National Center for Healthy Housing

American Public Health Association

National Healthy Housing Standard

Public Comment Version
June 5, 2013

National Healthy Housing Standard

Public Comment Version
June 5, 2013

Table of Contents

Introduction & Acknowledgments

INTRODUCTION

The Evolution of Healthy Housing Regulations

More than a century ago, growing concern about the toll of infectious diseases on Americans spurred a national public health movement aimed at eradicating slum housing conditions. This "sanitation movement" led to advances in housing, such as indoor plumbing, and space, light, and fresh air requirements. The conversion of squalid tenements to more healthful housing helped eliminate typhoid, cholera, and dysentery as major public health problems. Today, many of these public health laws remain in effect and are enforced by local environmental health professionals.

During the same time period, the building industry began to formalize its procedures for ensuring the health and safety of structures during construction and renovation. Modern building codes regulate a myriad of safety systems including design and structural requirements fire prevention, electrical, plumbing and mechanical systems, property maintenance, energy efficiency, and zoning. Building code officials are responsible for staying abreast of a vastly changing world of building technologies and with the ebbs and flows of the housing market, which typically drive the level of resources for building officials.

The result of these two parallel movements is a complex array of housing regulations, which are triggered during certain building stages (e.g., permitting for new construction), housing transactions (e.g., financing), and by concerns for public health (e.g. complaints about noise, vermin, or lead-based paint). Additional federal requirements overlay state and local regulations for housing owned or assisted by the federal government.

Housing as a Platform

Our homes are intended to shelter us from the elements, to provide privacy and a place of respite, and to ensure our safety from the outside world. In most states and localities, homes are safe and healthful havens, largely due to the protective regulations described above. Yet, in many communities, housing regulations have neither kept pace with the way Americans interact with their homes nor with the modern diseases that plague society—including chronic diseases such as asthma and depression, cancer, and certain injuries. Over 6 million homes are severely deficient, according to the American Housing Survey. These housing conditions can cause significant illness, injury and deaths at a very high cost to society. These costs include for example, $3.5 billion per year for asthma induced by dampness and mold in homes (Mudarri, 2007), $50 billion per year for childhood lead poisoning, and $217 billion from unintentional injuries in the home (Zaloshnja, 2005). There are 22,000 radon-related lung cancer deaths annually—more than drunk driving. Each cases costs about $1.1 million annually (Mason, 2010; EPA, 1992).

Housing quality is also an important marker of neighborhood conditions, with individual homes inextricably linked to the surrounding neighborhood. Blight reduces property values, increases crime, and erodes the cohesiveness and political power of communities, which directly and indirectly affect health. Where people live affects other societal outcomes as well, including the ability for children to do well in school and become productive members of society, the ability for older adults to age in place and maintain their independence, the transportation burdens associated with getting to work, and the likelihood of interfacing with the justice system.

The National Healthy Housing Standard

It is from this perspective of "housing as a platform" that the National Center for Healthy Housing (NCHH) and American Public Health Association (APHA) embarked on this project to create an attainable, enforceable, evidence-based National Healthy Housing Standard drawing upon the best thinking in the fields of public health, building science, housing code enforcement, and landlord/tenant law, and other disciplines. The Standard seeks to reduce preventable disease and injury and improve the overall health of neighborhoods by reducing substandard housing conditions.

The Standard's definitive minimal health-based provisions are designed to complement the policies already in use by local and state governments and federal agencies for the maintenance of existing homes. The standard is not intended to guide new construction or housing rehabilitation.

The inspiration and basis for the Standard is the 1986 document by APHA and the U.S. Centers for Disease Control and Prevention, "Housing and Health: Recommended Minimum Housing Standards." The Standard is an attempt to bridge the public health and building communities by integrating modern public health information into building code parlance. Although the document is intended to be "code ready," we recognize that housing regulations are unique and often tailored to local conditions. We expect and hope that users will adapt and tailor the document to their local needs.

Regulations are only as good as those who enforce them. When local health and housing resources are strained, housing conditions and public health are compromised. We know that to bring about our vision of ensuring that all people live in safe and healthy homes, we will need to marshal the political will and financial resources to translate these code provisions into lives saved and communities stabilized. The first half of the battle is to provide the best available information and tools for those in the position of improving housing conditions. The second half of the battle will require the building and public health sectors to recognize and coordinate their shared missions of keeping people safe in the places they live.

ACKNOWLEDGEMENTS

A National Committee on Housing and Health has provided visionary leadership to position the standard for relevance and widespread adoption. A Technical Review Work Group reviewed drafts, recommended improvements, and discussed significant issues during the development of the Standard. We are indebted to these experts and professionals for their thoughtful and complete engagement in the development of the Standard.

National Committee on Housing and Health:

Meri-K Appy, BA, President, Appy and Associates, LLC
Georges Benjamin, MD, FACP, Executive Director, American Public Health Association
Gail Christopher, DN, PhD, Vice President for Programs, W.K. Kellogg Foundation
Henry Cisneros, Chairman, City View
Carlos Dora, MD, PhD, Coordinator of Interventions for Healthy Environments, World Health Organization
Ruth A. Etzel, MD, PhD, FAAP, Professor of Epidemiology, University of Wisconsin Milwaukee
David Fukuzawa, M.Div., MSA, Program Director for Health, The Kresge Foundation
Lynn Goldman, MD, MPH, Dean, George Washington University School of Public Health and Health Services
Moises Loza, BA, Executive Director, Housing Assistance Council
Nic Retsinas, MCP, Senior Lecturer in Real Estate, Harvard Business School
Megan Sandel, MD, MPH, Pediatrician and Associate Professor, Boston University Medical Center
Steve Thomas, Spokesperson, Habitat for Humanity
Thomas M. Vernon, MD, Chair, National Center for Healthy Housing *(Chair of the National Committee)*

Technical Review Work Group:

Research & Academic Participants
Terry Brennan, Building Scientist and President, Camroden Associates
Dr. Patrick Breysse, Director, Occupational and Environmental Hygiene Program, Center for Global Health, Johns Hopkins University
David Ormandy, Principal Research Fellow, Institute of Health, University of Warwick UK
Dr. Claudette Reichel, Professor and Extension Housing Specialist, Louisiana State University
Dr. William Rose, Research Architect, University of Illinois Urbana-Champaign
Dr. Megan Sandel, Pediatrician and Associate Professor, Boston University Medical Center
Dr. Richard Shaughnessy, Program Director, Indoor Air Quality Research, University of Tulsa
Charles Treser, Senior Lecturer, Environmental and Occupational Health Sciences School of Public Health, University of Washington

State and Local Government Agency Participants

Suzanne Condon, Associate Commissioner and Director, Bureau of Environmental Health, Massachusetts Department of Public Health
Alan Johanns, Program Manager, Environmental Services Department, City of San Diego
Dr. James Krieger, Chief, Chronic Disease and Injury Prevention Section, Public Health, Seattle & King County *(Chair of the Work Group)*

Non-Governmental Organization Participants

Paul Haan, Executive Director, Healthy Homes Coalition of West Michigan
Kevin Kennedy, Managing Director, Center for Environmental Health, Children's Mercy Hospitals and Clinics
Beth McKee Huger, Executive Director, Greensboro Housing Coalition

Federal Agency Participants

Dr. Peter Ashley, Director, Policy and Standards Division, Office of Healthy Homes and Lead Hazard Control, U.S. Department of Housing and Urban Development
Dr. Mary Jean Brown, Chief, Healthy Homes and Lead Poisoning Prevention Program, U.S. Centers for Disease Control and Prevention
Greg Brunner, Engineer, Indoor Environments Division, U.S. Environmental Protection Agency
Dr. Karin Mack, Senior Behavioral Scientist, Injury Prevention Program, U.S. Centers for Disease Control and Prevention

Staff:

Jill Breysse, Project Manager
Dave Jacobs, Research Director
Jane Malone, Policy Director
Rebecca Morley, Executive Director

Support for the development of this Standard was provided under a grant agreement between the Kresge Foundation and the National Center for Healthy Housing. The contents of this report are solely the responsibility of the authors and do not necessarily represent the official views of the Kresge Foundation.

Sections of the 2012 Model Codes (copyright 2011) are reproduced with the permission of the International Code Council, Washington DC, www.ICCSAFE.org, all rights reserved:

- Sections 302.2, 302.6, 303.2, 303.18.1, 304.2, 305.4, 402.1, 402.2, 403.1, 403.2, 403.5, 404.3, 404.4.3, 505.4, 602.2.2, 602.2.3, 603.2, 603.3 of the 2012 International Property Maintenance Code
- Section 1210.2 of the 2012 International Building Code
- Sections 907.2.11.2, 907.2.11.3 of the 2012 International Fire Code.
- Sections 424.3, 424.5, 501.6, 504.4, 504.6 of the 2012 International Plumbing Code
- Sections E3901, E3902.1, M1901.1, P2713, P2708.3, P3009, R310.1, R310.2, R310.2.1, R311.7.5, R311.7.8, R312.1.1, R312.1.2, R312.1.3, R312.2.1 of the International Residential Code

Minimum Requirements

1. DUTIES OF OWNERS AND OCCUPANTS

1.1 Duties of Owners.

The owner has the duty to ensure that the dwelling, dwelling unit and premises are safe and healthy, in compliance with this standard and all applicable legal requirements.

1.1.1. The owner shall maintain the dwelling, shared or public area of the dwelling, and premises in a safe and healthy condition.

1.1.2. The owner shall be responsible for the collection and disposal of trash and the cleanliness of trash containers, bulk storage containers, recycling containers, and areas where the containers are stored.

1.1.3. The owner shall be responsible for maintaining the building and premises to keep pests from entering the building. The owner of a two-unit property and multifamily housing shall maintain the building, shared areas, and premises free from pest infestation and shall be responsible for pest elimination in accordance with integrated pest management methods.

1.1.4. The owner shall not cause or allow any water, sewage, electrical, or gas service, facility, or equipment required for safe and healthy occupancy to be removed , shut off, or discontinued for any occupied dwelling, except for such temporary interruption as may be necessary while repairs or alterations are being performed, or during temporary emergencies requiring discontinuance of service. This provision does not apply where the occupant has contractual control over the service and shall not be interpreted as preventing a utility company from discontinuing service for reasons allowed by law.

1.2 Duties of Occupants.

The occupant shall be responsible for the proper use and operation of the dwelling unit and supplied fixtures and facilities, keep them in a safe and healthy condition, and report breakdowns, leaks, and other problems requiring repair to the owner.

1.2.1. The occupant shall be responsible for the disposal of trash in supplied containers.

1.2.2. The occupant of a single-family dwelling shall be responsible for pest elimination in accordance with integrated pest management methods, unless the owner's failure to maintain the building and premises caused pest entry.

2. STRUCTURE, FACILITIES, PLUMBING, AND SPACE REQUIREMENTS

2.1 Structure.

Every foundation, roof, floor, exterior and interior wall, ceiling, inside and outside stair, porch, accessory structure, and fence shall be safe to use and capable of supporting the intended design loads and load effects and shall be in good condition. Fencing shall not have climbable cross pieces. Private swimming pools, hot tubs, and spas that hold water more than 24 inches (610 mm) in depth shall be completely surrounded by a fence or barrier at least 48 inches (1,219 mm) in height above the finished ground level that is accessible only through a self-closing and self-latching gate or door.

2.2 Facilities.

Every plumbing fixture and pipe, chimney, flue, smoke pipe, and every other facility, piece of equipment, or utility present in a dwelling or dwelling unit, or required under this standard, shall be constructed and installed in conformance with applicable statutes, ordinances, and regulations.

2.2.1. Mechanical, utility, and heating facilities shall be separated from habitable rooms and exits by unbroken walls or walls with doors.

2.3 Plumbing System.

Every plumbing fixture, stack, vent, and water, waste, and sewer pipe shall be properly installed, maintained in a safe and functional order, and be kept free from obstructions, leaks, and defects.

2.3.1. An approved potable water supply system shall provide an adequate amount of running water under pressure to fixtures at all times.

2.3.2. An adequate supply of heated running water under pressure shall be supplied to sinks, bathtubs, showers, and laundry facilities. Water heaters shall be set at a minimum temperature of 110° F (43° C). At bathtub faucets and shower heads, the maximum temperature shall be 120° F (49° C). Heated water shall be provided by either a tank-type or tankless water heater. A tank-type water heater shall have a pressure relief valve that discharges to a drip pan, storage tank, or the outside. The temperature of water from tankless water heaters shall not exceed 140° F (60° C).

2.3.3. Every waste pipe shall be connected to a public sewer system, an approved private sewage disposal system, or graywater system. No toilet waste pipe shall be connected to a graywater system.

2.3.4. Faucets shall be located above the overflow rim of sinks, tubs, or other fixtures that collect water.

2.4 Kitchen.

Every dwelling shall have a room or portion of a room in which food may be prepared and/or cooked and shall be supplied with the following:

2.4.1. A kitchen sink in good working condition that is properly connected to the heated and unheated water supply and waste pipes. Any provided dishwasher and components of the sink, including disposal and water filtration devices, shall be in good working condition and properly connected.

2.4.2. A counter for food preparation and cabinets and/or shelves sufficient to store occupants' food that does not require refrigeration, eating, drinking, and cooking equipment, and utensils. Cabinets shall have tight-fitting doors and no gaps between any surfaces. The counter, cabinets, and shelves shall be of sound construction and furnished with surfaces that are impervious to water and smooth and cleanable.

2.4.3. A range for cooking food and a refrigerator with a freezer. Each range, oven, cooktop, and refrigerator shall be properly installed with all necessary connections for safe and efficient operation and shall be maintained in good working condition.

2.4.3.1. The range shall include four or more burners and an oven unless both a separate oven, other than a microwave oven, and a cooktop with four or more burners are provided. Freestanding or built-in ranges shall have a vertical clearance above the cooking top of not less than 30 inches (762 mm) to unprotected combustible material. Reduced clearances are permitted in accordance with the listing and labeling of the range hood or other appliance.

2.4.3.2. The refrigerator shall be of sufficient size to store occupants' food that requires refrigeration, and shall be capable of maintaining a temperature less than 41° F (6° C) but more than 32° F (0° C). The freezer section shall be capable of maintaining a temperature below 0° F (-18° C). A refrigerator need not be supplied when the occupant is expected to provide same upon occupancy, so long as adequate connections for the safe and efficient installation and operation of a refrigerator are provided.

2.4.4. A kitchen floor in good condition, with a cleanable surface, and composed of nonabsorbent waterproof material.

2.5 Bathroom.

Every dwelling shall have a bathroom equipped with the following:

2.5.1. A toilet located in the bathroom or in another room that affords privacy, in good working condition, sealed to the floor, equipped with a water-sealed trap, and properly connected to the dwelling's water supply and to a waste pipe leading to an approved sewage system or private waste disposal system.

2.5.2. A sink in good working condition, with a stable connection to the wall or securely attached to the floor. The sink shall be properly connected to the heated and unheated water supply and a waste pipe.

2.5.3. A bathtub or shower in good working condition and located in the bathroom or in another room that affords privacy. The bathtub or shower shall be properly connected to the heated and unheated water supply and a waste pipe. The bottoms of bathtubs and shower floors shall have permanent or removable nonslip surfaces.

2.5.4. Bathroom and toilet room floor surfaces shall be cleanable and made of nonabsorbent waterproof materials. Bathroom wall materials that cover the wall extending 48 inches (1,219 mm) above a bathtub and 72 inches (1,827 mm) above the floor of a shower stall shall be cleanable and made of nonabsorbent waterproof materials. Such materials on walls and floors shall form a watertight joint with each other and with the bathtub or shower.

2.6 Minimum Space.

The dwelling shall provide privacy and provide adequate space to permit occupants to move around facilities and furniture and use them safely.

2.6.1. A bedroom shall not be the only passageway to the only bathroom in the dwelling unit.

2.6.2. A bathroom or toilet room shall not be the only passageway to any habitable room, hall, basement, or the exterior of the dwelling.

2.6.3. Every dwelling shall have closet space of sufficient size to store occupants' clothing and personal belongings.

2.6.4. The ceiling height of any habitable room shall be at least 84 inches (2,134 mm). In any habitable room with a sloping ceiling, at least one half of the floor area shall have a ceiling height of at least 84 inches (2,134 mm). If any part of a room has a ceiling height lower than 60 inches (1,524 mm), its floor area shall not be considered in computing the total floor area of the room.

2.6.5. A habitable room located partly or totally below grade shall be provided with natural light by windows in accordance with Subsection 4.3 and ventilation in accordance with Subsection 5.3. In such a room, the ceiling and any ducts, pipes, and other obstructions shall be at least 84 inches (2,134 mm) above the floor throughout the room and walls, and floors shall be waterproof and free of dampness.

2.7 Floors and Floor Coverings.

Floors and floor coverings shall be attached at each threshold, in good condition and free of bulges and buckling. Carpets shall have no tears, folds, or bumps. Uncarpeted floors shall have cleanable surfaces.

2.8 Noise.

The structure and facilities shall be maintained so that the noise level in the interior of the dwelling unit that can be attributed to exterior sources is below 45 L_{dn} (day-night equivalent sound level).

3. SAFETY AND PERSONAL SECURITY

3.1 Egress.

Every dwelling unit shall have at least two means of egress leading outside without passing through another dwelling.

3.1.1. Any bedroom located below the fourth floor shall be provided with an exterior window openable from the inside and of sufficient dimensions that it can be used as a means of emergency egress.

3.1.2. If a habitable room partly or totally below grade is intended for sleeping purposes, at least one exterior window shall be openable from the inside and accessible for easy and ready use as an emergency exit. The window shall have the following minimum dimensions: a net clear opening of 5.7 square feet (5,295 cm^2); 24 inches (609 mm) from the top of the sill to the bottom of head of the window frame, a width of 20 inches (508 mm), and a sill height of not more than 44 inches (1,117 mm) from the floor.

3.1.2.1. If the window opening sill height is below ground elevation, the horizontal dimension (width times projection) of the window well shall be at least nine square feet (8,361 cm^2) and the horizontal projection shall extend at least 36 inches (914 mm) from the exterior side of the window.

3.1.2.2. If a window well is deeper than 44 inches (1,117 mm) below ground elevation, there shall be a ladder permanently attached to serve as an emergency exit to ground elevation. The step distance between rungs shall be 18 inches (457 mm), and the rungs shall be at least 12 inches wide (305 mm) and shall project between three and six inches (76 and 152 mm) from the wall.

3.1.2. A door leading directly from the habitable room located below grade to the outside that provides an exit at grade level may be used in lieu of the specified window.

3.2 Locks/Security.

Exterior doors shall be equipped with a dead bolt locking device capable of being opened from the interior side without a key.

3.2.1. Within multifamily housing, dwelling unit entrance doors that open to a common area shall be equipped with a device that permits occupants to see a person at the door without fully opening the door.

3.2.2. Exterior windows that are capable of being opened and are potential means of entry shall be equipped with a lock on the interior side.

3.3 Smoke Alarm.

Every dwelling unit shall have a functioning smoke alarm in good working condition located on the ceiling outside each sleeping area in the immediate vicinity of the bedrooms, in each additional room used for sleeping purposes, and on every level except crawlspaces and uninhabitable attics. In dwellings or dwelling units with split levels that have no door between adjacent levels, the smoke alarm installed on the upper level shall suffice for the adjacent lower level.

3.3.1. In multifamily housing, a tamper-proof smoke detection system (interconnected with a central fire alarm system) or stand-alone smoke alarms in good working condition shall be installed on each level including basements, in heating system and storage rooms, in garages, and in other common areas.

3.3.2. Battery-operated smoke alarms shall be powered with lithium batteries. Hard-wired smoke alarms shall have lithium battery backup.

3.4 Fire Extinguisher.

Each dwelling unit shall have at least one working fire extinguisher in or near the kitchen.

3.5 Carbon Monoxide Alarm.

Every dwelling unit shall have at least one functioning carbon monoxide (CO) alarm on every occupiable floor and outside each separate sleeping area, in the immediate vicinity of every bedroom.

3.5.1. Battery-operated CO alarms shall be powered with lithium batteries. Hard-wired CO alarms shall have lithium battery back-up.

3.6 Walking Surfaces.

Every stairway, ramp, deck, porch and balcony shall be maintained structurally sound, in good repair, properly anchored, and capable of supporting the imposed loads.

3.6.1. Every inside and outside stairway shall have uniform risers and uniform treads with nonskid surfaces. Risers shall be no higher than 7¾ inches (196 mm). Treads shall be at least 10 inches (254 mm) deep.

3.6.2. Every stairway with four or more risers shall have at least one structurally sound handrail installed not less than 34 inches (867 mm) and not more than 38 inches (965 mm), measured vertically from the nose of the tread. The handrail shall be firmly fastened, capable of supporting normally imposed loads, and in good condition. If a side of a stairway is open to the floor or grade below, and the handrail provides the guard required by Subsection 3.7, the rail shall be supported by balusters 34 to 38 inches (867 to 965 mm) in height, measured vertically from the nose of the tread.

3.7 Guards.

Every stairway, porch, patio, landing, and/or balcony located more than 36 inches (914 mm) above an adjacent area shall have a structurally sound guard at least 36 inches (914 mm) high, measured vertically from the floor. The guard shall be firmly fastened, capable of supporting normally imposed loads, and in good condition. Balusters with a minimum thickness of one-half inch (13 mm) shall be placed at intervals that do not allow passage of a sphere greater than 4⅜ (111 mm) in diameter. There shall be no climbable cross pieces. If the balusters do not reach the floor, the narrowest opening between the bottom of the stair guard and the floor shall be a maximum of four inches (102 mm). Every exterior window that is located more than 72 inches (1,829 mm) above the grade below and is capable of being opened shall have a fall prevention device or window guard.

3.8 Chemical Storage.

Each dwelling unit shall have a cabinet or other facility that is lockable or not readily accessible to children for the storage of drugs and chemical agents for household use. Each dwelling shall have separate exterior or ventilated space for the storage of flammable substances.

4. LIGHTING AND ELECTRICAL SYSTEMS

4.1 Electrical System.

Every dwelling unit shall have electric service, outlets, and fixtures that are installed properly, maintained in good and safe working condition, and connected to a source of electric power.

4.1.1. Every dwelling unit shall be supplied with a three-wire, 120/240-volt, single-phase electrical service having a rating of not less than 100 amperes that is not shared with another dwelling unit.

4.1.2. Temporary wiring or extension cords shall not be used as permanent wiring.

4.2 Outlets.

Every habitable room shall contain at least two separate and remote wall-type, 125-volt, three-prong grounded duplex electric convenience outlets or one such duplex convenience outlet and one supplied wall or ceiling type electric light fixture. Duplex outlets shall be maintained in good working condition and located to avoid the use of extension cords for fixed appliances and overloading.

4.2.1. Each kitchen and each room containing a toilet, sink, bathtub, or shower stall shall contain at least one 125-volt three-prong duplex electric convenience outlet. Convenience outlets in these rooms, in garages, crawlspaces, unfinished basements, and outdoors shall be protected by ground fault circuit interrupters.

4.3 Natural Lighting.

Every habitable room shall receive daylight from at least one exterior window or skylight.

4.3.1. If a habitable room receives daylight from an adjacent room or area used seasonally, such as a porch, the daylight through this interconnection shall be available year-round.

4.3.2. The minimum total window or skylight area, measured between the interior window stops, shall be at least eight percent of the floor area of such room. If building components or structures located within 36 inches (914 mm) of the window obstruct daylight, this window shall not be deemed to face directly to the outdoors and shall not be included as contributing to the required minimum total window area.

4.3.3. Every bathroom and kitchen shall comply with the daylight requirement for habitable rooms contained in this section, except that no window or skylight shall be required if the room is equipped with a mechanical ventilation system consistent with Subsection 5.3.

4.4 Artificial Lighting.

Each room containing a toilet, sink, bathtub, or shower stall shall contain at least one ceiling or wall-type electric lighting fixture. Each non-habitable room, including laundry rooms, furnace rooms, and public halls, shall contain at least one ceiling or wall-type electric lighting fixture.

4.4.1. Light switches that control ceiling-or wall-type electric light fixtures shall be located conveniently for safe use.

4.4.2. Every public hall and stairway in multifamily housing shall be illuminated at all times with at least a 60-watt standard incandescent light bulb or equivalent illumination for each 200 square feet (18.6 square meters) of floor area, provided that the distance between light fixtures shall not be greater than 30 feet (7,620 mm).

4.4.3. If a building containing one or two dwelling units has a public hall or stairway, it shall be illuminated with at least a 60-watt standard incandescent light bulb or equivalent illumination for each 200 square feet (18.6 square meters) of floor that is controlled by a three-way switch or a motion-activated device.

5. HEATING, VENTILATION, AND ENERGY EFFICIENCY

5.1 Heating, Ventilation, and Air Conditioning Systems.

Facilities for heating, cooling, ventilation, and humidity control shall be maintained in good working condition and operated when necessary for the health and comfort of the occupants and in accordance with the design capacity of the installed equipment. When equipment is inoperative for more than 24 hours due to a mechanical problem or power failure other than a utility outage, alternative safe provisions for necessary heating, ventilating, or cooling shall be provided.

5.2 Heating System.

Every dwelling shall have a properly installed heating system that is in good and safe working condition and capable of safely and adequately heating all habitable rooms, bathrooms, and toilet rooms. The heating system, filtration components, heating elements, and cooling elements (if provided), shall be maintained and operated in accordance with manufacturer specifications, and shall be inspected and serviced annually by a licensed heating, ventilation, and air conditioning systems contractor.

5.2.1. Venting and Air Supply for Heating Equipment. Furnaces, water heaters, wood stoves, and other devices that employ combustion-burning fuel shall be vented to the outside of the structure in an approved manner that meets manufacturer specifications and shall be supplied with sufficient air to continuously support the complete combustion of fuel and prevent back-drafting.

5.2.2. Minimum Heat Temperature and Supply. The heating system shall be capable of maintaining a minimum room temperature of 68° F (20° C) in every habitable room, bathroom, and toilet room. If the dwelling unit is rented, leased, or let on terms either expressed or implied that heat will be supplied, heat shall be provided to maintain a minimum temperature of 68° F (20° C) in habitable rooms, bathrooms, and toilet rooms, and at no time during the heating season shall the system allow the temperature to exceed 78° F (25° C) in any room.

5.2.3. Forced-Air Systems. Any dwelling with a forced-air system shall have at least one thermostat within each dwelling unit capable of controlling the heating system, and cooling system if provided, to maintain temperature set point between 55° F (13° C) and 85° F (29° C) at different times of the day. The system shall have a clean air filter that meets manufacturer specifications installed at change in tenancy. This filter shall have a minimum efficiency reporting value (MERV) of eight unless the system is not equipped to use a MERV 8 filter.

5.2.4. Steam and Hot Water Systems. In dwellings with heating equipment utilizing steam or hot water with a temperature of 110° F (43° C) or greater, protective covers/barriers shall be installed on and maintained for exposed surfaces of radiators and piping between radiators.

5.2.5. Wood Stoves. A wood stove manufactured after June 1988 shall have a manufacturer's label certifying compliance with EPA's emission standard at 40 CFR 60 part AAA.

5.3 Ventilation.

Natural or mechanical ventilation, or a combination of the two, shall deliver fresh air to every habitable room and bathroom and be capable of removing moisture-laden air and other contaminants generated during cooking, bathing, and showering. The air exhausted from a bathroom, toilet room, or kitchen shall not be vented into habitable space or an attic.

5.3.1. Natural ventilation shall be provided in every habitable room by at least one window that faces directly outdoors and can be opened easily.

5.3.2. Bathroom Exhaust. A bathroom shall have an exterior window or an exhaust fan that vents to the outdoors.

5.3.3. Kitchen Exhaust. A kitchen shall have an exterior window or an exhaust fan that vents to the outdoors.

5.3.4. Clothes Dryer Exhaust. The exhaust from a clothes dryer shall be vented to the outdoors through a rigid or corrugated semi-rigid metal duct.

5.3.5. Exhaust vents. Pipes, ducts, conductors, fans, and blowers shall not discharge gases, steam, vapor, hot air, grease, smoke, odors, or other gaseous or particulate wastes directly upon abutting or adjacent public or private property or that of another occupant. Vent pipe openings and pest-proofing screens that cover them shall be maintained free of debris.

5.4 Air Sealing.

Openings into dwellings and dwelling units shall be sealed to limit air movement.

5.4.1. Exterior doors, windows and skylights shall be weathertight.

5.4.2. Walls, ceilings, and floors separating an adjoining garage from the living space shall be air-sealed, including cracks and other openings that allow airflow, such as utility and ductwork penetrations. Leaks in ductwork and air handling units located in the garage shall be sealed to prevent migration of airborne chemical agents from the garage space. There shall be no supply or return vent openings in the garage that connect to air handlers serving the habitable spaces. Any door or window connecting habitable space to an adjoining garage shall be metal, provided with an automatic closing mechanism and tightly sealed with weather-stripping.

5.4.3. In multifamily buildings, walls, ceilings and floors that separate the unit from neighboring units, corridors, chases, and stairwells, and openings such as utility and ductwork penetrations and cracks, shall be sealed as tightly as possible to limit air movement.

6. MOISTURE CONTROL, SOLID WASTE, AND PEST MANAGEMENT

6.1 Moisture Prevention and Control.

Every foundation, roof, roofing component, exterior wall, door, skylight, and window shall be watertight, free of persistent dampness or moisture, and in good condition.

6.1.1. The building shall have an adequate drainage system that directs water away from the structure.

6.1.2. Exterior wood surfaces, other than decay-resistant woods, shall be protected from the elements and decay by paint or other protective covering or treatment. Weep holes in brickwork shall be left open.

6.1.3. Premises shall be graded and maintained to prevent the erosion of soil and to prevent the accumulation of stagnant water on the premises or within any structure.

6.1.4. Interior and exterior surfaces such as but not limited to wood, cellulose insulation, and paper, paint, and other wall coverings, including paper-faced gypsum board, shall have no signs of chronic or persistent excessive dampness or moisture.

6.1.5. Building material that is discolored or deteriorated by mold or mildew or causes a moldy or earthy odor shall be cleaned, dried, and repaired. Structurally unsound material shall be removed and replaced.

6.1.5.1. Removal and repair of moldy material shall be conducted in accordance with New York City Guidelines on Assessment and Remediation of Fungi in Indoor Environments.

6.1.6. The underlying cause of excessive dampness or moisture, or moldy or earthy odor shall be corrected.

6.2 Solid Waste.

Every dwelling shall have adequate facilities for temporary storage of trash and recyclable materials.

6.2.1. There shall be trash containers outside the dwelling for the storage of trash awaiting collection or disposal. Containers shall be equipped with watertight and insect-proof covers. The total capacity of these facilities shall be sufficient to store occupants' trash between scheduled collection times, and shall be placed on a cleanable surface constructed to minimize spillage onto the adjacent area.

6.2.2. There shall be containers outside the dwelling for recyclable materials awaiting collection, with capacity sufficient to store occupants' recyclable materials between scheduled collection times.

6.3 Pest Management.

Every dwelling shall be maintained free of infestation, openings that allow pest entry, conditions that harbor pests or provide them with food or water, and visible pest residue or debris using integrated pest management methods.

6.3.1. There shall be no accumulation of trash, paper, boxes, lumber, scrap metal, food, or other materials that support rodent harborage in or about any dwelling, common areas, or premises. Stored materials shall be placed in boxes or stacked in stable piles elevated at least six inches (152 mm) above the ground or floor and at least six inches (152 mm) from the walls. Stored materials shall not block any egress routes.

6.3.2. Every premise, accessory structure, and fence shall be maintained in good repair and free of pest infestation.

6.3.2.1. There shall be no plantings in the soil within six inches (152 mm) of any dwelling.

6.3.2.2. There shall be no accumulation of stagnant water in or about any dwelling, building, common areas, or premises. Ornamental ponds and other water features shall have fountains or other mechanisms to prevent standing water, and the water in such features shall be flushed and replaced weekly.

6.3.3. Every window and storm door shall be supplied with adequate screens to prevent the entry of pests.

6.3.4. There shall be no openings in exterior walls, foundations, crawl spaces, basements, ground or first floors, roofs, or around windows or doors that equal or exceed one-quarter inch (6 mm) in diameter.

6.3.4.1. Pipes, drains, wires, or conduits and other openings that penetrate the roof or exterior walls, shall be caulked, including the areas surrounding such penetrations.

6.3.4.2. Vent pipe openings shall be covered with rodent- and corrosion-proof screens made of copper or stainless steel mesh or rigid metal cloth.

6.3.5. Foggers shall not be used to control or eliminate pests.

7. CHEMICAL AND RADIOLOGICAL AGENTS

7.1 General Requirements.

Dwellings, premises, and accessory structures shall be free from chemical and radiological agents, including but not limited to deteriorated lead-based paint, friable asbestos-containing material, formaldehyde, radon, pesticides, methamphetamine, and carbon monoxide. When there exists a regulatory limit that is more protective than the level included in this section, the more restrictive limit shall apply. Chemical and radiological agents shall be contained, removed, disposed of, and/or mitigated in a safe and healthy manner.

7.2 Lead-Based Paint.

Lead-based paint shall not be applied to the interior or exterior surface of any dwelling or dwelling unit.

7.2.1. Lead present on an existing painted surface above the following federal regulatory limits is deemed hazardous: (1) lead-based paint—0.5 percent by weight or 1.0 milligrams per square centimeter; (2) dust on floors—40 micrograms of lead per square foot of settled dust ($\mu g/ft^2$); (3) dust on interior window sills—250 $\mu g/ft^2$; (4) bare soil in children's play areas—400 ppm of lead; and (5) bare soil in areas of the yard that are not children's play areas—1,200 ppm.

7.2.2. Painted surfaces shall be maintained intact.

7.2.3. With the exception of paint that is tested and found not to contain lead-based paint in accordance with 40 CFR 745.82(a)(1) or (2), deteriorated paint on property built before 1978 shall be repaired in accordance with the renovation requirements of 40 CFR 745.

7.2.4. With the exception of paint that is tested and found not to contain lead-based paint in accordance with 40 CFR 745.82(a)(1) or (2), a painted surface shall not be disturbed using methods that involve (1) open-flame burning or torching or operating a heat gun at temperatures above 1,100° F; or (2) power sanding, grinding, power planing, needle gun, abrasive blasting, or sandblasting unless such machines have shrouds or containment systems and a High-Efficiency Particulate Air (HEPA) vacuum attachment that collects dust and debris at the point of generation. The shroud or containment system shall release no visible dust or air outside the shroud or containment system.

7.3 Asbestos.

Every owner shall maintain in good repair asbestos-containing material on the premises. Asbestos-containing material shall be identified, clearly labeled, and maintained free from any defects such as holes, cracks, tears, and/or looseness that may allow the release of asbestos fibers into the environment.

7.3.1. Damaged friable asbestos-containing material shall be mitigated in accordance with federal, state, or local requirements by licensed asbestos professionals.

7.3.2. Any construction, remodeling, or other activity that will disturb asbestos-containing materials shall be performed by licensed contractors.

7.3.3. Removal and disposal of asbestos-containing material shall comply with appropriate federal, state, and local requirements.

7.4 Formaldehyde.

Building materials consisting of hardwood plywood, medium-density fiberboard, and particleboard as defined by 15 USC 2697(b)(2) shall not be used for renovations within dwellings, unless the materials have been certified to meet the formaldehyde emission standards of 15 USC 2697(b)(2): (1) hardwood plywood with a veneer core, 0.05 parts per million (ppm); (2) hardwood plywood with a composite core, 0.05 ppm; (3) medium-density fiberboard, 0.11 ppm; (4) thin medium-density fiberboard, 0.13 ppm; and (5) particleboard, 0.09 ppm.

7.5 Radon.

Radon present at levels at or above the EPA action level of 4 picocuries radon per liter of air (pCi/L) in the lowest occupied level of the dwelling shall be mitigated.

7.6 Pesticides.

Pesticides shall be stored in accordance with manufacturer specifications and shall be applied only in areas and at concentrations which comply with manufacturer specifications.

7.6.1. When it is determined by an approved method that a hazardous amount of a pesticide has been applied in a location or at a concentration contrary to manufacturer specifications, the area affected by such pesticide shall be vacated until the hazard has been mitigated.

7.6.2. If a pesticide is stored in a location that does not comply with manufacturer specifications, the pesticide shall be properly stored or removed.

7.7 Methamphetamine.

A dwelling that has been used for illegal methamphetamine manufacture shall be vacated until certified by an approved testing method as safe from hazardous materials related to the methamphetamine manufacturing process.

7.8 Carbon Monoxide.

Carbon monoxide present at or above 35 ppm (31 mg/m^3) when measured over one hour, or above 10 ppm (9 mg/m^3) measured over eight hours, shall be deemed hazardous, and the cause of the hazard shall be repaired.

Definitions

The following definitions shall apply in the interpretation and enforcement of this standard:

Accessory Structure shall mean a detached structure such as garage or shed that is subordinate to the principal building(s) on the same premises.

Adequate shall mean sufficient to accomplish the purpose intended without unreasonable risk to human health or safety.

Approved shall mean established by the local or state authority having such administrative authority or determined by the designated official.

Asbestos shall mean chrysotile, amosite, crocidolite; or, in fibrous form, tremolite asbestos, anthophyllite asbestos, or actinolite asbestos. The federal limit for asbestos in any material or product is one percent asbestos.

Back-drafting shall mean improper venting of combustion appliances that causes combustion by-products to spill into the indoor environment rather than to exhaust outdoors.

Balusters shall mean pillars or columns in a series supporting a rail or guard.

Basement shall mean a portion of a building located partly or entirely below grade.

Biological Agent shall include but not be limited to mold, infestation, human and animal waste, wastewater, sewage, rotting material, and accumulation of trash that may harbor viruses, parasites, fungi, and bacteria.

Bulk Storage Container shall mean a metal trash container that is more than 40 inches (1016 mm) in height, has a capacity of more than two cubic yards (1.5 m^3), and is equipped with fittings for hydraulic and/or mechanical emptying, unloading, and/or removal.

Carbon Monoxide Alarm shall mean an electronic device that measures the level of carbon monoxide gas in the air and is equipped with a sensor that activates an audible alarm when an amount of carbon monoxide above the device's threshold level accumulates in the area in which the alarm is located.

Chemical Agent shall mean chemicals that have the potential to cause adverse health effects.

Chimney shall mean a vertical masonry shaft of reinforced concrete, or other approved noncombustible, heat-resisting material enclosing one or more flues, to remove products of combustion from solid, liquid, or gaseous fuel.

Cleanable shall mean moisture-resistant, free from cracks, chips, or tears, and designed to be cleaned frequently.

Dwelling shall mean any building wholly or partly used or intended to be used for living, sleeping, cooking, and eating.

Dwelling Unit shall mean a room or group of rooms used or intended to be used for living, sleeping, cooking, and eating by one or more individuals living together as a single household.

Egress shall mean an arrangement of facilities to permit safe exit from a building.

Electrical System shall mean a system that makes electricity available in a building and distributes it through outlets and lighting fixtures for occupant use.

Flue shall mean a conduit made of non-combustible heat-resisting material that is used to remove the products of combustion from solid, liquid, or gaseous fuel.

Formaldehyde shall mean the colorless, flammable carcinogenic chemical, an organic compound with the formula HCHO, which is used in the manufacture of building materials (e.g., pressed wood products) and household products. Federal limits for formaldehyde emissions from building materials (hardwood plywood, medium-density fiberboard, and particleboard) were established in 15 USC 2697(b)(2).

Friable shall mean the condition of asbestos that is so soft and weak in structure that it can be broken with simple finger-crushing pressure. Friable materials are of concern because of their ease of damage.

Grade shall mean the average finished ground level adjoining a building at all exterior walls.

Graywater System shall mean a system for collecting household waste water from plumbing fixtures other than toilets and treating it for non-potable reuse.

Guard shall mean a building component or a system of building components located near the open sides of elevated walking surfaces or adjacent to a window that minimizes the possibility of a fall from the walking surface or window to the lower level.

Habitable Room shall mean an enclosed floor space used or intended to be used for living, sleeping, cooking, or eating, and excluding bathrooms, toilet rooms, laundries, furnace rooms, pantries, kitchenettes, utility rooms, foyers, communicating corridors, stairways, closets, storage spaces, workshops, and rooms with less than 50 square feet (46,452 cm) of floor space.

Handrail shall mean a horizontal or sloping rail intended for grasping by the hand for guidance or support.

Harborage shall mean any conditions or place where pests can live, obtain water or food, nest, or seek shelter.

Healthy: See "safe and healthy."

Heating System shall mean facilities that, for the purpose of maintaining thermal comfort during cold weather, heat air or water through a furnace or heat pump and distribute such heat through vents, ducts, pipes, or radiators, or a series of hard-wired electrical heaters. Neither a cooking appliance nor a portable, unvented fuel-burning space heater is a heating system.

Infestation shall mean the recurrent presence of pests that present a hazard to humans, property, or the environment.

Insects shall mean all species of classes of Arachnida and Insecta (Hexapoda) of the phylum Arthropoda and includes flies, mosquitoes, bed bugs, crickets, cockroaches, moths, bees, wasps, hornets, yellow jackets, fleas, lice, beetles, weevils, gnats, ants, termites, mites, ticks, spiders, and scorpions.

Integrated Pest Management shall mean a systematic strategy for managing pests that uses prevention, exclusion, monitoring, and suppression of pests. Where chemical pesticides are necessary, a preference is given to materials and methods that maximize public safety and reduce environmental health risk. Methods to manage pests include eliminating their harborage places, removing or making inaccessible materials that serve as their food and water sources, using traps to identify and monitor pests, and—only if necessary—using the least-toxic pesticide for the identified pest.

L_{dn} (day-night equivalent sound level) shall mean a weighted average sound level measured over a 24-hour period with adjustments anticipating reduced levels during evening and night hours to factor occupants' extra sensitivity to noise during those time periods.

L_{eq} shall mean an average sound level measured over a specified time period.

Lead-Based Paint shall mean equal to or more than 1.0 milligram lead per square centimeter or 0.5 percent lead by weight for existing surfaces, paint, or other surface coatings, and equal to or more than 90 parts per million (ppm) or .009 percent lead for paint and other surface coatings at the point of purchase.

Lead-Based Paint Hazard is any deteriorated lead-based paint, dust-lead hazard, soil-lead hazard, lead-based paint present on chewable surfaces with teeth marks, or lead-based paint present on friction surfaces, in accordance with 40 CFR 745.65.

Let shall mean to lease or grant the use and possession of real property whether or not for compensation.

Methamphetamine is a synthetic drug with more rapid and lasting effects than amphetamine, used illegally as a stimulant and as a prescription drug to treat narcolepsy and maintain blood pressure.

Mold is a superficial often woolly growth produced especially on damp or decaying organic matter or on living organisms by a fungus.

Multifamily Housing shall mean any dwelling containing more than two dwelling units.

Occupant shall mean any individual living, sleeping, cooking, or eating in and having possession of a dwelling or dwelling unit.

Owner shall mean any person who alone, jointly, or severally with others, has legal title to the premises, dwelling, or dwelling unit, with or without accompanying actual possession thereof; has charge, care, or control of any premises, dwelling, or dwelling unit, as owner, agent of the owner, or other person; is executor, administrator, trustee, or guardian of the estate of the owner; is a mortgagee in possession; or is the senior officer or trustee of the association of unit owners of a condominium.

Person shall mean any individual, firm, corporation and its officers, association, partnership, cooperative, trustee, executor of an estate, governmental agency, or any other legal entity recognized by law.

Pests shall mean insects, rodents, and other vermin.

Plumbing shall mean and include all of the following facilities and equipment: water pipes, garbage disposal units, waste pipes, toilets, sinks, bathtubs, shower baths, catch basins, drains, vents, installed clothes washing machines and dishwashers, and any other supplied plumbing fixtures, together with all connections to water, sewer, or gas lines.

Potable Water shall mean water that complies with the maximum contaminant levels of the United States Environmental Protection Agency (EPA), or a regulatory limit that is more protective than EPA's, for coliform bacteria, *E. coli.*, nitrates, nitrites, turbidity, cryptosporidium, *Legionella*, and *Giardia lamblia*.

Premises shall mean a lot or parcel of land or plot of land, either occupied or unoccupied by any dwelling, and includes any such building, accessory structure, or other structure thereon.

Privacy shall mean the existence of conditions that permit an individual or individuals to be without observation, interruption or interference by unwanted individuals.

Properly Connected shall mean installed in accordance with all applicable codes and ordinances, or in good working order and not constituting a hazard to life or health.

Radon shall mean the odorless, tasteless, and invisible gas found in both outdoor air and indoor air that is a form of ionizing radiation produced by the decay of uranium in soil and water.

Recyclable Materials shall mean disposable products composed of glass, metal, paper, plastic, and similar content that can be processed to produce a new supply of the same material or be reused in the production of other materials.

Riser shall mean the vertical surface that connects one tread of a step or stair to the next.

Rodent shall mean any member of the order Rodentia and including field and wood mice, wood rats, squirrels, woodchucks, gophers, Norway rats (*Rattus norvegicus*), roof rats (*Rattus rattus*), and house mice (*Mus musculus*).

Safe and Healthy shall mean the condition of being free from danger and chemical, biological, and physical agents that may cause injury, disease, or death, and fit for human occupancy.

Smoke Detector shall mean a device that is equipped to activate an audible alarm when it detects the presence of combustion products in air.

Space Heater shall mean a self-contained convection or radiant heater designed to heat a room, two adjoining rooms, or some other limited space or area.

Supplied shall mean paid for, furnished by, provided by, or under the control of the owner or operator.

Toilet Room shall mean a room containing a water closet or urinal but not a bathtub or shower.

Trash shall mean garbage, refuse, and ashes.

Trash Container shall mean a container with a tight-fitting lid that is constructed of metal or other durable material that is impervious to rodents, insects, and handling stress; and is capable of being filled, emptied, and cleaned without creating unsanitary conditions.

Tread shall mean the horizontal surface of a step or stair.

Ventilation System shall mean the natural or mechanical process of supplying or removing conditioned or unconditioned air to or from a space.

Volatile Organic Compounds, or VOCs, are organic chemical compounds whose composition makes it possible for them to evaporate under normal indoor atmospheric conditions of temperature and pressure.

Waterproof shall mean impervious to water.

Watertight shall mean closely sealed, fastened, or fitted so that no water enters or passes through the surface.

Weathertight shall mean secure against penetration by air, wind, rain, snow, and other weather conditions.

Interpretation of Terms:
Where the words "dwelling," "dwelling unit," "premises," and "structure," or a particular building component are used in this standard, they shall be construed as if they were followed by the words "or any part thereof." Words used in the singular include the plural, and the plural the singular.

Annotated Requirements and Stretch Provisions

STRUCTURE, FACILITIES, PLUMBING, AND SPACE REQUIREMENTS

2.1 Structure.

Requirement:
Every foundation, roof, floor, exterior and interior wall, ceiling, inside and outside stair, porch, accessory structure, and fence shall be safe to use and capable of supporting the intended design loads and load effects and shall be in good condition. Fencing shall not have climbable cross pieces. Private swimming pools, hot tubs, and spas that hold water more than 24 inches (610 mm) in depth shall be completely surrounded by a fence or barrier at least 48 inches (1,219 mm) in height above the finished ground level that is accessible only through a self-closing and self-latching gate or door.

Rationale:
The structure of a dwelling is complex and comprises several parts. These different parts must all be adequately designed and properly maintained to ensure the habitable space is safe and healthy. The structure of a dwelling is dependent on foundation and footing, vapor barriers, house framing, roof framing, roofs, exterior walls and trims that are maintained in good condition. Poor construction of the structure can result in several negative consequences including dampness or condensation; poor energy efficiency; excessive noise; structural damage such as cracks in walls, open joints, loose roofs which allows pest intrusion; collapse of fixtures such as flooring, lighting and cabinets which can lead to injuries or even death. Structural deficiencies in a dwelling can cause falls, fires, burns and scalds, carbon monoxide and other poisoning, drowning and other injuries.

References:

- Jacobs, D.E. & Baeder, A. (2009). Housing interventions and health: A review of the evidence. Columbia, MD: National Center for Healthy Housing. Retrieved April 11, 2013, from http://www.nchh.org/LinkClick.aspx?fileticket=2lvaEDNBldU%3d&tabid=229
- U.S. Department of Housing and Urban Development. 2010. *Healthy Home Rating System Operating Guidance*. Retrieved April 11, 2013, from http://portal.hud.gov/hudportal/documents/huddoc?id=operating_guidance_hhrs_v1.pdf
- U.S. Centers for Disease Control and Prevention and U.S. Department of Housing and Urban Development. (2006). Healthy housing reference manual. Atlanta, GA: U.S. Department of Health and Human Services.

2.2 Facilities.

Requirement:
Every plumbing fixture and pipe, chimney, flue, smoke pipe, and every other facility, piece of equipment, or utility present in a dwelling or dwelling unit, or required under this standard, shall be constructed and installed in conformance with applicable statutes, ordinances, and regulations.

2.2.1. Mechanical, utility, and heating facilities shall be separated from habitable rooms and exits by unbroken walls or walls with doors.

Rationale:
Housing facilities in disrepair are likely to cause health burdens as a result of plumbing leaks, chimney, and flue and smoke pipe malfunctions. Chimneys in poor condition can cause condensation buildup within the chimney which can lead to deterioration and eventually collapse of the chimney. Additionally, carbon monoxide and other combustion-related chemical agents that leak through gaps and cracks can cause lasting damage to a resident's health. Fire outbreaks can also start in chimneys and lead to death or serious injuries.

References:

- Chimney Safety Institute of America. Avoiding Carbon Monoxide Hazards 2013. Retrieved April 11, 2013, from http://www.csia.org/homeowner-resources/Avoiding_Carbon_Monoxide_Hazards.aspx

2.3. Plumbing System.

Requirement:
Every plumbing fixture, stack, vent, and water, waste, and sewer pipe shall be properly installed, maintained in a safe and functional order, and be kept free from obstructions, leaks, and defects.

2.3.1. An approved potable water supply system shall provide an adequate amount of running water under pressure to fixtures at all times.

2.3.2. An adequate supply of heated running water under pressure shall be supplied to sinks, bathtubs, showers, and laundry facilities. Water heaters shall be set at a minimum temperature of 110° F (43° C). At bathtub faucets and shower heads, the maximum temperature shall be 120° F (49° C). Heated water shall be provided by either a tank-type or tankless water heater. A tank-type water heater shall have a pressure relief valve that discharges to a drip pan, storage tank, or the outside. The temperature of water from tankless water heaters shall not exceed 140° F (60° C).

2.3.3. Every waste pipe shall be connected to a public sewer system, an approved private sewage disposal system, or graywater system. No toilet waste pipe shall be connected to a graywater system.

2.3.4. Faucets shall be located above the overflow rim of sinks, tubs, or other fixtures that collect water.

Stretch Provisions:

- Bathtub and shower faucets shall have anti-scald devices, such as an automatic temperature control mixing valve, water temperature limiting device, or temperature-actuated flow reduction valve.
- Each dwelling unit in multifamily housing shall have a separate meter for water supplied to the unit.
- Multifamily housing with one or more central water heaters shall comply with ASHRAE Standard188P to assess and manage the risks associated with *legionella* in building water systems.
- Private well systems shall be tested annually to ensure a potable water supply.

Rationale:
Plumbing leaks may cause mold growth on building materials. People who are exposed to molds may experience nasal and eye irritation, respiratory and allergic diseases, and asthma exacerbation. Damp conditions may magnify levels of biological agents such as dust mites, bacteria and cockroaches. The containment of household sewage is instrumental in protecting the public from waterborne and vector-borne diseases. Water at 140° F can result in a second-degree burn after three seconds and a third-degree burn after five seconds. The long-term effects of scalds can include disability, disfigurement, or psychological harm and repeated skin grafts as the child grows.

References:

- International Code Council, *International Plumbing Code*, 2012.
- International Code Council, *International Residential Code*, 2012.
- International Code Council, *International Private Sewage Disposal Code*, 2012.
- World Health Organization (2010). *Technical and Policy Recommendations to Reduce Health Risks due to Dampness and Mould*. Copenhagen: World Health Organization Regional Office for Europe, Retrieved May 22, 2013 from http://www.euro.who.int/__data/assets/pdf_file/0015/121425/E92998.pdf
- Institute of Medicine. Damp Indoor Spaces and Health. The National Academies Press, Washington, DC. 2004. Available at: http://www.iom.edu/Reports/2004/Damp-Indoor-Spaces-and-Health.aspx
- U.S. Environmental Protection Agency, *EPA Science Matters*, 2011. Retrieved April 11, 2013, from http://www.epa.gov/sciencematters/april2011/leaks.htm
- Burge, H.A. (1990). Bioaerosols: Prevalence and health effects in the indoor environment. *Journal of Allergy and Clinical Immunology*, 86, 687–704.

Resources:

- Standards for Anti-Scald Devices: American Society of Sanitary Engineering for Plumbing and Sanitary Research. Available at: www.asse-plumbing.org

2.4 Kitchen.

Requirement:

Every dwelling shall have a room or portion of a room in which food may be prepared and/or cooked and shall be supplied with the following:

2.4.1. A kitchen sink in good working condition that is properly connected to the heated and unheated water supply and waste pipes. Any provided dishwasher and components of the sink, including disposal and water filtration devices, shall be in good working condition and properly connected.

2.4.2. A counter for food preparation and cabinets and/or shelves sufficient to store occupants' food that does not require refrigeration, eating, drinking, and cooking equipment, and utensils. Cabinets shall have tight-fitting doors and no gaps between any surfaces. The counter, cabinets, and shelves shall be of sound construction and furnished with surfaces that are impervious to water and smooth and cleanable.

2.4.3. A range for cooking food and a refrigerator with a freezer. Each range, oven, cooktop, and refrigerator shall be properly installed with all necessary connections for safe and efficient operation and shall be maintained in good working condition.

2.4.3.1. The range shall include four or more burners and an oven unless both a separate oven, other than a microwave oven, and a cooktop with four or more burners are provided. Freestanding or built-in ranges shall have a vertical clearance above the cooking top of not less than 30 inches (762 mm) to unprotected combustible material. Reduced clearances are permitted in accordance with the listing and labeling of the range hood or other appliance.

2.4.3.2. The refrigerator shall be of sufficient size to store occupants' food that requires refrigeration, and shall be capable of maintaining a temperature less than 41° F (6° C) but more than 32° F (0° C). The freezer section shall be capable of maintaining a temperature below 0° F (-18° C). A refrigerator need not be supplied when the occupant is expected to provide same upon occupancy, so long as adequate connections for the safe and efficient installation and operation of a refrigerator are provided.

2.4.4. A kitchen floor in good condition, with a cleanable surface, and composed of nonabsorbent waterproof material.

Stretch Provisions:

- The counters, wall surfaces, and other surfaces immediately adjacent to the range, sink, and counter shall be covered with an impervious finish.
- The corners and joints between fixtures, appliances, and walls shall be sealed to permit thorough cleaning and deter pests.
- There shall be enclosed cabinets (as opposed to a combination of shelves and cabinets) sufficient to store occupants' food that does not require refrigeration.

Rationale:

Properly designed kitchens enable the safe and hygienic preparation and cooking of food and reduce the risk of food poisoning. Damp, unmaintained surfaces may deteriorate, causing increased chance of growth of biological agents, presenting a risk of food contamination and food poisoning. Kitchen floors that are impervious to water and capable of being cleaned and maintained prevent the accumulation of dirt, moisture, and biological agents.

References:

- U.S. Department of Housing and Urban Development. 2010. *Healthy Home Rating System Operating Guidance.* Retrieved April 11, 2013, from http://portal.hud.gov/hudportal/documents/huddoc?id=operating_guidance_hhrs_v1.pdf

2.5 Bathroom.

Requirement:
Every dwelling shall have a bathroom equipped with the following:

2.5.1. A toilet located in the bathroom or in another room that affords privacy, in good working condition, sealed to the floor, and properly connected to the dwelling's water supply and to a waste pipe leading to an approved sewage system or private waste disposal system.

2.5.2. A sink in good working condition, with a stable connection to the wall or securely attached to the floor. The sink shall be properly connected to the heated and unheated water supply and a waste pipe.

2.5.3. A bathtub or shower in good working condition and located in the bathroom or in another room that affords privacy. The bathtub or shower shall be properly connected to the heated and unheated water supply and a waste pipe. The bottoms of bathtubs and shower floors shall have permanent or removable nonslip surfaces.

2.5.4. Bathroom and toilet room floor surfaces shall be cleanable and made of nonabsorbent waterproof materials. Bathroom wall materials that cover the wall extending 48 inches (1,219 mm) above a bathtub and 72 inches (1,827 mm) above the floor of a shower stall shall be cleanable and made of nonabsorbent waterproof materials. Such materials on walls and floors shall form a watertight joint with each other and with the bathtub or shower.

Stretch Provisions:

- Grab bars shall be firmly anchored to the wall adjacent to each bathtub or shower or permanently attached to the tub or shower.
- Tub and shower enclosures composed of tile or panel assemblies with caulked joints shall be installed over moisture-resistant backing material such as cement board. Paper-faced wall board shall not be used behind such tub and shower enclosures. Monolithic tub and shower enclosures (e.g., fiberglass with no seams) are exempt from these limitations unless required by the manufacturer.

Rationale:
Poorly maintained bathrooms can cause water damage, mold growth, and associated health issues. Exposure to bathroom-related biological agents can cause respiratory and gastrointestinal symptoms. Exposure to mold can cause symptoms such as nasal stuffiness, eye irritation, wheezing, skin irritation, allergic reactions, and asthma exacerbation. Structural deficiencies in the bathroom such as the lack of grab bars and nonslip surfaces may lead to falls, especially among young children and older adults. Children under the age of five years are most likely to fall in the bathroom, but older adults experience greater injuries. The most common injuries that result from falls associated with a bath, shower, or similar facility are cuts or lacerations, swelling or bruising, or fractures. Because of the many hard projections and surfaces found in bathrooms, and the fact that the user may be unprotected by clothing, outcomes from a bathroom fall are likely to be more severe than in other areas.

References:

- DiGuiseppi, C., Jacobs, D.E., Phelan, K.J., Mickalide, A.D., & Ormandy, D. (2010, September). Housing interventions and control of injury-related structural deficiencies: A review of the evidence. *Journal of Public Health Management Practice*, S32–S41.
- World Health Organization. (2009). *WHO Guidelines for Indoor Air Quality: Dampness and Mould*. Retrieved April 11, 2013, from http://www.euro.who.int/__data/assets/pdf_file/0017/43325/E92645.pdf
- World Health Organization (2010). *Technical and Policy Recommendations to Reduce Health Risks due to Dampness and Mould.* Copenhagen: World Health Organization Regional Office for Europe, Retrieved May 22, 2013 from http://www.euro.who.int/__data/assets/pdf_file/0015/121425/E92998.pdf
- Cutbill, M. (1982). *Analysis of accidents located in the bathroom*. London, U.K.: Department of Trade and Industry. As cited in U.S. Department of Housing and Urban Development, *Healthy Home Rating System Operating Guidance*. Retrieved April 11, 2013, from http://portal.hud.gov/hudportal/documents/huddoc?id=operating_guidance_hhrs_v1.pdf

2.6 Minimum Space.

Requirement:
The dwelling shall provide privacy and provide adequate space to permit occupants to move around facilities and furniture and use them safely.

2.6.1. A bedroom shall not be the only passageway to the only bathroom in the dwelling unit.

2.6.2. A bathroom or toilet room shall not be the only passageway to any habitable room, hall, basement, or the exterior of the dwelling.

2.6.3. Every dwelling shall have closet space of sufficient size to store occupants' clothing and personal belongings.

2.6.4. The ceiling height of any habitable room shall be at least 84 inches (2,134 mm).In any habitable room with a sloping ceiling, at least one half of the floor area shall have a ceiling height of at least 84 inches (2,134 mm). If any part of a room has a ceiling height lower than 60 inches (1,524 mm), its floor area shall not be considered in computing the total floor area of the room.

2.6.5. A habitable room located partly or totally below grade shall be provided with natural light by windows in accordance with Subsection 4.3 and ventilation in accordance with Subsection 5.3. In such a room, the ceiling and any ducts, pipes, and other obstructions shall be at least 84 inches (2,134 mm) above the floor throughout the room, and walls and floors shall be waterproof and free of dampness.

Rationale:
Privacy is a necessity to people, to some degree and during some periods. Providing adequate enclosed floor space for living, sleeping, cooking, or eating and storage helps prevent clutter and provides privacy to promote healthy living. Pest harborage, psychological distress, and injury hazards often result from clutter.

References:

- The Impact of Overcrowding on Health and Education: A Review of the Evidence and Literature. Office of the Deputy Prime Minister. London. May 2004.
- U.S. Department of Housing and Urban Development, Healthy Home Rating System Operating Guidance, available at: http://portal.hud.gov/hudportal/documents/huddoc?id=operating_guidance_hhrs_v1.pdf
- *Good housing and good health?* 2006, Housing Corporation & Care Service Improvement Partnership (CSIP) http://www.healthimpactproject.org/resources/document/Good_housing_and_good_health.pdf

2.7 Floors and Floor Coverings.

Requirement:
Floors and floor coverings shall be attached at each threshold, in good condition and free of bulges and buckling. Carpets shall have no tears, folds, or bumps. Uncarpeted floors shall have cleanable surfaces.

Stretch Provisions:
- Floors shall be covered with either (1) cleanable, low-pile carpet certified as having low volatile organic compound (VOC) emissions, or (2) cleanable, nonabsorbent covering certified as having low VOC emissions.

Rationale:
Worn carpet that is poorly maintained can pose slip, trip, and fall hazards. Carpet in poor condition may also be a source of chemical and biological agents that become lodged in the carpeting. Worn carpeting is difficult to vacuum adequately. Floors must be in good condition and cleanable to prevent the buildup of dirt, moisture, and chemical and biological agents.

References:

- Lewis, RD, Breysse PN, Lees PSJ, Diener-West M, Hamilton RG, and Eggleston P. Factors affecting the retention of dust mite allergen on carpet. AIHA Journal 59(9): 606–613. 1998

- Carpet and Rug Institute, Green Label and Green Label Plus. http://www.carpet-rug.org/residential-customers/selecting-the-right-carpet-or-rug/green-label.cfm
- California Department of Public Health, Emission Testing Method for California Specification 01350: Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.1. 2010. http://standards.nsf.org/apps/group_public/download.php/19152/CDPH%2001350%20V1-1.pdf

2.8 Noise.

Requirement:
The structure and facilities shall be maintained so that the noise level in the interior of the dwelling unit that can be attributed to exterior sources is below 45 L_{dn} (day-night equivalent sound level).

Stretch Provisions:

- Nighttime noise levels within bedrooms shall be 30 LAeq dB.
- HVAC equipment shall operate at a noise level that creates no more than 45 Ldn in habitable rooms.
- Wall and ceiling assemblies shall meet performance standards to attenuate exterior sound reaching occupants.
- Roof material, chimney baffles, exterior doors, mail slots, attic ventilation ports, wall-mounted air conditioners, and other building components that can admit excessive noise shall prevent sound intrusion.
- Windows shall prevent sound intrusion when closed.

Rationale:
The World Health Organization (WHO) has identified and documented seven categories of adverse health effects of noise pollution on humans: hearing impairment, speech intelligibility, sleep disturbance, cardiovascular disturbance, disturbances in mental health, negative social behavior and annoyance reactions, and impaired task performance. The negative health impacts of noise are related to the total noise exposure experienced from all noise sources in the environment, and can lead to a combination of these different negative impacts. Additionally, noise exposure disproportionately impacts certain segments of the population. Infants, children, those with mental or physical illnesses, and the elderly are particularly vulnerable to noise pollution.

References:

- Berglund, B., Lindvall, T., & Schwela, D. (1999). *Guidelines for Community Noise.* World Health Organization.
- Hagler, L. (1999). *Summary of Adverse Health Effects of Noise Pollution*. http://www.noiseoff.org/document/who.summary.pdf.
- Harris, Davis A. (1997). *Noise Control Manual for Residential Buildings*. New York: McGraw-Hill Professional.
- California Noise Insulation Standards, 1974, http://mlacoustics.com/projects/multifamily/CA.noise.final.pdf

Resources:

- HUD's regulatory standard for maximum interior noise level is 45 L_{dn}—24CFR 101(a)(9)
- HUD Guidance at http://portal.hud.gov/hudportal/documents/huddoc?id=DOC_16419.pdf

SAFETY AND PERSONAL SECURITY

3.1 Egress.

Requirement:
Every dwelling unit shall have at least two means of egress leading outside without passing through another dwelling.

3.1.1. Any bedroom located below the fourth floor shall be provided with an exterior window openable from the inside and of sufficient dimensions that it can be used as a means of emergency egress.

3.1.2. If a habitable room partly or totally below grade is intended for sleeping purposes, at least one exterior window shall be openable from the inside and accessible for easy and ready use as an emergency exit. The window shall have the following minimum dimensions: a net clear opening of 5.7 square feet (5,295 cm^2); 24 inches (609 mm) from the top of the sill to the bottom of head of the window frame, a width of 20 inches (508 mm), and a sill height of not more than 44 inches (1,117 mm) from the floor.

3.1.2.1. If the window opening sill height is below ground elevation, the horizontal dimension (width times projection) of the window well shall be at least nine square feet (8,361 cm^2) and the horizontal projection shall extend at least 36 inches (914 mm) from the exterior side of the window.

3.1.2.2. If a window well is deeper than 44 inches (1,117 mm) below ground elevation, there shall be a ladder permanently attached to serve as an emergency exit to ground elevation. The step distance between rungs shall be 18 inches (457 mm), and the rungs shall be at least 12 inches wide (305 mm) and shall project between three and six inches (76 and 152 mm) from the wall.

3.1.3. A door leading directly from the habitable room located below grade to the outside that provides an exit at grade level may be used in lieu of the specified window.

Rationale:
Escape from fire is an important public safety protection. Proper configuration of egress will prevent falls, which can result in physical injury, such as bruising, fractures, head, brain and spinal injuries, allow the timely evacuation of residents in an emergency, and permit entry by rescue workers wearing emergency equipment on their backs.

References:
- http://www.agg-net.com/files/attachments/documents/access__egress.pdf
- International Code Council, *International Residential Code,* 2012, Section 310–311.
- International Code Council, *International Fire Code*, 2012, Chapter 10.

3.2 Locks/Security.

Requirement:
Exterior doors shall be equipped with a dead bolt locking device capable of being opened from the interior side without a key.

3.2.1. Within multifamily housing, dwelling unit entrance doors that open to a common area shall be equipped with a device that permits occupants to see a person at the door without fully opening the door.

3.2.2. Exterior windows that are capable of being opened and are potential means of entry shall be equipped with a lock on the interior side.

Rationale:
Inadequate home security may result in a fear of a possible burglary occurrence or recurrence, stress caused by a burglary, and injuries caused to occupants by an intruder (aggravated burglary). The most common harm suffered as a result of burglary, or fear of burglary, is emotional stress. The emotional impact is greater for burglaries where there is successful entry to the dwelling. The risk of entry increases with declining levels of security.

References:

- U.S. Department of Housing and Urban Development, Healthy Home Rating System Operating Guidance, available at: http://portal.hud.gov/hudportal/documents/huddoc?id=operating_guidance_hhrs_v1.pdf

3.3 Smoke Alarm

Requirement:

Every dwelling unit shall have a functioning smoke alarm in good working condition located on the ceiling outside each sleeping area in the immediate vicinity of the bedrooms, in each additional room used for sleeping purposes, and on every level except crawlspaces and uninhabitable attics. In dwellings or dwelling units with split levels that have no door between adjacent levels, the smoke alarm installed on the upper level shall suffice for the adjacent lower level.

3.3.1. In multifamily housing, a tamper-proof smoke detection system (interconnected with a central fire alarm system) or stand-alone smoke alarms in good working condition shall be installed on each level including basements, in heating system and storage rooms, in garages, and in other common areas.

3.3.2. Battery-operated smoke alarms shall be powered with lithium batteries. Hard-wired smoke alarms shall have lithium battery backup.

Stretch Provisions:

- Smoke alarms shall be hard-wired with battery backup, and multiple stations shall be interconnected.

Rationale:

Smoke alarms that are properly installed and maintained play a vital role in reducing fire-related deaths and injuries. Having a working smoke alarm reduces the chances of dying in a reported fire by half. When smoke alarms fail to operate, it is usually because batteries are missing, disconnected, or dead. Research has demonstrated that almost one-quarter of smoke alarm failures were due to dead batteries. Interconnection of smoke alarms allows the warning to reach all occupants at the same time.

References:

- National Fire Protection Association. Smoke Alarm Safety at Home. Available at: http://www.nfpa.org/assets/files//PDF/Research/SmokeAlarmsSafetyTips.pdf
- International Code Council, *International Fire Code*, 2012, Section 907, Fire Alarm and Detection Systems.

3.4 Fire Extinguisher.

Requirement:

Each dwelling unit shall have at least one working fire extinguisher in or near the kitchen.

Stretch Provisions:

- The dwelling shall have installed an automatic fire sprinkler system that complies with the applicable locally adopted fire code. If the local fire code has no sprinkler requirement or no local fire code exists, the dwelling shall have installed an automatic fire sprinkler system that complies with either the International Fire Code© or the National Fire Protection Association Standard 5000.

Rationale:

Cooking equipment is the second leading cause of apartment or multifamily housing fire deaths, ranking behind smoking. Kitchens are the leading area of origin for home structure fires: two of every five (42percent) home structure fires started in the kitchen or cooking area. Sixteen percent of the civilian deaths, 38% of the civilian injuries, and 14% of the direct property damage resulted from these fires. Two-thirds (66 percent) of the reported apartment or multi-family housing fires and one-third (33percent) of the fires in one- or two-family homes originated in the kitchen. When an extinguisher is used, it put out the fire completely in half of the cases and minimized the fire but did not completely put it out in almost one-quarter of the fires.

Reference:

- Ahrens, M. Home Fires. National Fire Protection Association, 2013 http://www.nfpa.org/assets/files/pdf/os.homes.pdf

3.5 Carbon Monoxide Alarm.

Requirement:
Every dwelling unit shall have at least one functioning carbon monoxide (CO) alarm on every occupiable floor and outside each separate sleeping area, in the immediate vicinity of every bedroom.

3.5.1. Battery-operated CO alarms shall be powered with lithium batteries. Hard-wired CO alarms shall have lithium battery back-up.

Rationale:
Carbon monoxide is a colorless, odorless, and extremely toxic gas. At high concentrations, carbon monoxide can cause unconsciousness and death. At lower concentrations, it causes a variety of symptoms including headaches, dizziness, weakness, nausea, confusion, disorientation, and fatigue. These symptoms are sometimes confused with influenza and sometimes with depression. Carbon monoxide may also impair fetal development. Those most vulnerable to carbon monoxide exposure include unborn children, infants, the elderly, and people with anemia or heart or lung disease.

References:

- U.S. Environmental Protection Agency (EPA). An Introduction to Indoor Air Quality (IAQ): Carbon Monoxide. Available at: http://www.epa.gov/iaq/co.html
- U.S. Consumer Product Safety Commission (CPSC). CPSC Recommends Carbon Monoxide Alarm for Every Home. http://www.cpsc.gov/en/Recalls/2001/CPSC-Recommends-Carbon-Monoxide-Alarm-for-Every-Home/
- U.S. Consumer Product Safety Commission (CPSC). Carbon Monoxide Questions and Answers. http://www.cpsc.gov/en/Safety-Education/Safety-Education-Centers/Carbon-Monoxide-Information-Center/Carbon-Monoxide-Questions-and-Answers-/
- National Fire Protection Association (NFPA). NFPA 720, Standard for the Installation of Carbon Monoxide (CO) Detection and Warning Equipment. 2012.
- Underwriters Laboratories. ANSI/UL 2034, Standard for Single and Multiple Station Carbon Monoxide Alarms. 2008, Revised 2009.
- National Fire Protection Association. NFPA Technical Committee on Residential Occupancies, NFPA 101 and NFPA 5000 First Draft Meeting Minutes, August 13-14, 2012. Available at: http://www.nfpa.org/assets/files/aboutthecodes/101/bld-saf-res_fdminutes-08-12.pdf

3.6 Walking Surfaces.

Requirement:
Every stairway, ramp, deck, porch and balcony shall be maintained structurally sound, in good repair, properly anchored, and capable of supporting the imposed loads.

3.6.1. Every inside and outside stairway shall have uniform risers and uniform treads with nonskid surfaces. Risers shall be no higher than 7¾ inches (196 mm). Treads shall be at least 10 inches (254 mm) deep.

3.6.2. Every stairway with four or more risers shall have at least one structurally sound handrail installed not less than 34 inches (867 mm) and not more than 38 inches (965 mm), measured vertically from the nose of the tread. The handrail shall be firmly fastened, capable of supporting normally imposed loads, and in good condition. If a side of a stairway is open to the floor or grade below, and the handrail provides the guard required by Subsection 3.7, the rail shall be supported by balusters 34 to 38 inches (867 to 965 mm) in height, measured vertically from the nose of the tread.

Stretch Provisions:
- Stairways shall have handrails on both sides where the resulting width of the space between rails is at least 24 inches (600 mm).
- Railings shall have a graspable perimeter measuring four to six inches (100–160 mm), and, if non-circular in shape, shall have no sharp corners and a width smaller than 5/8 inch (15 mm).

Rationale:
Inadequate handrails and railings on stairways, ramps, decks, porches, and balconies can result in slips, trips, and falls, which cause physical injury such as bruising, fractures, head, brain and spinal injuries, and death. The likelihood of a fall is doubled if there is no wall or guarding to one side of the stair. Similarly, the lack of any handrail doubles the likelihood of a fall, even if there is a wall to both sides of the stairs. The nature of injury is in part dependent on the distance of a fall, and in part on the nature of the surface onto which the victim falls. Although falls on level ground tend to result in relatively minor injuries than other falls, they occur more frequently.

References:
- Metlife. The Essentials: Falls and Fall Prevention. Available at: https://www.metlife.com/assets/cao/mmi/publications/essentials/mmi-falls-fall-prevention-essentials.pdf
- International Code Council, *International Residential Code*, 2012. Sections 311.7, 312.1.2, 312.1.3, and 312.2.1
- U.S. Department of Housing and Urban Development, Healthy Home Rating System Operating Guidance, available at: http://portal.hud.gov/hudportal/documents/huddoc?id=operating_guidance_hhrs_v1.pdf

Resources:
- Roys, M. *Refurbishing Stairs in Dwellings to Reduce the Risk of Falls and Injuries*. Garston U.K.: IHS Building Research Establishment Press. 2013.

3.7 Guards.

Requirement:
Every stairway, porch, patio, landing, and/or balcony located more than 36 inches (914 mm) above an adjacent area shall have a structurally sound guard at least 36 inches (914 mm) high, measured vertically from the floor. The guard shall be firmly fastened, capable of supporting normally imposed loads, and in good condition. Balusters with a minimum thickness of one-half inch (13 mm) shall be placed at intervals that do not allow passage of a sphere greater than 4⅜ (111 mm) in diameter. There shall be no climbable cross pieces. If the balusters do not reach the floor, the narrowest opening between the bottom of the stair guard and the floor shall be a maximum of four inches (102 mm). Every exterior window that is located more than 72 inches (1,829 mm) above the grade below and is capable of being opened shall have a fall prevention device or window guard.

Stretch Provisions:
- The space between balusters shall be no greater than four inches (102 mm).

Rationale:
Falls can result in physical injury, such as bruising, fractures, and head, brain, and spinal injuries. The nature of injury is in part dependent on the distance of a fall, and in part dependent on the nature of the surface onto which the victim falls.

References:
- Metlife. The Essentials: Falls and Fall Prevention. https://www.metlife.com/assets/cao/mmi/publications/essentials/mmi-falls-fall-prevention-essentials.pdf
- Roys, M. *Refurbishing Stairs in Dwellings to Reduce the Risk of Falls and Injuries*. Garston, U.K.: IHS Building Research Establishment Press. 2013.

3.8 Chemical Storage.

Requirement:
Each dwelling unit shall have a cabinet or other facility that is lockable or not readily accessible to children for the storage of drugs and chemical agents for household use. Each dwelling shall have separate exterior or ventilated space for the storage of flammable substances.

Rationale:
Poison centers answer more than 3.6 million calls each year or one call every eight seconds. According to the American Association of Poison Control Centers, children younger than six years old account for about half of the calls placed to poison centers. A flammable or combustible liquid, gas or associated piping or filter is the main contributor in 4% of fires and 8% of fire-caused deaths.

References:

- EPA's Poison Prevention Program. Available at: http://www.epa.gov/pesticides/health/poisonprevention.htm
- American Association of Poison Control Centers—www.aapcc.org

LIGHTING AND ELECTRICAL SYSTEMS

4.1 Electrical System.

Requirement:
Every dwelling unit shall have electric service, outlets, and fixtures that are installed properly, maintained in good and safe working condition, and connected to a source of electric power.

4.1.1. Every dwelling unit shall be supplied with a three-wire, 120/240-volt, single-phase electrical service having a rating of not less than 100 amperes and that is not shared with another dwelling unit.

4.1.2. Temporary wiring or extension cords shall not be used as permanent wiring.

Rationale:
Faulty electrical systems result in fires, damage to property, burns, injuries, and death. In residential settings, children are more likely to be injured than adults, primarily from inserting household objects into electrical outlets.

References:

- U.S. Fire Administration. Electrical Home Fire Safety. Available at: http://www.usfa.fema.gov/citizens/home_fire_prev/electrical.shtm
- Electrical Safety Foundation International. Electrical Safety Workbook: A guide to understanding and maintaining your home's electrical system. Available at: http://www.fnal.gov/pub/takefive/documents/Elec%20Safety%20Workbook.pdf

4.2 Outlets.

Requirement:
Every habitable room shall contain at least two separate and remote wall-type, 125-volt, three-prong grounded duplex electric convenience outlets or one such duplex convenience outlet and one supplied wall or ceiling type electric light fixture. Duplex outlets shall be maintained in good and safe working condition and located to avoid the use of extension cords for fixed appliances and overloading.

4.2.1. Each kitchen and each room containing a toilet, sink, bathtub, or shower stall shall contain at least one 125-volt three-prong duplex electric convenience outlet. Convenience outlets in these rooms, in garages, crawlspaces, unfinished basements, and outdoors shall be protected by ground fault circuit interrupters.

Stretch Provisions:

- Habitable rooms shall have sufficient electric convenience outlets so that no location on a wall is more than six feet from an outlet.
- Every countertop space 12 inches (305 mm) or wider shall have a 125-volt three-prong duplex electric convenience outlet protected by a ground fault circuit interrupter, and no section of counter shall be more than 24 inches (610 mm) measured horizontally from an outlet.
- Electric convenience outlets in habitable rooms other than kitchens and rooms containing a toilet, sink, bathtub, or shower stall shall be protected by combination type arc-fault circuit interrupters.

Rationale:
Unlike circuit breakers and fuses, ground fault circuit interrupters (GFCIs) are installed to protect the user from electrocution. These devices provide protection against electrical shock and electrocution from ground faults or contact with live parts by a grounded individual. They constantly monitor electrical currents flowing into a product. If the electricity flowing through the product differs even slightly from that returning, the GFCI will quickly shut off the current. GFCIs detect amounts of electricity much smaller than those required for a fuse or circuit breaker to activate and shut off the circuit. UL lists three types of GFCIs designed for home use that are readily available and fairly inexpensive and simple to install. Arc-fault circuit interrupters (AFCIs) prevent electrical fires by protecting branch circuits.

References:

- U.S. Centers for Disease Control and Prevention and U.S. Department of Housing and Urban Development. Healthy Housing Reference Manual. (Atlanta: U.S. Department of Health and Human Services); 2006.
- International Code Council, *International Residential Code* 2012. Section E3901, Receptacle Outlets; Section E3902, Ground-Fault and Arc-Fault Circuit Interrupter Protection.

4.3 Natural Lighting.

Requirement:
Every habitable room shall receive daylight from at least one exterior window or skylight.

4.3.1. If a habitable room receives daylight from an adjacent room or area used seasonally, such as a porch, the daylight through this interconnection shall be available year-round.

4.3.2. The minimum total window or skylight area, measured between the interior window stops, shall be at least eight percent of the floor area of such room. If building components or structures located within 36 inches (914 mm) of the window obstruct daylight, this window shall not be deemed to face directly to the outdoors and shall not be included as contributing to the required minimum total window area.

4.3.3. Every bathroom and kitchen shall comply with the daylight requirement for habitable rooms contained in this section, unless the room is equipped with a mechanical ventilation system consistent with Subsection 5.3.

Rationale:
Research has revealed a strong relationship between light and human physiology. The effects of light on both the human eye and human skin are notable. Light allows us to see and affects body rhythms and psychological health. Lack of natural lighting has been linked to depression.

References:

- U.S. Centers for Disease Control and Prevention and U.S. Department of Housing and Urban Development. Healthy Housing Reference Manual. (Atlanta: U.S. Department of Health and Human Services); 2006.
- U.S. Department of Housing and Urban Development, Healthy Home Rating System Operating Guidance, available at: http://portal.hud.gov/hudportal/documents/huddoc?id=operating_guidance_hhrs_v1.pdf

4.4 Artificial Lighting.

Requirement:
Each room containing a toilet, sink, bathtub, or shower stall shall contain at least one ceiling or wall-type electric lighting fixture. Each non-habitable room, including laundry rooms, furnace rooms, and public halls, shall contain at least one ceiling or wall-type electric lighting fixture.

4.4.1. Light switches that control ceiling-or wall-type electric light fixtures shall be located conveniently for safe use.

4.4.2. Every public hall and stairway in multifamily housing shall be illuminated at all times with at least a 60-watt standard incandescent light bulb or equivalent illumination for each 200 square feet (18.6 square meters) of floor area, provided that the distance between light fixtures shall not be greater than 30 feet (7,620 mm).

4.4.3. If a building containing one or two dwelling units has a public hall or stairway, it shall be illuminated with at least a 60-watt standard incandescent light bulb or equivalent illumination for each 200 square feet (18.6 square meters) of floor that is controlled by a three-way switch or a motion-activated device.

Rationale:
Adequate lighting is important in allowing people to see unsanitary conditions and to prevent injury, thus contributing to a healthier and safer environment. Improper indoor lighting can also contribute to eyestrain from inadequate illumination, glare, and flicker. Artificial light is particularly important where domestic tasks require adequate light, for example in the kitchen over worktops, sinks and ranges.

References:

- U.S. Centers for Disease Control and Prevention and U.S. Department of Housing and Urban Development. Healthy Housing Reference Manual. (Atlanta: US Department of Health and Human Services); 2006.
- U.S. Department of Housing and Urban Development, Healthy Home Rating System Operating Guidance, available at: http://portal.hud.gov/hudportal/documents/huddoc?id=operating_guidance_hhrs_v1.pdf

HEATING, VENTILATION, AND ENERGY EFFICIENCY

5.1 Heating, Ventilation, and Air-Conditioning Systems.

Requirement:
Facilities for heating, cooling, ventilation, and humidity control shall be maintained in good working condition and operated when necessary for the health and comfort of the occupants and in accordance with the design capacity of the installed equipment. When equipment is inoperative for more than 24 hours due to a mechanical problem or power failure other than a utility outage, alternative safe provisions for necessary heating, ventilating, or cooling shall be provided.

5.2 Heating System.

Requirement:
Every dwelling shall have a properly installed heating system that is in good and safe working condition and capable of safely and adequately heating all habitable rooms, bathrooms, and toilet rooms. The heating system, filtration components, heating elements, and cooling elements (if provided), shall be maintained and operated in accordance with manufacturer specifications, and shall be inspected and serviced annually by a licensed heating, ventilation, and air conditioning systems contractor.

5.2.1. Venting and Air Supply for Heating Equipment. Furnaces, water heaters, wood stoves, and other devices that employ combustion-burning fuel shall be vented to the outside of the structure in an approved manner that meets manufacturer specifications and shall be supplied with sufficient air to continuously support the complete combustion of fuel and prevent back-drafting.

5.2.2. Minimum Heat Temperature and Supply. The heating system shall be capable of maintaining a minimum room temperature of 68° F (20° C) in every habitable room, bathroom, and toilet room. If the dwelling unit is rented, leased, or let on terms either expressed or implied that heat will be supplied, heat shall be provided to maintain a minimum temperature of 68° F (20° C) in habitable rooms, bathrooms, and toilet rooms, and at no time during the heating season shall the system allow the temperature to exceed 78° F (25° C) in any room.

5.2.3. Forced-Air Systems. Any dwelling with a forced-air system shall have at least one thermostat within each dwelling unit capable of controlling the heating system, and cooling system if provided, to maintain temperature set point between 55° F (13° C) and 85° F (29° C) at different times of the day. The system shall have a clean air filter that meets manufacturer specifications installed at each change in tenancy. This filter shall have a minimum efficiency reporting value (MERV) of eight unless the system is not equipped to use a MERV 8 filter.

5.2.4. Steam and Hot Water Systems. In dwellings with heating equipment utilizing steam or hot water with a temperature of 110° F (43° C) or greater, protective covers/barriers shall be installed on and maintained for exposed surfaces of radiators and baseboards and piping between radiators.

5.2.5. Wood Stoves. A wood stove manufactured after June 1988 shall have a manufacturer's label certifying compliance with EPA's emission standard at 40 CFR 60 part AAA.

Stretch Provisions:

- Any new combustion heating equipment installed in occupied or conditioned spaces shall be power-vented or sealed (direct vented) combustion equipment.
- The heating system shall be controlled by a programmable thermostat to avoid temperature extremes.
- The dwelling shall have provisions to maintain the indoor temperature below a maximum of 85°F, either through the use of mechanical air conditioning, ventilation systems or passive design features.

Rationale:
Exposure to cold temperatures can lead to hypothermia, frostbite, and death. There is a continuous relationship between indoor temperature and vulnerability to cold-related death. The colder the dwelling, the greater the risk. As temperatures rise, thermal stress increases, initially triggering the body's defense mechanisms, such as sweating.

High temperatures can increase cardiovascular strain and trauma, and where temperatures exceed 77° F, mortality increases and there is an increase in strokes. Dehydration when overheated is a problem primarily for the elderly and the very young.

Poorly maintained HVAC systems may pose safety risks including fire and explosion hazards, exposure to combustion-related chemical and physical agents, including carbon monoxide and particulate matter. Exposure to carbon monoxide can lead to headaches, nervous systems effects, and asphyxiation.

References:

- U.S. Department of Housing and Urban Development, Healthy Home Rating System Operating Guidance, available at: http://portal.hud.gov/hudportal/documents/huddoc?id=operating_guidance_hhrs_v1.pdf
- International Code Council, *International Property Maintenance Code*, 2012. Sections 602.2, 602.3
- U.S. Environmental Protection Agency (EPA). An Introduction to Indoor Air Quality (IAQ): Carbon Monoxide. Available at:
- Ostro, B. et al. The Effects of Temperature and Use of Air Conditioning on Hospitalizations. American Journal of Epidemiology, 2010. http://aje.oxfordjournals.org/content/172/9/1053.abstract?sid=d5111b06-c02a-4bd4-863a-27ba95c0a75a

Resources:

- Department of Energy (DOE) and National Renewable Energy Lab (NREL), Standard Work Specifications for Home Energy Upgrades. Heating and Cooling, Forced Air, System Assessment and Maintenance: https://sws.nrel.gov/spec/53003
- Air Conditioning Contractors of America (ACCA), HVAC Quality Installation Specification: https://www.acca.org/Files/?id=693
- EPA Guidance on Wood Stoves: http://www.epa.gov/oecaerth/monitoring/programs/caa/woodheaters.html
- EPA Guidance on Back-Drafting: http://www.epa.gov/iaq/homes/hip-backdrafting.html
- Building Performance Institute (BPI), Home Energy Auditing Standard, BPI-1100-T-2012: http://www.bpi.org/files/pdf/BPI-1100-T-2012_Home%20_Energy_Auditing_Standard.pdf

5.3 Ventilation.

Requirement:
Natural or mechanical ventilation, or a combination of the two, shall deliver fresh air to every habitable room and bathroom and be capable of removing moisture-laden air and other contaminants generated during cooking, bathing, and showering. The air exhausted from a bathroom, toilet room, or kitchen shall not be vented into habitable space or an attic.

5.3.1. Natural ventilation shall be provided in every habitable room by at least one window that faces directly outdoors and can be opened easily.

5.3.2. Bathroom Exhaust. A bathroom shall have an exterior window or an exhaust fan that vents to the outdoors.

5.3.3. Kitchen Exhaust. A kitchen shall have an exterior window or an exhaust fan that vents to the outdoors.

5.3.4. Clothes Dryer Exhaust. The exhaust from a clothes dryer shall be vented to the outdoors through a rigid or corrugated semi-rigid metal duct.

5.3.5. Exhaust vents. Pipes, ducts, conductors, fans, or blowers shall not discharge gases, steam, vapor, hot air, grease, smoke, odors, or other gaseous and particulate wastes directly upon abutting or adjacent public or private property or that of another occupant. Vent pipe openings and pest-proofing screens that cover them shall be maintained free of debris.

Stretch Provisions:

- Every kitchen shall have a continuous fan operating at five air changes per hour (ACH), or an intermittent fan operating at 100 cubic feet of air per minute (CFM).
- Every bathroom shall have a continuous fan operating at 20 CFM or an intermittent fan operating at 50 CFM.
- The dwelling shall have ventilation compliant with ASHRAE 62.2 Appendix A for Existing Buildings. The calculation of the amount of additional continuous ventilation that would be needed involves determining required airflow based on building occupancy and square footage size and subtracting baseline air flow already provided by existing fans that have measurable airflow, window operation, and air changes based on a blower door test.
- Kitchens and bathrooms shall be equipped with local exhaust fans that vent directly to the outdoors.

[Some stretch provisions for Subsection 6.1. Moisture Control apply to the ventilation system.]

Rationale:

Proper circulation of outdoor ventilation air throughout a habitable space, naturally through openings in the building envelope and/or mechanically with fans and HVAC systems, is important to dilute and remove airborne indoor chemical agents, and reduce airborne transmission of biological agents, humidity, and mold. Inadequate ventilation also increases carbon dioxide in habitable spaces, which may yield drowsiness and headaches and can result in elevated levels of volatile organic chemicals that off-gas from interior dwelling components. Inadequate ventilation increases interior humidity. Studies show the association between dampness and poor health. Damp environments are associated with the growth of dust mites, roaches, and mold. Some of the health effects include worsened asthma, wheezing, nausea and vomiting, headaches, fever, and diarrhea. Inadequately maintained or operated heating, ventilating, and air-conditioning (HVAC) systems can lead to microbial growth.

References:

- NIOSH. Indoor Environmental Quality. http://www.cdc.gov/niosh/topics/indoorenv/buildingventilation.html
- Krieger, J. and Higgins DL (2002). Housing and Health: Time Again for Public Health Action. Am J Public Health. 2002 May; 92(5): 758–768.
- Wisconsin Department of Public Health Services. Carbon Dioxide Fact Sheet. Available at: http://www.dhs.wisconsin.gov/eh/chemfs/fs/carbondioxide.htm
- ASHRAE 62.2-2010, Ventilation and Acceptable Indoor Air Quality in Low Rise Residential Buildings. American Society of Heating, Refrigerating and Air Conditioning Engineers. See https://www.ashrae.org/resources--publications/bookstore/standards-62-1--62-2

Resources:

- 2011 Enterprise Green Communities Criteria, p. 92-94
- International Code Council, *International Property Maintenance Code*, 2012. Section 302.6

5.4 Air Sealing.

Requirement:

Openings into dwellings and dwelling units shall be sealed to limit air movement.

5.4.1. Exterior doors, windows and skylights shall be weathertight.

5.4.2. Walls, ceilings, and floors separating an adjoining garage from the living space shall be air-sealed, including cracks and other openings that allow airflow, such as utility and ductwork penetrations. Leaks in ductwork and air handling units located in the garage shall be sealed to prevent migration of airborne chemical agents from the garage space. There shall be no supply or return vent openings in the garage that connect to air handlers serving the habitable spaces. Any door or window connecting habitable space to an adjoining garage shall be metal, provided with an automatic closing mechanism and tightly sealed with weather-stripping.

5.4.3. In multifamily buildings, walls, ceilings and floors that separate the unit from neighboring units, corridors, chases, and stairwells, and openings such as utility and ductwork penetrations and cracks, shall be sealed as tightly as possible to limit air movement.

Stretch Provisions

- Relocate air handling equipment and associated ductwork from garage to an area within the conditioned space.
- Adjust outdoor air and exhaust flows so the pressure within the unit is negative relative to bounding wall and ceiling cavities, and the overall ventilation rate for the unit has increased. Use smoke current tubes or other air flow tests to determine if air flows into the dwelling unit through openings in bounding walls (e.g., electrical outlets).

Stretch Provisions Pertaining to Second Hand Smoke Exposure

- Exempt tenants of multifamily housing who terminate a lease early from penalties or security deposit forfeiture if the reason for moving is incursion of tobacco smoke or the inception of a smoke free policy.
- Require the owner of multifamily housing to notify tenants and prospective tenants of any applicable smoke free policy.
- Require the owner of multifamily housing to work with current tenants to develop a smoke free policy.

Rationale:

Controlling air leakage into homes can save the occupant money by making the home energy efficient and can prevent health problems associated with moisture. Airborne moisture can lead to mold growth which causes respiratory distress in children and adults, including those with asthma, allergies, or other respiratory diseases. Air-sealing and isolation of attached garages is important to prevent migration of carbon monoxide and other airborne chemical agents (e.g., from vehicle exhaust; fuels, solvents, and other chemicals stored or used in the garage) into habitable rooms. Sealing of each unit is necessary to prevent migration of smoke, cooking odors, noise, radon, pests, and other elements into the dwelling unit.

References:

- Department of Energy Guidance: https://www.jea.com/Manage_My_Account/Ways_to_Save/Saving_By_Room/Whole_House/Wholehouse.aspx

Resources:

- Department of Energy (DOE) and National Renewable Energy Lab (NREL), Standard Work Specifications for Home Energy Upgrades. Air Sealing, Attached Garages, Garage Openings. https://sws.nrel.gov/spec/315011
- Department of Energy (DOE) and National Renewable Energy Lab (NREL), Standard Work Specifications for Home Energy Upgrades. Ventilation, Special Consideration, Removing Supply Vents from Garages. https://sws.nrel.gov/spec/661881
- ASHRAE 62.2-2010, Ventilation and Acceptable Indoor Air Quality in Low Rise Residential Buildings, Section 6.5.1. American Society of Heating, Refrigerating and Air Conditioning Engineers. See https://www.ashrae.org/resources--publications/bookstore/standards-62-1--62-2

MOISTURE CONTROL, SOLID WASTE, AND PEST MANAGEMENT

6.1 Moisture Prevention and Control.

Requirement:
Every foundation, roof, roofing component, exterior wall, door, skylight, and window shall be watertight, weathertight, free of persistent dampness or moisture, and in good condition.

6.1.1. The building shall have an adequate drainage system that directs water away from the structure.

6.1.2. Exterior wood surfaces, other than decay-resistant woods, shall be protected from the elements and decay by paint or other protective covering or treatment. Weep holes in brickwork shall be left open.

6.1.3. Premises shall be graded and maintained to prevent the erosion of soil and to prevent the accumulation of stagnant water on the premises or within any structure.

6.1.4. Interior and exterior surfaces such as but not limited to wood, cellulose insulation, and paper, paint, and other wall coverings, including paper-faced gypsum board, shall have no signs of chronic or persistent excessive dampness or moisture.

6.1.5. Building material that is discolored or deteriorated by mold or mildew or causes a moldy or earthy odor shall be cleaned, dried, and repaired. Structurally unsound material shall be removed and replaced.

6.1.5.1. Removal and repair of moldy material shall be conducted in accordance with New York City Guidelines on Assessment and Remediation of Fungi in Indoor Environments.

6.1.6. The underlying cause of excessive dampness or moisture, or moldy or earthy odor shall be corrected.

Stretch Provisions:
The building and its systems shall meet the following performance criteria:

- Ventilation air is dried to a dew point value that is below the dew point maintained inside the building when the building is being mechanically cooled;
- Condensation inside HVAC components and air distribution ductwork is drained to an appropriate sanitary drain or condensate collection system;
- Indoor surfaces of both occupied and unoccupied spaces are not cooled to temperatures so low as to create an average surface relative humidity (RH) of over 80 percent that lasts for more than 30 days or a surface cold enough to allow visible condensation;
- Indoor dew point is low enough to ensure that there is no condensation on the exposed surfaces of cool HVAC components or on sensitive building materials or furnishings. The indoor dew point shall not be high enough to allow any surface RH over 80 percent when averaged over 30 days. The caution against condensation and long-term average surface RH above 80 percent applies not only to visible surfaces in occupied spaces but also to surfaces inside building cavities and unconditioned space;
- Humidifiers are sized, installed, and controlled so they do not overload the air with humidity, which increases the risk of condensation inside air distribution systems and exterior walls and roofing assemblies; and
- Cold HVAC and plumbing components and systems such as chilled-water pipes and valves, supply air ducts, cold domestic water lines, and cold condensate drain piping are sufficiently and continuously insulated to keep the temperature of all of their surfaces at least 10° F (4° C) above the dew point of the surrounding air.

Rationale:
Indoor dampness and mold are associated with a variety of adverse health effects including asthma-related health outcomes and respiratory illness. Damp indoor environments can increase the presence of biological agents such as mold, dust mites, and bacteria. These environments may also attract cockroaches and rodents and cause building materials to deteriorate. Exposure to allergens can trigger allergic symptoms such as rhinitis, conjunctivitis, eczema, cough, and wheeze. For a sensitized person, repeated exposure can lead to asthma, and it appears that the severity

of the asthma intensifies with increasing humidity, house dust mite, and mold levels. Some fungi, particularly when in very high concentrations, can also colonize the airways of susceptible individuals, particularly asthmatics. Toxins from some molds (mycotoxins) can cause nausea and diarrhea, can suppress the immune system, and have been implicated in pulmonary hemorrhage. Damage from mold or damp conditions and the smells associated with damp and mold can cause depression and anxiety. Feelings of shame and embarrassment can lead to social isolation.

References:

- U.S. Department of Housing and Urban Development, Healthy Home Rating System Operating Guidance, available at: http://portal.hud.gov/hudportal/documents/huddoc?id=operating_guidance_hhrs_v1.pdf
- Mendell MJ, Mirer AG, Cheung K, My T, Douwes J, *Respiratory and Allergic Health Effects of Dampness, Mold, and Dampness Related Agents: A Review of the Epidemiologic Evidence; Environ Health Perspect*. 119:748–756 (2011). doi:10.1289/ehp.1002410
- Institute of Medicine. Damp Indoor Spaces and Health. The National Academies Press, Washington, DC. 2004. Available at: http://www.iom.edu/Reports/2004/Damp-Indoor-Spaces-and-Health.aspx
- World Health Organization (2010). *Technical and Policy Recommendations to Reduce Health Risks due to Dampness and Mould.* Copenhagen: World Health Organization Regional Office for Europe, Retrieved May 22, 2013 from http://www.euro.who.int/__data/assets/pdf_file/0015/121425/E92998.pdf

Resources:

- American Society of Heating, Refrigeration and Air Conditioning Engineers, *ASHRAE Position Document on Limiting Indoor Mold and Dampness in Buildings*, 2012
- U.S. EPA, A Brief Guide to Mold, Moisture, and Your Home. Reprinted 2010. http://www.epa.gov/mold/moldguide.html
- Institute of Inspection, Cleaning and Restoration Certification (IICRC), S520 Standard and Reference Guide for Professional Mold Remediation. 2008.
- New York City Department of Health and Mental Hygiene. Guidelines on Assessment and Remediation of Fungi in Indoor Environments. 2008 http://www.nyc.gov/html/doh/downloads/pdf/epi/epi-mold-guidelines.pdf

6.2 Solid Waste.

Requirement:

Every dwelling shall have adequate facilities for temporary storage of trash and recyclable materials.

6.2.1. There shall be trash containers outside the dwelling for the storage of trash awaiting collection or disposal. Containers shall be equipped with watertight and insect-proof covers. The total capacity of these facilities shall be sufficient to store occupants' trash between scheduled collection times, and shall be placed on a cleanable surface constructed to minimize spillage onto the adjacent area.

6.2.2. There shall be containers outside the dwelling for recyclable materials awaiting collection, with capacity sufficient to store occupants' recyclable materials between scheduled collection times.

Rationale:

In 2010, Americans generated about 250 million tons of trash and recycled and composted over 85 million tons of this material, equivalent to a 34.1 percent recycling rate. On average, we recycled and composted 1.51 pounds of our individual waste generation of 4.43 pounds per person per day. The risk that poorly stored or accumulated solid waste poses to health is difficult to quantify as little epidemiological work in this area has been reported recently. The potential health outcomes may include gastrointestinal disease (from spread of infection) and asthma and allergic rhinitis (from allergens). Household waste may, in addition, present a physical hazard of cuts to young children. Emotional distress is also commonly associated with pest infestations and accumulations of solid waste. Establishing solid waste collection, storage, and disposal provisions helps reduce pest infestations, the growth and spread of biological agents, odor emissions, and windblown litter.

References:

- U.S. Department of Housing and Urban Development, Healthy Home Rating System Operating Guidance, available at: http://portal.hud.gov/hudportal/documents/huddoc?id=operating_guidance_hhrs_v1.pdf
- U.S. Environmental Protection Agency. Municipal Solid Waste, available at: http://www.epa.gov/epawaste/nonhaz/municipal/index.htm

6.3. Pest Management.

Requirement:
Every dwelling shall be maintained free of infestation, openings that allow pest entry, conditions that harbor pests or provide them with food or water, and visible pest residue or debris using integrated pest management methods.

6.3.1. There shall be no accumulation of trash, paper, boxes, lumber, scrap metal, food, or other materials that support rodent harborage in or about any dwelling, common areas, or premises. Stored materials shall be placed in boxes or stacked in stable piles elevated at least six inches (152 mm) above the ground or floor and at least six inches (152 mm) from the walls. Stored materials shall not block any egress routes.

6.3.2. Every premise, accessory structure, and fence shall be maintained in good repair and free of pest infestation.

6.3.2.1. There shall be no plantings in the soil within six inches (152 mm) of any dwelling.

6.3.2.2. There shall be no accumulation of stagnant water in or about any dwelling, building, common areas, or premises. Ornamental ponds and other water features shall have fountains or other mechanisms to prevent standing water, and the water in such features shall be flushed and replaced weekly.

6.3.3. Every window and storm door shall be supplied with adequate screens to prevent the entry of pests.

6.3.4. There shall be no openings in exterior walls, foundations, crawl spaces, basements, ground or first floors, roofs, or around windows or doors that equal or exceed one-quarter inch (6 mm) in diameter.

6.3.4.1. Pipes, drains, wires, or conduits and other openings that penetrate the roof or exterior walls, shall be caulked, including the areas surrounding such penetrations.

6.3.4.2. Vent pipe openings shall be covered with rodent- and corrosion-proof screens made of copper or stainless steel mesh or rigid metal cloth.

6.3.5. Foggers shall not be used to control or eliminate pests.

Rationale:
Poorly stored food waste will attract pests. These pests may then come into contact with food before it is prepared or eaten or may come into direct contact with persons. Vermin, such as rodents, have long been linked to property destruction and disease. Proper food storage, rat-proofing construction, and ensuring good sanitation outside the home have served to eliminate or reduce rodent problems in the 21st century home. Children who live in dwellings infested with cockroaches show high levels of sensitivity to cockroach allergen. Contact with cockroaches can cause dermatitis, uticaria, rhinitis, bronchitis, and asthma. Some people have an aversion to cockroaches amounting to a phobia and can suffer anxiety when in the presence of the insects. Rats and mice are known to be infected with pathogenic organisms. Rats have been found to be infected with such zoonotic agents as *Yersinia entercolitica* (Yersiniosis), *Listeria spp* (Listeriosis), *Cryptosporidium parvum* (Cryptosporidiosis), *Toxoplasmagondii* (Toxoplasmosis), *Leptospira spp* (Leptospiral Jaundice or Weil's disease), *Trichinella spiralis*, and *Trichuris spp* (Whipworm infection).

References:

- U.S. Environmental Protection Agency. Pesticides: Controlling Rodents. March 19, 2013. Available at: http://www.epa.gov/pesticides/controlling/rodents.htm
- U.S. Department of Housing and Urban Development, Healthy Home Rating System Operating Guidance, available at: http://portal.hud.gov/hudportal/documents/huddoc?id=operating_guidance_hhrs_v1.pdf

Resources:

- New York City Department of Health Brochure on Rodent Control: http://www.nyc.gov/html/doh/downloads/pdf/pest/rodent_control.pdf
- New York State IPM Program www.nysipm.cornell.edu

CHEMICAL AND RADIOLOGICAL AGENTS

7.1 General Requirements.

Requirement:
Dwellings, premises, and accessory structures shall be free from chemical and radiological agents, including but not limited to deteriorated lead-based paint, friable asbestos-containing material, formaldehyde, radon, pesticides, methamphetamine, and carbon monoxide. When there exists a regulatory limit that is more protective than the level included in this section, the more restrictive limit shall apply. Chemical and radiological agents shall be contained, removed, disposed of, and/or mitigated in a safe and healthy manner.

7.2 Lead-Based Paint.

Requirement:
Lead-based paint shall not be applied to the interior or exterior surface of any dwelling or dwelling unit.

7.2.1. Lead present on an existing painted surface above the following federal regulatory limits pursuant to federal law 42 USC is deemed hazardous: (1) lead-based paint—0.5 percent by weight or 1.0 milligrams per square centimeter; (2) dust on floors—40 micrograms of lead per square foot of settled dust (µg/ft^2); (3) dust on interior window sills—250 µg/ft^2; (4) bare soil in children's play areas—400 ppm of lead; and (5) bare soil in areas of the yard that are not children's play areas—1,200 ppm.

7.2.2. Painted surfaces shall be maintained intact.

7.2.3. With the exception of paint that is tested and found not to contain lead-based paint in accordance with 40 CFR 745.82(a)(1) or (2), deteriorated paint on property built before 1978 shall be repaired in accordance with the renovation requirements of 40 CFR 745.

7.2.4. With the exception of paint that is tested and found not to contain lead-based paint in accordance with 40 CFR 745.82(a)(1) or (2), a painted surface shall not be disturbed using methods that involve (1) open-flame burning or torching or operating a heat gun at temperatures above 1,100° F; or (2) power sanding, grinding, power planing, needle gun, abrasive blasting, or sandblasting unless such machines have shrouds or containment systems and a High-Efficiency Particulate Air (HEPA) vacuum attachment that collects dust and debris at the point of generation. The shroud or containment system shall release no visible dust or air outside the shroud or containment system.

Stretch Provisions:

- Lead present above the following federal regulatory limits is deemed hazardous: (1) lead-based paint—0.06 percent by weight; (2) dust on floors—10 micrograms of lead per square foot of settled dust (µg/ft2); (3) dust on interior window sills—100 µg/ft2; (4) bare soil in children's play areas—400 ppm of lead; and (5) bare soil in areas of the yard that are not children's play areas—1,200 ppm; and (6) 40 ppm on porches.

Rationale:
Lead is a heavy metal that accumulates in the body when ingested and has toxic effects on the nervous system, cognitive development, and blood production. Sources of lead include lead-based paint and the dust it generates, soil, drinking water, and consumer products. Lead-contaminated soil may be found particularly around older buildings contaminated by flaking external paintwork, and adjacent to industrial premises using (or previously having used) lead, and near busy roads from the exhaust fumes from leaded gasoline. Lead is readily absorbed from the intestinal tract, especially in children, and its absorption is enhanced by dietary deficiency of iron and calcium.

Even with relatively low levels of lead in blood, studies show effects on a child's nervous system. The highest risk group is young children aged 0–5 years because of lead's potential effect on neurological development, and because physiologically they take up lead more readily. Pregnant women and their babies are at risk since lead can pass through the placental barrier.

References:

- U.S. Department of Housing and Urban Development, Healthy Home Rating System Operating Guidance, available at: http://portal.hud.gov/hudportal/documents/huddoc?id=operating_guidance_hhrs_v1.pdf
- National Center for Healthy Housing et al., Communication to the Environmental Protection Agency, 2009. http://www.nchh.org/Portals/0/Contents/EPA_Lead_Standards_Petition_Final.pdf

7.3 Asbestos.

Requirement:
Every owner shall maintain in good repair all asbestos-containing material on the premises. All friable asbestos-containing material shall be identified, clearly labeled, and maintained free from any defects such as holes, cracks, tears, and/or looseness that may allow the release of asbestos fibers into the environment.

7.3.1. Damaged friable asbestos-containing material shall be mitigated in accordance with federal, state, or local requirements by licensed asbestos professionals.

7.3.2. Any construction, remodeling, or other activity that will disturb asbestos-containing materials shall be performed by licensed contractors.

7.3.3. Removal and disposal of all asbestos-containing material shall comply with all appropriate federal, state, and local requirements.

Rationale:
Exposure to asbestos increases the risk of developing lung disease. This risk is made worse by smoking. In general, the greater the exposure to asbestos, the greater the chance of developing harmful health effects. Disease symptoms may take many years to develop following exposure. Asbestos products were historically used extensively in building materials. Vermiculite insulation in homes may be contaminated with asbestos. A mine near Libby, Montana, was the source of over 70 percent of all vermiculite sold in the United States from 1919 to 1990. There was also a deposit of asbestos at that mine, so the vermiculite from Libby was contaminated with asbestos. Vermiculite from Libby was used in the majority of vermiculite insulation in the United States and was often sold under the brand name Zonolite. Vermiculite insulation should be assumed to be contaminated with asbestos and should not be disturbed. Trained professionals must be hired to remove vermiculite insulation. Many asbestos-containing building materials continue to be legal to sell and to use. Intact asbestos is not a hazard. It becomes a hazard when damaged or deteriorated and releases friable asbestos. The EPA and most states license asbestos inspectors.

References:

- Agency for Toxic Substances and Disease Registry. (2001). *Public health statement for asbestos.* Atlanta: U.S. Department of Health and Human Services. Retrieved April 11, 2012 from: http://www.atsdr.cdc.gov/toxprofiles/phs61.html.
- Asbestos National Emissions Standard for Hazardous Air Pollutants (NESHAP).
- U.S. EPA. Asbestos Fact Sheet. Available at: www.epa.gov/asbestos/pubs/ashome.html.
- U.S. EPA. Protect Your Family from Asbestos-Contaminated Vermiculite Insulation. Available at: http://www.epa.gov/asbestos/vermiculite.html
- U.S. Centers for Disease Control and Prevention and U.S. Department of Housing and Urban Development. Healthy Housing Reference Manual. (Atlanta: US Department of Health and Human Services); 2006.

7.4 Formaldehyde.

Requirement:
Building materials consisting of hardwood plywood, medium-density fiberboard, and particleboard as defined by 15 USC 2697(b)(2) shall not be used for renovations within dwellings, unless the materials have been certified to meet the formaldehyde emission standards of 15 USC 2697(b)(2): (1) hardwood plywood with a veneer core, 0.05 parts per million (ppm); (2) hardwood plywood with a composite core, 0.05 ppm; (3) medium-density fiberboard, 0.11 ppm; (4) thin medium-density fiberboard, 0.13 ppm; and (5) particleboard, 0.09 ppm.

Rationale:
Formaldehyde is a prominent VOC found in household products and construction products. It is a colorless, strong-smelling gas that can cause watery eyes; burning sensations in the eyes, nose, and throat; nausea; coughing; chest tightness; wheezing; skin rashes; and allergic reactions. Laboratory animal studies have revealed that formaldehyde can cause cancer in animals. Formaldehyde is considered a probable human carcinogen. The most significant source of formaldehyde in homes has been pressed wood products made using adhesives that contain Urea Formaldehyde (UF) resins. These products include particleboard (used as subflooring and shelving and in cabinetry and furniture), hardwood plywood paneling (used for decorative wall covering and used in cabinets and furniture), and medium-density fiberboard (used for drawer fronts, cabinets, and furniture tops). Medium-density fiberboard contains a higher resin-to-wood ratio than any other UF pressed wood product and is generally recognized as being the highest formaldehyde-emitting pressed wood product.

In 2010, the U.S. Congress enacted the Formaldehyde Standards for Composite Wood Products Act to limit formaldehyde emissions from composite wood products and finished goods that contain composite wood products sold, offered for sale, supplied, used or manufactured for sale, and specified limits on formaldehyde emission levels based on California regulations. EPA has drafted proposed regulations to implement these national formaldehyde emission standards.

References:

- Formaldehyde Standards for Composite Wood Products Act. http://www.gpo.gov/fdsys/pkg/USCODE-2010-title15/html/USCODE-2010-title15-chap53-subchapVI-sec2697.htm
- U.S. Environmental Protection Agency, Formaldehyde Emissions from Pressed Wood Products. 2013. http://www.epa.gov/oppt/chemtest/formaldehyde/
- California Code of Regulations, Title 17, sections 93120-92120.12. 2007. Airborne Toxic Control Measures (ATCM) to reduce formaldehyde emissions from composite wood. State of California. http://www.arb.ca.gov/regact/2007/compwood07/fro-final.pdf
- Offerman, F. Ventilation and Indoor Air Quality in New Homes. 2009 California Air Resources. Board and California Energy. Available at http://www.arb.ca.gov/research/apr/past/04-310.pdf
- U.S. Consumer Product Safety Commission. An update on formaldehyde. Washington, DC: Consumer Product Safety Commission; 2013. CPSC Document 725. Available from URL: http://www.cpsc.gov/PageFiles/121919/AN%20UPDATE%20ON%20FORMALDEHYDE%20final%200113.pdf
- U.S. Department of Housing and Urban Development. Formaldehyde emission controls for certain wood products. 24 CFR3280.308. Washington, DC: U.S. Department of Housing and Urban Development; 2001. Available from URL: http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&SID=46901dfd7c16964546415c08dc1bb70d&rgn=div8&view=text&node=24:5.1.4.1.1.4.13.8&idno=24

7.5 Radon.

Requirement:
Radon present at levels at or above the EPA guidance level of four picocuries radon per liter of air (pCi/L) in the lowest occupied level of the dwelling shall be deemed hazardous. Radon determined by an approved testing method to exceed four pCi/L shall be mitigated.

Rationale:
The U.S. Environmental Protection Agency (EPA) estimates that about 21,000 lung cancer deaths each year in the U.S. are radon-related. Exposure to radon is the second-leading cause of lung cancer after smoking. Radon is an odorless, tasteless, and invisible gas produced by the decay of naturally occurring uranium in soil and water. Radon decays rapidly and the resulting products can very quickly attach themselves to particles in the air. If these particles are inhaled, they can be deposited in the lungs where the process of radioactive decay continues. The particles emitted can cause cells lining the lungs to be genetically mutated and initiate cancer or facilitate a process already initiated by other carcinogens. The risk related to radon increases with dose and duration of exposure. The highest risk is for smokers. As radon is soluble in water, it can be ingested, resulting in the organs of the gastrointestinal tract receiving the largest dose. EPA has established a recommended maximum exposure level of four pCi/L in occupied areas. Approximately 1 in 15 homes nationwide have radon above this level.

References:

- U.S. Environmental Protection Agency. Radon Home Page. 2013. http://www.epa.gov/radon/index.html
- U.S. Environmental Protection Agency. State Radon Contact Information. 2013. http://www.epa.gov/radon/whereyoulive.html
- American Association of Radon Scientists & Technologists, Inc. (AARST), National Radon Proficiency Program. http://nrpp.info/
- American Association of Radon Scientists & Technologists, Inc. (AARST), ANSI-AARST Standard: Protocol for Conducting Radon and Radon Decay Product Measurements in Multifamily Buildings (MAMF-2012). http://www.aarst.org/
- National Radon Safety Board (NRSB). http://www.nrsb.org/
- U.S. Environmental Protection Agency. Assessment of risks from radon in homes. Washington, DC: U.S. Environmental Protection Agency; 2003. Available from URL: http://www.epa.gov/radon/ risk_assessment.html.
- U.S. Department of Health and Human Services. Surgeon General releases national health advisory on radon. Washington, DC: U.S. Department of Health and Human Services; 2005. Available from URL: http://www.hhs.gov/surgeongeneral/ pressreleases/sg01132005.html.

7.6 Pesticides.

Requirement:

Pesticides shall be stored in accordance with manufacturer specifications and shall be applied only in areas and at concentrations which comply with manufacturer specifications.

7.6.1. When it is determined by an approved method that a hazardous amount of a pesticide has been applied in a location or at a concentration contrary to manufacturer specifications, the area affected by such pesticide shall be vacated until the hazard has been mitigated.

7.6.2. If a pesticide is stored in a location that does not comply with manufacturer specifications, the pesticide shall be properly stored or removed.

Rationale:

The health effects of pesticides vary with the product. However, local effects from most of the products will be on eyes, noses, and throats; more severe consequences, such as on the central nervous system and kidneys and on cancer risks, are possible. An EPA survey revealed that bathrooms and kitchens are areas in the home most likely to have improperly stored pesticides. In the United States, EPA regulates pesticides under the pesticide law known as the Federal Insecticide, Fungicide, and Rodenticide Act. Since 1981, this law has required most residential-use pesticides to bear a signal word such as "danger" or "warning" and to be contained in child-resistant packaging. This type of packaging is designed to prevent or delay access by most children under the age of five years.

References:

- U.S. Environmental Protection Agency. Sources of indoor air pollution—pesticides. Washington, DC:
- U.S. Environmental Protection Agency. Available from URL: http://www.epa.gov/iaq/pesticid.html.

7.7 Methamphetamine.

Requirement:

A dwelling that has been used for illegal methamphetamine manufacture shall be vacated until certified by an approved testing method as safe from hazardous materials related to the methamphetamine manufacturing process.

Rationale:

Homes formerly used as methamphetamine (meth) labs put residents especially children at serious health risks. Meth can be inhaled or absorbed through the skin. Effects resulting from acute exposures include cough, headache, chest pain, burns to skin, eyes, nose and mouth, shortness of breath, dizziness, pulmonary edema, coma, and death. Exposure over a longer period can lead to liver and kidney damage, neurological problems, and increased risk of cancer.

References:

- American Academy of Pediatrics Council on Environmental Health. Drug (Methamphetamine) Laboratories. In: Etzel RA, ed. Pediatric Environmental Health, 3rd Edition. Elk Grove Village, IL: American Academy of Pediatrics; 2012, 737–748.
- Minnesota Department of Health (2013). Methamphetamine and Meth Labs. http://www.health.state.mn.us/divs/eh/meth/lab/potenteffects.html
- U.S. Centers for Disease Control and Prevention (CDC). MMWR. "Public Health Consequences among First Responders to Emergency Events Associated with Illicit Methamphetamine Laboratories—Selected States, 1996–1999." http://www.atsdr.cdc.gov/hs/hsees/Horton_MethLabs.pdf

7.8 Carbon Monoxide.

Requirement:

Carbon monoxide present at or above 35 ppm (31 mg/m^3) when measured over one hour, or above 10 ppm (9 mg/m^3) measured over eight hours, shall be deemed hazardous, and the cause shall be repaired.

Rationale:

Carbon monoxide is a colorless, odorless, and extremely toxic gas. Blood hemoglobin has a greater affinity for carbon monoxide than it does for oxygen, which means that inhalation of this gas will reduce the ability of the blood to take up oxygen. At high concentrations, carbon monoxide can cause unconsciousness and death. At lower concentrations, it causes a range of symptoms from headaches, dizziness, weakness, nausea, confusion, and disorientation, to fatigue. These symptoms are sometimes confused with influenza and sometimes with depression. In people with ischemic heart disease, it can result in episodes of increased chest pain. Carbon monoxide may also impair fetal development. Those most vulnerable to carbon monoxide exposure include unborn children, infants, children, the elderly, and people with anemia or heart or lung disease. The highest rate of deaths from carbon monoxide poisoning occurs in older age groups, especially in people aged 75-plus years. This may be for several reasons, including the increasing prevalence of cardiovascular illness and neurological decline at older ages, and the fact that the elderly tend to spend a high proportion of their time at home indoors.

References:

- American Academy of Pediatrics Council on Environmental Health. Carbon Monoxide. In: Etzel RA, ed. Pediatric Environmental Health, 3rd Edition. Elk Grove Village, IL: American Academy of Pediatrics; 2012, 367–377
- U.S. Environmental Protection Agency (EPA). An Introduction to Indoor Air Quality (IAQ): Carbon Monoxide, http://www.epa.gov/iaq/co.html
- World Health Organization *Guidelines for Indoor air Quality: Selected Pollutants*. (2010) Copenhagen: World Health Organization Regional Office for Europe. Retrieved May 22, 2013 from: http://www.euro.who.int/__data/assets/pdf_file/0009/128169/e94535.pdf