Healthy and Affordable Housing: Practical Recommendations for Building, Renovating and Maintaining Housing

READ THIS

BEFORE YOU TURN OVER A UNIT

Asthma Regional Coordinating Council of New England

U.S. Department of Energy
Building America
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This document and the recommendations within do not represent federal or state government policy. They are the opinions of the authors.

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The Building Connection

Housing and Asthma

Asthma is a serious disease that affects millions of Americans, particularly children. Asthma is also increasing at an alarming rate. Many air contaminants are found at higher levels indoors than outdoors. Among them are the most common asthma triggers: particles from molds, dust, mites, mice, rats, roaches and pets.

Indoor air contains other contaminants such as carbon monoxide, volatile organic compounds (chemicals released from materials), nitrogen dioxide, sulfur dioxide, radon and other particles that can also affect individuals.

Some indoor air contaminants come from outside (e.g. ozone, sulfur dioxide, carbon monoxide, pollens and other particles) and can also affect individuals.

How a unit is turned over and maintained has significant effects on the control of asthma triggers and other indoor and outdoor contaminants.

Asthma affects millions of Americans, especially children

The Seven Steps to a Healthy Home

There are seven steps to a healthy home. A healthy home is:

- Dry
- Clean
- Well Ventilated
- Combustion Product Free
- Pest Free
- Toxic Chemical Free
- Comfortable

Dry and Clean

Water, clutter and dust permit or encourage the growth of mold, insects, rodents and mites. Keeping a home dry controls mold and pests.

Well Ventilated

Ventilation provides a mechanism to remove contaminants.

Combustion Product Free

Combustion products such as carbon monoxide should not be present in a healthy home.

Toxic Chemical Free

Toxic cleaning compounds, pesticides, oil- or alkyd-based paints and solvents can lead to poor

indoor air quality. Many of the containers these products are stored in slowly release the chemicals into the indoor air.

Pest Free

Pests lead to allergic reactions and pests lead to pesticides. Food and water lead to pests.

Comfortable

Uncomfortable homes can make people take action that makes a home unhealthy. A lack of comfort can lead to a lack of ventilation and over-humidification. If people are cold they won't ventilate their home. If people can't afford to heat their home they won't ventilate their home. In the summertime, some people need to keep their windows closed because of outdoor pollutants such as pollen. If people are hot they'll open their windows. If they open their windows they can't filter the air. If they can't filter the air they can't keep out the pollen. If people are dry they'll humidify. When they humidify they over-humidify. When they over-humidify they get mold.

Recommendations

Condition Survey

It is important to determine the existing condition of the unit. What works, what doesn't? Are there any leaking pipes? Are there any rain leakage issues? How about ground water? Are there any life-safety issues? Are there surfaces painted with lead-based paints? Is there asbestos?

Categorize the identified problems according to the seven steps:

- Dry
- Clean
- Well Ventilated
- Combustion Product Free
- Pest Free
- Toxic Chemical Free
- Comfortable

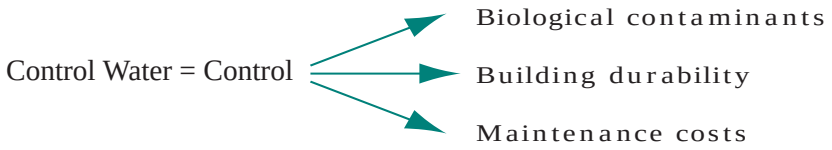
Within each category prioritize the identified problems:

- Things that absolutely must be done because of life safety concerns or serious durability concerns;
- Things that should be done, but might not be done because they can't be done for program reasons (money, time, etc.);
- Things that are a good idea, but we might not get around to this time.

Do the things that absolutely must be done, and then as many of the others as you can do within program limitations.

Dry

Water is a precondition for mold, insects, rodents, dust mites and is arguably the most important factor in the design and construction of a healthy home. Water is also the most important factor affecting the durability of a home and the most important factor affecting maintenance costs.



The three most important sources of water requiring control are:

- Rain
- Ground Water
- Plumbing Leaks

Make sure the roof doesn't leak. If it does fix it. Make sure that the windows and doors don't leak. If they do fix them. Remember in all of the fix strategies that caulking and sealants are temporary and should not be used unless there are no other options. Using flashings and drainage pans are the preferred methods of rain control.


Gutters and downspouts

Keep ground water out of foundations. If the basement leaks fix it. The fundamental principles of ground water control are to keep rainwater away from the foundation wall perimeter and to drain groundwater with sub-grade perimeter drains before it gets to the foundation wall. Make sure that the ground slopes away from the foundation. Make sure that gutters drain away from the foundation. Make sure that gutters and downspouts are clean and connected.

Plumbing leaks need to be fixed. Check clothes washers and hot water heaters. Make sure there are shut off valves. The rubber hose connections to clothes washers are prone to failure. Check them carefully and replace them frequently. Better still, replace with metal reinforced hoses.

If there is a clothes dryer, vent it to the outside.

All cold water pipes should be insulated to control summer condensation. Foam insulations are recommended; fiberglass insulation should be avoided.


Bathroom exhaust fan

Make sure that the bathroom and kitchen fans work. If there are no bathroom or kitchen fans see if you can get some installed.

Basements are often damp. Make sure that there is nothing in a damp basement that can decay. Get rid of all cellulose based materials (paper, cardboard boxes, gypsum board, wood). Remove all the wood that you can that touches below grade walls and floors. Make sure that subsequent tenants don't store anything in a damp basement. Provide alternative storage areas whenever possible. One trick to reduce evaporation into a basement that often works is painting the floor with a latex based concrete floor paint (not an epoxy). You want a paint that breathes a little – not a paint that is a perfect barrier because it will blister.

If you have a crawlspace make sure that the crawl space has a complete continuous polyethylene ground cover.

Polyethylene ground cover in crawlspace

If you have a damp basement install a dehumidifier. Don't open basement windows in the summertime to try to dry it out, the basement will only get wetter. Outside air in the summertime is humid and the water in the air will condense on cold basement walls.

It's important that attics are well ventilated. Make sure that there are attic vents at both the soffit and ridge. And make sure the vents are not blocked with insulation.

And finally get rid of any and all wallpaper. Wallpaper keeps walls from drying if they get wet; vinyl wallpaper is even worse. Paint walls, don't use wallpaper.

Proper grading around house

On the outside make sure that all wood siding is painted. Especially the bottom edges of trim. Replace any rotted trim with backprimed trim – with all ends and field cuts sealed.

Absolutely, no installed carpet in areas prone to get wet: bathrooms, laundry rooms, kitchens, entryways and damp basements.

Clean

Before you turn over a unit, thoroughly clean the unit, especially areas that are hard to reach.

Over two thirds of dust in homes originates outdoors, and is tracked in on feet. House dust is known to contain many hazardous materials including pesticides and lead. House dust contains many asthma triggers.

It is important to stop the dust at the door. A three part track-off approach is recommended:

1. Permeable, rugged outdoor mat that collects gritty materials; a grate over a collection hole is an alternative approach
2. Rugged indoor mat that collects grit and water; and
3. A hard surface, easily mopped floor to collect very fine particles left by drying foot prints.

Whenever possible, replace carpets with washable flooring. Use window treatments such as blinds or shades that can be easily wiped. Use hard surfaces rather than textiles. Use semi-gloss paints instead of flat or matte finishes. Such surfaces are easier to clean using mild soaps.

Change the furnace filter regularly . Filters should be rated at MERV 6-8 (35 percent or better dust spot efficiency).

High efficiency furnace filter

Well Ventilated

Indoor humidity and airborne contaminants are both controlled by ventilation. There are two kinds of ventilation: spot ventilation and dilution ventilation. Both are necessary in a healthy home. Spot ventilation deals with point sources of contamination such as bathrooms and kitchens. Dilution ventilation deals with low level contamination throughout the home.

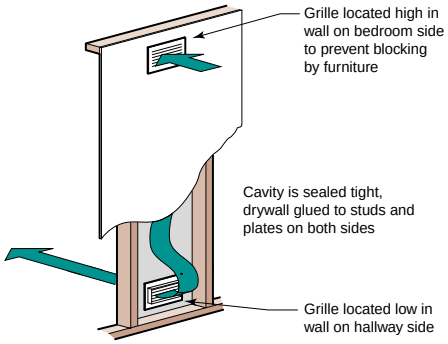
Every home requires exhaust to the outside from bathrooms and from kitchens. In kitchens, recirculating fans should be avoided because they can become breeding grounds for biologicals, a major source of odors, and in all cases allow grease vapors to coat surfaces throughout the home, plus they don't remove moisture.

All bathrooms require exhaust fans ducted to the outside – even bathrooms with operable windows. No exceptions. When fans are replaced, use low sone fans (less than 3 sones) because they are quiet and more durable.

Dilution ventilation can be provided three ways: exhaust, supply or balanced. In all cases it should be continuous and fan powered.

To reduce formaldehyde emissions (an irritant and asthma trigger) from particleboard surfaces, reduce the amount of particleboard. Use wire shelving in closets. Wire shelving is easy to clean and permits air circulation. With kitchen and bathroom cabinets constructed from particleboard, seal the exposed particleboard surfaces with 100 percent acrylic paint.

Air pressure differences cause air to move. That is both good and bad. Air change is good when it causes dirty air to be replaced with clean air. Air change is bad when dirty air is brought into a home. The bad air change is commonly associated with high negative air pressures (suction) in homes. High negative pressure can come from the continuously operating large exhaust fans or from the stack effect in tall buildings. High negative pressures can draw contaminants (such as radon and soil gas) into homes from below grade. High negative pressures can also cause problems with combustion and venting in furnaces, boilers and water heaters. Additionally, high negative pressures can cause smoke and odors to be drawn from neighboring units.




Power vented hot water heater

High negative pressures can be avoided several ways. The first is to seal forced air ductwork, particularly on the return (or suction) side. The second is to provide air pressure balancing between rooms (transfer grilles) when forced air systems are used. The third is to compartmentalize (isolate) multi-family units and high rises to limit stack effect air pressure differences.

Combustion Product Free

When something is burned it produces products of combustion, particularly carbon monoxide and very small particles that irritate the lungs. Products of combustion should never be found in the indoor air of a healthy home.

Gas cook tops and gas ovens produce products of combustion. They should only be used in conjunction with exhaust ventilation. Even with exhaust ventilation, some individuals with asthma and other respiratory diseases can be adversely affected. Electric ranges and ovens couples with exhaust ventilation may be the only option with these individuals. All cook tops and ovens should be installed in conjunction with range fans that are exhausted to the exterior.

Ideally, garages should not be connected to a healthy home. Discrete, separate garages constructed away from homes are preferred. If garages are connected to a home, they should be ventilated to the exterior with a passive vent stack. Air handling devices such as furnaces or air conditioners forced air ductwork should never be located in garages. Weatherstrip the door between the garage and the home and air seal the common wall.

Gas furnaces, gas boilers and gas water heaters should be aerodynamically uncoupled from occupied spaces; combustion gases should not be allowed into the occupied spaces. They should always be sealed combustion power vented devices.

Smoking should not occur in healthy homes.

Fireplaces should be vented to the exterior. Vent-free fireplaces should never be installed.

Pest Free

Infestations of cockroaches, dust mites, mice and rats can all cause allergic reactions. Even after the pests are gone, their skin, hair and feces can remain and cause allergies.

Making a home pest resistant produces a healthier home two ways: it reduces exposure to allergens and asthma triggers released by the pests and it can reduce the amount of pesticides used by the occupants.

Keep them out by changing the surrounding landscape and block pest entries and passages. Reduce food and water availability. Use pesticides appropriately.

Keep bushes and trees at least 3 feet from homes. Bushes and trees near a home provide food, a living place and sheltered passage for pests such as rats, mice, bats, birds, roaches and ants.

Seal utility openings and joints between materials. Use corrosion proof materials such as copper or stainless steel mesh. Rodents can chew through many materials and squeeze through tiny openings.

In the Northeast, dust mites do not generally live in buildings because buildings are too dry for much of the year. They colonize bedding, stuffed animals and favorite chairs because we humidify these things with our bodies. Control is by washing these items in hot water (greater than 130° Fahrenheit), which kills the mites and washes away allergens.

Dust mite habitats

- Review existing pest condition before you do anything;
- Use pesticides only if you have pests and you know what the pest is and controlling food, water and pathways doesn't work; and
- Don't apply pesticides regularly, apply them only if you need them.

Pesticides

In the design and construction of new buildings, pesticides have a very limited and targeted role to play. In a neighborhood infested with a difficult species, like roaches or termites, use a limited amount of low toxicity pesticide in targeted locations. In high risk termite areas, exclusion techniques and inspection detailing, combined with treated wooden materials and soil treatment are useful. For roaches, dusting with boric acid in areas that would be hard to treat later is an effective, low risk strategy. For example, dust with boric acid inside the kick space beneath sink, then seal the kick space as completely as possible.

Improper storage of pesticides

To assess risk factors associated with a pesticide, look at:

- Registration, classification, use, mode of action
- Specificity, effectiveness, repellency
- Toxicity to humans
- Cautions on label, data gaps
- Toxicity in the environment
- Resistant populations

Look especially for products like insect growth hormone regulators, which are very species specific, effective and have low toxicity for the applicators, occupants and the environment.

Don't spray pesticides; apply them directly to surfaces to be treated. Or, as an alternative use baits and traps.

Toxic Chemical Free

Toxic cleaning compounds, pesticides, oil- or alkyd-based paints and solvents can lead to problems. Many of the containers these products are stored in slowly release the chemicals into the indoor air. These products should not be stored inside the house. When in doubt, throw them out. Dispose of properly. Contact local office for hazardous waste if in doubt.

Comfortable

One of the major reasons that people are uncomfortably dry in the winter is due to excessive air change. This excessive air change typically occurs because of large openings in attics and exterior walls. The large openings in attics are often easy to access and easy to air seal. This air sealing should be done with rigid materials not with fiberglass insulation. This air sealing will also reduce the potential for ice damming, reduce energy use and improve comfort.

Humidifiers should be discouraged. Humidifiers add uncontrolled amounts of water to indoor air. They also have to be cleaned each week.

If people insist on adding moisture to indoor air a vaporizer is preferred. If a vaporizer is used, the interior relative humidity should be kept below 30 percent in the winter.

Check List

1. **Moisture: Check these locations for moisture**

   _____ **Under windows and doors, including sliding doors.**

   _____ **Under sinks and dishwasher**

   _____ **Around toilets, tubs and showers**

   _____ **Washing machine connections**

2. **Cleanliness**

   _____ **Dust and debris from repairs has been removed**

   _____ **Gutters and downspouts are connected and clear of leaves**

3. **Ventilation**

   _____ **HVAC filter is proper size and efficiency**

   _____ **Exhaust fans are working and exhaust ducts are clear**

4. **Combustion Safety**

   _____ **All gas and oil fired appliances are operating properly**

   _____ **Exhaust ducts and flues are clear**

   _____ **Smoke alarms are working properly**

5. **Pest Free**

   _____ **No evidence of insects or rodent droppings**

   _____ **No holes for insect, rodent entry into building**

6. **Toxic Chemicals**

   _____ **No toxic chemicals stored in building**

7. **Comfort**

   _____ **HVAC – good air flow to all rooms**

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