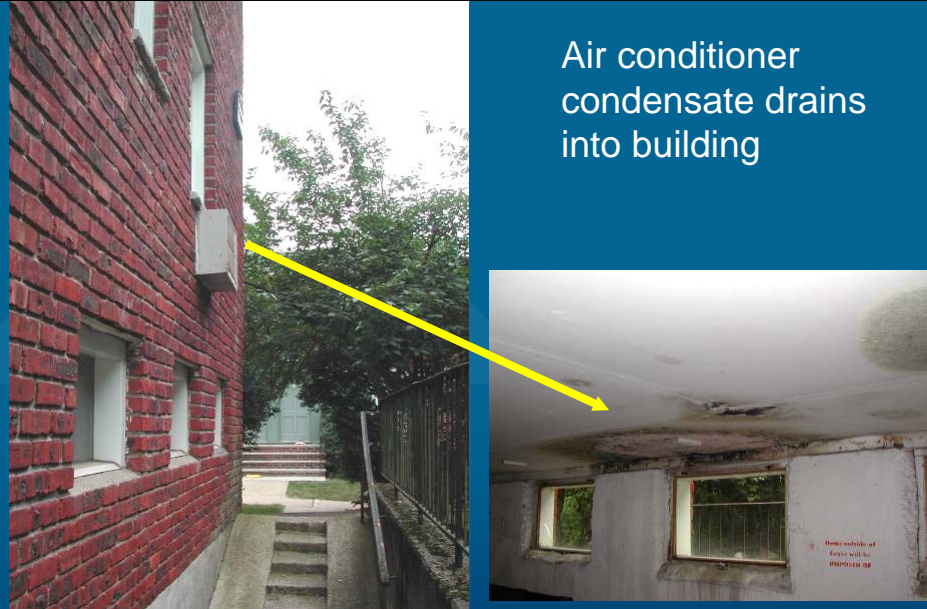


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Air conditioner condensate drains into building



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Poorly managed rainwater often causes moisture problems – either or by humidifying the whole house. Efflorescence is sometimes mistaken for mold.




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Ground slopes toward house

Below grade


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Bad Crawlspace

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



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Good Crawlspace



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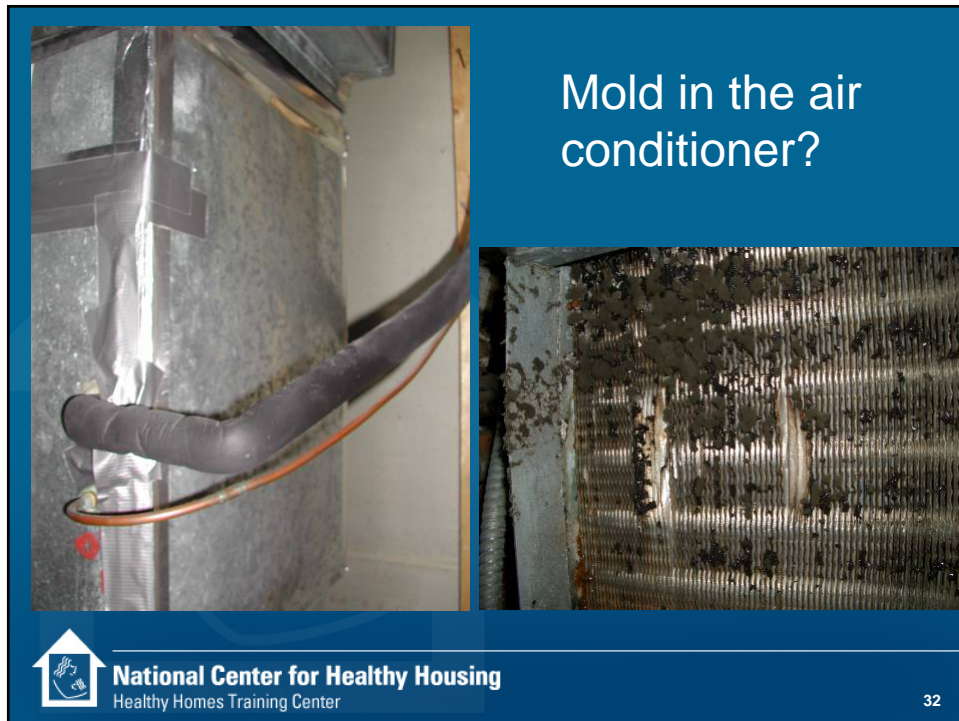
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Plumbing problems



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Condensation when cold outside



Mold around window where there is no insulation.

Mold due to poor insulation or wind blowing through insulation.



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



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Keep It Clean



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Keep It Clean

- 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



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

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Where does house dust come from?

- Brought-In
- Home-Grown
 - Lead Dust
 - Dust Mites
- Resident-Made
 - Garbage
 - Clutter



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What can we do to buildings to make them more cleanable?

- Install dust walk-off systems at entryways
- Keep activities which 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



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Isolate Problems



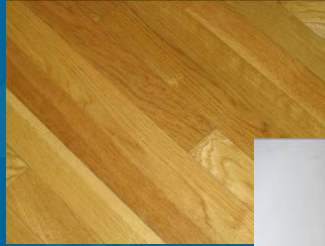
Keep pets off beds and out of bedroom.



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Cleanable Flooring



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What to look for in a vacuum?

- Beater Bar
- Vacuum Strength
- Filter Type
- Dirt Sensor



HEPA[®]
Air Filter



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How clean is clean?

- 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?



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What cleaning measures are problematic?

- Carpet cleaning
- Overuse of anti-microbials
- Sanitizers
- Air fresheners



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Duct Cleaning

EPA recommends duct cleaning when:

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



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Keep It Ventilated



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Keep It Ventilated

- Pollutants can be found in concentrations 2-5 times higher indoors than outdoors.
- Proper ventilation can reduce hazards of:
 - Volatile organic compounds
 - Radon
 - Moisture
 - Environmental tobacco smoke
 - Particulate matter
 - Allergens
 - Mold
 - Carbon monoxide



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Ventilation Problems

- Almost 8 million homes (7.3%) were uncomfortably cold for more than 24 hours last winter.
- More than 1.3 million homes (1.2%) used a space heater without a flue.

From American Housing Survey – 2005



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Combustion Contaminants?

- Carbon Monoxide
 - Fatigue, headaches, dizziness, confusion
 - The “Silent Killer”
- Nitrogen Dioxide
 - Eye, nose, and throat irritation
 - Shortness of breath
- Moisture
 - Damp Indoor Environments



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Sources of Combustion Contaminants

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



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Carbon Monoxide

Approximately 300 deaths plus more than 100,000 medical visits occur per year.



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Carbon Monoxide Alarms

- Protects Against Life-Threatening Conditions
- Placement:
 - 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

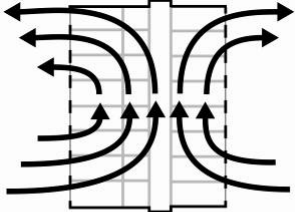


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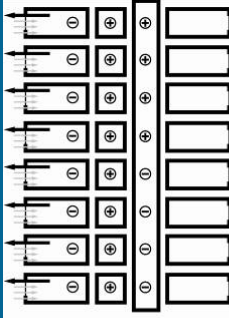

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Typical Air Flow

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




Distributed Ventilation

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

Multi-family dwellings need planned fresh air supply:

- Neighbors are closer together
- Stack effect- this dominates in cold weather



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Find the exterior exhaust



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Filter Heated and Cooled Air



Poorly sealed
access panel

Well sealed panel



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Keep It Pest-Free



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Keep It Pest-Free

- Integrated Pest Management
 - 10 Elements per HUD Guidance
 - Housekeeping
 - Maintenance
 - Exclusion
 - Ongoing Monitoring
 - Pesticides when needed



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How Common are Pests?

- Signs of rodents in last three months
 - Rats - 880,000 (0.8%) homes
 - Mice - 6.1 million (5.6%) homes
 - Not sure what kind of rodent – 309,000 (1.3%) homes
- Cockroaches and other pests not measured
 - 50% of public housing residents say they had cockroaches
 - 10% had them all of the time.

From American Housing Survey – 2005 and HUD's Real Estate Assessment Center



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Why Pest Free?

Health effects associated with pesticides include:

- Eye, nose, throat irritation
- Skin rashes, stomach cramps, nausea
- Central nervous system damage
- Kidney damage
- Increased risk of cancers



Use of some pesticides associated with increased risk of childhood leukemia.



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Spray paint and pesticide in a kitchen.



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Integrated Pest Management

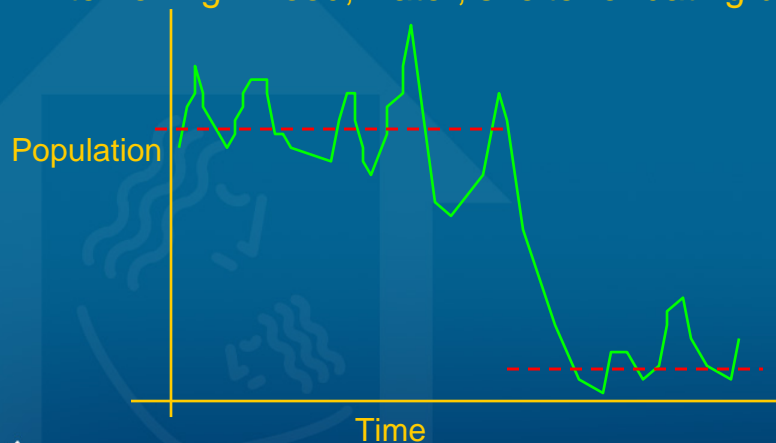
- Keep them out and give them no place to hide
 - Change surrounding landscape
 - Block pest entries, passages, hiding places
- Reduce food availability
 - Practice proper food storage and disposal
 - No dirty dishes in the sink overnight
 - Clean crumbs, grease etc.
- Knock down population
 - Traps
 - Appropriate pesticides



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Colonizing organisms must be controlled by changing the carrying capacity of the building – intervening in food, water, shelter or dating bars.

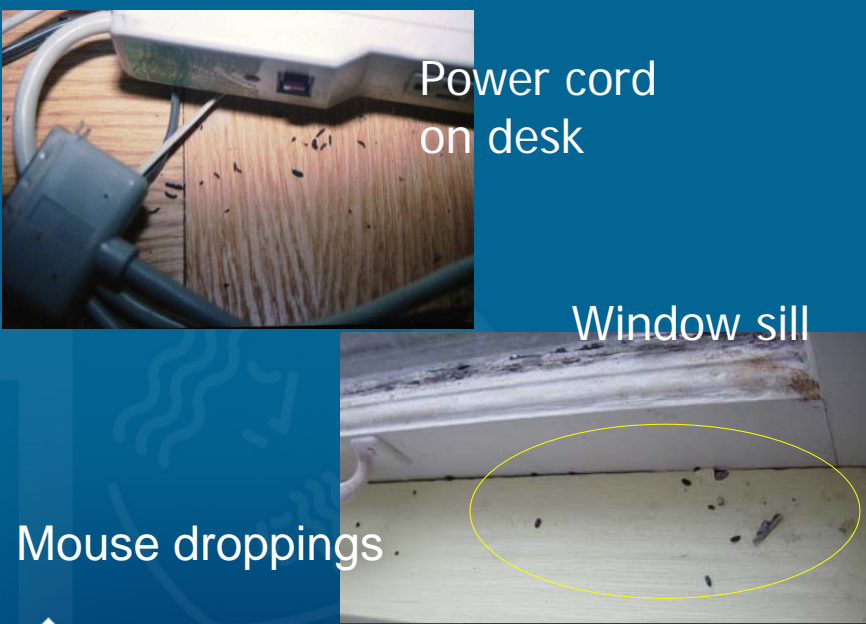


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Power cord on desk


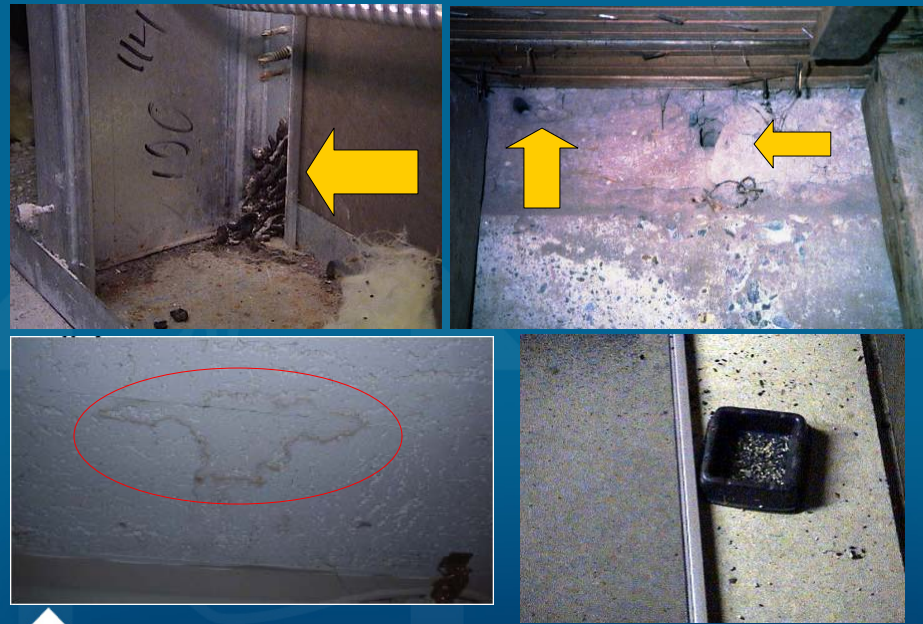
Window sill

Mouse droppings



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Holes in Wall



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EPA Pesticide Product Label

- Product Name
- Ingredients
 - Active
 - Inert / Other
- “Keep Out of Reach of Children”
- Signal Work - 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)

EPA Registration Number is Key



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Illegal and Risky Pesticides

- Pesticides that look like candy
- Insecticide chalk
(aka Miraculous or Chinese chalk)
- “Tres Pasitos”



candy!



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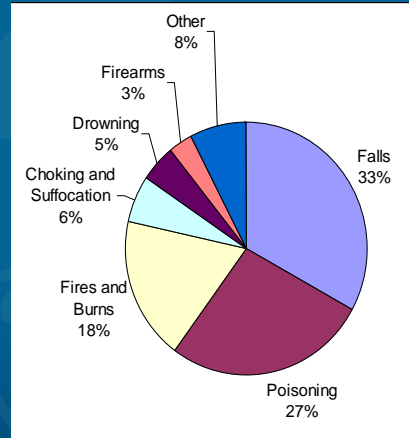
Keep It Safe



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Keep It Safe



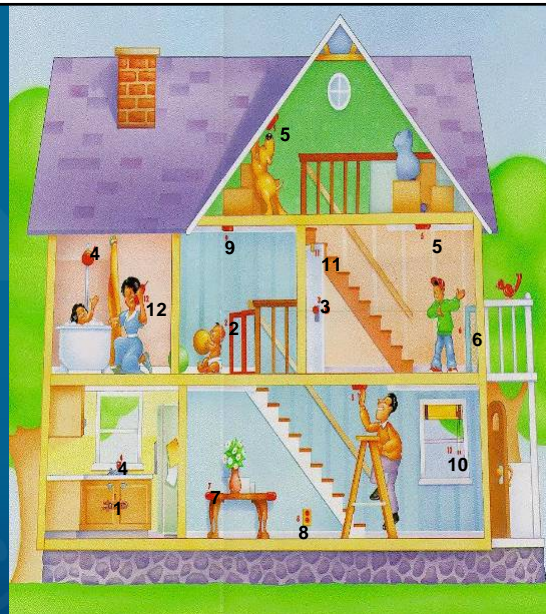
What are the most common causes of home injury deaths?



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There are many ways to be injured in the home



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Safety Related Housing Issues

- 1 million homes have holes in floors
- 2.5 million multi-unit homes with common stairways have loose steps
- 2.1 million homes have light fixtures in public halls that do not work.
- Electrical Wiring
 - 50,000 have no wiring
 - 700,000 have exposed wiring
 - 1,500,000 have rooms without electrical outlets

From American Housing Survey – 2005



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Which age groups are most susceptible?

Falls are leading cause of nonfatal home injury for children from birth through 14 and for older population.



Adults 80+ years of age are at **20** times higher risk for death from injury than younger individuals.

The highest rate of injury death for infants is from **choking and suffocation.**



Highest rate of injury death for 1-14 year olds is **fires and burns.**

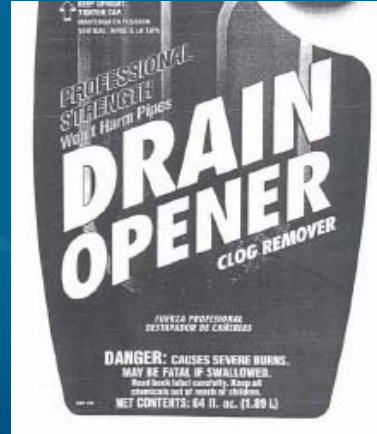


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Product Label

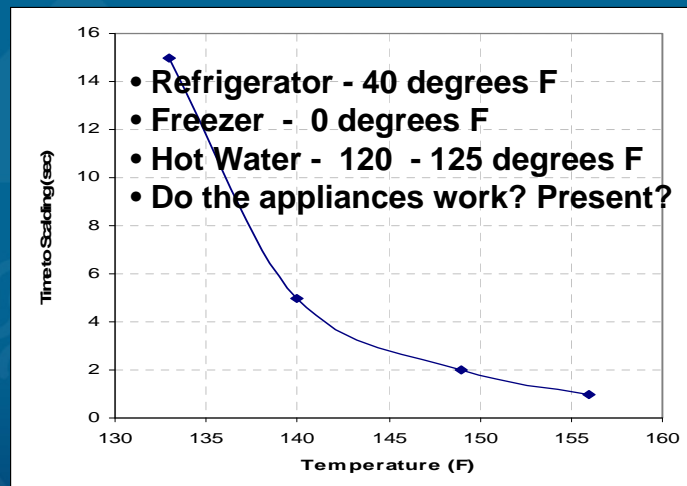
- Signal word
 - CAUTION
 - WARNING
 - DANGER
 - POISON
- Affirmative statement of principal hazard
 - ex: HARMFUL IF SWALLOWED, FLAMMABLE, CORROSIVE
- Statement to read other cautions on another panel if all labeling is not on Principal Display Panel



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Temperature guidance for fridge, freezer, hot water



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Keep It Contaminant-Free



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Keep It Contaminant-Free

- Lead and Lead-Based Paint
- Environmental Tobacco Smoke
- Radon
- Biologicals (see Keep It Dry)
- Combustion By-Products (see Keep It Ventilated)
- Pesticides (see Keep It Pest-Free)
- Asbestos
- Volatile Organic Compounds (VOCs)
- Sewer Gas



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Why Avoid Lead? Related Health Effects

- Reduced IQ
- Learning disabilities
- Impaired hearing
- Reduced attention spans, behavior problems
- Anemia
- Kidney damage
- Damage to central nervous system
- Coma, convulsions, death



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Lead Sources

- Peeling, Chipping Paint / Deteriorated Paint
- Dust
- Soil
- Drinking water
- Consumer Products such Pottery, Cribs, Jewelry, Candle Wicks
- Cultural Items
- Contaminated Sites



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Peeling paint outside



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Lead: Age of Housing Matters

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



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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.
 - Federal courses teach:



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Asbestos: What is it?



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Asbestos: Health Effects

- Lung Cancer
- Mesothelioma
- Asbestosis

Smokers are at
greater risk!



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Environmental Tobacco Smoke

Contains over 4,000 substances including more than 50 compounds known to cause cancer.



Health effects include:

- In non smoking adults: lung cancer, heart disease.
- In children: asthma, sudden infant death syndrome, bronchitis, pneumonia, ear infections.



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Smoke-Free Home Rules: State Performance

	92-93	98-99	2003	% Increase
Total	43.2%	60.2%	72.2%	67.1%
Max.	69.6%	81.1%	88.8%	107.9%
Min.	25.7%	38.9%	53.4%	27.6%



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What Can You Do About Tobacco Smoke in Homes and Cars?

- Quit, if you're ready there's help
- Don't smoke around children
- Smoke outside
- Exhaust vent the places where people smoke



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Volatile Organic Compounds

- Environmental Tobacco Smoke
- Paints
- Cleaning chemicals
- Carpets
- Pressed wood furniture
- Air fresheners
- Vinyl floors



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- VOC concentrations are 2-5 times greater in the home.
- During or immediately after paint stripping activities, VOC levels can be 1,000 times higher than outdoors.



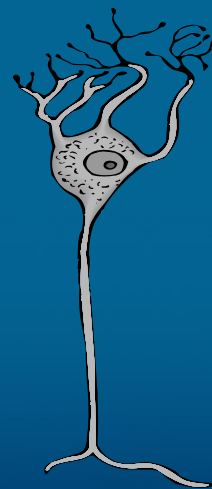
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Why Avoid VOCs?

Potential Health Effects:

- Eye, nose, throat irritation
- Headache, nausea, loss of coordination
- Liver, kidney, and brain damage
- Cancer
- Child developmental problems



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VOC Solutions

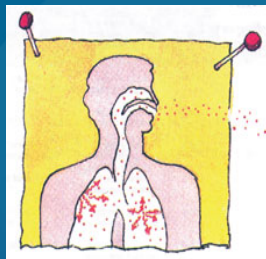
- Control the source
 - Avoid using products that contain VOCs
 - Use lower VOC options (i.e. paints)
 - Keep containers sealed
 - Store away from air draw sources
 - Remove unwanted products from home
- Ventilate
 - Open doors and windows
- Don't use what you don't have to



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Radon

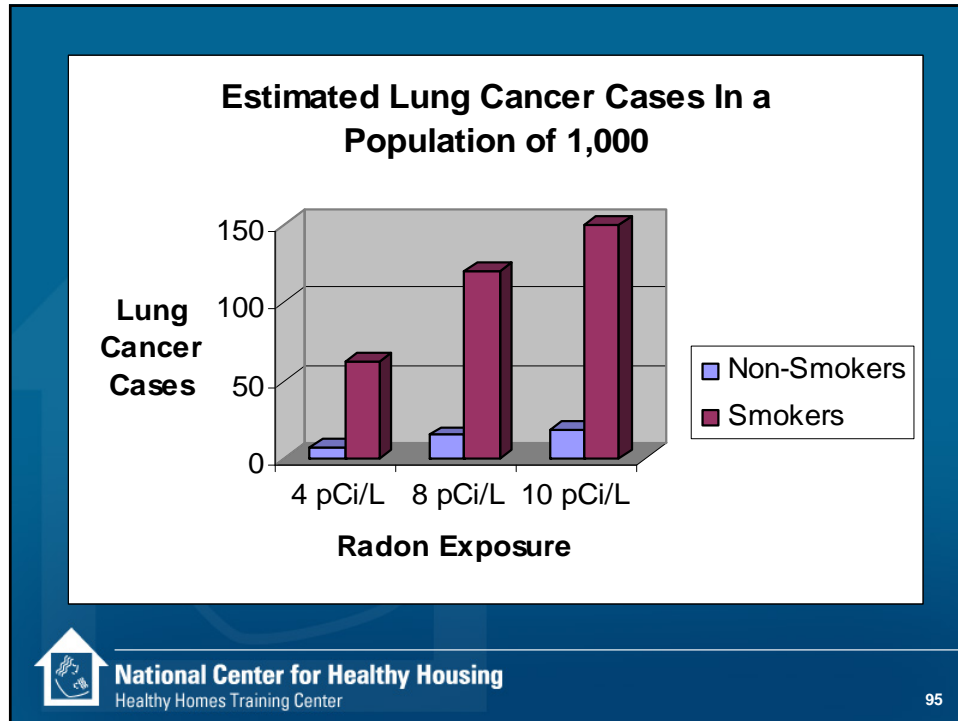


- 2nd leading cause of lung cancer with more than 20,000 deaths annually (smoking is #1)
- Leading cause of lung cancer in nonsmokers and people who have never smoked.



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Testing for Radon

- **Short Term**
 - Minimum 48 hours - \$10-\$20
 - Useful results (home sales, rental, occupancy)
 - If >4 pCi/L, do it a second time or do a long term test
- **Long Term**
 - 91 days to 1 yr - \$20-\$30
 - Better indicator of need to mitigate
 - If result is 4 pCi/L or higher, fix the home



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Radon Reduction Systems

Type of System	Average Cost
■ New Construction Passive Sub-Slab Depressurization System	\$350-500
■ New Construction Active Sub-Slab Depressurization System	\$650-800
■ Existing Housing Active Sub-Slab Depressurization System	\$800-2,500



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Sewer Gas

- A mixture of gases generated by bacteria and fungi while digesting wastes
- Sources: dried out traps in sinks and toilets, public sewers, septic systems, swamps, and ponds
- Often contains methane, hydrogen sulfide, ammonia, carbon dioxide, and carbon monoxide
- Causes asphyxiation, leading to unconsciousness, brain damage, and death.



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Keep It Maintained



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Keep It Maintained

- Inspect
- Clean
- Lubricate
- Replace
- Repair
- Organize

Healthy Homes Maintenance Checklist

The following checklist was developed for the Healthy Homes Training Center and Network as a tool for healthy home maintenance. A healthy home is one that is well-structured, maintained, and rehabilitated in a manner that is conducive to good designed health.

To maintain a healthy home, occupants should keep it dry, clean, and pest free, and prevent injury and control chemical contaminants such as radon and tobacco. Good home maintenance can help to reduce allergens, prevent illness, and reduce injury from accidents. This checklist provides basic guidelines; items may need to be checked more often depending on local conditions and manufacturer suggestions.

Downloaded for the National Healthy Homes Training Center by Terry Brennan, Committee Associate and Ellen D'Amico, PhD Associates.

	Yes	No	Not Applicable	Not Done	Not Done	Not Done	Not Done
Yard & Exterior							
Make sure away from house							
No trip, ice, chalking, loose soil, tripping	✓						
Fence around pool in-lot	✓						
Check for signs of rodents, birds, insects, termites	✓						
Check outdoor faucets and hoses	✓						
Clean window wells and check drainage	✓						
Clean gutters and downspouts	✓						
Basement & Crawlspace							
No wet surfaces, puddles	✓						
Sump pump and check sump warning	✓						
Floor drain working	✓						
Moisture treatment walls/floors	✓						
Check for signs of rodents, birds, insects, termites	✓						
Exterior Roof, Walls, Windows - check for leaks							
Roofs in good condition	✓						
Check chimneys, siding, flashing vents, skylight openings	✓						
Make sure gutters discharge water away from building	✓						
Check attic vents	✓						
Check attic for signs of mold/moist	✓						
Check for leaks and air leaks	✓						
Look for peeling paint, delamination	✓						
Look for signs of leaks where deck attached to house	✓						
Check brick window & door lintel flashing seal	✓						
Check for signs of leaks at window and door sills	✓						
Clean dryer vent	✓						
Clean exhaust ducts and flues	✓						

Maintenance Checklist continued on back



National Center for Healthy Housing
 Healthy Homes Training Center

National Healthy Homes Training Center and Network
Seven Principles

