Health@Home

High-Performance Housing Rehabilitation Guidelines

Guidelines for incorporating healthy housing principles and practices in housing rehabilitation programs

U.S. Department of Housing and Urban Development
Office of Energy and Environment, Office of Community Planning and Development
March 2021

Acknowledgements

This document was prepared for HUD's Office of Community Planning and Development, Office of Energy and Environment, through the Community Compass Technical Assistance program by AECOM, Tohn Environmental Strategies LLC, and Livable Housing, Inc.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

This page intentionally left blank

INTRODUCTION

Americans spend about 70 percent of their time in their homes. In addition to remaining lead paint in pre-1978 homes, millions of U.S. homes have moderate to severe physical housing problems, including roofing problems; heating, plumbing, and electrical deficiencies; water leaks and moisture or mold problems; pests; damaged paint; harmful radon gas; and trip and fall hazards.[1] These types of housing conditions contribute to a variety of health issues, including unintentional injuries, asthma and respiratory ailments, radon-induced lung cancer, and lead poisoning.

These health issues have impacts beyond health: they may result in children missing school and adults missing work, as well as increased healthcare costs. Environmentally related diseases that include those linked to housing such as lead poisoning, cancer, and asthma have been estimated to cost more than $76 billion annually.[2] Forty percent of asthma cases are associated with indoor and home exposures and alone result in annual costs of $405 million.[3]

As we make our homes more energy efficient, healthy housing measures become even more important. Providing additional air sealing and tighter building envelopes, the need for moisture control and other measures to avoid concentrating contaminants in the home increases exponentially. In addition, these healthy housing measures have taken on new importance with the advent of Covid-19, as asthma and other respiratory ailments have been identified as a significant risk factor for the new virus.

Further adding urgency to the issue of healthy housing, Americans are living longer, and the way in which homes are designed, built, and maintained can support our ability to age in place, allowing families to remain within their support network and continue to be part of the neighborhood fabric to which they are accustomed. There is also growing interest in identifying ways that housing design can help facilitate the health and wellness of families by incorporating innovative active design features.

The Rehab Opportunity: Adopting the Healthy Housing Principles

Rehabilitation of existing housing presents a unique opportunity to address many of these housing-related health risks and hazards. Straightforward fixes can sometimes address multiple hazards simultaneously. For example, addressing moisture issues can reduce asthma risks, but also help reduce pest infestations that are linked to respiratory risks.

The housing rehabilitation guidelines presented in this document focus on the health and well-being of residents by identifying rehab practices that minimize contaminants and injury-causing materials. They are organized around the eight widely accepted Principles of Healthy Homes[4] with one additional principle added to address active design measures that promote exercise and healthy living.

1 American Housing Survey (AHS) https://www.census.gov/programs-surveys/ahs.html.
2 Trasande, L and Liu, Y. 2011. "Reducing the staggering costs of environmental disease in children, estimated at $76.6 billion in 2008." *Health Affairs* (Millwood) 30(5):863–870.
3 Lanphear, BP; Kahn, RS; Berger, O et al. 2001. "Contribution of Residential Exposures to Asthma in U.S. Children and Adolescents." *Pediatrics* 107(6): E98.
4 Developed by the National Center for Healthy Housing with support from HUD and the Centers for Disease Control.

The eight principles are:

1. Keep It Dry
2. Keep It Contaminant Free
3. Keep It Pest Free
4. Keep It Well Ventilated
5. Keep It Clean
6. Keep It Safe
7. Keep It Well Maintained
8. Keep It Thermally Controlled

We have added a ninth principle:

- Healthy Living and Active Design

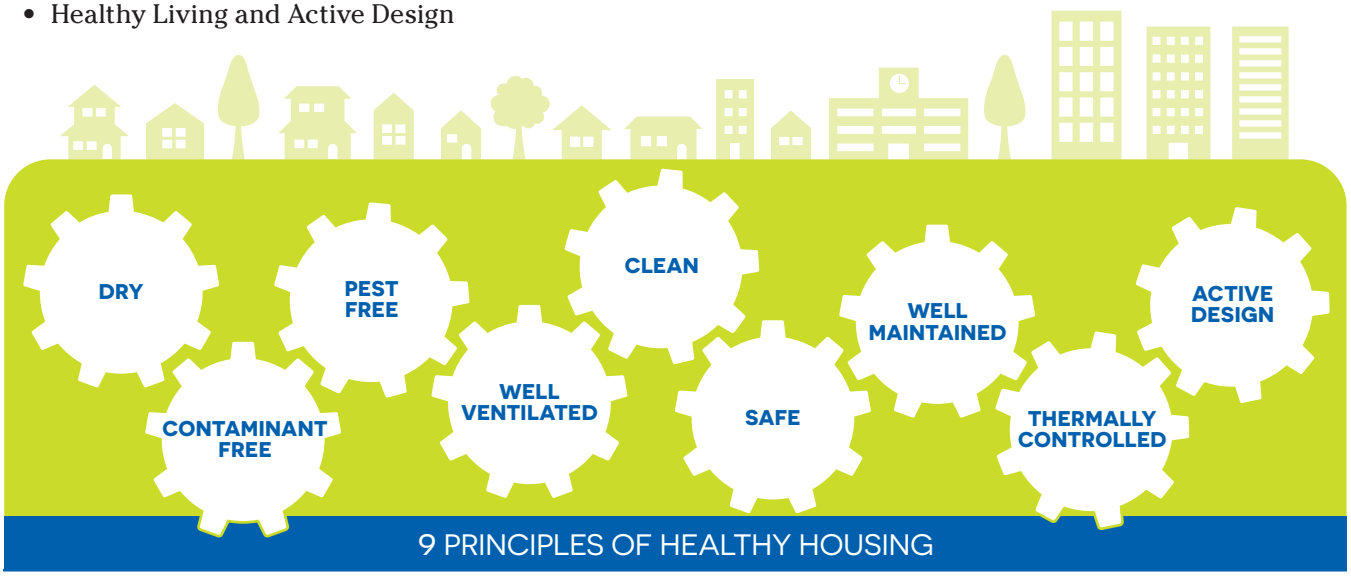


Figure 1: The Nine Principles of Healthy Housing

Because each principle has an impact on multiple sources of exposures, implementation of multiple principles can significantly reduce exposure to hazards.

Resident health and wellness are also a function of ongoing operation and maintenance of the property. Therefore, the guidelines also address post-rehab building maintenance and operations, as well as resident education. The guidelines provide suggestions for engaging residents in the maintenance of their living spaces and identifying actions they can take as individuals or families.

Use of These Guidelines

These guidelines are intended for use in conjunction with housing rehabilitation programs. Table 1 illustrates how the **Health@Home** guidelines fit into the universe of housing standards and regulations for different types of housing, as well as different scales of intervention (new construction/substantial rehabilitation, moderate rehabilitation, and weatherization/retrofits.)

Table 1: Using the Health@Home Guidelines

	Development Scale		
	New Construction OR Substantial Rehab	Moderate Rehabilitation	Weatherization OR Energy Retrofits
Single Family 1-4 Units	– EPA Indoor Air Plus (Single Family only), – Enterprise Green Communities Criteria, – National Green Building Standard, – LEED, and – Other green building standards as appropriate.	Health@Home Guidelines	– EPA, Healthy Indoor Environment Protocols for Home Energy Upgrades (Single Family and Low Rise); – EPA, Energy Savings Plus Health: Indoor Air Quality Guidelines for Multifamily Residential Building Upgrades
Low-Rise Multi-Family 1-3 Stories			
Mid-Rise Multi-Family 3-8 Stories			
High-Rise Multi-Family 8+ Stories		EPA, Energy Savings Plus Health: Indoor Air Quality Guidelines for Multifamily Residential Building Upgrades	

For new construction or substantial rehabilitation, a variety of green building certifications or standards already exist that incorporate healthy housing criteria. But standards for moderate rehabilitation that explicitly address the eight Healthy Housing principles do not exist. These guidelines are aimed at filling this gap and are intended primarily for use in **moderate rehabilitation of single family homes and low- or mid-rise multifamily housing**. While many of the guidelines also apply to high-rise residential buildings, certain elements that apply in these settings, such as ventilation requirements, are not included in these guidelines.

Healthy Housing and HUD-Financed Housing Rehabilitation

Removing lead and other health hazards from housing is one of HUD's current five Strategic Goals.[5] HUD's current 2018–22 Strategic Plan also identifies healthy housing as one of the agency's 2018 Agency Priority Goals.

HUD supports a variety of programs that support housing rehabilitation, including the HOME Investment Partnerships Program (HOME), Community Development Block Grants (CDBG), Public Housing Operating and Capital Funds, Indian Housing Block Grant and Indian Community Development Block Grant, as well as FHA single family and mortgage financing programs. Participating Jurisdictions (PJs) who use HOME funds for rehabilitation purposes are, for example, required to establish local rehabilitation standards for all HOME-assisted rehabilitation activities.[6] HOME PJs also routinely incorporate energy efficiency features in housing rehabilitation projects and are encouraged to adopt standards that embrace a "whole home" approach. This document can assist HOME PJs and other housing rehabilitation practitioners to incorporate healthy housing criteria into their housing rehabilitation standards.

This document is designed to be a template of housing rehabilitation standards, and users should customize it to suit their local *climate, housing market, client needs,* and *budgets*. However, this standard is not meant to supersede or replace requirements for specific hazards (such as lead or lead-based paint removal) that may be provided for in other programs (Weatherization Assistance Program, Community Development Block Grant, etc.). Finally, in Section B – Standards, recognizing that many jurisdictions are attempting to make their housing standards more resilient to future natural hazards and are focused on early pre-disaster mitigation efforts, we have included several specific recommendations for activities that a jurisdiction may undertake during rehab operations which may help with these goals.

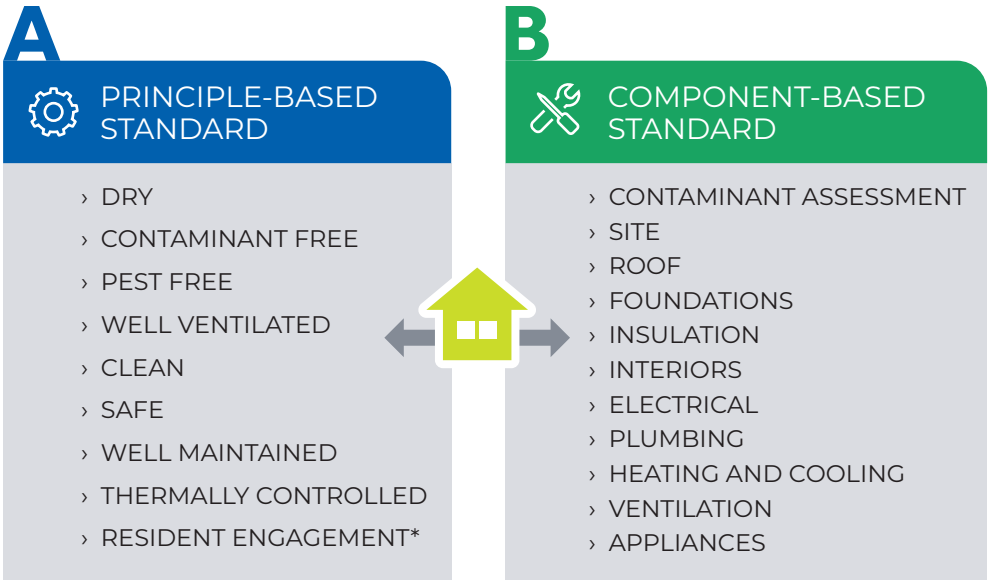
Organization of the Guidelines

As illustrated in Figure 2, this document presents two formats that housing rehabilitation programs and their partners can use to implement the recommended rehab guidelines.

- **Section A** is organized around the nine Healthy Housing Principles discussed above;
- **Section B** is a set of rehab standards organized around building components.

The building component-based standards are intended to provide additional considerations for users who are developing rehab standards for their programs. The two sections may be used together, or they may be used independently of each other, depending on the needs of the users and their program. Table 2 provides a crosswalk between the principles and practices outlined in Section I and the construction standards outlined in Section II. An expanded matrix showing detailed correlation between the Healthy Housing Principles and Building Components is included in Appendix D.

5 U.S. Department of Housing and Urban Development, FY 2018-22 Strategic Plan. See https://www.hud.gov/sites/dfiles/SPM/documents/HUDSTRATEGICPLAN2018-2022.pdf.
6 See HOME regulations at 24 CFR §92.251(b).



* All of the items in the principle-based standard are presented in the component-based standard, with the exception of resident engagement.

Figure 2: Two Formats That Can Be Used to Implement the Recommended Rehab Guidelines

Table 2: Healthy Housing Principles and Activities by Component Category

	Dry	Contaminant Free	Pest Free *	Well Ventilated	Clean *	Safe/ Accessible	Well Maintained *	Thermally Controlled
CONTAMINANT ASSESSMENT	Yes	Yes	Yes		Yes			
SITE	Yes	Yes	Yes			Yes		
ROOF / EXTERIOR	Yes	Yes	Yes			Yes	Yes	Yes
FOUNDATION	Yes	Yes	Yes			Yes		
INSULATION & SEAL	Yes		Yes					Yes
INTERIOR		Yes	Yes		Yes	Yes	Yes	
ELECTRICAL						Yes		
PLUMBING		Yes	Yes		Yes	Yes	Yes	
HEATING & COOLING		Yes						Yes
VENTILATION	Yes	Yes		Yes				
APPLIANCES						Yes		

** Sections with relevant Resident Engagement actions*

Potential Audiences

A range of users will find the information and resources in these guidelines of value. Specific users and use cases of this document may include:

Program Managers:

- Define and implement a process to create a Healthy Housing Rehab Standard. Ideally this would be an inclusive consensus-based process, engaging program staff.
- Standardize program implementation across staff and projects.
- Communicate program standards to clients, partners, and others within their organization.

Program Staff:

- Develop a local Healthy Housing Program Standard.
- Better evaluate program performance for monitoring purposes.

Case Managers/Intake Staff/Underwriters:

- Customize a local Healthy Housing Program Standard for their program in conjunction with PJ and subrecipient staff.
- Customize a local Healthy Housing Program Standard that communicates program guidelines to clients.

Construction/Rehabilitation Specialists:

- Assist in the implementation of a local Healthy Housing Standard for their program, determine the appropriate treatments to homes based on these guidelines, and communicate program guidelines to clients.

Resource Documents

The guidelines outlined in this document draw upon health protections identified in several core documents, including those listed below. A full list of all relevant resources considered or referenced in the proposed guidance is provided in Appendix C.

- U.S. Department of Housing and Urban Development and Centers for Disease Control, *Healthy Housing Reference Manual*
- Environmental Protection Agency (EPA), *Healthy Indoor Environment Protocols For Home Energy Upgrades*
- EPA, *Energy Savings Plus Health: Indoor Air Quality Guidelines for Multifamily Building Upgrades*
- Enterprise Community Partners, *Green Communities Criteria*
- Enterprise Community Partners, *Aging in Place Design Guidelines*
- Centers for Disease Control, General Services Administration, and Center for Active Design, *Fitwel*
- National Center for Healthy Housing (NCHH), *National Healthy Housing Standard*
- NCHH, *Field Guild for Cleanup of Flooded Homes*
- New York City, *Integrated Pest Management Tool Kit*
- New York City Health Department, *Guidelines on Assessment and Remediation of Fungi in Indoor Environments*

A HEALTHY HOUSING PRINCIPLES

In this section, the **Health@Home** guidelines are organized around the following eight Healthy Housing principles, developed by the NCHH with support from HUD and the Centers for Disease Control and Prevention (CDC), with the addition of a ninth principle aimed at promoting exercise and healthy living:

1. **Keep It Dry**
2. **Keep It Contaminant Free**
3. **Keep It Pest-Free**
4. **Keep It Well Ventilated**
5. **Keep It Clean**
6. **Keep It Safe**
7. **Keep It Well Maintained**
8. **Keep It Thermally Controlled**
9. **Healthy Living and Active Design**

For each of these principles, we identify relevant housing rehabilitation measures. Key references and tools are also listed, where appropriate, to help users undertake the work. In some cases, these healthy housing principles apply to both post-rehab building operations and maintenance, or resident behavior, as well as to actual rehab activities. Post-occupancy resident education (for single-family properties) and building management (for multifamily housing) are critical to the success of any program. Residents can be allies in creating a safe and healthy home. Accordingly, an effective standard should highlight opportunities for resident education, and thus this guidance includes such actions. Unless otherwise noted, all of the recommended actions apply to both single-family and multifamily residential buildings.

1 KEEP IT DRY

Moisture and mold are linked to increased risk of asthma and other respiratory ailments, as well as allergic reactions in some individuals. Excessive moisture can also contribute to pest problems and deterioration of lead-based paint.

1.1 PREVENTION: STORMWATER MANAGEMENT

Ensure that stormwater management is adequate for the building site and climate.

- Size *gutters and downspouts* appropriately, either by increasing the dimensions of gutters and downspouts to the next size when the system is inadequate, or by sizing them per the manufacturer's recommendations.

- Downspouts and grading must direct water away from the building to prohibit water infiltration into the structure.
- Sub-surface drainage systems are an approved remedy for moving stormwater away from the structure when sufficient grading is not feasible because of site conditions.

1.2 PREVENTION: LEAKS

Identify and repair all roof leaks, building envelope leaks, and plumbing leaks. Assess affected areas for structural issues, deterioration of components, and mold, and take appropriate actions to address the issues.

1.3 PREVENTION: SURFACES

In high-moisture areas such as kitchens, bathrooms, and laundry rooms, use cleanable, durable, moisture-resistant materials, such as waterproof shower surrounds constructed of fiberglass or ceramic tile flooring that is impervious to water and sealed to adjoining bathing fixtures, countertops, and sinks.

Ensure all countertop materials adjoining sinks are water tight and well-sealed to the sink bowl to prevent leaks into cabinetry.

When installing new tubs/showers, use durable substrates under ceramic tile or fiberglass tub/shower kits that are water tight. Install water-resistant drywall (such as paperless drywall or "green board") in areas without constant water immersion or intrusion (i.e., kitchens, countertops, etc.), or water-impervious surfaces (such as cement board) directly adjoining the tub/shower.

1.4 MOLD

Address any instances of suspected mold per EPA guidelines for threshold levels and treatment. Identify and cure the moisture problem that created it. Clean up all existing mold (active or inactive) per the New York City Health Department Guidelines on Assessment and Remediation of Fungi in Indoor Environments, and/or the NCHH's Field Guild for Cleanup of Flooded Homes.

1.5 PREVENTION: HIGH RELATIVE HUMIDITY

High relative humidity (RH) can damage building components, increase the opportunities for mold growth, and create the potential for some types of pest infestation. Instances where the RH is above 55 percent should be addressed by curing the source of moisture and/or additional ventilation. (See other remedies in Principle 3, *Keep It Pest Free*, and Principle 4, *Keep It Well Ventilated.*)

1.6 VENTILATION

See Section 4, *Keep It Well Ventilated* to address moisture issues created by everyday occupant activities.

The matrix below shows the relationships among the Keep It Dry principle-based standard and the component-based standards in Section B.

Principles (Section A)	Contaminants	Site	Roofing	Building Exterior	Foundations and Structure	Insulation, Air Sealing	Interiors	Plumbing	Space Conditioning	Ventilation
A.1 Dry										
A.1.1 Stormwater Management		2.2 Grading	3.1 Flat and Low-Slope Roofing	4.3 Windows	5.2 Basement Floors	6.1. Air Sealing				
A.1.2 Leaks		2.3 Landscaping/ Trees and Shrubs	3.2 Pitched Roofs	4.2 Exterior Cladding; 4.3 Windows; 4.4 Ext Doors	5.3 Crawl Spaces					
A.1.3 Surfaces		2.1 Paving/ Walkways; 2.2 Grading; 2.4 Lawn	3.3 Gutters and Down-spouts		5.4 Sump Pump Systems			9.3 Plumbing Fixtures		
A.1.3 Countertops	1.4 Mold/ Moisture; 1.7 VOCs						7.6 Kitchen Cabinets and Counter-Tops			
A.1.3 Tubs/ Showers								9.1 Drain/ Waste/ Vent; 9.3 Plumbing Fixtures		
A.1.4 Mold	1.4 Mold/ Moisture				5.1 Foundations	6.1 Air Sealing			10 - 10.3 Space Conditioning	11 Ventilation (All)
A.1.5 Relative Humidity	1.4 Mold/ Moisture					6.1 Air Sealing			10 Space Conditioning	11 Ventilation (All)
A.1.6 Ventilation	See Section A.4 – Keep It Well Ventilated									

2 KEEP IT CONTAMINANT FREE

Common contaminants in the home include asbestos, lead, radon, building materials, pesticides, and tobacco smoke.

2.1 LEAD

Exposure to **lead** can result in neurological damage, decreases in IQ, learning difficulties, slowed growth and, in rare cases, death, particularly for children and pregnant women.

2.1.1 LEAD-BASED PAINT

The Lead Safe Housing Rule applies to all HUD-funded projects in pre-1978 buildings (target housing). Specific requirements depend on whether the housing is being disposed of or assisted by the federal government, the type and amount of financial assistance, the age of the structure, and whether the dwelling is rental or owner-occupied. Consult the summary of requirements for specific information, or view the HUD Assisted Housing Programs to see which are affected by the Lead Safe Housing Rule.

When disturbing lead-based paint in all housing constructed prior to January 1, 1978 (target housing), avoid creating lead hazards and comply with applicable HUD requirements in CFR title 24 part 35 Subpart J "Rehabilitation."

Note: Requirements vary with *the level of work being conducted*.

All projects disturbing potential lead surfaces in pre-1978 housing must:

- Have a HUD-approved Risk Assessment completed to identify all of the lead-based paint hazards prior to completing a scope of work. Include all necessary lead-based paint stabilization or abatement in the scope of work.
- Include requirements in the specifications that the contractor must contain the work area to prevent the spread of dust and debris.
- Require the contractor be trained in lead-safe work practices, minimize dust, and avoid the use of tools and techniques that generate dust.

Specify a thorough cleaning using wet washing and High-Efficiency Particulate Air (HEPA) vacuums, and require clearance testing if more than 2 square feet of paint is disturbed in any interior room. See the HUD guidelines at https://www.hud.gov/program_offices/healthy_homes/lbp/hudguidelines.

The **Lead Safe Housing Rule applies to all HUD-funded and other federally funded projects in buildings built prior to 1978** (target housing). **Specific requirements depend on a number of factors, including the type and amount of financial assistance**, the age of the structure, and whether the dwelling is rental or owner-occupied.

Key requirements at all levels of rehabilitation assistance include occupant protection, use of workers trained in lead-safe work practices, and clearance testing. HUD requires abatement when federal rehabilitation assistance exceeds $25,000 per unit. Consult the Lead Safe Housing Rule requirements web site for specific information: https://www.hud.gov/program_offices/healthy_homes/enforcement/lshr_summary.

For assistance with program implementation, see NCHH HUD Lead-Based Paint Regulation Implementation for Rehabilitation Programs (http://www.nchh.org/Policy/National-Policy/HUD-Lead Based Paint-Regulation-Implementation-for-Rehabs.aspx).

2.2 LEAD SERVICE LINES

If the water heater is to be replaced, determine if there is a lead service line (LSL) that connects the drinking water main under the street with the building. If a LSL is present, consider replacement before or while replacing the water heater.

Follow American National Standards Institute (ANSI) / American Water Works Association (AWWA) C810-17 Standard, *Replacement and Flushing of Lead Service Lines*, when replacing the LSL. To determine if the service line is lead, contact your local water utility for guidance and inspect the line as it enters the property. See www.lslr-collaborative.org for additional guidance.

2.3 ASBESTOS

Materials containing asbestos that are damaged or not intact can allow this contaminant to become airborne and subsequently inhaled, increasing the risk of developing lung disease and certain cancers.

Asbestos-containing material (ACM) may be found in one of several locations: on steam or water pipe wrappings, acoustic ceiling tiles, roof shingles, and floor tiles. If the possibility of such ACM exists, do not disturb it. If suspected ACM is damaged (e.g., unraveling, frayed, breaking apart), immediately isolate the area(s).

For suspected ACM that is damaged or that must be disturbed as part of the housing rehabilitation activity, contact an asbestos professional for abatement or repair in accordance with federal, state, and local requirements.

Attic insulation that contains vermiculite may contain asbestos. Do not remove or disturb attic insulation that looks like vermiculite (pictured to the right) unless the material has been tested and found to be asbestos-free.

Figure 3: Vermiculite insulation

2.4 RADON

Determine if the home has a functioning active radon mitigation system. Such systems include a radon vent fan (usually located in an attic, in an attached garage, or on the building exterior) and an indicator (visual or sound) that the fan is sucking air out of the soil. If a previously installed radon mitigation system is not operating correctly, advise the property owner to contact the system installer or consult the state radon office.

Prior to work, test for radon in the lowest occupied living level. Testing is highly recommended in all locations across the United States; however, it is most important in EPA Radon Zones 1 and 2, where radon risks are typically higher (see Figure 2). Some states may have more specific radon maps, which can be consulted when available. (Short-term tests can be used [e.g., EPA National Radon Program Services test kit], although long-term tests provided more accurate results. For more information, please see the EPA testing guidance: https://www.epa.gov/radon.) If pre-work levels are equal to or exceed 4 picocuries per liter (pCi/L), consider

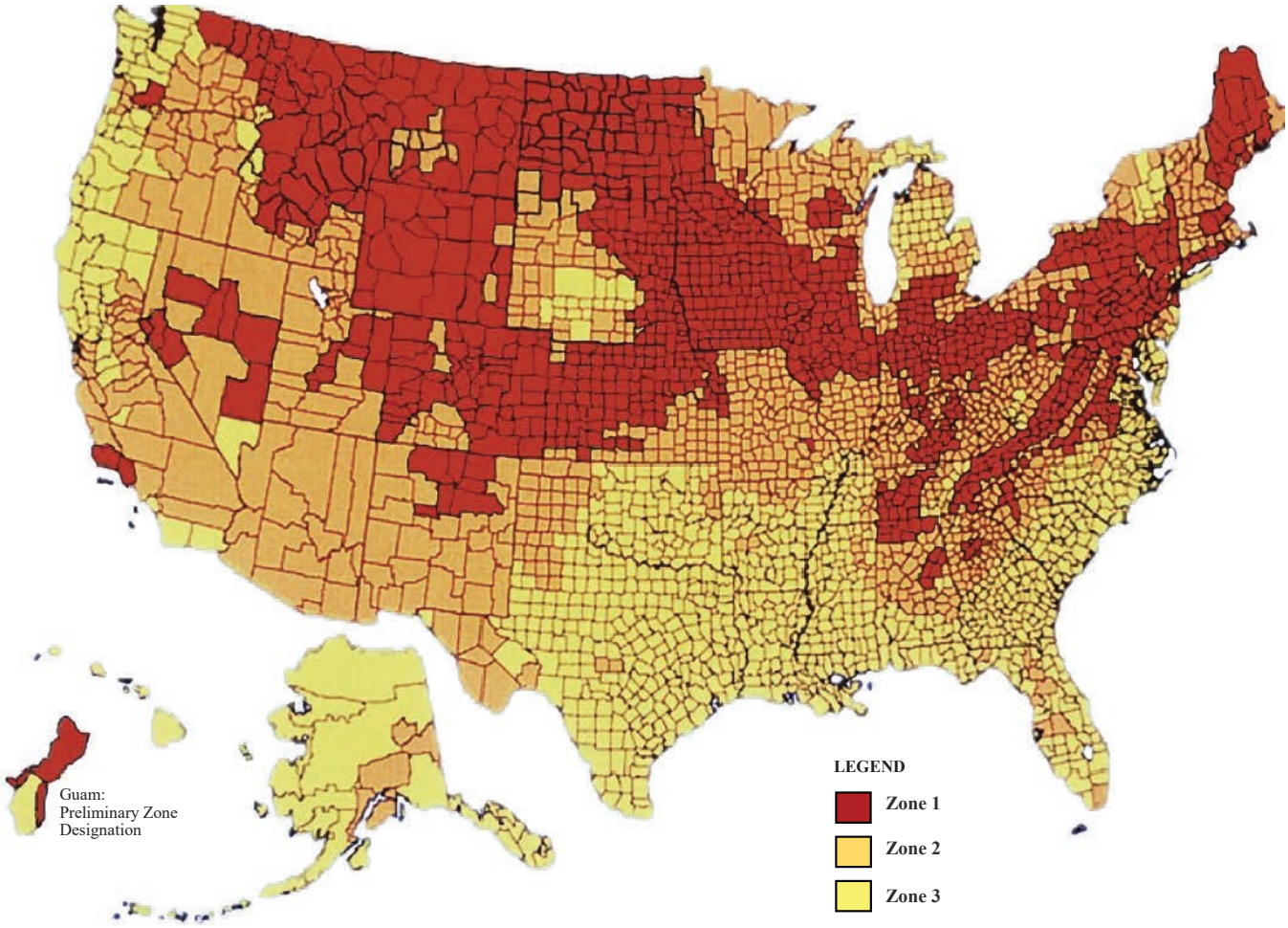


Figure 4: EPA Map of Radon Zones (https://www.epa.gov/radon/epa-map-radon-zones)

installing a radon mitigation system in accordance with ASTM E2121, Standard Practice for Installing Radon Mitigation Systems in Existing Low-Rise Residential Buildings, and applicable state requirements.

If the work scope includes activities that could change indoor air pressure or building tightness (e.g., insulation; air sealing; heating, ventilation, and air conditioning [HVAC] replacement; larger renovation; etc.) and the home does not have an active mitigation system, **conduct pre- and post- work radon testing and follow the actions below**, which are consistent with EPA Healthy Indoor Environment Protocols for Home Energy Upgrades.

If pre/post test results indicate a potential increase in radon: If radon levels after energy upgrades are ≥4 pCi/L and are higher than radon levels before upgrades, install mitigation in accordance with ASTM E2121 or ANSI / American Association of Radon Scientists and Technologists (AARST) SGM-SF-2017, *Soil Gas Mitigation Standards for Existing Homes*. For post-test levels above 4 pCi/L, consider a long-term test (minimum 90 days) to confirm an increase before undertaking mitigation.

If pre/post testing is not feasible or pre-work levels are 2 pCi/L, undertake precautionary measures, to help prevent radon increases when there is potential radon exposure (as indicated by the EPA radon guidance).

1. ***Install whole dwelling ventilation in accordance with American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 62.2 standard, Ventilation for Acceptable Indoor Air Quality (see Section 4, Keep It Well Ventilated, which recommends standard 62.2 to the extent feasible). Note: exhaust only systems have been shown to potentially increase radon in some basements; if basements are occupied, consider alternative ventilation strategies such as balanced systems, taking into account other sources that warrant ventilation such as cooking sources.***
2. ***Cover exposed earthen floors in basements and crawlspaces according to section 1.2 of EPA's Indoor airPLUS Construction Specifications or section 2.0403.2 of National Renewable Energy Laboratory's Single-Family Standard Work Specifications (sws.nrel.gov).***
3. ***Air seal sumps (e.g., install an airtight sump cover) in such a way that water can drain from above, such as with a ball valve, and below the sump cover.***

Note: Radon mitigation in multifamily properties should meet AARST Radon Mitigation Standards for Multifamily Buildings, RMS-MF 2018.

2.5 CONTAMINANTS IN BUILDING MATERIALS: FORMALDEHYDE AND VOLATILE ORGANIC COMPOUNDS

Building materials can contain chemicals, such as volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and formaldehyde, that can increase respiratory and other health risks, including cancer. VOCs can include chemicals such as formaldehyde and acetaldehyde, along with benzene, toluene, and perchloroethylene. SVOCs can include phthalates and chemicals used in products such as vinyl flooring.

2.5.1 FORMALDEHYDE: COMPOSITE WOOD

Select products with label indicating compliance with Toxic Substances Control Act (TSCA) Title VI or California 93120 Phase 2 requirements. Such certified products limit emissions of formaldehyde.

2.5.2 PAINTS AND ADHESIVES

Paints

Use low VOC interior paints and primers compliant with South Coast Air Quality Management District (SCAQMD) Rule 1113 thresholds (e.g., Master Painters Institute [MPI] GS-2, Extreme Green; Greenwise Gold; and GreenSeal (GS) 11 v 3.2 meet some of the SCAQMD thresholds).

Adhesives

Use low-VOC adhesives and sealants (including caulk) compliant with South Coast Air Quality Management District (SCAQMD) Rule 1168 thresholds. Note: Projects located in cold climates only (Climate Zones 6 and 7 based on International Energy Conservation Code 2012) may be exempted from requiring low-VOC adhesives and sealants if they prove problematic due to the cold.

2.5.3 CARPETS AND FLOORING

In the short term, such as immediately after new carpeting is installed, VOCs may cause headaches and nausea, along with irritation to the eyes, nose, and throat.

- Do not install carpets in building entryways, laundry rooms, bathrooms, kitchens/kitchenettes, utility rooms, or any rooms built on foundation slabs.
- Limit use of carpet in other areas to minimize collection of allergens and contaminants. If carpet is installed, products must meet the Carpet and Rug Institute's Green Label or Green Label Plus certification for carpets, pads, and carpet adhesives.

2.5.4 HARD FLOORS

Hard surface flooring products must be either ceramic tile, solid unfinished hardwood floors, or meet the Scientific Certification System's FloorScore program criteria.

2.6 TOBACCO SMOKE

Exposure to tobacco smoke, whether direct or secondhand, causes adverse health outcomes such as asthma and other respiratory illnesses, cardiovascular disease, and cancer.

During construction and post-occupancy, consider smoke-free policies for all properties. See https://www.hud.gov/program_offices/healthy_homes/smokefree.

2.7 SEWER LINES

Inspect existing sewer lines for signs of leaks. If there are regular back-ups of the sewer system, consider using a scope to determine if there are systemic issues with the connection to the municipal system or the on-site septic system.

The matrix on the following page shows the relationships among the Keep It Contaminant Free principle-based standard and the component-based standards in Section B.

Principles (Section A)	Contaminants	Site	Roofing	Building Exterior	Foundations and Structure	Interiors	Plumbing	Space Conditioning	Ventilation
A.2 Contaminant Free	1 Contaminants and Other Hazards					7.1 Interiors; 7.6 Kitchen Cabinets and Countertops; 7.7 Flooring; 7.7.2 Finishes		10.3 Distribution System	11.2 Kitchen Ventilation; 11.4 Whole House Ventilation
A.2.1 Lead		2.4 Lawn		4.2-7 Building Exteriors			9.1-4 Plumbing		
A.2.2.1 Lead-Based Paint	1.1 Lead-Based Paint	2.4 Lawn		4.2-7 Building Exteriors		7.3 Interiors; Doors: 7.7.2 Finishes			
A.2.2.2 Lead Service Lines	1.8 Water Quality Testing						9.1-2 Plumbing		
A.2.2 Asbestos	1.2 Asbestos		3.2 Pitched Roofs			7.7 Flooring;		10.1 Heating Equipment	
A.2.3 Radon	1.6 Radon	2.2 Grading			5.1 Foundations				
A.2.4 Formaldehyde and Other VOCs	1.7 VOCs				5.2 Basement Floors	7.6 Kitchen Cabinets and Countertops; 7.7 Flooring; 7.7.2 Finishes			
A.2.4.1 Composite Wood					5.3 Crawl Spaces	7.6 Kitchen Cabinets and Countertops; 7.7 Flooring; 7.7.2 Finishes			
A.2.4.2 Paints						7.7.2 Finishes			
A.2.4.3 Adhesives						7.6 Kitchen Cabinets and Countertops; 7.7 Flooring; 7.7.2 Finishes			
A.2.4.4 Flooring						7.7 Flooring;			
A.2.5 Pesticides		2.4 Lawn				7.6 Kitchen Cabinets and Countertops;			
A.2.6 Tobacco Smoke						7.1 Smoke, Fire and Co Alarms			
A.2.7 Sewer Lines	1.9 Sewer System						9.1-2 Plumbing		

3 KEEP IT PEST FREE

Exposure to mice and cockroaches can trigger asthma attacks. For pest control, using pesticides may create a bigger problem, as pesticide residues in homes may pose risks for neurological damage and cancer. Therefore, resident education is important for ongoing protection and prevention of pests.

3.1 IDENTIFY AND ADDRESS PEST PROBLEMS

Identify existing pest infestations as part of the building analysis. Pest infestations that create a potential health hazard, or that are likely to impede an affordable housing rehabilitation effort, should be addressed using Integrated Pest Management (IPM) strategies. See Stop Pests' Pests Solutions page to assist in identification, as well as New York City Department of Health, Integrated Pest Management Tool Kit and Stop Pests, IPM: A Guide for Affordable Housing for IPM practices.

3.2 PREVENT PEST ENTRY

Block, seal, and eliminate pest entry points around the building envelope. For example, seal gaps in walls, floors, around doors and windows, between the foundation and upper portion of the building, and joint areas using non-toxic sealing methods such as window screens, door sweeps, escutcheon plates, and elastomeric sealants. Install door sweeps that have rodent-resistant elements on exterior doors; seal openings around pipes, conduits, or wires using pest-proof mesh or metal-based products in conjunction with caulks or other sealants; and ensure garbage cans and dumpsters have secure lids.

In areas with evidence of existing rodent infestations or likely future rodent issues, patch exterior holes and cracks that are larger than ¼-inch by ⅜-inch with rodent- and corrosion-resistant materials (e.g., copper mesh, hardware cloth, sheet metal, stainless steel, concrete) and install exterior door sweeps with rodent-proof materials. Protect air intakes from potential bird and pest entry (e.g., cover openings with ½-inch screen or galvanized mesh). Follow other pest-proofing strategies in the NYC IPM Tool Kit.

3.3 REDUCE RELATIVE HUMIDITY

Address high RH to reduce the health risk of allergens generated by dust mites. RH levels below 50 percent significantly reduce the potential for dust mite infestations. See Section 1, "Keep It Dry" and Section 4, "Keep It Well Ventilated."

3.4 OPERATIONS AND MAINTENANCE: ADOPT INTEGRATED PEST MANAGEMENT

Common pests can cause serious health problems. Pests such as cockroaches and rodents, as well as the chemicals we use to control them, can cause and trigger allergies and asthma by becoming components of house dust and contaminating indoor air. Because IPM focuses on prevention, it provides more effective, long-term control, and also reduces the need to use pesticides.

All properties benefit from pest prevention strategies that are consistent with an IPM approach. However, an IPM plan may not be necessary for scattered site, single-family rehabs. In such cases, resident education (including materials listed in Section 9, Healthy Living and Resident Engagement) can provide helpful advice to help residents avoid and address pest issues.

IPM focuses on pest prevention by eliminating the root causes of pest problems by following these steps:

- Identification: Since each pest has different habits, biology, and life cycles, positive identification and finding where they are coming from will lead to more effective control. Using monitoring glue traps for cockroaches can be helpful.
- Prevention and exclusion: Preventing the conditions that pests need by eliminating pests' food, water, and shelter is critical to successful control. Pest proofing strategies to prevent pests from entering the buildings are a key strategy. See Section 3.2.
- Monitoring: New infestations can be controlled best if spotted early. Record pest sightings to document where and when the problems occur. Regularly monitor using traps to track progress or need for further steps such as bait rotation, treatment of adjacent units, etc. Ongoing monitoring is one of the most important steps in effective pest management. In multifamily housing in particular, ongoing monitoring is important for early control and prevention of bed bug infestations.
- Multiple tactics: Pesticides are used in a targeted manner (specifically for the elimination and prevention of cockroach infestation), and only by a licensed and experienced professional. If pesticides are used, bait and gels are a preferred approach for cockroach problems; spraying and fogging are discouraged. Rodenticide/rodent baits, when used in conjunction with structural and mechanical controls, can provide long-term control. Effective bed bug control requires a multifaceted approach that includes decluttering, exclusion (i.e., use of mattress covers), and resident education.

3.5 "KEEP IT PEST FREE" RELATED RESIDENT EDUCATION ACTIONS

Keep trash covered and food stored in tightly sealed containers to minimize attracting pests. See NYC Pest Management Tips for Residents (https://www1.nyc.gov/site/doh/health/health-topics/pests-and-pesticides.page).

- Eliminate clutter and harborage.
- Avoid pooling of water or other excessive moisture problems inside the dwelling unit. Clean up and dry out any wet areas in a timely manner.
- Run bath fans during and after bathing/showering to keep moisture and relative humidity controlled.
- Report pest sightings and plumbing and water leaks to the property owner and/or management.

The matrix below shows the relationships among the Keep It Pest Free principle-based standard and the component-based standards in Section B.

PRINCIPLES (Section A)	Contaminants	Site	Building Exterior	Foundations and Structure	Insulation, Air Sealing	Interiors	Space Conditioning	Ventilation
A.3 Pest Free								
A.3.1 Identify and Assess	1.5 Pest infestations	2.4 Lawn	4.2 Exterior cladding	5.1 Foundations	6.1 Air sealing			
A.3.2 Prevent Pest Entry			4.2 Exterior cladding	5.2 Basement floors	6.1 Air sealing	7.6 Kitchen cabinets and countertops		
A.3.3 Reduce Relative Humidity				5.3 Crawl spaces	6.1 Air sealing		10 Space conditioning	11 Ventilation (all)
A.3.4 Adopt IPM								

4 KEEP IT WELL VENTILATED

Pollutants can be found in concentrations 2 to 5 times higher indoors than outdoors. Increasing the supply of fresh air can help reduce exposure to indoor asthma triggers, allergens, and other contaminants. Ventilating local sources of moisture or contaminants from showers, combustion from fireplaces, or cooking appliances can also reduce indoor exposures that can increase respiratory and other health risks. Proper sealing of all exterior ventilation points is also essential to preventing the intrusion of exterior pollutants into the building environment.

4.1 BATHROOMS, KITCHENS, AND DRYERS

Ensure bathrooms, kitchens, and clothes dryers exhaust to the exterior and comply with ASHRAE 62.2 2016 requirements.

- Verify that all bathrooms and kitchens have point source exhaust ventilation ducted to the exterior (not to an attic or crawl space) with ductwork conforming to the manufacturer's requirements.
- Vent clothes dryers to the exterior with ductwork that conforms to the manufacturer's requirements and is free from obstructions and lint accumulation. Apply "Minimum Actions" in the "Source Ventilation" section of the EPA Healthy Indoor Environment Protocols for Home Energy Upgrades. See https://www.epa.gov/indoor-air-quality-iaq/healthy-indoor-environment-protocols-home-energy-upgrades.
- Consider installing exhaust fans in bathrooms with switching mechanisms that increase the likelihood of their use, such as switching the fan and light fixture with the same switch or using a humidistat to automate the operation of the fan relative to humidity level.

4.2 WHOLE HOUSE VENTILATION

To address significant reductions in air leakage (and subsequent reductions in ventilation) associated with substantial rehabilitation projects and projects with extensive air sealing and insulation work, install ventilation measures that meet ASHRAE Standard 62.2 2016 requirements for whole-building ventilation. Until recently, 62.2 applied only to single-family housing; however, 62.2 now covers all housing.

4.3 HVAC FILTRATION

Ensure that HVAC forced air systems have a leak-free filter housing on the return air ductwork, with a Minimum Efficiency Reporting Value (MERV) 8 filter, and that it is not clogged. Check that a MERV 8 filter is consistent with the manufacturer's instruction.

4.4 HVAC DUCT

Inspect and identify all joints, seams, and leaks in the ventilation duct system that can be sealed. Seal supply and return duct work in unconditioned space with duct mastic, and in conditioned spaces wherever practicable. Conform to EPA's "Minimum Actions" relative to duct systems in EPA's Energy Savings Plus Health Indoor Air Quality Guidelines for Multifamily Building Upgrades Section 16, Compartmentalization, which also apply to duct sealing in single-family homes.

The matrix below shows the relationships among the Keep It Well Ventilated principle-based standard and the component-based standards in Section B.

Principles (Section A)	Contaminants	Building Exterior	Insulation, Air Sealing	Space Conditioning	Ventilation
A.4 Well Ventilated					
A.4.1 Bath, Kitchen, Dryers	1.3 Carbon Monoxide				11.1-3 Bath, Kitchen, Clothes Dryers Ventilation
A.4.2 Whole House		4.2 Exterior Cladding; 4.3 Windows			11.4 Whole House Ventilation
A.4.3 HVAC Filters				10.1-2 Heating & AC Equipment	
A.4.4 HVAC Ducts			6.1 Air Sealing	10.3-4 Distribution System & Flues/ Exhaust for Combustion Systems	

5 KEEP IT CLEAN

Ensuring building surfaces can easily be cleaned helps residents reduce exposure to contaminants, allergens, and pests, and eliminate pest harborage. Cleaning practices can also help to reduce such exposures.

5.1 OPERATIONS AND MAINTENANCE: SURFACES SUSCEPTIBLE TO BACTERIAL GROWTH OR PEST CONTAMINATION

Kitchen and bathroom vanity countertops, as well as base cabinets, must be in good condition, watertight, and easily cleaned.

5.2 REHAB: SURFACES IN HIGH-USE AREAS

When replacing surfaces in high-use areas during rehabilitation, use materials that are easily cleaned and durable to withstand repeated cleanings (e.g., floors in kitchens, baths, and entryways and countertops in kitchens and bathrooms). Consider flooring that limits VOC off-gassing and is certified for wearability, e.g., laminate flooring with a North America Laminate Flooring Association (NALFA) certification (nalfa.com) or a European Abrasion Criteria (AC) scale rating of 4 or better. A Scientific Certification System's FloorScore certification is also a measure of low VOC content and wearability.

5.3 REHAB: JOB SITE CLEANING

Require construction contractors to clean with vacuums (HEPA filtered vacuums are preferred) at the end of each work day.

5.4 "KEEP IT CLEAN" RELATED RESIDENT ACTIONS

- Place trash and recyclables in the appropriate containers.
- Avoid accumulation of dust, dirt, and debris, cleaning any such areas in a timely manner.

- Regularly vacuum carpets and wet wash or mop resilient flooring.
- Use green cleaning products, such as those certified by Green Seal or EPA's Safer Choice program.

The matrix below shows the relationships among the Keep It Clean principle-based standard and the component-based standards in Section B.

PRINCIPLES (Section A)	Contaminants	Interiors	Plumbing
A.5 Clean			
A.5.1 Surfaces		7.6 Kitchen cabinets and countertops	9.3 Plumbing fixtures
A.5.2 High-Use Areas		7.6 Kitchen cabinets and countertops	
A.5.3 Job Site Cleaning	1.10 Job site cleaning		

6 KEEP IT SAFE

Falls, poisonings, fires, and burns are the most common causes of home injuries and deaths. Children and older adults are at higher risk.

6.1 CARBON MONOXIDE ALARMS

Install carbon monoxide (CO) alarms outside every bedroom, at every level, and near the garage entry if there is an attached garage. If battery-operated alarms are installed, they must have 10-year lithium batteries. It is recommended that CO alarms have a digital display and provide peak level readings. Apply the "Minimum Actions" in the "Home Safety" section of EPA's Healthy Indoor Environment Protocols for Home Energy Upgrades document.

6.2 SMOKE ALARMS

Install smoke alarms inside and outside every bedroom and on every floor. If battery-operated alarms are installed, they must have 10-year lithium batteries. Apply the "Minimum Actions" in the "Home Safety" section of EPA's Healthy Indoor Environment Protocols for Home Energy Upgrades document.

6.3 PROVIDE ADEQUATE LIGHTING AND CONTROLS

Fluorescent Light Ballasts – If fluorescent lights do not have the statement "No PCBs" or are not marked as electronic, assume that the ballasts contain PCBs and replace them with new lighting fixtures. Alternatively, contact the manufacturer to determine whether the ballasts contain PCBs. If the manufacturer is not sure whether the ballasts contain PCBs, assume that they do and replace them with new lighting fixtures. See EPA Guidance: EPA PCB-Containing Light Ballasts.

Light Quality – Lighting must be sufficient to enable occupants to safely travel on stairs (interior and exterior) and in all occupied rooms.

Light Switches:

- Lighting for all occupied spaces should be controllable by switches at all entrances to the space (e.g., stairways and hallways).

- When new switches and receptacles are installed, they should conform to universal design principles for height. Lighted switches should be considered for residents with low vision. See Enterprise Community Partners, Aging in Place Design Guidelines.

Ground Fault Circuit Interrupters (GFCI) – Kitchen countertop and bathroom receptacles must be GFCI protected. Laundry, basement, and exterior receptacles must also be GFCI protected.

Arc Fault Circuit Interrupters (AFCI) – Bedroom receptacles must be AFCI protected.

Electrical Distribution – Exposed knob and tube wiring should be replaced. Inspect aluminum wiring carefully, and if wiring is exposed, either replace it entirely or install UL-approved connectors at each electrical device to eliminate aluminum wire-to-device connections. Every room should have a minimum of two duplex receptacles placed on separate walls and one light fixture or receptacle switched at each room entrance. Where the source wiring circuit is accessible (e.g., first floor above basements, in gutted rooms, etc.), receptacles must be grounded. All switch, receptacle, and junction boxes must have appropriate cover plates. Wiring must be free from hazards, and all circuits must be properly protected at the panel. Floor receptacles should be removed, and a metal cover plate installed. Exposed, UL-approved electrical raceway is allowed.

Electrical Service – Distribution panels must have a main disconnect, a minimum of 10 circuit-breaker-protected circuits, a 100-amp minimum capacity, and be adequate to safely supply existing and proposed devices. If a working central air conditioning system is present, the minimum service will be 150 amps. 200-amp services are recommended if replacing an existing panel.

6.4 REDUCE TRIP AND FALL HAZARDS

Trip Hazards – Hazards such as excessively high thresholds, uneven stairs, and loose or damaged flooring should be addressed.

Stairs – All stairs should have handrails. Handrails should be considered on both sides of staircases, depending on occupant needs.

Grab Bars and Blocking – Grab bars should be present in bathrooms when occupants exhibit mobility issues. Use Americans with Disabilities Act (ADA) guidelines for location of grab bars. Whenever wall finishes are removed in stairways or bathrooms, consider the installation of blocking to facilitate the easy and secure installation of handrails and grab bars in the future, regardless of occupancy.

6.5 UNIVERSAL DESIGN AND VISIBILITY

Consider universal design and visibility principles in all rehabilitation projects, especially for substantial rehabilitation projects. Refer to the Enterprise Community Partners, Aging in Place Design Guidelines.

The matrix below shows the relationships among the Keep It Safe principle-based standard and the component-based standards in Section B.

6.6 REDUCE WILDFIRE RISKS ON THE SITE – IN AREAS WITH WILDFIRE RISK

The site surrounding the home should be free of wildfire pathways that could ignite the structure. The removal of potential pathways for the spread of wildfires from the property site to the house, and the creation of ignition-free zones within 5 feet of a home are recommended in areas with a risk for wildfires. Stored,

flammable materials, such as wood piles, brush piles, vehicles, should be kept away from a home to reduce fire damage. Note: flammable materials that create a pathway going uphill toward a house can spread a wildfire much quicker than flammable materials on level ground.

6.7 REDUCE WILDFIRE RISKS ON THE BUILDING – IN AREAS WITH WILDFIRE RISK

Clear flammable debris in gutters, downspouts, and on roofs. If residing, consider nonflammable claddings such as fiber cement. Install 1/8-inch wire mesh screening at bathroom, kitchen and whole house ventilation outlets and inlets, to prevent the entry of flying embers during a wildfire. Ensure dryer vents do not have screens because they will clog with trapped lint. All ventilation outlets, including dryer vents, should be constructed on nonflammable materials, such as heavy gauge metal, such as steel, and have secure flaps that close tightly. For attic ventilation systems, soffit inlet vents and roof outlet vents should also have 1/8-inch wire mesh screening, to prevent the entry of flying embers during a wildfire.

6.8 REDUCE RISKS FOR HIGH WIND DAMAGE – IN AREAS WITH HIGH WIND RISK

In areas with a high-risk for wind damage, consider the replacement of existing, windows, skylights and doors, with less than 5 years useful life remaining, with wind-rated components that are impact code approved by either Miami Dade County or the Florida Building Code. Windows and doors may also be protected by Miami Dade County or the Florida Building Code approved storm shutters. Lists of such products are available at the Miami-Dade building code website at: http://www.miamidade.gov/building/pc-search_app.asp and the Florida Building Code (FBC) at: http://www.floridabuilding.org/pr/pr_app_srch.aspx.

Consider the replacement of existing, garage doors, with less than 5 years useful life remaining, with a wind-rated garage door that meets one of the following standards ASTM E330, ANSI/DASMA 108, Florida Building Code TAS 202, or the installation of a garage door hurricane brace on an existing garage door with at least 5 years remaining useful life, such as the Secure Door® Brace. See www.disastersafety.org/garagedoor for additional information.

6.9 REDUCE RISKS OF INJURY DURING EARTHQUAKES – IN AREAS WITH EARTHQUAKE RISK

Consider the distribution of FEMA document 528, Earthquake Home Hazard Hunt, as a tool for educating owners about simple repairs that can reduce the risk of seismic damage during mild occurrences.

6.10 REDUCE RISKS FOR STRUCTURAL DAMAGE FROM EARTHQUAKE

Consider repairs that more securely connect the masonry foundation walls to the frame portion of a structure are a permitted expense when there is risk of seismic related damage. See FEMA publications P-530, *Earthquake Safety at Home*, and P-1100, *Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings*, for recommendations for strengthening structural connections.

6.11 REDUCE RISKS FOR STRUCTURAL DAMAGE FROM FLOODING – IN FLOOD HAZARD AREAS

Consider the installation or maintenance of foundation flood vents in Special Flood Hazard Areas (SFHAs) that are designated as Zone A (A, AE, A1-30, AH, and AO) on Flood Insurance Rate Maps (FIRMs) per National Flood Insurance Program (NFIP) Technical Bulletins. See FEMA Technical Bulletin 1, *Requirements for Flood Openings*.

	Principles (Section A)	Contaminants	Site	Building Exterior	Foundations and Structure	Interiors	Electrical
A.6	Safe				5.5 Structural Walls		
A.6.1	CO Alarms	1.3 Carbon Monoxide				7.1 Smoke, Fire, and CO Alarms	
A.6.2	Smoke Alarms			4.5 Exterior Porches		7.1 Smoke, Fire, and CO Alarms	
A.6.3	Lighting and Controls		2.5 Exterior Lighting	4.6 Exterior Steps			8.1 Electrical Service; 8.2 Electrical Distribution; 8.3 GFCI; 8.4 Kitchen Receptacles; 8.5 Lighting
A.6.4	Reduce Trips and Falls		2.1 Paving and Walks	4.6 Exterior Steps; 4.7 Exterior Railings	5.1 Foundations; 5.2 Basement Floors	7.4 Stairs; 7.10 Grab Bars	
A.6.5	Universal Design/Visit Ability			4.1 Mailboxes			

7 KEEP IT WELL MAINTAINED

Poorly maintained homes are at risk for pests, moisture problems, deteriorating paint, and structural issues. Routine inspection, cleaning, and repairs can address minor repairs and problems before they become large repairs and problems.

7.1 NCHH MAINTENANCE CHECKLIST

Provide all program participants with the Healthy Homes Maintenance Checklist, which provides suggested maintenance actions for each season for exteriors, basements and crawl spaces, interiors, appliances, plumbing fixtures, HVAC and electrical equipment, garages, and attics. Recommended actions include changing furnace filters no less than every 6 months (some filter manufacturers may recommend changing every 3 months), check that gutters and downspouts are clear and functioning each spring, clean dryer vents in spring and fall, and check washer hose connections and hot water heaters for leaks annually

7.2 MATERIALS AND COMPONENTS

When replacing components such as mechanical equipment or materials in high-use areas, consider the level of maintenance required and specify components and materials that are easier to maintain. (Also see Section 1, “Keep It Clean”)

7.3 “KEEP IT WELL MAINTAINED” RELATED RESIDENT ACTIONS

- Manage indoor moisture levels by using exhaust fans in kitchens and bathrooms. (See Section 4.1 on switching mechanisms for exhaust fans.)
- Monitor the effectiveness of roofing, gutters, downspouts, and grading for stormwater management.
- Replace HVAC filters every 6 months.

The matrix to the right shows the relationships among the Keep It Well Maintained principle-based standard and the component-based standards in Section B.

PRINCIPLES (Section A)		Roofing
A.7	Well Maintained	
A.7.1	NCHH Maintenance Checklist	
A.7.2	Materials and Components	3.1-3 Roofing

8 KEEP IT THERMALLY CONTROLLED

Houses that do not maintain adequate temperatures may place the safety of residents at increased risk from exposure to extreme cold or heat.

8.1 SUFFICIENT HEATING AND COOLING

Ensure that heating and cooling systems are adequately sized, properly maintained, and correctly operated to maintain safe interior temperatures during seasonal extremes for heat and cold.

8.2 CAULK WINDOWS

Caulk windows and exterior door frames.

8.3 SEAL DUCTS

Seal heating and cooling ducts.

8.4 INSTALL THERMOSTATS

Install programmable thermostats and ensure residents can operate them.

8.5 EFFICIENT HVAC EQUIPMENT

When replacing HVAC equipment, specify systems that are as efficient as possible within the budget. Also ensure that they are properly sized; use Air Conditioning Contractors of America (ACCA) Manual J, Residential Load Calculation, to properly size furnaces and boilers.

8.6 INSULATE WALLS

Insulate walls or other portions of the building envelope that are exposed for repair or replacement.

8.7 "KEEP IT THERMALLY CONTROLLED" RELATED RESIDENT ACTIONS

- Use programmable thermostats to reduce energy use.
- In owner-occupied homes, ensure HVAC systems are inspected annually.

The matrix below shows the relationships among the Keep It Thermally Controlled principle-based standard and the component-based standards in Section B.

PRINCIPLES (Section A)	Building Exterior	Insulation, Air Sealing	Space Conditioning	Ventilation
A.8 Thermally Controlled				
A.8.1 Sufficient Heating and Cooling			10.2-2 Heating and Air Conditioning Equipment	
A.8.2 Caulk Windows	4.3 Windows	6.1 Air Sealing		
A.8.3 Seal Ducts		6.1 Air Sealing	10.3-4 Distribution System and Flues/ Exhaust for Combustion Systems	
A.8.4 Install Thermostats				
A.8.5 Efficient HVAC Equipment				
A.8.6 Insulate Walls		6.2 Insulation		

9 HEALTHY LIVING AND ACTIVE DESIGN

Consider incorporating strategies to increase opportunities for resident physical activity or increased mobility both outside and inside the home, as well as strategies that help create healthier environments in and around the home. These measures can help address rising obesity rates that put Americans at risk for a range of chronic diseases, including heart disease, stroke, Type 2 diabetes, and some cancers.[7]

When possible, consider the following as part of your program:

9.1 SUPPORT STRATEGIES TO INCREASE PHYSICAL ACTIVITY

- Highlight convenient/accessible pedestrian routes.
- Dedicate space for bicycle parking.

9.2 OUTDOOR SPACES TO PROVIDE SAFE AND HEALTHIER ENVIRONMENTS

- Provide or enhance outdoor space accessible to all occupants, including gardens, and opportunities for intergenerational play and relaxation.
- Extend a tobacco-free policy to outdoor spaces.
- Install fences to enhance safety for children.
- Increase safety by installing secure and appropriate lighting.
- Ensure soil in garden and play areas is free of lead contamination.

9.3 ENTRANCES TO ENCOURAGE PHYSICAL ACTIVITY AND PROVIDE SAFETY

- Maintain multifamily entryways and orient them toward pedestrian routes.
- In multifamily buildings, implement active design strategies in stairwell design, such as improved lighting, clear signage to direct residents to stairways, and signage to affirm health benefits of physical activity. See, for example, Center for Active Design, Active Design Guidelines.[8]

7 The economic costs associated with obesity are anticipated to double every decade, to nearly a trillion dollars annually by 2030, if current trends continue. The human costs are equally as urgent, with chronic diseases causing 7 out of every 10 deaths in the U.S. and nearly 60 percent of all deaths worldwide.

8 Center for Active Design https://centerforactivedesign.org/todays-health-epidemic/

9.3.1 ACTIVE DESIGN RESOURCES FOR HEALTH@HOME GUIDELINES

There are multiple resources that promote and assist with the inclusion of Healthy Living/Active Design principles and activities. One such resource, Fitwel**,** was developed by the CDC, the General Services Administration, and the Center for Active Design to incorporate healthy design and building use strategies into construction and substantial rehabilitation projects.

Fannie Mae's Healthy Housing Rewards™ initiative provides financial incentives for borrowers to meet the Fitwel℠ Certification System.

9.3.2 RESIDENT ENGAGEMENT

The actions of building residents can support healthy living and building maintenance, and maximize the environmental benefits of healthy housing. Engaging residents to increase their knowledge about and practice of green and healthy living is key to the success of healthy homes initiatives.

Programs can provide residents with information and resources to help them pursue healthier living strategies connected to their home. These include:

- Green and healthy choices for housing repairs and maintenance; see **Appendix B**.
- Preventing and responding to pest problems; see NYC Pest Management Tips for Residents (https://www1.nyc.gov/site/doh/health/health-topics/pests-and-pesticides.page).
- Smoking cessation resources; contact 1-800-QUIT-NOW for free service with educational materials, coaches, quitting plans, and referrals to local resources; Spanish speaking option: 1-855-DÉJELO-YA (1-855-335-3569).
- A list of local farmers markets to encourage healthy eating.
- Local resources to support gardens to grow healthy foods and encourage outdoor activity.

9.3.3 ADDITIONAL RESOURCES FOR RESIDENT ENGAGEMENT

- HUD, Help Yourself to a Healthy Home, booklet: https://www.hud.gov/program_offices/healthy_homes/healthyhomes
- Enterprise Green Communities, Resident Engagement Strategies and Tools to Engage Residents in Green & Heathy Living:
  - https://www.enterprisecommunity.org/download?fid=1969&nid=4436
  - https://www.enterprisecommunity.org/solutions-and-innovation/green-communities/tools-and-services/resident-engagement

B

HEALTHY HOUSING REHAB STANDARDS (by Building Component)

The information related to the component-based standards is presented in 12 categories as listed below. At the outset of each section, the key connections to resident health are described and the linkages to the relevant Healthy Housing Principle(s) are highlighted in a text box. Additionally, where relevant, information is provided that would show the interconnected nature of the housing systems and how improvements to one can improve myriad health issues. For example, the figure below illustrates the many sources of contaminants that would affect a home's indoor air quality.

Each of the building components is hyperlinked in the list below to allow easy navigation to the relevant subsections. In addition, you may click on the key principles in each of the following tables to navigate to the relevant section.

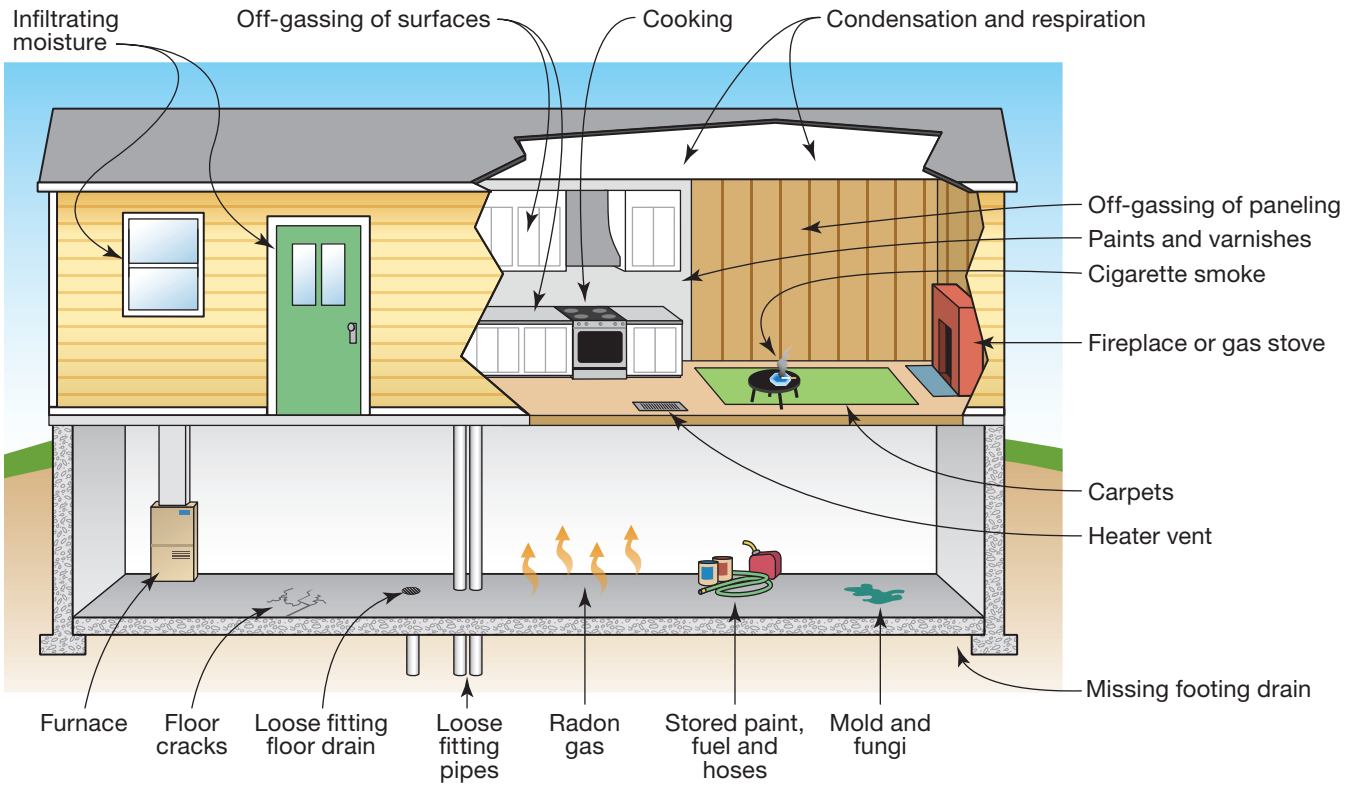


Figure 5: Healthy Housing Reference Manual

ICONOGRAPHY

Each of the repair and replacement standards throughout this section has been tagged with an icon to represent the "type" of rehab or repair work that would be anticipated. These icons are general in nature, and do not reflect code requirements of various jurisdictions, but are actions that could be taken to improve the overall health of the occupants of the home. The icons and their definitions are:

O&M: These are actions that should be taken either by building management or could readily be assumed by the home-owner once they have taken ownership of the home.

INDOOR AIR QUALITY: These are actions that should be undertaken to ensure the cleanliness of the air inside the home, as well as those to ensure that air entering the home is properly treated.

OTHER CONTAMINANTS: These actions will help to achieve reductions in pest infestations and droppings, molds, lead poisoning and radon, not typically associated with air quality.

SAFETY & FALLS: These actions will protect the home user from injury.

RESILIENCY/MITIGATION: These actions may enhance the ability for housing to withstand various hazards and their impacts, as well as to reduce the amount of time it takes for a family to return to pre-disaster conditions.

1 CONTAMINANTS AND OTHER HAZARDS – ASSESSMENT AND CLEARANCE TESTING

- DRY
- CONTAMINANT FREE
- PEST FREE
- CLEAN

Key concepts and relationships

- The following contaminants and hazards must be addressed in all of the related component categories that follow; e.g., LBP requirements must be applied to all painted surfaces such as windows and doors, and Mold & Moisture requirements must be applied to all components subject to moisture problems.
- Some assessment must be completed by third-party certified testers when appropriate or required by regulation; e.g., EPA or state regulations may require the use of certified Asbestos Surveyors for Asbestos.

1.1 LEAD-BASED PAINT

Key Principle: Contaminant Free

Minimum Life: 5 years

Repair Standard

For all houses constructed prior to 1978 a Risk Assessment per HUD regulations will be completed to identify all LBP Hazards. An alternative to the Risk Assessment is to assume all painted surfaces contain LBP and to address them as such. All LBP hazards will be addressed per HUD regulations, and the property/unit must pass a dust clearance test per the HUD regulations. Lead-safe work practices must be followed for all work that disturbs LBP, and only certified lead abatement contractors used to perform work to address LBP hazards. See: www.hud.gov/program_offices/healthy_homes/lbp/hudguidelines.

Replacement Standard

When "Interim controls" of surfaces containing LBP is impractical, the most affordable solution for abatement of the component will be chosen. Walls containing LBP may be covered with drywall or gutted and replaced with drywall. Trim and other wood or metal components containing LBP may be removed and replaced with similar materials. Lead-safe work practices must be followed, and only certified abatement contractors used to perform the work. Clearance testing is required as outlined in the Repair Standard.

1.2 ASBESTOS

Key Principle: Contaminant Free

Minimum Life: NA

Repair Standard

Building materials suspected to contain asbestos shall be tested by a firm that is state approved for asbestos surveys. Non-friable asbestos materials, such as cementitious exterior wall shingles, may be left intact and painted if appropriate. Vinyl asbestos resilient floor tiles may be labeled as such and covered with underlayment and new resilient flooring.

Replacement Standard

Building materials suspected to contain asbestos shall be tested by a firm that is state-approved for asbestos surveys. Friable asbestos components such as boiler or pipe insulation, badly deteriorated cementitious shingles, or deteriorated flooring should be removed and, if necessary, replaced with non-hazardous materials. Asbestos abatement should be performed by contractors with current state licenses for asbestos remediation. Clearance testing should be performed for all asbestos work, and the contractor must provide a manifest that proves the asbestos was disposed of properly.

1.3 CARBON MONOXIDE

Key Principles: Contaminant Free; Dry

Minimum Life: NA

Repair Standard

Examine the chimney and flue of all atmospherically-vented combustion appliances for evidence of back-drafting (condensation, rust, appropriate slope on flue pipe).

Implement combustion appliance zone (CAZ) testing by a qualified professional such as a Building Performance Institute, Inc. (BPI)- certified Building Analyst (BA), Home Energy Professional (HEP), Energy Auditor (EA), or Quality Control Inspector (QCI) whenever there is evidence or suspicion of a back-drafting combustion appliance. Repairs to flues of existing atmospherically vented combustion appliances with significant useful life remaining are an approved expense.

The cost of repairs to the flues/chimneys of such appliances that are at the end of their useful life should be compared to the cost of replacement with an appliance that is either power vented or possess sealed combustion and could avoid the use of a chimney.

Replacement Standard

Replacement of existing flues and chimneys (or chimney liners) should be compared to the cost of abandoning such flue/chimney combinations and the installation of new power vented or sealed combustion appliances that could avoid the use of a chimney.

1.4 MOLD AND MOISTURE

Key Principles: Contaminant Free; Dry

Minimum Life: NA

Repair Standard

Any presence of mold is unacceptable and must be addressed, and moisture problems that precipitated the presence of mold must be remediated. Repairs associated with both mold remediation and moisture management are approved expenses.

When there is a suspicion of high humidity levels, testing of relative humidity (RH) is required. RH persistently above 55 percent should be addressed by locating and resolving the source of moisture, e.g., repairs to roofing and storm water management systems.

Replacement Standard

All carpeting, drywall or other gypsum-based wall coverings or any other non-structural components with mold present should be removed and replaced. Installation of materials that are mold resistant, e.g., paperless drywall, should be considered. Wood components should be tested and documented to contain a moisture content of less than 15 percent prior to the installation of insulation or wall finishes in all wall cavities where mold was present.

When there is a suspicion of high humidity levels, testing of relative humidity (RH) is required. RH levels persistently above 55 percent should be addressed by locating and resolving the source of moisture, e.g., roofing, gutters and downspout placement, site grading, and appropriate ventilation. This is especially important relative to basement moisture.

1.5 PEST INFESTATIONS

Key Principles: Pest Free; Contaminant Free; Dry

Minimum Life: NA

Repair Standard

Identify existing pest infestations as part of the building analysis. Pest infestations that create a potential health hazard, or that are likely to impede an affordable housing rehabilitation effort, should be addressed using integrated pest management (IPM) strategies. Repairs that restrict the passage of pests into and throughout the building are an approved expense.

Replacement Standard

When there is a pest infestation, and where building materials have deteriorated sufficiently to require replacement, using new components that are proven to be more pest-resistant are an approved expense.

1.6 RADON

Key Principle: Contaminant Free

Minimum Life: 5 years

Repair Standard

All housing in this program will be subject to a short-term radon test in these instances:

- At the inspection stage, prior to creation of a scope of work
- Where rehabilitation activities could have affected indoor air pressure or air tightness
- Post-installation of radon mitigation measures, retesting to ensure mitigation results in levels less than 4pCi/L

If the result is a reading of 4 pCi/L or higher, consider a long term (minimum 90 days) test to confirm an increase before undertaking mitigation. Repairs to existing passive or active radon mitigation systems, or the conversion of a passive system to an active system are approved program expenses when radon levels are at or above the 4 pCi/L action level.

Replacement Standard

Follow the testing protocol outlined in the Repair Standard. If testing determines that radon levels are at or above the 4 pCi/L action level the installation of passive or active radon systems is an approved expense.

1.7 VOLATILE ORGANIC COMPOUNDS

Key Principle: Contaminant Free

Minimum Life: 10 years

Repair Standard

Materials used in repairs, must meet the following standards to minimize the presence of volatile organic compounds (VOC) and specifically formaldehyde:

- All paints and primers must meet the most recent Green Seal G-11 Environmental Standard. https://www.greenseal.org/green-seal-standards/standards-list
- Adhesives must comply with Rule 1168 of the South Coast Air Quality Management District. http://www.aqmd.gov/home/research/guidelines
- All caulks and sealants, including floor finishes, must comply with Regulation 8, Rule 51, of the Bay Area Air Quality Management District.
- All particleboard components should meet ANSI A208.1 for formaldehyde emission limits, or all exposed particleboard edges should be sealed with a low-VOC sealant or have a factory-applied, low-VOC sealant prior to installation. All composite wood must be compliant with TSCA Title VI or California 93120 Phase 2 requirements.

Replacement Standard

All new materials installed must meet the requirements outlined in the “Repair” section above.

1.8 WATER QUALITY TESTING: LEAD AND OTHER CONTAMINANTS

Key Principle: Contaminant Free

Minimum Life: 5 years

Repair Standard

- Test for lead in drinking water using an EPA certified laboratory.
- Lead water supply lines, AKA lead service lines (LSL): Inspect for lead supply lines. Check with the municipal water department for records.
- Test water in private wells: Test for presence of lead, total coliform bacteria, nitrates, total dissolved solids and pH levels. Use an EPA or state certified drinking water for private well water testing.
- Repairs to the domestic water supply system to address contaminants in water are an approved expense.

Replacement Standard

Replacement of LSL is an approved expense. Abandonment of a private well and connection to a municipal/local water system is an approved expense. The addition of a filtration system that has been proven to address contaminants present in domestic water supplies is an approved expense.

1.9 SEWER SYSTEM

Key Principle: Contaminant Free

Minimum Life: 20 years

Repair Standard

The drain, waste and vent system must be leak-free and operating without restriction. All plumbing fixtures must be properly vented. If the sewer connection regularly backs-up, the use of a scope to visually examine the drain lines for blockage or deterioration is an approved expense. Dye testing of septic systems is an approved expense.

Replacement Standard

Replacement of any portion of the drain, waste, vent system shall be done using approved plastic piping, and should be approved by the Codes Inspector. If a septic system has been deemed unrepairable, connection to the municipal system should be required if available. Otherwise, replacement of the septic system is an approved expense if within budget restraints.

1.10 JOB SITE CLEANING

Key Principles: Clean; Contaminant Free; Dry

Minimum Life: NA

Repair and Replacement Standard

At a minimum, job sites should be cleaned at the end of each day with a vacuum. HEPA vacuums are preferred. Job site cleaning as defined should be a contractual requirement and clearly stated in the General Requirements of the Scope of Work.

2 SITE

- DRY
- CONTAMINANT FREE
- PEST FREE
- SAFE

Key concepts and relationships

- Well-constructed and maintained paving ensures safe passageway from the street to the house or from the driveway to the house.
- Positive grading is the simplest and most sustainable way to prevent storm water intrusion to the structure and future moisture issues.
- Trees and shrubbery that are located too close to the house aid pest entry, create safety issues for the structure and promote moisture problems.
- Bare soil may be contaminated with LBP, which poses a hazard for children at play outdoors, and for vegetable gardening. Additionally, humans and/or pets are can create a LBP hazard indoors by tracking that contaminated soil into the home.
- Bare soil also leads to erosion, adding to and or creating grading problems, storm water management issues, and possibly moisture problems.
- Enhanced lighting can make exterior areas safer by reducing the potential for injury, and possibly reducing the likelihood of intruders.

2.1 PAVING AND WALKS

Key Principle: Safe

Minimum Life: 10 years

Repair Standard

Essential paving, such as front sidewalks and driveways with minor defects should be repaired; repairs should match the surrounding pavement. Tripping hazards greater than ¾ inch must be addressed. Non-essential, highly deteriorated paving, such as sidewalks that are unnecessary, should be removed and appropriately landscaped.

Replacement Standard

Essential walks and driveways deemed beyond repair should be replaced with concrete per City specification.

2.2 OUTBUILDINGS

Minimum Life: 5 years

Repair Standard

Unsafe and blighted structures, including outbuildings, will be removed and not replaced. Detached garages should have operable and lockable doors and windows.

Replacement Standard

No outbuilding replacement is permitted in this program.

2.3 FENCING

Minimum Life: 5 years

Repair Standard

The repair or replacement of fencing must be appropriate for the neighborhood and meet the code requirements.

Replacement Standard

The repair or replacement of fencing must be appropriate for the neighborhood and meet the code requirements.

2.4 GRADING

Key Principle: Dry

Minimum Life: 5 years

Repair Standard

All grading adjacent to the building and for a distance of at least 10 feet away from the building should slope away from the structure at a pitch of at least 1 inch per foot. All bare earth should be reseeded, or sod should be installed to cover as per "Lawn" repair standard.

Replacement Standard (NA)

2.5 TREES AND SHRUBS

Key Principles: Pest Free; Safe; Dry

Minimum Life: 5 years

Repair Standard

Trees and shrubs that are dead, dying, within 4 feet of the building foundation, damaging the foundation, or hazardous in any manner, should be removed. Removal includes cutting close to the ground, grinding of tree stumps to 6 inches below the finished grade, removing shrub roots, and installing topsoil and re-seeding. Final grading after removal of plant material must produce a positive grade that directs storm water away from the structure. See Pest Infestation in Section 1, Contaminants and Other Hazards.

Replacement Standard

Replacement trees and shrubs are not an approved expense.

2.6 LAWN

Key Principles: Safe; Contaminant Free

Minimum Life: 1 years

Repair Standard

Bare sections of lawn should be reseeded with State Extension Service-recommended, drought-resistant varieties such as Tall Fescue. Soil treatments to address lead contamination are an approved expense. See LBP in Section 1, Contaminants and Other Hazards.

Replacement Standard

Wholesale replacement of lawn grasses is not an approved program expense, though over-seeding is permitted with state extension service-recommended, drought-resistant varieties such as Tall Fescue.

2.7 EXTERIOR LIGHTING

Key Principle: Safe

Minimum Life: 5 years

Repair Standard

Existing exterior light fixtures should be operable on either dusk-to-dawn, motion detection or manual switching. Incandescent bulbs should be replaced when possible with LED bulbs for energy savings and longevity.

Replacement Standard

New exterior light fixtures that are flood lights with combined dusk-to-dawn and motion-detecting switching are an approved expense to adequately light the yard for safe entry by residents and intruder discouragement. ENERGY STAR certified fixtures are required.

2.8 WILDFIRE PATHWAYS

Minimum Life: 5 years

Repair Standard

The site surrounding the home should be free of wildfire pathways that could ignite the structure. The removal of potential pathways for the spread of wildfires from the property site to the house, and the creation of ignition-free zones within 5 feet of a home are an approved program expense. Such pathways and highly inflammable components include: vehicles; stored, flammable items such as wood piles, construction debris, yard waste, including such storage under decking or porches; flammable mulch or other vegetation within 6 inches of flammable exterior wall cladding; shrubs within 20 feet of the structure, especially those under trees; trees spaced less than 30 feet apart; flammable fencing that leads to the house. Note: flammable materials that create a pathway going uphill toward a house can spread a wildfire much quicker than flammable materials on level ground.

Replacement Standard

The replacement of flammable plant materials within 5 feet of the house with hardscape such as gravel, pavers or concrete, is an approved expense in areas with a high-risk for wildfires.

3 ROOFING, GUTTERS AND DOWNSPOUTS, AND STORMWATER MANAGEMENT

Key concepts and relationships

- DRY
- WELL MAINTAINED

- Moisture problems resulting from roof leaks are common. Roofing that is watertight and has a reliable useful remaining life is crucial to the health of the occupants and the longevity of the structure.
- The remaining life of existing roofing should be considered before attempting repairs to existing roofing. Replacement is often more cost effective when compared to the risk of damage when the roof is likely to fail within a few years.
- Reroofing over existing roofing is not advised.
- Gutters and downspouts are part of the roofing system and when designed and installed properly move storm water well away from the structure.
- The decking (sheathing), underlayment, flashing and drip edge are all important components of the roofing system and must be evaluated for condition and expected life.

3.1 FLAT AND LOW-SLOPE ROOFING

Key Principles: Dry; Well Maintained

Minimum Life: 5 years

Repair Standard

Built-up roofing that is leak-free should be re-coated and flashing and accessories repaired if such repairs can predictably ensure a minimum remaining life of at least 5 years. If repairs cannot ensure a minimum life of 5 years, replacement is an approved expense. Inactive antennae and satellite dishes should be removed.

Replacement Standard

The most cost-effective roof of either modified bitumen, EPDM or TPO will be installed. Roof sheathing must be intact, structurally sound and provide an even plane for the new roof covering.

3.2 PITCHED ROOFS

Key Principles: Dry; Well Maintained

Minimum Life: 10 years

Repair Standard

Missing and leaking shingles and flashing should be repaired on otherwise functional roofs. Slate, metal and tile roofs should be repaired when possible and when such repairs should ensure a minimum remaining life of 5 years. If repairs cannot ensure a minimum life of 5 years, replacement is an approved expense. Inactive antennae and/or satellite dishes should be removed.

Replacement Standard

No more than two layers of roofing are permitted. Fiberglass, asphalt, three-tab, class A shingles with a prorated 30-year warranty with a continuous ridge vent should be installed over shingle-manufacturer-approved underlayment with new drip edge at the entire perimeter. Roof sheathing must be intact, structurally sound and provide an even plane for the new roof covering.

3.3 GUTTERS AND DOWNSPOUTS

Key Principles: Dry; Well Maintained

Minimum Life: 5 years

Repair Standard

Gutters and downspouts must be in good repair, leak free, and be appropriately sized to collect storm water from all roof surfaces. Splash blocks may be installed if, in combination with proper grading, they can predictably move water away from the foundation. The system must move all storm water away from the building and prevent water from entering the structure. In addition to positive drainage away from the building, outlets should be a minimum of 3 feet away from the foundation whenever there is a history of water problems.

Replacement Standard

Gutters and downspouts should be installed and collect storm water from all roof surfaces. Splash blocks may be installed if, in combination with proper grading, they can predictably move water away from the foundation. The system must move all storm water away from the building and prevent water from entering the structure. In addition to positive drainage away from the building, outlets should be a minimum of 3 feet away from the foundation whenever there is a history of water problems. Underground drain leaders connected to downspouts are an allowable expense when it is a more affordable solution that regrading.

3.4 WILDFIRE PATHWAYS

Minimum Life: 5 years

Repair Standard

Roofing on homes in wildfire prone areas should be free from flammable debris. The removal of flammable debris from gutters, downspouts and roofing is an eligible expense in areas with a high-risk for wildfires.

Replacement Standard

The installation of non-flammable gutter guards, is an approved expense in areas with a high-risk for wildfires.

3.5 WILDFIRE PATHWAYS – ROOFING

Repair Standard **(NA)**

Minimum Life: 5 years

Replacement Standard

Roofing in wildfire prone areas should be nonflammable. Untreated wood shingles should be carefully considered for replacement. The replacement of existing, flammable roofing, with less than 5 years useful life remaining, with non-flammable roofing material, such as metal, is an approved expense in areas with a high-risk for wildfires.

3.6 HIGH WIND AND HURRICANE RESISTANCE – ROOFING

Minimum Life: 5 years

Repair Standard

Roofing in areas prone to hurricanes, tornadoes, and other high wind events, should be secured to the roof decking, with no signs of loose edges on the roof surface. Securing loose shingles with a continuous bead of roofing cement at the lowest row of shingles and with 3 one-inch applications of roofing cement under all loose shingles, is an approved expense.

Replacement Standard

The replacement of existing roofing with less than 5 years remaining useful life, with a IBHS Fortified™ roof system, is an approved expense in areas with a high-risk for wind damage. See fortifiedhome.org/roof for additional information.

4 BUILDING EXTERIOR

Key concepts and relationships

- LBP is an important health concern on pre-1978 structures, see the reference to a Risk Assessment in LBP in Section 1, Contaminants and Other Hazards.
- Integrated pest management (IPM) is a strategy that controls pest infestation with measures that minimize the use of pesticides that are potentially harmful to humans. IPM begins with eliminating pest access into the building.
- Moisture control is a crucial role of the building envelope. The envelope must contain a water control layer that combines a continuous weather resistive barrier with window and door flashing to create a system that sheds water naturally, minimizing the need for sealants.
- Older fiber cement shingles containing asbestos are safe if intact.
- The lack of visible house numbers can seriously delay responders in an emergency.

- DRY
- CONTAMINANT FREE
- PEST FREE
- SAFE
- WELL MAINTAINED
- THERMALLY CONTROLLED

4.1 EXTERIOR HOUSE NUMBERS AND MAILBOXES

Key Principle: Safe

Minimum Life: 5 years

Repair and Replacement Standard

All houses should have contrasting 4” house numbers clearly displayed near the front door, and a standard size mailbox, preferably wall-hung, at the entrance.

4.2 EXTERIOR CLADDING

Key Principles: Dry; Contaminant Free; Pest Free

Minimum Life: 10 years

Repair Standard

Siding and trim should be intact, weatherproof, and free from potential pest entry points. See Pests in Section 1, Contaminants and Other Hazards. All penetrations through the cladding should be sealed to prevent pest entry using materials that are rodent proof, such as sheet metal or copper mesh to seal holes before applying caulk or foam. All exterior wood components should have a minimum of one continuous coat of paint, and no exterior painted surface should have any deteriorated paint. See LBP in Section 1, Contaminants and Other Hazards. Older fiber cement shingles may contain asbestos. See Asbestos in Section 1, Contaminants and Other Hazards. Siding containing asbestos may be maintained in place and painted if it is intact. Individual shingles may be replaced with non-asbestos shingles that match. Buildings designated as historic should have existing wood siding repaired in kind. New exterior wood should blend with existing and be spot-primed and top-coated in a lead-safe manner per HUD Lead-Based Paint regulations.

Replacement Standard

Buildings not designated as historic may have siding replaced with vinyl siding to match the existing configuration. If replaced, soffit material should be vented/perforated vinyl. Solid wood siding to match and fiber cement siding are approved alternatives.

4.3 WINDOWS

Key Principles: Dry; Safe; Pest Free; Thermally Controlled; Well Maintained; Contaminant Free

Minimum Life: 10 years

Repair Standard

All windows should operate, remain in an open position when placed there, have a screen to cover the open section, and lock when closed. See LBP in Section 1, Contaminants and Other Hazards.

Replacement Standard

Windows that are not repairable may be replaced and should meet the ENERGY STAR standard for this geographic region. www.energystar.gov/index.cfm?c=windows_doors.pr_anat_window Windows on key façades of historic designated properties should meet the local jurisdiction's requirements for materials and configuration. Other new windows may be vinyl and double-glazed. New window installations should be properly flashed and connected shingle-style to other components of the weather-resistive barrier.

4.4 EXTERIOR DOORS

Key Principles: Safe; Thermally Controlled; Well Maintained; Contaminant Free

Minimum Life: 10 years

Repair Standard

Exterior doors should be solid, weather-stripped, have door sweeps (using pest proof-materials in areas with rodent issues), and should operate smoothly. They should include a peephole, a dead bolt, and an entrance lock set. See LBP in Section 1, Contaminants and Other Hazards.

Replacement Standard

Replacement doors on key façades of historic designated properties should meet the local jurisdiction's requirements for materials and configuration. Steel or fiberglass, six-panel doors may be installed on the front of the property for buildings that are not historically significant, and at entrances to historically designated properties not visible from the front street. Dead bolt locks should be installed on all exterior doors and keyed to match. All new doors should be weather-stripped to be air tight and include door sweeps with pest-proof materials in areas with rodent issues. They should include a peephole and an entrance lock set. Lever style latches should be considered based on resident needs and needs of regular visitors. New door installations should be properly flashed and connected shingle-style to other components of the weather-resistive barrier.

4.5 EXTERIOR PORCHES

Key Principles: Safe; Well Maintained; Contaminant Free

Minimum Life: 10 years

Repair Standard

Deteriorated concrete porches should be repaired when possible. Unsafe wood porch components should be repaired with readily available materials to conform closely to historically accurate porches in the neighborhood. Porch repairs should be structurally sound, with smooth and even decking surfaces. Deteriorated wood structural components should be replaced with preservative-treated wood. See LBP in Section 1, Contaminants and Other Hazards.

Replacement Standard

Porches on buildings designated as historic should meet the local jurisdiction's requirements for materials and configuration. Other porches should be rebuilt to conform closely to historically accurate porches in the neighborhood. Decks on non-historic porches should be replaced with 5/4-inch preservative-treated decking. Replaced railings must meet code. Replaced wood structural components should be preservative-treated.

4.6 EXTERIOR STEPS AND RAMPS

Key Principle: Safe

Minimum Life: 10 years

Repair Standard

Steps, stairways, and ramps Must be structurally sound, reasonably level, with smooth and even surfaces. Repairs should match existing materials. If the potential for lead-based paint exists, see LBP in Section 1, Contaminants and Other Hazards.

Replacement Standard

On historic designated structures, new stairs should meet the local jurisdiction's requirements for materials and configuration. On other properties, stairs should match existing or match historically sensitive designs on similar buildings in the neighborhood. Preservative treated wood should be used for structural elements, and for treads and risers on wood stairs in the absence of historic requirements. Wood-framed, accessible ramps are an eligible expense based upon occupancy. Concrete is an approved material for steps and landings if it is cost effective compared to wood.

4.7 EXTERIOR RAILINGS

Key Principle: Safe

Minimum Life: 10 years

Repair Standard

Existing handrails must be structurally sound. Guard rails are required on any accessible area with a walking surface over 30" above the adjacent ground level. Sound railings may be repaired if it is possible to maintain the existing style. On historic structures, railing repairs should be historically-sensitive. See LBP in Section 1, Contaminants and Other Hazards.

Replacement Standard

Handrails must be present on one side of all exterior steps or stairways with more than two risers and around porches or platforms over 30" above the adjacent ground level and must meet local codes. Handrails and guard rails should conform to the style of similar components in the neighborhood. On historically designated structures, new railings should meet the local jurisdiction's requirements for materials and configuration. Other new railings should be historically-sensitive. Installation of handrails on both sides of stairs is approved based on the needs of the occupants.

4.8 WILDFIRE PATHWAYS - CLADDING

Repair Standard (NA)

Minimum Life: 5 years

Replacement Standard

Re-siding with non-flammable materials, such as fiber-cement siding, is an acceptable expense in areas with a high-risk for wildfires.

4.9 HIGH WIND AND HURRICANE RESISTANCE – GARAGE DOOR

Minimum Life: 5 years

Repair Standard

The installation of a garage door hurricane brace on an existing garage door with at least 5 years remaining useful life, such as the Secure Door® Brace, is an approved expense in areas with a high-risk for wind damage.

Replacement Standard

The replacement of existing, garage doors, with less than 5 years useful life remaining, with a wind-rated garage door that meets one of the following standards ASTM E330, ANSI/DASMA 108, Florida Building Code TAS 202, is an approved expense in areas with a high-risk for wind damage. See disastersafety.org/garagedoor for additional information.

4.10 HIGH WIND AND HURRICANE RESISTANCE – WINDOWS/DOORS

Minimum Life: 5 years

Repair Standard

Windows and doors should seal tightly and have working latches/locks.

Replacement Standard

The replacement of existing, windows, skylights and doors, with less than 5 years useful life remaining, with wind-rated components that are impact code approved by either Miami Dade County or the Florida Building Code, is an approved expense in areas with a high-risk for wind damage. Windows and doors may also be protected by Miami Dade County or the Florida Building Code approved storm shutters. Lists of such products are available at the Miami-Dade building code website at: http://www.miamidade.gov/building/pc-search_app.asp and the Florida Building Code (FBC) at: http://www.floridabuilding.org/pr/pr_app_srch.aspx.

5 FOUNDATIONS AND STRUCTURE

Key concepts and relationships

- Foundations should be inspected for structural problems and for water and pest infiltration. Foundations must be free of open holes and cracks to prevent pest and water entry.
- Serious issues with the foundation that are beyond the capacity of staff to evaluate should be examined by a structural engineer.
- Foundation replacements are generally beyond the scope of housing rehabilitation efforts because of the cost.

- **DRY**
- **CONTAMINANT FREE**
- **PEST FREE**
- **SAFE**

5.1 FOUNDATIONS

Key Principles: Safe; Dry; Pest Free

Minimum Life: 20 years

Repair Standard

Foundations should be repaired to be sound, reasonably level, and free from movement. Damaged or deteriorated pargeting should be patched in kind. See Radon in Section 1, Contaminants and Other Hazards. Radon mitigations systems are an approved treatment. All penetrations through the foundation should be sealed to prevent pest entry using materials that are rodent proof, such as sheet metal or copper mesh to seal holes before applying caulk or foam. See Pests in Section 1, Contaminants and Other Hazards.

Replacement Standard

Foundation replacements are beyond the scope of the program.

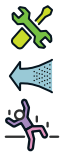
5.2 BASEMENT FLOORS

Key Principles: Safe; Dry; Pest Free; Contaminant Free

Minimum Life: 20 years

Repair Standard

Basements should not have exposed dirt. Acceptable repairs include the installation of a plastic vapor barrier, sealed to the foundation and capped with a concrete slab a minimum of 2 inches thick. Concrete slabs in basements must be continuous, free of cracks and holes and sealed to the foundation to prevent moisture and soil gas (e.g. radon). Radon mitigation systems are an approved treatment. See Radon in Section 1, Contaminants and Other Hazards. All penetrations through the basement foundation should be sealed to prevent pest entry using materials that are rodent proof, such as sheet metal or copper mesh to seal holes before applying caulk or foam. See Pests in Section 1, Contaminants and Other Hazards.



Replacement Standard

The installation of new concrete slabs is an approved expense, and new concrete slabs must have a continuous layer of plastic vapor barrier installed under the slab and sealed to the foundation.

5.3 CRAWL SPACES

Key Principles: Safe; Dry; Pest Free; Contaminant Free

Minimum Life: 20 years

Repair Standard

Crawl spaces should not have exposed dirt, acceptable repairs include the installation of a plastic vapor barrier, sealed to the foundation. Concrete slabs in crawl spaces must be continuous, free of cracks and holes and sealed to the foundation to prevent moisture and soil gas (e.g. radon) intrusion. See Radon in Section 1, Contaminants and Other Hazards. Radon mitigation systems are an approved treatment. All penetrations through the crawl space foundation should be sealed to prevent pest entry using materials that are rodent proof, such as sheet metal or copper mesh to seal holes before applying caulk or foam. See Pests in Section 1, Contaminants and Other Hazards.

Replacement Standard

Same requirement as the Repair Standard.

5.4 SUMP PUMP SYSTEMS

Key Principles: Safe; Dry; Pest Free; Contaminant Free

Minimum Life: 20 years

Repair Standard

Existing sump pumps must be operational and must discharge ground water to a location approved by the municipality, but in a manner that prevents the discharge from reentering the structure. The sump should have an airtight cover to prevent soil gasses from entering the living space, installed in such a way that water can drain from above, such as with a ball valve, or other type of airtight drain mechanism in the cover. See Radon in Section 1, Contaminants and Other Hazards.

Replacement Standard

The installation of new sump pump systems is allowed only after all exterior storm water management options are exhausted and the water infiltration issue remains. New sump pumps must meet the requirements under the Repair Standard.

5.5 STRUCTURAL WALLS

Key Principle: Safe

Minimum Life: 15 years

Repair Standard

Structural framing and masonry should be free from visible deterioration, rot, or serious insect damage (termites, carpenter ants, etc.), and be adequately sized for current loads. Prior to rehab, all sagging floor joists or rafters should be visually inspected, and structural damage and its cause should be corrected.

Replacement Standard

New structural walls should be minimum 2 x 4 at minimum and placed 16 inches apart on center. All exterior walls that are part of the building envelope (the air barrier and thermal barrier separating the conditioned space from the non-conditioned space) should be insulated with a minimum R-13 insulation and sheathed to code.

5.6 FIREWALLS

Minimum Life: 5 years

Repair Standard

Party walls will be maintained without cracks and plaster deterioration and if wood frame, covered with 5/8" type X gypsum, glued and screwed to structure.

Replacement Standard

When frame walls and floors adjoining other dwellings are gutted, new wall finish installations will conform to local requirements for fire ratings.

5.7 ADDITIONS

Repair Standard (NA)

Minimum Life: 60 years

Replacement Standard

New additions are acceptable only when it is necessary to add additional bedroom space. Plans must be submitted to the City Building Official for review and approval prior to bidding. All standards for Exterior Building Surfaces, Roofing, Windows and Doors, Insulation and Ventilation, Plumbing, Electrical, HVAC apply.

5.8 SEISMIC MITIGATION - FOUNDATIONS

Minimum Life: 5 years

Repair Standard

Repairs that more securely connect the masonry foundation walls to the frame portion of a structure are a permitted expense when there is risk of seismic related damage. See FEMA publications P-530, *Earthquake Safety at Home*, and P-1100, *Vulnerability-Based Seismic Assessment and Retrofit of One- and Two-Family Dwellings*, for recommendations for strengthening structural connections.

Replacement Standard

Wholesale replacement of foundations systems for seismic risk mitigation is beyond the scope of this program.

5.9 FLOODING - FOUNDATIONS

Minimum Life: 5 years

Repair Standard

Existing foundation flood vents in Special Flood Hazard Areas (SFHAs) that are designated as Zone A (A, AE, A1-30, AH, and AO) on Flood Insurance Rate Maps (FIRMs) shall be in good working order and installed per manufacturer's instructions and per National Flood Insurance Program (NFIP) Technical Bulletins. See FEMA Technical Bulletin 1, *Requirements for Flood Openings*. The elevation of homes as a mitigation measure against flooding, is beyond the scope of this program.

Replacement Standard

The installation of foundation flood vents in SHFAs designated a Zone A is an approved expense.

6 INSULATION, AIR SEALING, AND MOISTURE CONTROL

Key concepts and relationships

- Air sealing has many benefits for health, including fire stopping, moisture movement, pest control, thermal control, and contaminant control
- Inexpensive opportunities to insulate the building envelope regularly occur during rehabilitation.

– PEST FREE
– THERMALLY CONTROLLED

6.1 AIR SEALING

Key Principles: Pest Free; Thermally Controlled

Minimum Life: 10 years

Repair Standard

All accessible holes, cracks and chases should be sealed to prevent pest entry and air leakage using caulks, spray foams and copper mesh or other pest resistant materials. See Pests in Section 1, Contaminants and Other Hazards.

Replacement Standard

All accessible holes, cracks and chases, including those exposed in the removal of finishes, should be sealed to prevent pest entry and air leakage using caulks, spray foams and copper mesh or other pest resistant materials.

6.2 INSULATION

Key Principle: Thermally Controlled

Minimum Life: NA

Repair Standard

If accessible, the benefit of adding attic insulation after air sealing should be considered for its cost/benefit by having an energy audit conducted by either a BPI- or Residential Energy Services Network (RESNET)-certified auditor.

Replacement Standard

The building envelope should have a continuous air barrier and a continuous thermal barrier that is in contact with the air barrier. Attic insulation must be a minimum of R38, with soffit baffles installed when there are soffit vents to maintain ventilation at the eves. All exterior walls opened during renovations should be insulated with un-faced fiberglass batts or damp spray cellulose to R13 for 2x4 framing, and R19 for 2x6 framing. Rim joists should be insulated to R19 with either foil-faced foam board approved for exposure to living space (e.g., Thermax) or class 1-rated spray foam. Crawl spaces should be addressed first per Section B5.3, after which insulation of the perimeter walls is an allowable expense, using either foil-faced foam board approved for exposure to living space (e.g., Thermax) or class 1-rated spray foam.

6.3 ROOF VENTILATION

Minimum Life: 5 years

Repair Standard

Shingled roofs shall have a combination of operable ridge vents and soffit vents with balanced free space ventilation between soffit and ridge vents. 1 SF of free space ventilation is required for every 300 SF of attic space.

Replacement Standard

The building envelope should have a continuous air barrier and a continuous thermal barrier that is in contact with the air barrier. Attic insulation must be a minimum of R38, with soffit baffles installed when there are soffit vents to maintain ventilation at the eves. All exterior walls opened during renovations should be insulated with un-faced fiberglass batts or damp spray cellulose to R13 for 2x4 framing, and R19 for 2x6 framing. Rim joists should be insulated to R19 with either foil-faced foam board approved for exposure to living space (e.g., Thermax) or class 1-rated spray foam. Crawl spaces should be addressed first per Section B5.3, after which insulation of the perimeter walls is an allowable expense, using either foil-faced foam board approved for exposure to living space (e.g., Thermax) or class 1-rated spray foam.

6.4 WILDFIRE PATHWAYS – ROOF VENTILATION

Minimum Life: 5 years

Repair Standard

The installation of 1/8-inch wire mesh screening at soffit inlet vents and roof outlet vents, is an approved expense in areas with high-risk for wildfires, to prohibit burning embers from entry.

Replacement Standard

The replacement of soffit and roof venting, with components designed to prohibit the entry of glowing embers, is an approved expense in areas with high-risk for wildfires.

7 INTERIORS

INTERIORS – SMOKE, FIRE, AND CARBON MONOXIDE (CO) ALARMS

- CONTAMINANT FREE
- PEST FREE
- CLEAN
- SAFE
- WELL MAINTAINED

Key concepts and relationships

- Smoke, Fire and CO Alarms are essential warning systems.
- There are many options to consider, including:
  - Hard wired installation versus battery operated models
  - Hard wired installations with or without battery back-up
  - Whether or not to interconnect smoke/fire alarms, and if hard wired interconnection or wireless interconnection is appropriate.
  - CO detectors come with a digital read-out or may simply sound an alarm at a given level. The digital readout gives better information about low levels of CO.
- Reference documents: See the Home Safety section of the EPA Healthy Indoor Environment Protocols for Home Energy Upgrades document.

7.1 CO ALARMS

Key Principles: Safe; Well Maintained

Minimum Life: 2 years

Repair Standard

Operable CO alarms, with a sensor expiration date no shorter than 2 years in the future, must be located outside every bedroom, at every level and near the garage entry if there is an attached garage. If battery operated alarms do not have operable batteries installed, install new alkaline batteries. See CO in Section 1, Contaminants and Other Hazards.

Replacement Standard

Install CO alarms outside every bedroom, at every level and near the garage entry if there is an attached garage. Battery operated CO alarms must have permanently-installed 10-year lithium batteries and sensors rated for 10 years. It is recommended that CO alarms have a digital display and provide peak level readings.

7.2 SMOKE/FIRE ALARMS

Key Principles: Safe; Well Maintained

Minimum Life: 2 years

Repair Standard

Operable smoke/fire alarms, with a sensor expiration date no shorter than 2 years in the future, must be located outside every bedroom and at every level. If battery operated alarms do not have operable batteries installed, install new alkaline batteries.

Replacement Standard

Install smoke alarms inside and outside every bedroom and at every level. If battery operated alarms are installed, they must have 10-year lithium batteries. Hard wired alarms must have battery back-up. Multifamily dwellings should have interconnected alarms throughout. Both hard wired and wireless interconnected functionality are acceptable.

7.3 INTERIOR DOORS

Key Principles: Safe; Well Maintained

Minimum Life: 5 years

Repair Standard

Baths and occupied bedrooms should have operating doors, free from friction contact with door jambs and security lock sets. See LBP in Section 1, Contaminants and Other Hazards.

Replacement Standard

Replacement doors may be hollow-core, pressed-wood product consistent with the style of existing doors, including security lock sets for bathrooms and bedrooms and passage locksets for closets and other doors. Lever style handles should be considered based on resident needs and needs of regular visitors.

INTERIORS – STAIRS

Key concepts and relationships

Inadequately lighted, slippery staircases with insufficient handrails are responsible for many unnecessary injuries, especially among young children and older adults.

- Lighting is critically important in staircases. See the Lighting standard under the Electrical section. The ability to easily find and operate light switches is essential for navigating staircases, thus the requirement for lighted switches in the Lighting section.
- Stair tread surfaces are often hazardous because of smooth treads and slippery or worn carpeting.
- Functional and secure handrails are an important component for every staircase. For some occupants, handrails on both sides of the stairs are significantly safer.
- Application of Universal Design principles to staircases, so that visitors to the property are safe, is an allowable program expense.

7.4 STAIRS – HANDRAILS

Key Principles: Safe; Well Maintained

Minimum Life: 10 years

Repair Standard

All interior staircases must have a minimum of one full length handrail on one side of the stairs, firmly secured to the structure's framing, with handrail returns at both ends. The handrail should be smooth through its entire length with a diameter of 1¼ to 1½ inches and a minimum 1 ½-inch space between the wall and the handrail. The top of the handrail should be between 34 and 38 inches from the nosing of the stair tread, although it is an allowable program expense to adjust the height of the handrail to suit the occupant(s).

Replacement Standard

All "Repair Standard" requirements apply. A second handrail is an allowable expense based on the needs of the occupant(s).

7.5 STAIRS – TREADS AND RISERS

Key Principles: Safe; Well Maintained

Minimum Life: 15 years

Repair Standard

All interior staircases must have treads and risers that are solid and secure, are not slippery and do not have coverings that present a tripping hazard. Worn carpet should be removed and replaced with slip-resistant rubber stair treads or recoated with a non-slip finish.

Replacement Standard

Broken treads and/or risers must be replaced in kind. As in the "Repair Standard," treatment of the tread surface to minimize the risk of slipping or tripping is required. Reinforcement of the staircase stringers with additional framing is an allowable expense when the expected life of the existing stair system is reduced by inadequate or damaged stringers. Total replacement of the staircase is an allowable expense if it is the most cost-effective solution.

KITCHEN CABINETS AND COUNTERTOP

Key concepts and relationships

- The clutter of kitchens with insufficient storage attracts pests by providing harborage. Providing adequate storage creates the opportunity to reduce clutter.
- Food prep and clean-up requires smooth cleanable work surfaces to minimize the potential for food-borne illness.
- Adequate kitchen storage and workspace encourages home cooking and potentially healthier eating habits.

7.6 KITCHEN CABINETS AND COUNTERTOP

Key Principles: Clean; Safe; Contaminant Free; Pest Free

Minimum Life: 5 years

Repair Standard

Kitchens should have a minimum of 8 feet of countertop with base cabinets (dishwasher included if present) and wall cabinets. Existing cabinets with hardwood doors and face frames may be repaired if in good condition. All cabinets should be sound and cleanable. Repairs should use low or no VOC adhesives and coatings. See VOC in Section 1, Contaminants and Other Hazards. All penetrations in new cabinets for mechanical system components, such as plumbing or electrical, should be sealed to adjoining building components to prevent pest entry. Kick plates should be sealed to prevent pest entry from underneath or from adjacent cabinets. See Pests in Section 1. Contaminants and Other Hazards.

Replacement Standard

New cabinets should have hardwood doors and face frames. There should be a minimum of 8 lineal feet of countertop that includes a back-splash, with corresponding base cabinets and wall cabinets, and a dishwasher. Corners in countertop designs are permitted if factory assembled. A drawer base (12 inches or 15 inches) should be included in new cabinetry. A plastic laminate panel to match the countertop, or a stainless-steel panel, should be installed as a base-cabinet to wall-cabinet backsplash behind the range and extending 6 inches past the range on both sides, or if the range is in a corner, along the side wall and trimmed with chrome metal edging. All penetrations in new cabinets for mechanical system components, such as plumbing or electrical, should be sealed to adjoining building components to prevent pest entry. Kick plates should be sealed to prevent pest entry from underneath or from adjacent cabinets. See Pests in 1, Contaminants and Other Hazards.

FLOORING

Key concepts and relationships

- Flooring has significant potential to collect dirt and contaminants. Flooring should therefore be cleanable, and smooth flooring is highly recommended over carpet.
- In wet areas, such as bathrooms and kitchens, flooring must be water- and slip- resistant as well as easily cleanable, and the substrate must be smooth and consistent.
- Continuous and well-sealed concrete basement floors can reduce moisture and soil gas (radon) infiltration into the living space.
- New flooring and adhesives used in flooring installations should be low VOC.

7.7 FLOORING	Key Principles: Safe; Well Maintained; Contaminant Free
	Minimum Life: 3 years

Repair Standard

Kitchen and Bathrooms: Bathroom, kitchen, and other water-susceptible floor areas should be water- and slip-resistant, such as sheet vinyl or ceramic tile. It should be free from defects, and tripping and slip hazards. In rooms other than kitchens and baths, damaged wood flooring should be repaired.

Other Areas: When existing deteriorated carpet is installed over hardwood floors, the carpet should be removed, and when the budget allows, the hardwood should be refinished. (See Finishes below.) Adhesives used for repairs should be low VOC and compliant with South Coast Air Quality Management District (SCAQMD) Rule 1168 thresholds. See basement floors requirements.

Replacement Standard

Kitchens and Bathrooms: New bathroom flooring must be slip-resistant resilient sheet goods or ceramic tile over an approved underlayment. New kitchen flooring should be resilient sheet goods, resilient tile, or ceramic tile over an approved underlayment. In both kitchens and baths where resilient flooring is installed over a wood floor system, the substrate must be extremely smooth and consistent or ¼-inch minimum flooring underlayment must be installed as a substrate.

Other Areas: Whenever possible, rooms other than kitchens and baths with existing wood flooring should be maintained as wood floors and refinished. (See Finishes for wood floor coatings below.) For rooms other than kitchens or baths without usable wood floors, use smooth, cleanable flooring that limits VOC off gassing, does not contain phthalates, and is certified for wearability, e.g., laminate flooring with a North America Laminate Flooring Association (NALFA) certification (nalfa.com) or a European Abrasion Criteria (AC) scale rating of 4 or better. Products that meet the Scientific Certification System's FloorScore certification are highly encouraged. Carpet and associated products that are Carpet and Rug Institute's Green Label-certified are an allowable expense, except in areas prone to moisture: building entryways, laundry rooms, bathrooms, kitchens, kitchenettes, utility rooms, or any rooms with on-grade or below-grade concrete slabs. See Volatile Organic Compounds in Section 1, Contaminants and Other Hazards.

FINISHES

Key concepts and relationships

- For the purposes of this standard, the term "finishes" should refer to the coatings on walls, ceilings, floors and other building components.
- Wall and ceiling finishes should be low- or no- VOC and in high use or wet areas, a satin or semi-gloss finish is recommended for cleanability and water resistance.
- Finishes for wood floors should be low-or no- VOC and should be catalytic (two component) for wearability. Single component, water-based finishes are not approved for refinishing wood floors because of their poor abrasion resistance.
- The interior wall and ceiling finishes are required to be intact and continuous for lead-based paint compliance, pest management and air infiltration. Air infiltration can affect energy efficiency, comfort and the spread of contaminants.
- Kitchen countertops must be intact, structurally sound and cleanable for safe food prep.

7.7.1 INTERIOR WALLS AND CEILINGS

Key Principles: Contaminant Free; Pest Free; Well Maintained

Minimum Life: 3 years

Repair Standard

Wall and ceiling surfaces should be sound (secure), continuous and free from cracks and holes that would allow the movement of pests or air infiltration. Cracks and holes should be patched with materials that match the surrounding surfaces and resist rodent intrusion. See Pests in Section 1, Contaminants and Other Hazards. If wall finishes are removed in staircases or in bathrooms, install blocking to support grab bars and handrails wherever they might be required.

Replacement Standard

When necessary, plaster should be replaced by ½-inch gypsum board. Fire-rated assemblies should be specified on a project-by-project basis as required by local codes. When framing is exposed in staircases and bathrooms, install blocking for grab bars that would align with ADA requirements for grab bar and handrail installations.

7.7.2 FINISHES

Key Principles: Contaminant Free; Well Maintained

Minimum Life: 5 years

Repair Standard

All interior coating finishes should be intact, cleanable and free from hazards. See LBP in Section 1, Contaminants and Other Hazards.

Replacement Standard

New paint coatings should be low VOC. See VOC in Section 1, Contaminants and Other Hazards. New coatings in high-wear and wet areas should be satin or semi-gloss for wear resistance and cleanability.

CLOSETS

Key concepts and relationships

Closets are necessary for the storage of clothes and other personal belongings; however, they should be kept neat and clean to avoid clutter and reduce the safety concerns of falling objects.

7.8 CLOSETS

Key Principles: Safe; Pest Free; Clean; Well Maintained

Minimum Life: 5 years

Repair Standard

Existing closets with a minimum depth of 2 feet should be maintained in good repair and have a shelf and clothes rod.

Replacement Standard

New closets may be created if there is a significant lack of storage space and the budget permits. New closets should have a depth of 2 feet and include a shelf and clothes rod. Wire shelving systems with a single shelf and clothes rod are an approved option.

7.9 FIRE SAFETY – EGRESS

Key Principle: Safe

Minimum Life: NA

Repair Standard

Multifamily structures must have two means of egress from each unit.

Replacement Standard

Egress windows are required in all new sleeping and living areas unless other secondary means of escape requirements are met. The minimum dimensions for egress window clear openings are 20 inches wide by 24 inches tall, with a clear opening of 5.7 square feet. No bedrooms should be created in attics or basements unless Life Safety Code egress requirements are met.

7.10 GRAB BARS

Minimum Life: 10 years

Repair Standard

Existing grab bars must be secured or reinstalled to ensure that they are capable of supporting the occupants during use.

Replacement Standard

The installation of grab bars is an eligible expense based on the needs of the occupancy or the needs of those who regularly visit. New installations should conform to ADA guidelines and be capable of supporting the occupants. Attachment to framing or solid blocking is preferred. Hollow wall fasteners are an approved alternative to fastening to solid wood, but they must be designed for grab bar installations and have the appropriate load ratings.

7.11 SEISMIC MITIGATION – OCCUPANT EDUCATION

Minimum Life: NA

Repair Standard

The distribution of FEMA document 528, Earthquake Home Hazard Hunt, is recommend as a tool for educating owners about simple repairs that can reduce the risk of seismic damage during mild occurrences.

Replacement Standard (NA)

8 ELECTRICAL

ELECTRICAL SERVICE

 – **SAFE**

Key concepts and relationships

- The ever-increasing number of electrical devices, and the negligible cost difference with electrical services with less capacity, supports the installation of 200 AMP services as a standard approach.
- Providing electrical panels with the capacity for expanding the number of circuits over time is prudent.
- Inadequate electrical services and distribution leads to the excessive and often inappropriate use of extension cords.

8.1 SERVICE AND PANEL

Key Principle: Safe

Minimum Life: 10 years

Repair Standard

Distribution panels should have a main disconnect, a minimum of 10 circuit-breaker-protected circuits, a 100-AMP minimum capacity, and be adequate to safely supply existing and proposed devices. If a working central air conditioning system is present, the minimum service should be 150 AMP.

Replacement Standard

Inadequate panels should be replaced with a 200-AMP service with a main disconnect panel containing a minimum of 30 circuit breaker positions.

ELECTRICAL DISTRIBUTION

Key concepts and relationships

- Electrical circuits in wet or damp areas must be Ground Fault Circuit Interrupter (GFC)I-protected.
- Arc fault protection protects against fires created by faulty extension cords and poor connections between sockets and plugs.
- Adequate lighting can reduce injuries from tripping and falling. The ability to easily locate a light switch, controlling a functioning light fixture, while moving from one room to another can reduce the risks for injury.
- Special accommodations may be appropriate for occupants with reduced vision.

8.2 INTERIOR ELECTRIC DISTRIBUTION

Key Principle: Safe

Minimum Life: 7 years

Repair Standard

Exposed knob and tube wiring should be replaced. Aluminum wiring should be carefully inspected, and either damaged wiring should be replaced in its entirety, or Underwriters Laboratories (UL)-approved connectors should be installed at each electrical device to eliminate aluminum wire-to-device connections. Every room should have a minimum of two duplex receptacles, placed on separate walls, and one light fixture or receptacle switched at each room entrance. Where the source wiring circuit is accessible (e.g., first floor above basements, in gutted rooms, etc.), receptacles should be grounded. All switch, receptacle, and junction boxes should have appropriate cover plates. Wiring should be free from hazards, and all circuits should be properly protected at the panel. Floor receptacles should be removed, and a metal cover plate installed. Exposed, UL-approved electrical raceway is allowed. Bedroom receptacles should be protected by an arc fault breaker. There must be one electrical receptacle at the service panel. Basements should have a minimum of three keyless bare bulb fixtures switched at the top of the stairs.

Replacement Standard

Whenever wall finishes are removed in a room, that room should be rewired to the latest version of the National Electric Code (NEC).

8.3 GROUND FAULT CIRCUIT INTERRUPTERS

Key Principle: Safe

Minimum Life: 5 years

Repair Standard

Non-functioning GFCIs must be replaced. Kitchen counter, bath and laundry receptacles within 6 feet of a sink should be replaced with a GFCI-protected receptacle or protected by a GFCI device.

Replacement Standard

Kitchen counter, bath, and laundry receptacles must be replaced with a GFCI-protected receptacle or protected by a GFCI device.

8.4 KITCHEN ELECTRIC RECEPTACLES

Key Principle: Safe

Minimum Life: 5 years

Repair Standard

Existing receptacles, fixtures and switches must be safe and grounded.

Replacement Standard

Permanently installed or proposed stoves, refrigerators, freezers, dishwashers, disposals, washers and dryers must have separate circuits sized to NEC standards. Two separate 20-amp counter circuits are required in each kitchen area.

8.5 LIGHTING

Key Principle: Safe

Minimum Life: 7 years

Repair Standard

All light fixtures and their controlling switches in rooms, hallways, stairs, and other passageways must be in working condition and provide adequate lighting for safe movement between living spaces. Switches must be available at every entry to a space to control the lighting. Switched receptacles are an approved option for bedrooms. Attics, basements, and crawl spaces must have switched utility light fixtures providing adequate light to safely enter and exit those spaces.

Fluorescent light ballasts must be labeled "No PCBs" or be labeled as electronic. For any ballasts without such labeling, contact the manufacturer to determine whether the ballasts contain PCBs or assume that they contain PCBs and replace them with new lighting fixtures. If the manufacturer is not sure whether the ballasts contain PCBs, assume that they do and replace with new lighting fixtures. See EPA Guidance: EPA PCB-Containing Light Ballasts. Dispose of PCB-containing ballasts per EPA regulations.

Replacement Standard

All requirements of the Repair Standard apply. Attics, basements and crawl spaces must have utility fixtures switched at each entry to those spaces. All new light fixtures in living space must be ENERGY STAR labeled. New switches should be lighted for easy identification in the dark.

9 PLUMBING

DRAIN/WASTE/VENT SYSTEM

- CONTAMINANT FREE
- PEST FREE
- CLEAN
- SAFE
- WELL MAINTAINED

Key concepts and relationships

- Drain lines must be properly vented to operate correctly. The presence of plumbing vents should be confirmed during the property inspection, along with physical testing of plumbing fixtures to confirm that they operate correctly.
- Undetected or ignored plumbing leaks create significant structural damage over time. Such leaks also encourage some types of pest infiltration and can contribute to mold growth. Inspections should include the interiors of cabinetry with plumbing and all plumbing in basements and crawl spaces.

9.1 DRAIN, WASTE, AND VENT LINES

Key Principles: Contaminant Free; Dry

Minimum Life: 5 years

Repair Standard

Waste and vent lines must function without losing the trap seal.

Replacement Standard

When walls are removed exposing vent and waste lines, those lines shall be reworked to meet the current plumbing code.

DOMESTIC WATER SUPPLY

Key concepts and relationships

- The purity of the domestic water supply is to a large degree reliant on the building's piping and fixtures.
- Testing of well water on a regular interval is highly recommended.
- Shutoff valves at the main supply and at each fixture are important when a serious leak occurs but also for regular maintenance.
- See info on Lead Service Lines (LSL).

9.2 WATER SUPPLY

Key Principles: Contaminant Free; Safe

Minimum Life: 10 years

Repair Standard

The main shut off valve must be operable and completely stop the flow of water to the house. All fixtures must be leak-free and deliver sufficient cold water and, where applicable, hot water. See Water Quality Testing in Section 1, Contaminants and Other Hazards.

Replacement Standard

The main shut off valve must be operable and completely stop the flow of water to the house, and should be replaced if it does not. Lead and galvanized pipe that is part of the water service or the distribution system should be replaced with copper. All fixtures and shutoff valves should be certified "lead-free." One freeze-protected exterior hose bib is required. Copper or cross-linked polyethylene (PEX) water piping is approved for domestic water supply. Lead Service Lines (LSL) are approved for full replacement. See Water Quality Testing in Section 1, Contaminants and Other Hazards.

PLUMBING FIXTURES

Key concepts and relationships

- Adequate washing facilities are crucial to safe food prep, food clean-up and personal hygiene.
- Leaking plumbing fixtures create moisture problems and the potential for mold, building decay and pest infestation.
- When replacing plumbing fixtures for leaks or other functional problems, consider the benefits of low-flow plumbing fixtures.
- Toilets that do not perform well (inadequate flushing) create a health hazard. The MAP website provides a quantitative assessment of the functionality of toilets.

9.3 PLUMBING FIXTURES

Key Principles: Contaminant Free; Safe

Minimum Life: 3 years

Repair Standard

Every dwelling unit must have a minimum of one single bowl sink with hot and cold running water in the kitchen, appropriate for washing dishes, and at least one bathroom containing a bathroom sink, a shower and/or tub unit and a toilet. Both sink and tub/shower must have hot and cold running water. All fixtures and faucets must have working, drip-free components. Single lever handled faucets and comfort height commodes should be considered based upon occupancy.

Replacement Standard

Minimum requirements for new fixtures include: single-lever, metal faucets and shower diverters with 15-year, drip-free warranty and maximum 2.0- gallon-per-minute (GPM) flow; ceramic low-flow toilets (1.28 GPF), freestanding sinks or sinks with vanities, and fiberglass tubs with shower surrounds. Walk-in showers are allowable depending on occupancy. Single-lever handled faucets and comfort height toilet should be considered based upon occupancy. Toilets with greater that a 1.6 GPF rating should be replaced with EPA Water Sense-certified toilet using a maximum 1.28 GPF model. When installing new tubs/showers use durable substrates under ceramic tile, or fiberglass tub/shower kits that are water-tight. Install water resistant drywall, or water impervious surfaces directly adjoining the tub/shower.

DOMESTIC WATER HEATING

Key concepts and relationships

- Hot water is crucial to safe food prep, food clean-up, laundering clothes & bedding (dust mites), and personal hygiene.
- Water temperature should be tested to be under 125 degrees at the point of delivery to avoid scalding.
- Water heaters that leak, show signs of back-drafting combustion gases, or are clearly at the end of their useful life are potential health risks and should be considered for replacement if repairs should not successfully address the health risks.
- When replacing a water heater for reasons of health risks, consider that gas-fired water heaters cost less to operate compared to standard electric water heaters, with approximately $250 to $275 in savings per year.

9.4 WATER HEATERS

Key Principles: Contaminant Free; Safe

Minimum Life: 5 years

Repair Standard

Each housing unit must have a working water heater with a minimum expected remaining life of 5 years; if it is gas-fired it should have a minimum capacity of 40 gallons, if electric, 50 gallons. Gas-fired water heaters must be free of evidence of back-drafting, such as corrosion or water stains at the top of the heater. If there is any suspicion of back-drafting, a BPI-approved Combustion Zone Test (CAZ Test) must be performed by a qualified professional such as a BPI-certified Building Analyst (BA), HEP Energy Auditor (EA), or Quality Control Inspector (QCI). See CO in Section 1, Contaminants and Other Hazards.

Replacement Standard

If a water heater warrants replacement, the new water heaters may be gas-fired, electric or an electric heat pump, whichever is determined as the most practical combination of being economical to operate while minimizing the risk of combustion gases back drafting. Minimum capacity should be 40-gallons, with a 6-year warranty. High-efficiency, power-vented or sealed combustion models are required if the flue is in poor condition or there is suspicion of previous back-drafting of the water heater that cannot be addressed with improved natural venting. See CO in Section 1, Contaminants and Other Hazards.

10 SPACE CONDITIONING – HEATING AND COOLING

– CONTAMINANT FREE
– THERMALLY CONTROLLED

Key concepts and relationships

- Consistent and appropriate temperatures can help to reduce some chronic health risks.
- Climate is a key factor in defining standards for heating and cooling equipment, and this template should be adjusted to suit your climate.
- All-electric heat pumps may make sense in warmer climates.
- Gas-fired units may be more affordable to operate in colder climates where natural gas service is available.
- An energy audit by either a BPI- or RESNET-certified auditor, or a manual J calculation by the heating, ventilation, and air conditioning (HVAC) contractor, detailing the building's heating and cooling loads based on the building envelope and climate, with estimated utility costs comparing the fuel options, are the preferred methods for choosing the efficiency rating of mechanical equipment.
- Air conditioning may not be an appropriate requirement in colder climates, but necessary in others. Excessive heat can make some chronic health conditions worse and can result in heat-related illness or death. Running an air conditioning system can also help reduce high humidity levels.
- Distribution systems can significantly affect the effectiveness and efficiency of an HVAC system. Leaky ductwork, especial return ductwork, can introduce contaminants into the living space in addition to reducing efficiency and balanced delivery of conditioned air.

10.1 HEATING SYSTEM

Key Principle: Thermally Controlled

Minimum Life: 10 years

Repair Standard

Workable existing heating systems should be inspected and serviced to operate in a safe manner. Filters on forced air systems must have an airtight housing and, at minimum, a Minimum Efficiency Reporting Value (MERV) 8 filter, taking into account manufacturer's recommendations. Providing spare furnace filters is an allowable expense. See Asbestos in Section 1, Contaminants and Other Hazards.

Replacement Standard

If the heating system warrants replacement, new gas-fired heating systems should be rated at ≥92 percent Annual Fuel Utilization Efficiency (AFUE) or better. New oil-fired furnaces should be rated at >83 percent AFUE or better. New oil-fired boilers should be rated at >85 percent AFUE or better. New heat pumps should be rated at ≥16 Seasonal Energy Efficiency Ratio (SEER). New units should be sized using the Air Conditioning Contractors of America (ACCA) Manual J load calculation and ACCA Manual S for equipment selection. If new ductwork is to be installed, ACCA Manual D should be used for ductwork design. Heat pumps are an approved option when both heating and air conditioning are required and if they are comparable or better than other alternatives in terms of cost to operate. Thermostats should be programmable and accompanied by appropriate resident education to ensure their proper use. When electric resistance heating systems are replaced, soffits for ductwork and/or new distribution pipes for hot water heating systems should be provided. Up to 4 lineal feet of resistance electric heating strips per 1,000 square feet of floor area may be retained or installed in areas that are not cost effective to heat via ductwork or hot water distribution systems. New furnaces should have a minimum MERV 8 filter and an airtight filter housing that allows easy access and replacement of filters. Consider using thicker pleated filters to increase the interval between the replacement of filters.

10.2 AIR CONDITIONING

Key Principle: Thermally Controlled

Minimum Life: NA

Repair Standard

Existing central air conditioning should be inspected, serviced and refurbished to operate safely. The repair or replacement of window-mounted air conditioners in not an approved expense.

Replacement Standard

Non-functioning, non-repairable central air conditioners should be removed and drained of all CFCs. If the air conditioning system warrants replacement, the new system should have an efficiency rating of at least 16 SEER. New units should be sized using the ACCA Manual J load calculation and ACCA Manual S for equipment selection. If new ductwork is to be installed, ACCA Manual D should be used for ductwork design.

10.3 DISTRIBUTION SYSTEM

Key Principles: Thermally Controlled; Contaminant Free

Minimum Life: 5 years

Repair Standard

Duct work and radiator piping should be well-supported, insulated in unconditioned space and adequate to maintain 68°F measured 36 inches off the floor when the outside temperature is the average yearly minimum, in all habitable and essential rooms. All duct work should be insulated to R-8, sealed at all seams with mastic (not tape), and pressure-tested to eliminate leakage. For more detailed specifications, please refer to the Standard Work Specification for duct sealing: https://sws.nrel.gov/spec/501061.

Replacement Standard

All duct work should be insulated to R-8, sealed at all seams with mastic (not tape), pressure-tested to eliminate leakage, and run in concealed space. For more detailed specifications, please refer to the Standard Work Specification for duct sealing: https://sws.nrel.gov/spec/501061.

10.4 FLUES AND COMBUSTION EXHAUST

Key Principles: Thermally Controlled; Safe

Minimum Life: NA

Repair Standard

Unused masonry chimneys should be either completely removed or removed to below the roofline wherever roofing is replaced. Chimneys that are removed to below the roofline should be sealed with a permanent cap that is air- and pest-proof. Holes in ceilings and walls resulting from chimneys that have been removed should be patched in kind. Unsound chimneys should be repaired or removed. When unlined chimneys must be used for combustion exhaust, they must be lined. Unused metal flues should be completely removed, and the resulting holes in ceiling and wall finishes should be patched in kind. See CO in Section 1, Contaminants and Other Hazards.

Replacement Standard

The creation of new flues is not recommended in this program. The use of high-efficiency closed combustion appliances is recommended to avoid the need for new flues. Replacement furnace flues, when required, should be metal double- or triple-walled as recommended by the furnace manufacturer. See CO in Section 1, Contaminants and Other Hazards.

11 VENTILATION

Key concepts and relationships

- WELL VENTILATED
- DRY
- CONTAMINANT FREE

- Mechanical ventilation for bathrooms reduces contaminants, moisture levels (high Relative Humidity – RH), and the potential for mold in almost every climate.
- Running the bathroom fan for an extended time after a shower has proven to significantly improve moisture levels. A 20-minute delay is recommended using an 80-cubic-foot-per-minute (CFM) fan.
- Good ductwork design is crucial for exhaust fan performance. Smooth metal ductwork is more than 10 times as effective at moving air compared to typically installed flexible ductwork of the same diameter.
- Mechanical kitchen ventilation, for both gas and electric stoves, significantly reduces moisture and harmful particulate levels produced from cooking.
- Outlets for exhaust fans must be pest-proof, using either screens, flappers, or a combination of both.

11.1 BATH VENTILATION

Key Principles: Ventilated; Dry

Minimum Life: 5 years

Repair Standard

Existing bathrooms must have an operable exhaust fan, with functioning ductwork exhausted to the exterior (not the attic or crawl space) and rated at a minimum of 50 CFM airflow. A switching system that maximizes the potential for occupant use must be installed, such as having the fan switched with the lights with a time delay setting of 20 minutes, or switched by a humidistat. Optionally, a 20 CFM continuously running fan with functional ductwork to the exterior is acceptable. Replacing flexible ductwork with smooth metal ducts is an allowable expense.

Replacement Standard

To ensure compliance with American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 62.2, full bathrooms must have a bath fan, ducted to the outside with insulated, smooth metal duct, that is rated at a minimum 80 CFM, or proven to operate at a minimum of 50 CFM, and switched one of three ways: by a switch at the entrance with an adjustable time-delay function that runs the fan for an additional period after the fan is switched off, either built into the switch or built into the fan; or a motion detector with an adjustable time-delay function that runs the fan for an additional period after the motion detector ceases to sense motion; or by a humidistat. Half bathrooms must be mechanically vented to the exterior with a minimum 50 CFM fan (time delay not required). Insulated ductwork (to at least R6) is required for all exhaust fans whose ducting runs through unconditioned space. Outlets for exhaust ductwork should prevent pest entry and back drafting of outside air. See Pests in Section 1, Contaminants and Other Hazards.

11.2 KITCHEN VENTILATION

Key Principles: Ventilated; Dry; Contaminant Free

Minimum Life: 5 years

Repair Standard

All kitchens must have functional mechanical ventilation operating at a minimum 100 CFM.

Replacement Standard

All kitchens should have mechanical ventilation in the form of a kitchen range hood sized for the cooktop of the cooking appliance. The ventilation should operate at a maximum of 3 sones, and produce a minimum of 100 CFM after accounting for ducting losses. All ductwork should be heavy-gauge galvanized metal and be air tight with mastic-sealed seams (no duct tape). In cold and mixed climates, it is preferred that mechanical ventilation exit at side walls and not at the soffit to minimize the potential for ice damming. Outlets for exhaust ductwork should prevent pest entry and back drafting of outside air. See Pests in Section 1, Contaminants and Other Hazards.

11.3 CLOTHES DRYER EXHAUST

Key Principles: Ventilated; Dry

Minimum Life: 5 years

Repair Standard

All clothes dryers must be vented to the exterior with smooth metal ductwork and an outlet that seals against air and pest infiltration when the dryer is not operating, without the use of screening. (e.g., utilizing a positively sealing flap on the exterior.)

Replacement Standard

New dryer ductwork must be smooth metal, either galvanized steel or aluminum, with foil ductwork tape sealing the seams (not duct tape), and exhausted to the exterior with the shortest possible run. It must have an outlet that seals against air and pest infiltration when the dryer is not operating, without the use of screening. (e.g., utilizing a positively-sealing flap on the exterior). Ductwork installation in unconditioned space must be insulated to a minimum R6.

11.4 WHOLE HOUSE VENTILATION

Key Principles: Ventilated; Dry; Contaminant Free

Minimum Life: 5 years

Repair Standard

Repairs to existing whole house-ventilation systems are an approved expense.

Replacement Standard

Projects that require gut rehabilitation or substantial rehabilitation that includes significant air sealing and insulation work must meet the most recent ASHRAE 62.2 standard for whole house ventilation. [Not Applicable to larger multi-family housing, where ASHRAE 62.1 2016 is relevant.]

11.5 WILDFIRE PATHWAYS – VENTILATION OUTLETS

Minimum Life: 5 years

Repair Standard

The installation of 1/8-inch wire mesh screening at bathroom, kitchen and whole house ventilation outlets and inlets, is an approved expense in areas with high-risk for wildfires, to prohibit burning embers from entry. Such screening is not permitted on dryer vents.

Replacement Standard

The replacement of flammable ventilation outlets, such as those constructed of plastic, with nonflammable, metal outlets, is an approved expense.

12 APPLIANCES

Key concepts and relationships
Appliances can create safety risks if they tip over.

– SAFE

12.1 KITCHEN APPLIANCES

Key Principle: Safe

Minimum Life: 3 years

Repair Standard

All units must have a working and cleanable range. Freestanding ranges must have anti-tipping protection installed. If there is an existing appliance in otherwise good condition, it may be retained with minor repairs. Repairs to kitchen appliances are otherwise not an approved expense.

Replacement Standard

All redesigned kitchens will have ENERGY STAR-labeled appliances where applicable. Replacement of appliances is otherwise not an approved expense.

APPENDIX A
GREEN AND HEALTHY BUILDING PRODUCTS – SAMPLE RESIDENT HANDOUT

Every home requires maintenance and periodic home repairs. The resources listed below provide information to help you use products and supplies that are both green and help to create a healthier home environment.

PAINT

Use low VOC interior paints and primers compliant with South Coast Air Quality Management District (SCAQMD) Rule 1113 thresholds (e.g., Master Painters Institute (MPI) GS-2, Extreme Green; Greenwise Gold; and GreenSeal (GS) 11 v 3.2 meet some of the SCAQMD thresholds).

CARPET

Avoid installing carpets in wet areas where moisture and mold problems can be created: building entryways, laundry rooms, bathrooms, kitchens, utility rooms, or rooms built on foundation slabs. Limit use of carpet in other areas to minimize collection of allergens and contaminants. If carpet is installed, use products that meet the Carpet and Rug Institute's Green Label or Green Label Plus certification for carpet, pad, and carpet adhesives. See https://carpet-rug.org.

HARD FLOORS

Use flooring that meets the Scientific Certification System's FloorScore program criteria. See www.rfci.com.

CLEANING PRODUCTS AND SUPPLIES

If purchasing cleaning products, consider EPA Safer Choice (https://www.epa.gov/saferchoice/products) or Green Seal certified products (http://www.greenseal.org/FindGreenSealProductsAndServices.aspx).

Try making your own homemade all-purpose green cleaning solution:

- 1 quart warm water
- 1 teaspoon liquid soap
- 1⁄2 cup undiluted white vinegar

WATER CONSERVING TOILETS, SHOWERHEADS, AND FAUCETS

Use products that meet the EPA Water Sense criteria for reduced water use. See http://www.epa.gov/watersense/.

Toilets: Assess low-flow toilet performance by consulting Maximum Performance of Toilet Fixtures: Study of Toilet Effectiveness (http://www.map-testing.com).

AIR FRESHENERS AND PORTABLE AIR CLEANERS

See the Connecticut Department of Public Health Fact Sheet, "Air Fresheners: What You Need to Know" published in July 2013 (http://www.ct.gov/dph/lib/dph/environmental_health/eoha/pdf/air_freshener_fs.pdf).

Information on certified portable air cleaners (2017) can be found at https://www.arb.ca.gov/research/indoor/aircleaners/certified.htm.

APPENDIX B
SUPPLEMENTAL HEALTHY HOUSING RESIDENT ENGAGEMENT RESOURCES

The resources below provide additional information about how to maintain and renovate homes in a way that creates a healthier living environment. These documents may be useful to program staff or residents and homeowners moving into newly renovated housing. The healthy housing maintenance checklist is a key resource that can be a useful handout, particularly for owner-occupied housing.

DRY

Mold and Moisture: EPA A Brief Guide to Mold, Moisture, and Your Home https://www.epa.gov/sites/production/files/2016-10/documents/moldguide12.pdf.

CONTAMINANT FREE

Asbestos: Learn about Asbestos (EPA): https://www.epa.gov/asbestos/learn-about-asbestos

Lead: Protect Your Family From Lead in Your Home (EPA): https://www.epa.gov/sites/production/files/2017-06/documents/pyf_bw_booklet_format_2017_508.pdf

Lead in Drinking Water – Lead water supply lines, AKA Lead Service Lines (LSL); Consult the Lead Service Line Replacement Collaborative.

Radon: A Citizen's Guide to Radon (EPA): https://www.epa.gov/sites/production/files/2016-02/documents/2012_a_citizens_guide_to_radon.pdf

Tobacco Smoke: Implementing HUD's Smoke-Free Policy in Public Housing (HUD): https://www.hud.gov/program_offices/healthy_homes/smokefree

Mold: National Center for Healthy Housing (NCHH), Creating a Healthy Home – A Field Guide for Clean-up of Flooded Homes: http://nchharchive.org/LinkClick.aspx?fileticket=ANhnOoaHSfY=&tabid=166

PEST FREE

Integrated Pest Management Toolkit for Building Owners, Managers, and Staff (Page 21 for residents): https://www1.nyc.gov/assets/doh/downloads/pdf/pesticide/ipm-toolkit.pdf

VENTILATED

Environmental law Institute (EPA) Indoor Air Quality Guide for Tenants: https://www.eli.org/sites/default/files/docs/iaq_tenants_guide_10_17.pdf

CLEAN

Safer Choice Label (EPA safer cleaning products): https://www.epa.gov/saferchoice/learn-about-safer-choice-label

Products that meet the Safer Choice Standard: https://www.epa.gov/saferchoice/products#sector=Home

SAFE

Home Safety (HUD): https://www.hud.gov/sites/documents/DOC_25474.PDF

MAINTAINED

NCHH Healthy Homes Maintenance Checklist: http://www.nchh.org/Portals/0/Contents/Healthy_Housing_Checklist.pdf

THERMALLY CONTROLLED

Heat-Related Illness (CDC): https://www.cdc.gov/disasters/extremeheat/warning.html

Frostbite and Hypothermia: (CDC) https://www.cdc.gov/disasters/winter/staysafe/hypothermia.html

RESIDENT ENGAGEMENT

See the Enterprise Green Communities: Resident Engagement Strategies, https://www.enterprisecommunity.org/download?fid=1969&nid=4436

Enterprise Green Communities: Tools to Engage Residents in Green & Heathy Living, https://www.enterprisecommunity.org/solutions-and-innovation/green-communities/tools-and-services/resident-engagement

ACTIVE DESIGN

Fitwel Standard Building design guidance to incorporate active design and other healthy homes features: https://fitwel.org/

Center for Active Design: Active Design Guidelines, https://centerforactivedesign.org/guidelines/

APPENDIX C
REFERENCES

The resources listed below were used in the development of this guidance document.

- Centers for Disease Control, General Services Administration, and Center for Active Design, *Fitwel Scorecard Checklist for Workplace and Multifamily Residential*, 2017, URL: Fitwel Scorecard
- Green Seal, Green Seal Product Guidelines website, 2018, URL: Green Seal
- Enterprise Community Partners, *2015 Enterprise Green Communities Criteria*, 2015, URL: Green Communities Criteria
- Enterprise Community Partners, *Aging-in-Place Design Guidelines*, 2016, URL: Aging in Place Design Guidelines
- Environmental Protection Agency (EPA), *Energy Savings Plus Health: Indoor Air Quality Guidelines for Multifamily Building Upgrades*, 2016, URL: Indoor Air Quality Guidelines for Multifamily Building Upgrades
- *Healthy Indoor Environment Protocols for Home Energy Upgrades*, 2011, URL: Healthy Indoor Environment Protocols For Home Energy Upgrades
- The National Center for Healthy Housing (NCHH), *National Healthy Housing Standard*, 2014, URL: National Healthy Housing Standard
- NCHH and Enterprise Community Partners, *Creating A Healthy Home: a Field Guide for Clean-up of Flooded Homes*, 2008, URL: Field Guild for Cleanup of Flooded Homes
- New York City Department of Health and Mental Hygiene, *Integrated Pest Management Toolkit for Building Owners, Managers and Staff*, 2014, URL: Integrated Pest Management Tool Kit
- New York City Department of Health and Mental Hygiene, *Guidelines on Assessment and Remediation of Fungi in Indoor Environments*, 2008, URL: Guidelines on Assessment and Remediation of Fungi in Indoor Environments
- South Coast Air Quality Management District, CA, *SCAQMD Rule Book, Rule 1168*, Amended October, 2017, URL: District (SCAQMD) Rule 1168
- US Department of Housing and Urban Development (HUD) and the US Centers for Disease Control and Prevention (CDC), *Healthy Housing Reference Manual,* 2006, URL: Healthy Housing Reference Manual
- US Department of Housing and Urban Development (HUD), *Help Yourself to a Healthy Home*, 2016 https://www.hud.gov/program_offices/healthy_homes/healthyhomes

APPENDIX D
DETAILED CROSSWALK BETWEEN PRINCIPLES AND REHAB STANDARDS

	PRINCIPLES (Section A)	STANDARDS (Section B)										
		B.1. Contaminants	B.2. Site	B.3. Roofing	B.4. Building Exterior	B.5. Foundations and Structure	B.6. Insulation, Air Sealing	B.7. Interiors	B.8. Electrical	B.9. Plumbing	B.10. Space Conditioning	B.11. Ventilation
A.1	**Dry**											
A.1.1	Storm water management		B.2.2 Grading	B.3.1 Flat and low-slope roofing	B.4.3 Windows	B.5.1.2 Basement Floors	B.6.1. Air sealing					
A.1.2	Leaks		B.2.3 Landscaping/ Trees and shrubs?	B.3.2 Pitched roofs	B.4.2 Exterior Cladding; B.4.3 Windows; B.4.4 Ext Doors	B.5.1.3 Crawl spaces						
A.1.3	Surfaces		B.2.1 Paving/ Walkways; B.2.2 Grading; B.2.4 Lawn	B.3.3 Gutters and downspouts		B.5.1.4 Sump Pump Systems				B.9.3 Plumbing Fixtures		
A.1.3.1	Countertops	B.1.4 Mold/ Moisture; B.1.6 VOC's						B.7.4 Kitchen Cabinets and Countertops				
A.1.3.2	Tubs/showers									B.9.1 Drain/ Waste/Vent; B.9.3 Plumbing Fixtures		
A.1.3.3	Mold	B.1.4 Mold/ Moisture				B.5.1 Foundations	B.6.1 Air Sealing				B.10.0 - 10.3 Space Conditioning	B.11.0 Ventilation (all)
A.1.3.4	Relative humidity	B.1.4 Mold/ Moisture					B.6.1 Air Sealing				B.10.0 Space Conditioning	B.11.0 Ventilation (all)
A.1.3.5	Ventilation	See Section A.4 - Ventilation for detailed cross referencing										

	PRINCIPLES (Section A)	STANDARDS (Section B)										
		B.1. Contaminants	B.2. Site	B.3. Roofing	B.4. Building Exterior	B.5. Foundations and Structure	B.6. Insulation, Air Sealing	B.7. Interiors	B.8. Electrical	B.9. Plumbing	B.10. Space Conditioning	B.11. Ventilation
A.2	**Contaminant Free**	**B.1 Contaminants and Other Hazards**						**B.7.1 Interiors; B.7.4 Kitchen Cabinets and Countertops; B.7.5 Flooring; B.7.6 Finishes**			**B.10.3 Distribution System**	**B.11.2 Kitchen Ventilation; B.11.4 Whole House Ventilation**
A.2.1	Lead		B.2.4 Lawn		B.4.2-7 Building Exteriors					B.9.1-4 Plumbing		
A.2.2.1	Lead Based Paint	B.1.1 Lead Based Paint	B.2.4 Lawn		B.4.2-7 Building Exteriors			B.7.2 Interiors; Doors: B.7.6 Finishes				
A.2.2.2	Lead Service Lines	B.1.8 Water Quality Testing								B.9.1-2 Plumbing		
A.2.2	Asbestos	B.1.2 Asbestos		B.3.2 Pitched roofs				B.7.5 Flooring;			B.10.1 Heating Equipment	
A.2.3	Radon	B.1.5 Radon	B.2.2 Grading			B.5.1.1 Foundations						
A.2.4	Formaldehyde and other VOCs	B.1.6 VOCs				B.5.1.2 Basement Floors		B.7.4 Kitchen Cabinets and Countertops; B.7.5 Flooring; B.7.6 Finishes				
A.2.4.1	Composite wood					B.5.1.3 Crawl spaces		B.7.4 Kitchen Cabinets and Countertops; B.7.5 Flooring; B.7.6 Finishes				
A.2.4.2	Paints							B.7.6 Finishes				

	PRINCIPLES (Section A)	STANDARDS (Section B)										
		B.1. Contaminants	B.2. Site	B.3. Roofing	B.4. Building Exterior	B.5. Foundations and Structure	B.6. Insulation, Air Sealing	B.7. Interiors	B.8. Electrical	B.9. Plumbing	B.10. Space Conditioning	B.11. Ventilation
A.2.4.3	Adhesives							B.7.4 Kitchen Cabinets and Countertops; B.7.5 Flooring; B.7.6 Finishes				
A.2.4.4	Flooring							B.7.5 Flooring				
A.2.5	Pesticides		B.2.4 Lawn					B.7.4 Kitchen Cabinets and Countertops				
A.2.6	Tobacco Smoke							B.7.1 Smoke, Fire and CO Alarms				
A.2.7	Sewer Lines	B.1.9 Sewer system								B.9.1-2 Plumbing		
A.3	**Pest Free**											
A.3.1	Identify and Assess	B.1.4 Pest Infestations	B.2.4 Lawn		B.4.2 Exterior Cladding	B.5.1.1 Foundations	B.6.1 Air Sealing					
A.3.2	Prevent pest entry				B.4.2 Exterior Cladding	B.5.1.2 Basement Floors	B.6.1 Air Sealing	B.7.4 Kitchen Cabinets and Countertops				
A.3.3	Reduce Relative Humidity					B.5.1.3 Crawl spaces	B.6.1 Air Sealing				B.10.0 Space Conditioning	B.11.0 Ventilation (all)
A.3.4	Adopt IPM											
A.4	**Well Ventilated**											
A.4.1	Bath, Kitchen, Dryers	B.1.3 Carbon Monoxide										B.11.1-3 Bath, Kitchen, Clothes Dryers Ventilation
A.4.2	Whole House				B.4.2 Exterior Cladding; B.4.3 Windows							B.11.4 Whole House Ventilation

	PRINCIPLES (Section A)	STANDARDS (Section B)										
		B.1. Contaminants	B.2. Site	B.3. Roofing	B.4. Building Exterior	B.5. Foundations and Structure	B.6. Insulation, Air Sealing	B.7. Interiors	B.8. Electrical	B.9. Plumbing	B.10. Space Conditioning	B.11. Ventilation
A.4.3	HVAC Filters										B.10.1-2 Heating & AC Equipment	
A.4.4	HVAC Ducts						B.6.1 Air Sealing				B.10.3-4 Distribution System & Flues/ Exhaust for Combustion Systems	
A.5	**Clean**											
A.5.1	Surfaces							B.7.4 Kitchen Cabinets and Countertops		B.9.3 Plumbing Fixtures		
A.5.2	High Use Areas							B.7.4 Kitchen Cabinets and Countertops				
A.5.3	Job site cleaning	B.1.10 Job Site Cleaning										
A.6	Safe					B.5.2.1 Structural walls						
A.6.1	CO Alarms	B.1.3 Carbon Monoxide						B.7.1 Smoke, Fire and CO Alarms				
A.6.2	Smoke Alarms				B.4.5 Exterior Porches			B.7.1 Smoke, Fire and CO Alarms				
A.6.3	Lighting and Controls		B.2.5 Ext. Lighting		B.4.6 Exterior Steps				B.8.1 Electrical Service; B.8.2 Electrical Distribution; B.8.3 GFCI; B.8.4 Kitchen Receptacles; B.8.5 Lighting			

		STANDARDS (Section B)										
	PRINCIPLES (Section A)	B.1. Contaminants	B.2. Site	B.3. Roofing	B.4. Building Exterior	B.5. Foundations and Structure	B.6. Insulation, Air Sealing	B.7. Interiors	B.8. Electrical	B.9. Plumbing	B.10. Space Conditioning	B.11. Ventilation
A.6.4	Reduce falls		B.2.1 Paving and Walks		B.4.6 Exterior Stairs; B.4.7 Exterior Railings	B.5.1.1 Foundations; B.5.1.2 Basement Floors		B.7.3 Stairs; B.7.9 Grab Bars				
A.6.5	Universal design/ visitability				B.4.1 Mailboxes							
A.7	**Well Maintained**											
A.7.1	NCHH Maintenance chedklist											
A.7.2	Materials and componennts			B.3.1-3 Roofing								
A.8	**Thermally Controlled**											
A.8.1	Sufficient Heating and Cooling										B. 10.2-2 Heating & AC Equipment	
A.8.2	Caulk windows				B.4.3 Windows		B.6.1 Air Sealing					
A.8.3	Seal ducts						B.6.1 Air Sealing				B.10.3-4 Distribution System & Flues/ Exhaust for Combustion Systems	
A.8.4	Install thermostats											
A.8.5	Efficient HVAC equipment											
A.8.6	Insulate walls						B.6.2 Insulation					
A.9	Active Design											