

Advancing Healthy Housing A STRATEGY FOR ACTION



2013

A Report from the Federal
Healthy Homes Work Group



Acknowledgements

This document – *Advancing Healthy Housing A Strategy for Action* – was developed by the federal Healthy Homes Work Group under the auspices of the President’s Task Force on Environmental Health Risks and Safety Risks to Children. The *Strategy for Action* paves the way for improving the lives of Americans by reducing health and safety risks in one of the most meaningful places – the home. Many thanks go to all who contributed to and championed this significant accomplishment.

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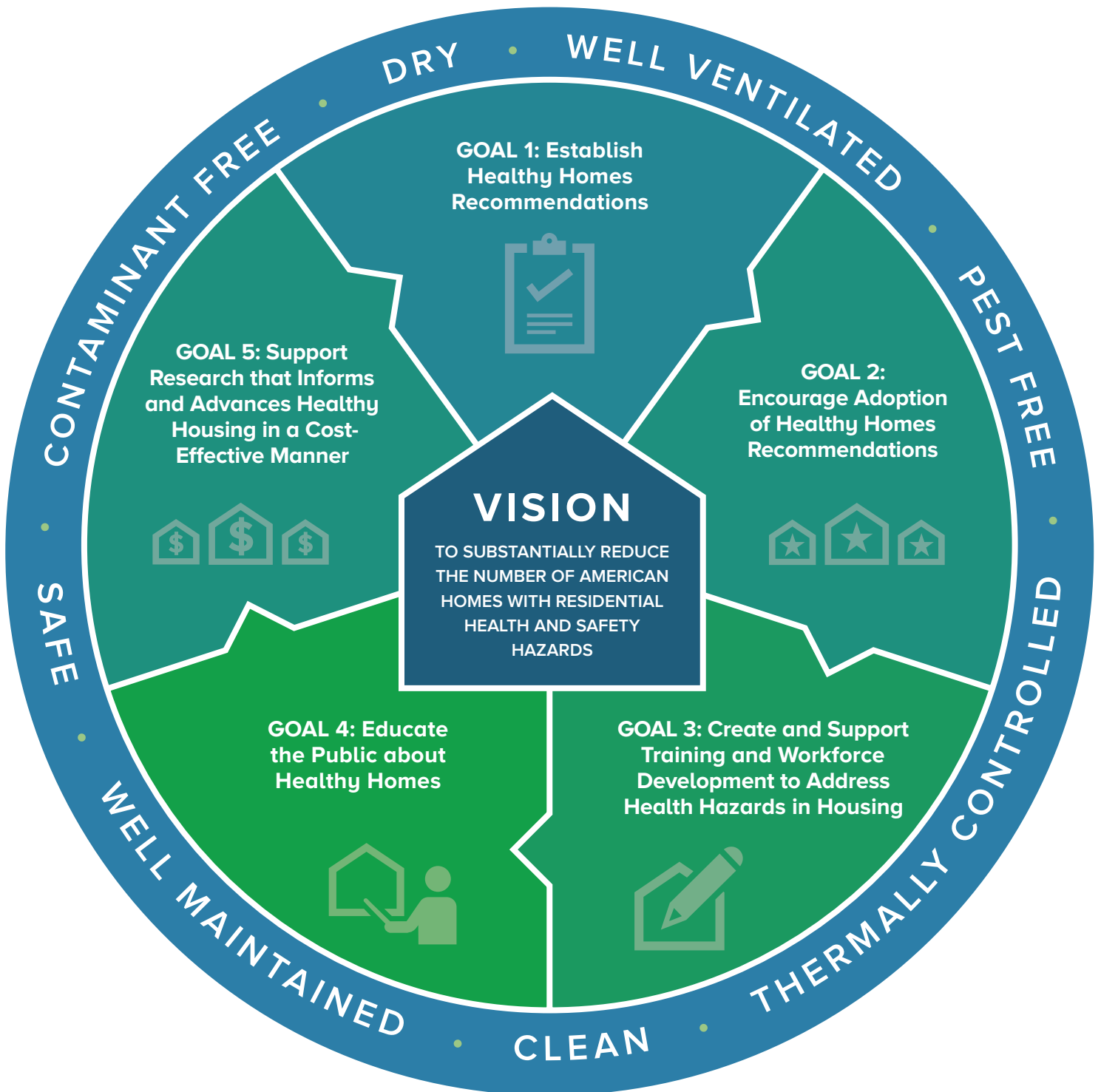
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Healthy Homes Model



Abbreviations

AMI	Area Median Income
APHA	American Public Health Association
CDC	U.S. Centers for Disease Control and Prevention
CO	Carbon Monoxide
DOE	U.S. Department of Energy
DOL	U.S. Department of Labor
EPA	U.S. Environmental Protection Agency
HEPA	High Efficiency Particulate Air
HHS	U.S. Department of Health and Human Services
HUD	U.S. Department of Housing and Urban Development
HHWG	Healthy Homes Work Group
IAA	Interagency Agreement
IPM	Integrated Pest Management
KPI	Key Performance Indicator
NHANES	National Health and Nutrition Examination Survey
NIEHS	National Institute of Environmental Health Sciences
NIFA	National Institute of Food and Agriculture
NIST	National Institute of Standards and Technology
OSHA	Occupational Safety and Health Administration
RHS	Rural Housing Service (U.S. Department of Agriculture)
SIRG	State Indoor Radon Grant
USDA	U.S. Department of Agriculture
USDA CES	USDA Cooperative Extension System
USGBC LEED	U.S. Green Building Council Leadership in Energy & Environmental Design
VOC	Volatile Organic Compound

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A home has a unique place in our everyday lives. Homes are where we start and end our day, where our children live and play, where friends and family gather to celebrate, and where we seek refuge and safety.



Executive Summary

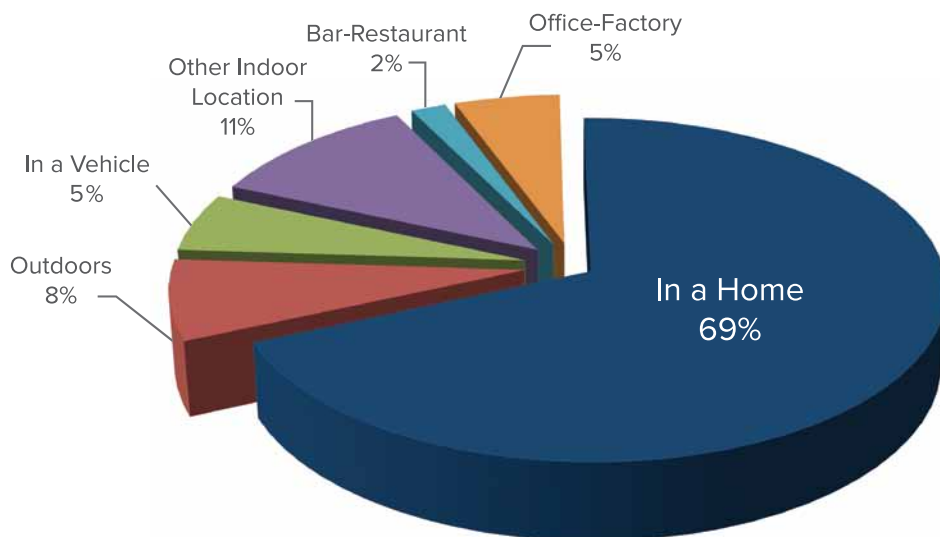
A home has a unique place in our everyday lives. Homes are where we start and end our day, where our children live and play, where friends and family gather to celebrate, and where we seek refuge and safety.

In the *United States Housing Act of 1937*, Congress established as the policy of the United States to “**remedy the unsafe and unsanitary housing conditions and the acute shortage of decent, safe, and sanitary dwellings for families of low income, in rural or urban communities, that are injurious to the health, safety, and morals of the citizens of the Nation.**”¹

This document – *Advancing Healthy Housing A Strategy for Action* (referred to as *Strategy for Action* or *Strategy*) – outlines goals and priorities in healthy housing for the next three to five years based upon the consensus opinion of the federal interagency Healthy Homes Work Group (HHWG). The HHWG includes the Department of Housing and Urban Development (HUD), organizations within the Department of Health and Human Services (HHS) including the Centers for Disease Control and Prevention (CDC) and the National Institute of Environmental Health Sciences (NIEHS), the Department of Agriculture (USDA), the Environmental Protection Agency (EPA), the Department of Energy (DOE), the Department of Labor (DOL), and the National Institute of Standards and Technology (NIST). The final development of the *Strategy* occurred under the auspices of the President’s Task Force on Environmental Health Risks and Safety Risks to Children (the Task Force), which has the objectives to identify priority issues that can be best addressed through interagency efforts and to recommend and implement interagency actions. The initiatives encompassed in this *Strategy for Action* will capitalize on the collective expertise within the HHWG and the Task Force to advance the policy established in the United States Housing Act: “...to assist States and political subdivisions of States to remedy the unsafe

housing conditions and the acute shortage of decent and safe dwellings for low-income families [and] to assist States and political subdivision of States to address the shortage of housing affordable to low-income families.”² Whether in new or existing initiatives, the Task Force recognizes that all actions will be subject to the annual budget processes that require balancing priorities within available resources.

The initiatives encompassed in this *Strategy for Action* will capitalize on the collective expertise within the HHWG and the Task Force to advance the policy established in the United States Housing Act: ‘... to assist States and political subdivisions of States to remedy the unsafe housing conditions and the acute shortage of decent and safe dwellings for low-income families [and] to assist States and political subdivision of States to address the shortage of housing affordable to low-income families.’²



Personal Time in the U.S. by Microenvironment. Klepeis et al., 2001.

THE NEED FOR HEALTHY HOUSING

People in the United States spend about 70% of their time in a residence³, suggesting that the condition of the home is a factor in a person's well-being. Poor housing conditions, such as a dilapidated structure; roofing problems; heating, plumbing, and electrical deficiencies; water leaks and intrusion; pests; damaged paint; and radon gas are associated with a wide range of health conditions, including unintentional injuries, respiratory illness, asthma, lead poisoning, and cancer, respectively.⁴ The HHWG believes that no housing program can be considered successful unless the residents it serves live in homes that are healthy and safe.

While unhealthy and inadequate housing continue to affect the health of millions of people from all income levels, geographic areas, and walks of life in the United States⁵, in some situations, susceptible and vulnerable populations, such as children, the poor, minorities, individuals with behavioral health issues, and people with chronic medical conditions, may be disproportionately impacted by inadequate housing.^{6, 7, 8} Currently in the United States, millions of homes have moderate to severe physical housing problems.^{9, 10}

Although the health risks associated with homes are many and varied, the household hazards that contribute to those risks tend to be interrelated. For example, some research has suggested that excess moisture, poor indoor air quality, and high levels of contaminated dust are common root causes for residential health hazards.¹¹ The HHWG believes that additional research is needed to determine whether addressing these deficiencies concurrently, rather than attempting to tackle each hazard individually, would yield the greatest results in the most efficient, cost-effective manner.^{12, 13}

THE POTENTIAL COST BURDEN OF UNHEALTHY HOUSING

Homes with risks like radon, lead, or other unsafe conditions can have a physical toll on their inhabitants, while also imposing a considerable economic burden in a larger societal context. A number of peer-reviewed studies have been published on the economic burden of specific hazards in at-risk homes, and each study reported costs into the billions of dollars on an annual basis.^{14, 15, 16, 17, 18} For example, one study estimated that the costs for asthma due to one root cause in the home – dampness and mold – were estimated at several billions of dollars in 2004,¹⁹ while an even higher cost burden was attributed to unintentional injuries in the home in another study.²⁰ Until we

can conduct further research, we will not know the total fraction of all health-care costs attributable exclusively to hazards in the home environment and how they may relate to one another; however, current findings suggest hazards associated with the home contribute to both the health and economic burdens of society.

In addition to an evolving understanding on the health outcomes and costs associated with hazards in the home, additional information is beginning to surface on the effectiveness of intervention programs. Current findings suggest that these home-based hazards are preventable, and opportunities exist for intervention programs that would not only reduce health impacts on occupants, but the economic burden as well, resulting in a positive return on investment. Reported findings demonstrate intervention programs on lead poisoning prevention, reducing asthma triggers in the home, and the installation of smoke alarms, for example, are effective at producing a strong return for every dollar invested.^{21, 22, 23} In addition, preliminary research suggests that interventions to prevent childhood residential injuries also have the potential to generate medical cost savings.²⁴

For many of these problems, straightforward fixes may be available. For others, there is a need for increased research to inform policies and practices that minimize adverse health outcomes for those at greatest risk, including young children, immunocompromised individuals and older Americans. With additional research, the HHWG hopes to support healthy housing for all people living in the United States regardless of age, race, ethnicity, income level, or geography. The case study example provided in Appendix A demonstrates the comprehensive scope of healthy homes deficiencies that may be encountered, possible remedial actions that can be adopted to improve conditions, and the impact of those actions on the health and safety of the affected family.

THE INTENTION

This *Strategy* provides an initial framework to coordinate federal action for advancing healthy housing through a comprehensive approach. With additional research, the goal is to craft a “healthy homes model” that aims to implement the United States Housing Act goal: “... that our Nation should promote the goal of providing decent and affordable housing for all citizens through the efforts and encouragement of Federal, State, and local governments, and by the independent and collective actions of private citizens, organizations, and the private sector.”²⁵

The *Strategy* is being published to focus attention on the public health impact of housing and to further the national dialogue on how we can promote healthy homes in the United States.

The *Strategy* urges a dynamic and coordinated effort to improve housing factors that affect health and outlines a series of mutually supportive coordinated actions that may accomplish the vision of achieving substantial reductions in the number of American homes with residential health and safety hazards. It encourages federal agencies to be proactive and to consider taking the first steps in implementing the priority actions. The *Strategy* also invites and encourages participation from many sectors to join in the discussion about healthy homes issues; to make informed, shared, and compassionate decisions; and to develop imaginative and realistic solutions that will help ensure that safe, healthy, affordable, and accessible homes are available to everyone in the United States.

And finally, the *Strategy* advances the healthy homes model by promoting a consensus-based conceptual model of healthy housing focused on supporting the health of its residents. As Kathleen Sebelius, Secretary of Department of Health and Human Services, has stated: “I urge all Americans to embrace the holistic approach to creating healthy homes described in the *Surgeon General’s Call to Action to Promote Healthy Homes*.”²⁶

CONCEPT OF A HEALTHY HOME

“A healthy home is sited, designed, built, maintained, and renovated in ways that support the health of its residents.”²⁷

– U.S. Surgeon General, 2009

The concept of a healthy home has evolved over decades, beginning with the American Public Health Association’s (APHA) seminal 1938 work, “Basic Principles of Healthful Housing,”²⁸ and continuing with the CDC’s Basic Housing Inspection Manual in 1976, which was updated by the publication of the “Healthy Housing Reference Manual” by CDC and HUD in 2006.²⁹ The *Strategy* will continue the precedent set by those efforts and build upon “The Surgeon General’s Call to Action to Promote Healthy Homes” that was published in 2009³⁰ to promote the concept of a healthy home.

Identifying the specific elements of a healthy home is still an evolving process, and the characteristics listed below are not intended to be exhaustive; however, the federal Healthy Homes Work Group believes that in the vast majority of cases, homes that meet the following characteristics can provide a safe and healthy environment for residents:

DRY

CLEAN

PEST FREE

SAFE

CONTAMINANT FREE

WELL VENTILATED

WELL MAINTAINED

THERMALLY CONTROLLED

These characteristics may be impacted by a wide range of factors, including the design, construction, maintenance, age, and overall condition of the building as well as the actions and behaviors of the home's occupants.

FEDERAL AGENCY COLLABORATION

Being able to coordinate federal programs in a comprehensive and strategic fashion is vital to implementing the *Strategy*.

Agencies across the federal government have embraced the healthy housing model to promote safe, decent, and sanitary housing as a means that may prevent diseases and injury (See Appendix B for a listing of agency-specific activities). In addition, agencies have collaborated on a number of inter-agency healthy homes initiatives. Cooperative work through interagency agreements (IAAs) with federal agencies have also resulted in important program achievements, such as outreach and training initiatives through the USDA's National Institute of Food and Agriculture (NIFA) and Rural Housing Service (RHS) and the federal radon action plan.³¹ Interagency collaboration culminated in the planning and delivery of two federal Healthy Homes Conferences, the first held in September 2008 and the second in June 2011, both sponsored by HUD, CDC, EPA, and USDA. These conferences served as an incubator for the exchange of ideas, and helped to focus national attention on the importance of safe, healthy, efficient, and affordable homes for America's families.

EMERGENCE OF THE FEDERAL HEALTHY HOMES WORK GROUP

Although staff from the various agencies have successfully worked together informally to link and collaborate on their individual programs, a formal structure or organization connecting healthy homes activities was lacking. In response, federal partners with a core interest in healthy homes joined forces in 2009 to form the federal Healthy Homes Work Group (HHWG).³² The primary goal of the HHWG is to promote nationwide access to safe and healthy homes. The HHWG works to influence existing programs, and to identify new opportunities and ensure that programs are operating effectively and efficiently. It also links program activities to the broader mission of each individual agency and encourages the integration of the healthy homes model into federal programs.

NEED FOR A FEDERAL STRATEGY FOR ACTION ON HEALTHY HOUSING

With limitations on individual agency resources, it is imperative that the federal partners of the HHWG leverage their resources and expertise to implement a national healthy homes agenda.

The HHWG challenged itself to:

- Establish a comprehensive federal strategy to promote healthy homes;
- Promote comprehensive approaches to controlling and preventing major housing-related exposures and hazards;
- Identify and find ways to eliminate barriers that impede collaboration and that complicate assisting those in need of federal technical assistance and/or funding; and
- Collaborate with key federal and non-federal stakeholders to implement a healthy homes implementation agenda at the community level.

This *Strategy* outlines the goals and priorities in healthy housing for the HHWG during the next three to five years. It is a first step in organizing the work of the federal agencies committed to making healthy homes available to all Americans, thus serving both as a roadmap for coordinated activities and as a visible statement of the agencies' commitments to carry out specific activities. It is encouraging that much progress on the broader healthy homes agenda has been made already by HHWG partners, demonstrating a high level of effective interagency collaboration upon which future activities can build.

The *Strategy* is built upon a framework utilizing an overarching Vision Statement and five related Goals.

The *Strategy* will use this framework to improve the nation's overall health through coordinated action to address health and safety hazards in housing. 🏡

VISION: Substantially reduce the number of American homes with residential health and safety hazards.^{126, 127}

The *Strategy for Action* advances five goals to achieve this vision:

-
- GOAL 1:** Establish Healthy Homes Recommendations
 - GOAL 2:** Encourage Adoption of Healthy Homes Recommendations
 - GOAL 3:** Create and Support Training and Workforce Development to Address Health Hazards in Housing
 - GOAL 4:** Educate the Public about Healthy Homes
 - GOAL 5:** Support Research that Informs and Advances Healthy Housing in a Cost-Effective Manner

Over 30 million U.S. housing units have significant physical problems or elevated levels of lead, radon, or other contaminants that place their occupants at potential risk for illnesses and injuries.^{35, 36, 37}



Introduction

Over 30 million U.S. housing units have significant physical problems or elevated levels of lead, radon, or other contaminants that place their occupants at potential risk for illnesses and injuries.^{35, 36, 37} For example:

- The American Housing Survey (2009) reported that nearly 6 million U.S. housing units have moderate to severe physical infrastructure problems – including water leaks and intrusion; injury hazards; pests; and heating, plumbing, and electrical deficiencies, based on occupant reporting at the time.³⁸ About 23 million housing units have one or more lead-based paint hazards and of these homes, an estimated 3.6 million homes with children under age six (the age group most sensitive to lead poisoning) have one or more lead-based paint hazards; 1.1 million were low income households with one or more children under age six.³⁹
- More than 6.8 million housing units have radon exposures above the current EPA action level.⁴⁰ Radon exposure is estimated to be the leading cause of lung cancer among nonsmokers.^{41, 42}
- Based on the National Survey on Lead and Allergens in Housing (2000), approximately 17 million homes had a high exposure burden to indoor allergens. In one study, high exposure to indoor allergens was associated with asthma symptoms among residents with allergic asthma.⁴³

The bottom line is that unhealthy and unsafe housing may have an effect on the health of millions of people in the United States.^{44, 45}

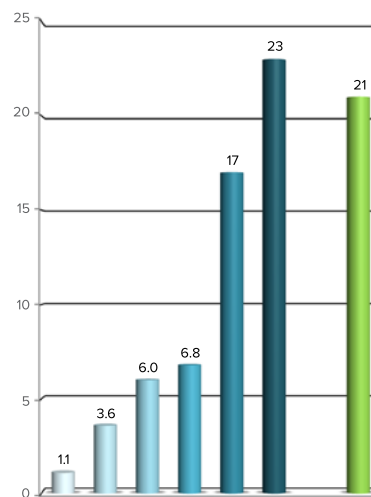
CONSEQUENCES OF UNHEALTHY HOMES

In the United States today, we too often hear tragic stories resulting from incidents

involving common hazards in the home – preventable hazards – that can cause injury and illness in residents. Examples of these types of preventable hazards include: unprotected open upper-story windows; accessible poisonous substances; chemical exposures, including carbon monoxide and lead contaminated dust; poor lighting; lack of handrails on stairs; and electrical hazards. Anyone can suffer from housing-related illness and injury; however, certain groups such as children, the elderly, and individuals with chronic illness are often more vulnerable to the effects of residential health and safety hazards.^{46, 47, 48}

While further research in this area is necessary, some research has suggested that unintentional injuries (UI) may be a major contributor to housing-related health and economic burdens,^{49, 50, 51} **with estimates of billions of dollars in direct and indirect healthcare costs annually; falls within the home may contribute to over 40% of those direct and indirect injury-related healthcare costs.**⁵

Number of housing units (Millions)



- 1.1 million low income households with one or more lead-based paint hazard AND one or more children under age six
- 3.6 million homes with one or more lead-based paint hazards AND one or more children under age six
- 6 million housing units with moderate to severe physical infrastructure problems
- 6.8 million housing units with radon level above 4 pCi/L
- 17 million homes with high exposure burden to indoor allergens
- 23 million housing units with one or more lead-based paint hazards
- FOR PERSPECTIVE: The states of California and New York have a combined total of 21 million housing units (US Census, 2010)

While falls in residential settings are relevant to all age groups, children (≤ 14 years) and older adults (≥ 75 years) are often the focus of fall prevention campaigns since they contribute almost half of the nonfatal falls in homes.⁵³ The cause of the injury varies by age group; one study has suggested that falls on stairs or steps rank as the highest contributor to unintentional injury costs among older adults and also when summarizing across all age groups as a whole, while falls from the bed are responsible for the majority of injury costs in young children.⁵⁴ Additional research will help determine how such differences should be taken into consideration when planning interventions and prevention strategies.

Respiratory disease symptoms from conditions such as asthma, chronic obstructive pulmonary disease, and emphysema can be worsened by exposures that may be encountered in the home.^{55, 56} Asthma, in particular, places a considerable burden on affected children and their families, impacting a child's ability to play, learn, and sleep.⁵⁷ Asthma is one of the leading chronic childhood diseases in the United States and a contributor to childhood disability. In addition to biologic allergens and dampness due to moisture intrusion, other indoor air pollutants that may have an important effect on childhood asthma include: secondhand smoke, irritant and sensitizing chemicals and fumes, outdoor air pollution that infiltrates homes, and pollutants (e.g., carbon monoxide, nitrogen dioxide) generated by combustion devices, such as unvented space heaters or fireplaces.^{58, 59} According to the CDC, over 7 million children in the United States currently have asthma,⁶⁰ placing a considerable strain on the families of affected children.⁶¹ It is estimated that 39% of doctor-diagnosed asthma in children under 6 years of age would be prevented with the elimination of residential exposure sources (e.g., pet dander, secondhand smoke, and the use of gas stove or oven for heating the home).

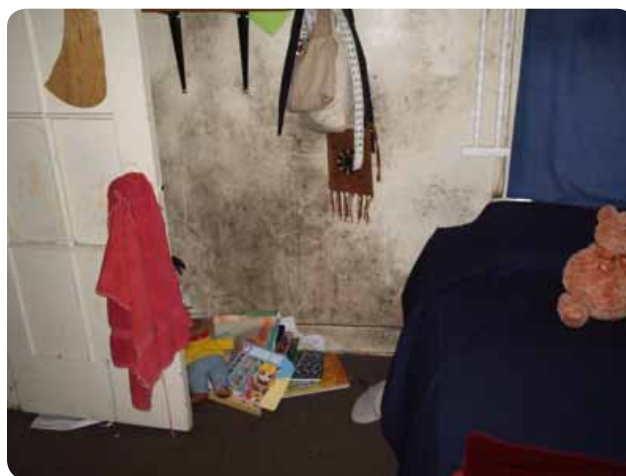
Exposure to lead-based paint hazards in housing remains a critical and important issue. Researchers have estimated that approximately 70 percent of lead poisoning cases are attributed to lead-based paint hazards in the home.⁶² Based on a considerable body of research showing consistent associations between relatively low blood lead level (BLL) and adverse health effects (including reduced IQ and behavioral problems),⁶³ the CDC has recently adopted a blood-lead reference value of 5 micrograms per deciliter ($\mu\text{g}/\text{dL}$) and the current estimate is that approximately 450,000 children have BLLs at or above this value.⁶⁴

Radon gas is an example of a naturally-occurring health risk that silently enters dwellings. Exposure to radon in the home is estimated to cause 21,000 lung cancer deaths annually.⁶⁵ EPA estimates that 1 in 15 homes have a radon level of 4 picoCuries per liter (pCi/L) of air or more in the living area of the home, the level at or above which EPA recommends fixing the home. While progress has been made to test and

fix homes with elevated radon levels, and build homes with radon-resistant features, the problem of exposure to indoor radon grows larger each year due to the growing housing stock.⁶⁶ In addition, it is estimated that less than 10% of new homes incorporate low-cost Radon Resistant New Construction practices, indicating that overall fewer U.S. homes are tested for or mitigated for radon exposure each day.⁶⁷

Although the health risks associated with homes are many and varied, the household hazards that contribute to those risks tend to be interrelated. For example, some research has suggested that excess moisture, poor indoor air quality, and high levels of contaminated dust are common root causes for residential health hazards. The HHWG believes that additional research is needed to determine whether addressing these deficiencies concurrently, rather than attempting to tackle each hazard individually would yield the greatest results in the most efficient, cost-effective manner.^{68, 69} For example, one study has suggested that mitigating uncontrolled moisture can alleviate conditions associated with allergies and asthma (mold and pests).⁷⁰

THE POTENTIAL COST BURDEN OF UNHEALTHY HOUSING



Some research has suggested that an at-risk home can have not only a physical toll on its inhabitants, such as unnecessary emergency room visits due to housing related injuries and illness, but it may also cost the nation billions of dollars annually in healthcare costs. Unintentional injury, lead poisoning, asthma, radon-induced lung cancer, as well as lost productivity in the labor force, are a few examples of effects from housing-based hazards that result in billions of dollars in costs.^{71, 72, 73, 74, 75, 76} One study estimated the total cost for unintentional injuries in the home was billions of dollars annually in direct and indirect costs, with almost half of that due to falls alone.^{77, 78} Another study estimated that the costs for asthma due to one root cause in the home – dampness and mold – were estimated at several billions of dollars in 2004.⁷⁹

The health and economic burdens from preventable hazards associated with the home are considerable, but recent evidence indicates that intervention-based programs intended to reduce in-home hazards may be a cost-effective approach to pursue. One study reported that nearly 30% of residential injuries in their randomized controlled trial with children were preventable with intervention.⁸⁰ Similarly, 70% of lead poisonings were estimated to be the result of dust exposures from lead-based paint in the home, which is also preventable.⁸¹ Other studies have reported similar findings, citing at-risk home characteristics that, if remedied, could lead to potential childhood medical cost savings, including reductions in the amount of pet dander and cockroach allergen, not using a stove or oven for home heating, and prevention of lead exposures.^{82, 83, 84, 85} These findings are further supported by studies on the return on investment for intervention programs. Reported findings demonstrate that intervention programs on lead poisoning prevention, reducing asthma triggers in the home, and the installation of smoke alarms, for example, are effective at producing a strong return for every dollar invested.^{86, 87, 88}

HEALTHY HOMES CONCEPT

For many of these problems, effective interventions and strategies to reduce exposures and risks are available.^{89, 90} For others, there is a need for increased research to inform policies and practices that minimize adverse health outcomes, especially among susceptible and vulnerable populations such as infants and children, immunocompromised individuals, and older Americans. With additional research, the HHWG hopes to support healthy housing for all people living in the United States regardless of age, race, ethnicity, income level, or geography.

The concept of a healthy home has evolved over decades, beginning with the American Public Health Association's (APHA's) seminal 1938 work, "Basic Principles of Healthful Housing,"⁹¹ and continuing with the CDC's Basic Housing Inspection Manual in 1976, which was updated by the publication of the "Healthy Housing Reference Manual" by CDC and HUD in 2006.⁹² The *Strategy* will continue the precedent set by those efforts and build upon "The Surgeon General's Call to Action to Promote Healthy Homes" that was published in 2009⁹³ to promote the concept of a healthy home. This *Strategy* defines a "healthy home" as one that provides the most basic needs for the promotion of physical, mental, and social health, regardless of the income status of the resident or location of the dwelling. **In other words, a healthy home is sited, designed, built, renovated, and maintained in ways that support the health and well-being of its residents.**

There are a number of basic, interrelated characteristics⁹⁴ that have been recently adopted by experts and practitioners for describing a healthy home. Understanding of the healthy homes concept is still evolving and these characteristics are not intended to be exhaustive; however, the

HHWG believes that in the vast majority of cases, homes that meet the following characteristics can provide a healthy environment for residents:

DRY

Damp houses provide a nurturing environment for mites, roaches, rodents, and molds, all of which are associated with asthma. In addition, moisture contributes to the sub-surface decay of building materials that leads to the deterioration of lead-based paints.^{95, 96, 97, 98}

CLEAN

Clean homes reduce pest infestation and exposures to contaminants.⁹⁹

PEST FREE

Exposure to pests such as roaches and rodents can trigger asthma in children.^{100, 101, 102}

SAFE

Injuries such as falls, burns, and poisonings occur most often in the home.¹⁰³

CONTAMINANT FREE

Levels of contaminants such as lead, radon, carbon monoxide, secondhand smoke, and other chemicals are often much higher indoors.^{104, 105}

WELL VENTILATED

An adequate ventilation rate in homes is important to reduce exposure to airborne contaminants.^{106, 107}

WELL MAINTAINED

Poorly maintained homes are at risk for moisture, pest problems, and injury hazards.¹⁰⁸

By looking at the home as a system, the healthy homes approach resolves conflicts among its core principles. For example, the healthy homes practice of integrated pest management reduces exposure to harmful pesticides (contaminant-free) and results in a pest-free home. Although not included in the original list above of seven healthy home characteristics,¹⁰⁹ the HHWG suggests that "thermally controlled" be included as another important characteristic of a healthy home. Populations that are most vulnerable to temperature extremes include young children, the elderly, and those with chronic medical conditions.¹¹⁰ Adequate insulation may have the added benefit of reducing utility costs for residents. Therefore, we recommend adding one additional characteristic to the seven mentioned above:

THERMALLY CONTROLLED

Houses that do not maintain adequate temperatures may place the safety of residents at increased risk from exposure to extreme cold or heat.¹¹¹

HEALTHY HOMES INTERVENTIONS ARE EFFECTIVE

Research has demonstrated improved health outcomes in some situations from policies promoting home-based interventions to mitigate certain health and safety hazards. For example, lead poisoning prevention policies have greatly reduced childhood lead exposure in the United States.¹¹² The increased use of smoke alarms in residences due to smoke alarm policy initiatives and legislation have been shown to reduce residential fatal fires and fire deaths.¹¹³

Housing interventions can be selected and implemented strategically to address multiple health and safety hazards.¹¹⁴ For example, sealing cracks around the foundation of a home may help to prevent moisture intrusion

and the movement of pests into the home, thereby potentially reducing the risks for adverse health outcomes such as asthma stemming from multiple exposure sources.

The Healthy Homes activities of the federal HHWG partners have contributed significantly to the understanding of housing conditions and their connection to residents' health, identified effective interventions and preventive measures, and demonstrated the health benefits of targeting interventions to reduce or eliminate health hazards in homes. Each agency has funded research and demonstration projects on healthy homes issues, consistent with their individual mandates, with positive results:

Cuyahoga County Board of Health and Bellingham, WA Opportunity Council

In Cuyahoga County, OH (Cuyahoga County Board of Health) and Bellingham, WA (Opportunity Council) grantees partnered with a weatherization program to provide an integrated approach to improve both energy efficiency and indoor environmental quality. These projects demonstrated the benefits of this integrated approach and the Department of Energy is now providing training and encouraging Weatherization Programs to adopt this “weatherization plus health” model.^{117, 118}



Boston Public Health Commission and the Harvard School of Public Health

Grant-funded projects to the Boston Public Health Commission and the Harvard School of Public Health included Integrated Pest Management (IPM) interventions and related cleaning and educational efforts in private and public housing, as well as limited case management and community health support from trained advocates. In pre-post analyses, significant reductions in a 2-week recall respiratory symptom score were observed, dropping from 2.6 to 1.5 on an 8-point scale ($p = 0.0002$). Reductions in the frequency of wheeze/cough, slowing down or stopping play, and waking at night were also noted.¹¹⁹



NY State Healthy Neighborhoods Program

A recent program evaluation of the NY State Healthy Neighborhoods Program used data collected between October 2007 and December 2009. During this period, the Program provided healthy homes services to over 36,000 residents in 13,120 dwellings in 12 counties across the state. Among the 22% of homes that were randomly reassessed at a follow-up visit, the analysis indicates significant improvements in tobacco control, fire safety, lead poisoning prevention, indoor air quality, and general environmental health and safety (e.g., pests, mold). For residents with asthma, there were significant improvements in the presence of environmental triggers, self-management, and short-term morbidity outcomes, including up to 3.5 fewer days with worsening asthma in a 3 month period.



Cuyahoga County and Case Western Reserve University

A randomized controlled trial in Cleveland, OH (Cuyahoga County and Case Western Reserve University) funded by HUD demonstrated significant improvement in asthma symptoms (including reduced acute care usage) among children following remediation focusing on mold and moisture problems in their homes. During the 12 months of follow-up, the control (non-intervention) group saw an almost 20% higher rate of emergency department visits or hospital in-patient visits than the intervention group. The difference between the two groups was 30% from 6 months post-randomization to the end of follow-up.¹¹⁵



HUD Healthy Homes and Neighborhood House

In Seattle, WA, a HUD Healthy Homes grant to non-profit “Neighborhood House” and partners was used to upgrade 35 green-built public housing units (built through HUD’s HOPE VI Program) to “Breathe Easy Homes” with special features to improve indoor air quality and reduce indoor asthma triggers.¹¹⁶ Children with asthma, who were moved into these homes, experienced a mean of 12.4 asthma symptom-free days per 2 week period after one year, compared with 8.6 asthma symptom-free days in the control group. Urgent asthma-related clinical visits in the previous 3 months decreased from 62% to 21% and the caretakers’ quality of life increased significantly. Significant reductions in exposures to mold, rodents, and moisture were reported in the Breathe Easy Homes.



Furthermore, the CDC's Task Force on Community Preventive Services (Task Force) conducted a review of published research of home-based interventions for asthma that was reported in the *Guide to Community Preventive Services*.¹²⁰ The following statement was included in the report:

"The Task Force recommends the use of home-based, multi-trigger, multi-component interventions with an environmental focus for children and adolescents with asthma on the basis for strong evidence for effectiveness in reducing symptom days, improving quality of life or symptom scores, and in reducing the number of school days missed."

The panels and the Task Force also conclude that further research is needed to strengthen the evidence base for many other housing interventions that may improve health for adults with asthma, but for which the evidence is insufficient.

In 2007, CDC and the National Center for Healthy Housing (a nonprofit based in Columbia, Maryland) convened panels of government and non-government experts to review the existing scientific literature and assess the effectiveness of interventions designed to reduce four key housing exposures that cause or exacerbate adverse health outcomes. The panels reviewed interventions designed to reduce exposure to interior biological agents, chemical agents, and structural deficiencies and assess community-level housing interventions.^{121, 122, 123, 124}

The expert panels identified several interventions that they believed had sufficient scientific evidence to help improve health outcomes, including:

- **Multi-faceted tailored asthma interventions**
- **Integrated Pest Management (allergen reduction)**
- **Integrated Pest Management (pesticide reduction)**
- **Moisture intrusion elimination**

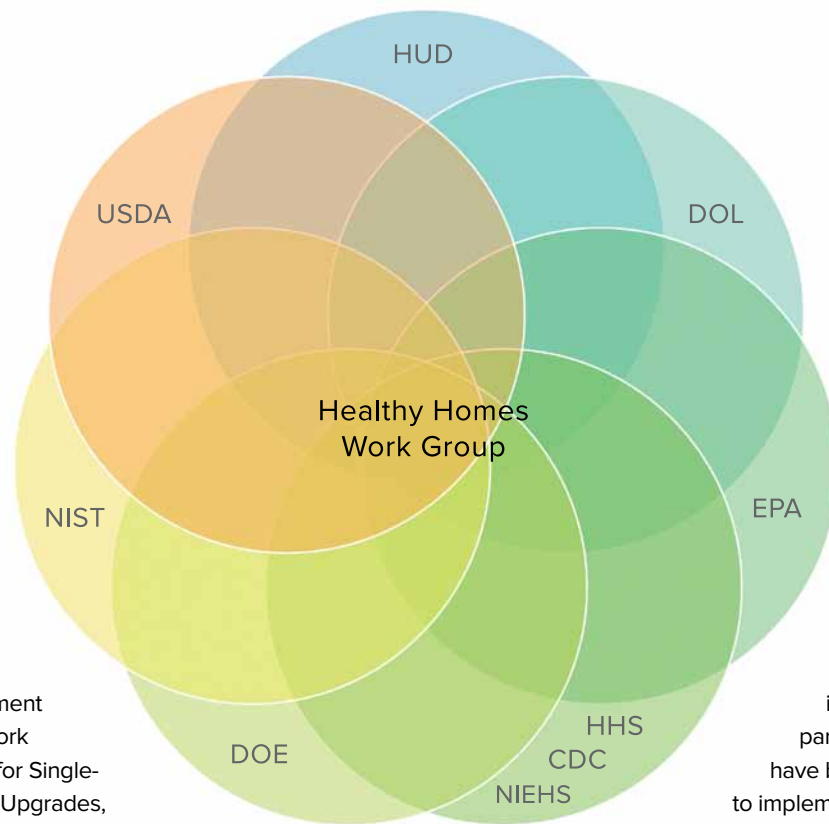
- **Radon in indoor air mitigation through active sub-slab depressurization**
- **Lead paint hazard control**
- **Training for small property manager personnel**
- **Guidelines related to drinking water for immune-compromised Individuals**
- **Installation of working smoke alarms**
- **Four-sided fencing to isolate swimming pools**
- **Pre-set safe temperature hot water heaters**

FEDERAL AGENCY COLLABORATION

Being able to braid federal programs in a coordinated, synergistic fashion is vital to implementing the *Strategy for Action*.

Agencies across the federal government have embraced the healthy housing model to promote safe, decent, and sanitary housing as a means for preventing diseases and injury, both as independent agencies (Appendix B provides a sample listing of recent healthy homes activities by agency) and collaboratively with other federal agencies. For example, HUD, CDC, and EPA have collaborated to support capacity building efforts needed to develop and sustain local programs that will evaluate and produce healthy homes. This collaboration has supported outreach and training through the USDA's National Institute of Food and Agriculture (NIFA).

An agreement between HUD and CDC resulted in the development of a "healthy homes practitioners" training course (<http://www.nchh.org/Training/HealthyHomesTrainingCenter/TrainingCourses/Essentials.aspx>) for health and housing professionals and a training network to deliver the training throughout the country. In addition, EPA and HUD have supported a national clearinghouse of information on residential lead-based paint issues, accessible through the National Lead Information Center (1-800-424-LEAD and <http://www.epa.gov/lead/nlic.html>). Hearing- or speech- challenged individuals may access the telephone number through TTY by calling the toll-free Federal Relay Service at 800-877-8339). CDC and HUD also provide fiscal and technical support to state and local entities to advance healthy homes within communities.



EPA and DOE have coordinated closely in developing Healthy Indoor Environment Protocols for Home Energy Upgrades in existing homes, a complimentary document to DOE's Standard Work Specifications (SWS) for Single-Family Home Energy Upgrades, and in launching the successful Energy STAR and Indoor Air PLUS programs for new home construction. EPA and DOE are also coordinating on the development of Healthy Indoor Environment Protocols for Multifamily Energy Upgrades that will be complimentary to DOE's SWS for Multifamily Energy Upgrades. The SWS identify specifications to promote weatherization work that is effective, durable, and safe. The SWSs are being developed as resources for the weatherization network under DOE's Weatherization Assistance Program, and are part of an effort to engage the home performance industry in developing a suite of resources that include work quality specifications, training program accreditation, job task analyses, and certifications for workers.

HUD has also collaborated with DOE to support research on indoor air quality and in the development of a Healthy Homes Electronic Assessment tool that can be used as a standalone assessment or as part of an energy audit for home energy upgrades.

The first two national Healthy Homes Conferences, held in September 2008 and June 2011, sponsored by HUD, CDC, EPA, and the USDA, helped to focus national attention on the importance of safe, healthy, and efficient homes for America's families.

In June 2011, at the National Healthy Homes Conference in Denver, Colorado, senior leaders from EPA and HUD announced the release of the Federal Radon Action Plan

(http://www.epa.gov/radon/pdfs/Federal_Radon_Action_Plan.pdf) to reduce radon exposure in housing the federal government owns or influences. There are nine participating agencies that have been working together to implement the Plan. The federal partners recently released a Federal Radon Action Plan Scorecard, a tool designed to display the current status of federal activity.

Although staff from the various agencies have successfully worked together informally to link and collaborate on their individual programs, as demonstrated above, a formal structure or organization connecting the activities has been lacking. Furthermore, no individual agency has the necessary expertise or capacity to implement a national healthy homes agenda. In response, federal agencies with a key interest in healthy homes joined to form the federal Healthy Homes Work Group (HHWG) in 2009. The HHWG includes HUD; the CDC, the National Institute of Environmental Health Sciences (NIEHS), and other organizations within the Department of Health and Human Services (HHS); the EPA; the Department of Energy (DOE); the Department of Agriculture (USDA); the Department of Labor (DOL); and the National Institute of Standards and Technology (NIST).

The HHWG's overall goal is to promote nationwide access to safe, affordable, and healthy homes. To this end, the HHWG works to promote enhancements and improvements of existing programs; identify new opportunities; and, ensure that programs are operating effectively and efficiently. It also links program activities to the broader mission of each individual agency and encourages the integration of healthy homes concepts into federal programs.

ADVANCING HEALTHY HOUSING

This report, *Advancing Healthy Housing A Strategy for Action*, reflects the HHWG members' commitment to unifying federal action to advance healthy housing through a comprehensive approach. With additional research, the goal is to craft a "healthy homes model," as one that our Nation can adopt to achieve reductions in healthcare costs to individuals and society.

The *Strategy* is being published to focus attention on the public health impact of housing and to further the national dialogue on how we can promote healthy homes in the United States.

The *Strategy* urges a dynamic and coordinated effort to improve housing factors that affect health and outlines a series of mutually supportive and necessary coordinated actions that may accomplish the vision of achieving substantial reductions in the number of American homes with residential health and safety hazards. It encourages federal agencies to be proactive. The *Strategy* also invites and encourages participation from many sectors to join in the discussion about healthy homes issues; to make informed, shared, and compassionate decisions; and to develop imaginative and realistic solutions that will help ensure safe, healthy, affordable, and accessible homes.

The *Strategy* advances the healthy homes model by promoting a consensus-based conceptual model of healthy housing. As mentioned previously, a healthy home is sited, designed, built, renovated, and maintained in ways that support the health and well-being of its residents.¹²⁵ The healthy homes conceptual model will include the essential elements of what the HHWG believes a home should have to meet the health needs of its residents.

The *Strategy* will support actions that federal agencies can take through their respective programs, in addition to initiatives resulting from interagency coordination that would contribute to mainstreaming the healthy homes model and reducing the number of American homes with residential health and safety hazards.

FEDERAL STRATEGY FOR ACTION ON HEALTHY HOUSING

The HHWG challenged itself to:

- Establish a comprehensive federal strategy to promote healthy homes;
- Promote comprehensive approaches to controlling and preventing major housing-related exposures and hazards;
- Identify and eliminate barriers that impede collaboration and complicate assisting those in need of federal technical assistance and/or funding; and
- Collaborate with key federal and non-federal stakeholders to advance a healthy homes implementation agenda at the community level.

This *Strategy for Action* outlines the Goals and priorities for healthy housing as agreed upon by the HHWG for the next three to five years. It is a first step in organizing the work of the federal agencies committed to making healthy homes available to all Americans, thus serving both as a roadmap for coordinated activities and as a visible statement of the agencies' commitments to carry out specific activities.

This *Strategy* aims to leverage concurrent and related initiatives, including:

- The Middle Class Task Force's Recovery through Retrofit initiative;
- HUD's, CDC's, and USDA's Healthy Homes programs;
- EPA's lead, pesticides, radon, asthma, and healthy and green partnership programs;
- EPA's, HUD's and Department of Transportation's (DOT's) Sustainable Communities Partnership;
- HUD's and HHS' Partnership for Livable Homes and Communities;

- DOE's Weatherization Assistance Program and Weatherization Plus Health initiative;
- DOL's efforts in training workers for, and connecting workers to, jobs in a clean energy economy and green construction;
- EPA's and DOE's ENERGY STAR program; and,
- The President's Task Force on Environmental Health Risks and Safety Risks to Children.

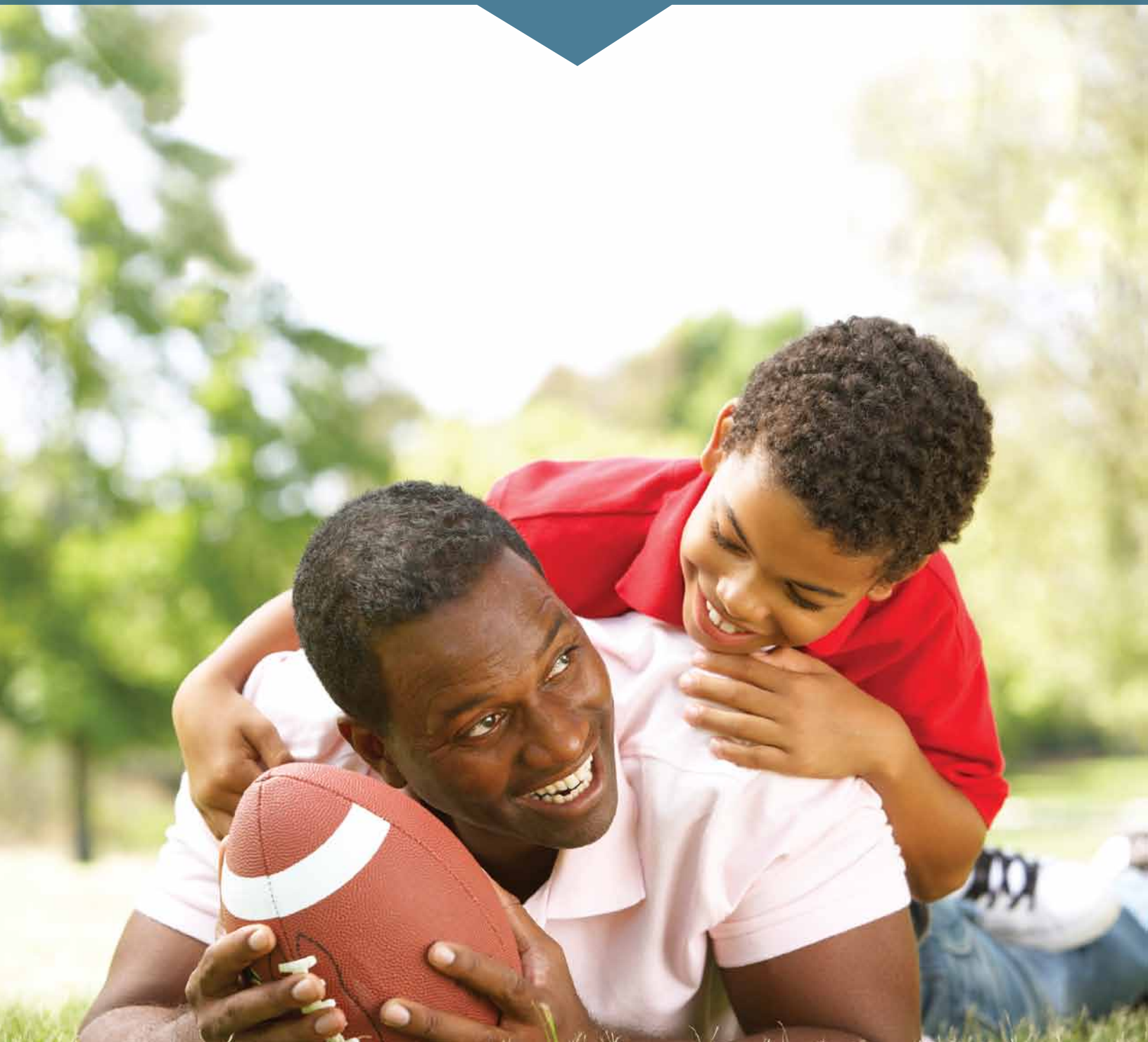
Projects to be undertaken by HHWG member agencies to implement the *Strategy* will be consistent with applicable legal authorities and subject to the availability of appropriations. The *Strategy* will evolve in response to ongoing

efforts, the experience of partners, and advances in research. As an initial step in advancing the *Strategy*, the HHWG will create an implementation plan, which will prioritize action items, define roles and responsibilities, and establish timelines. As the *Strategy* is implemented, the scope and performance measures for priority actions and projects may be realigned as efficiencies and opportunities for further improvement are identified, within financial and staffing limitations.

The *Strategy* is a formalization of ongoing activities to organize the work of federal agencies. It strives to better coordinate federal activities and ultimately enable synergistic improvements in the delivery of services related to healthy homes. ▲

THE STRATEGY IS A FORMALIZATION OF ONGOING ACTIVITIES TO ORGANIZE THE WORK OF FEDERAL AGENCIES. IT STRIVES TO BETTER COORDINATE FEDERAL ACTIVITIES AND ULTIMATELY ENABLE SYNERGISTIC IMPROVEMENTS IN THE DELIVERY OF SERVICES RELATED TO HEALTHY HOMES.

The *Strategy for Action* is driven by an overarching vision statement from which the priority actions and agency collaborative projects are derived.



GOALS

Advancing Healthy Housing

The Strategy for Action is driven by an overarching vision statement from which the priority actions and agency collaborative projects are derived.

VISION: Substantially reduce the number of American homes with residential health and safety hazards.^{126, 127}

The *Strategy for Action* advances five goals to achieve this vision:

- GOAL 1:** Establish Healthy Homes Recommendations
- GOAL 2:** Encourage Adoption of Healthy Homes Recommendations
- GOAL 3:** Create and Support Training and Workforce Development to Address Health Hazards in Housing
- GOAL 4:** Educate the Public about Healthy Homes
- GOAL 5:** Support Research that Informs and Advances Healthy Housing in a Cost-Effective Manner

To track progress in achieving these goals and to coordinate activities, the federal partners will develop a more detailed implementation plan that will prioritize desired actions and key performance indicators (KPI) necessary to track progress for each of the goals. The HHWG will ensure that the priority actions

and performance indicators adopted are measurable at a national level and are consistent with related national goals, in particular those that were recently adopted as part of Healthy People 2020 (see Appendix D for a list of Healthy People 2020 goals that are particularly relevant to the *Strategy*). Below are examples of key performance indicators that could be used for tracking progress in projects that the HHWG believes can help achieve the five *Strategy* goals post implementation.

EXAMPLES OF KEY PERFORMANCE INDICATORS:

- Reduction in the number of children who sustain fatal and non-fatal injuries in the home.
- Reduction in the average blood-lead level in children under the age of six and the number of children that have elevated blood-lead levels.
- Improved asthma control among children through multifaceted interventions that include mitigation of indoor asthma triggers.
- Increase in the number and percentage of new and existing homes with radon reducing features, especially in high radon areas.
- Increase in the percentage of homes with working carbon monoxide (CO) and smoke alarms.
- Reduction in the number of homes with moderate or severe physical hazards as determined by the American Housing Survey.

GOAL 1

Establish Healthy Homes Recommendations



In collaboration with partners and external stakeholders, the federal HHWG will develop consensus on the basic concept of a healthy home, including the definition of criteria to describe a healthy home.

These criteria will build off of the eight approaches described in the **Introduction** and focus on health, regardless of the income-status of the residents and workers, or location of the dwelling. Agreement on common criteria for healthy homes will help harmonize communications and program coordination, as well as establish effective partnerships.

The healthy homes criteria will be intended as voluntary recommendations to inform activities such as the design of new homes, and the maintenance, assessment, repair, and renovation of existing homes. The criteria will build upon and/or incorporate current codes, regulations and recognized consensus standards, and voluntary program specifications, such as Indoor airPLUS¹²⁹, and not create

new requirements and regulations. The focus of the HHWG is on the development and promotion of performance-based criteria as opposed to contaminant-specific exposure thresholds. For example, Indoor airPLUS specifications includes a whole house ventilation standard that was developed through a consensus organization and the use of low emission materials (i.e., wood products, paint) rather than developing concentration-based thresholds for individual volatile organic compounds.¹³⁰

The HHWG's goal is for the healthy homes recommendations to be considered by federal agencies, tribal governments, state and local governments, and non-governmental organizations, and sought after for inclusion in current green building and product certifications.



The healthy homes criteria will be supplemented as appropriate through development of targeted recommendations and implementation tools (e.g., objective assessment protocols and implementation tools for assessing home health hazards); model codes for adoption and implementation into local communities; and guidelines for federal and market-driven programs (such as the U.S. Green Building Council's Leadership in Energy and Environmental Design (USGBC's LEED) Certification program [www.usgbc.org/LEED], DOE's Guidelines for Home Energy Professionals project [http://www1.eere.energy.gov/wip/retrofit_guidelines.html], and the Enterprise Foundation's *Green Communities* initiative [www.greencommunitiesonline.org/]). The intent will be to encourage the inclusion of health and safety in the planning and development phases, so that positive and negative impacts are identified and addressed in a timely fashion as housing construction methods and materials evolve.

For example, USGBC's LEED program is a green building certification system, providing third-party verification that a building or community was designed and built using strategies "aimed at improving performance across all the metrics that matter most: energy savings, water efficiency, carbon dioxide emissions reduction, improved indoor environmental quality, and stewardship of resources and sensitivity to their impacts." Nevertheless, LEED and similar certification programs often emphasize energy concerns. Wider adoption of Indoor airPLUS qualifications in the LEED for Homes Rating System is one example of advancing healthy homes criteria through existing programs.

PRIORITY ACTION

1.1 Establish Recommendations for Assessing Health and Safety Hazards

A home should support the health and well-being of its residents, and protect against harm caused by health and

safety deficiencies. Common assessment criteria can help people understand the definitions and terms associated with achieving this goal.

The HHWG will support a process to establish a set of clear and objective consensus recommendations for assessment tools that identify health and safety hazards for different types of housing, and housing in different climate zones. These will be voluntary. No regulatory requirements or action will be associated with them. These consensus recommendations could potentially be used by voluntary standards developers, code inspectors, energy auditors, energy raters, home inspectors, community health nurses, or other workers whose jobs involve identifying and, potentially, remediating health and safety hazards in housing. The HHWG's goal is that these voluntary recommendations would be considered by federal agencies, tribal governments, state and local governments, and non-governmental organizations. One example is EPA's Healthy Indoor Environment Protocols for Home Energy Upgrades,¹³¹ developed in collaboration with DOE's Guidelines for Home Energy Professionals Project as detailed under Federal Interagency Collaboration above.¹³²

In addition to these criteria recommendations, stakeholders may need implementation tools, including sample assessment forms, quality control measures, and portable software tools. The HHWG will inventory and share appropriate guidance and tools to assist healthy homes stakeholders, and where appropriate participate in the development of new implementation tools, such as HUD's Healthy Homes Rating System that is currently being piloted to assess the risk and likelihood of harm from 29 hazards found in the home (see Appendix C for more information) and the Healthy Homes Electronic Assessment tool supported by HUD and DOE. These tools can help simplify the comparison of housing quality between communities and facilitate improvement in the general quality of housing in our communities. ▲

**A HOME SHOULD SUPPORT THE HEALTH AND WELL-BEING OF ITS RESIDENTS,
AND PROTECT AGAINST HARM CAUSED BY HEALTH AND SAFETY DEFICIENCIES.**

GOAL 2

Encourage Adoption of Healthy Homes Recommendations



One of the keys to increasing the nation's stock of healthy homes is to encourage the incorporation of the healthy homes recommendations developed in Goal 1 into ongoing public and private sector housing practices, programs, and delivery systems.

Several federal programs currently address housing and environmental exposures and hazards, as well as provide federal funding to create and support affordable and energy efficient housing. Each of these programs represents an opportunity for the HHWG to encourage incorporation of healthy homes recommendations in order to expand the reach and impact of healthy homes.

One clear opportunity involves working with existing energy and health programs to assist them in addressing a variety of healthy homes issues, including unintentional injuries and poisonings, exposure to contaminants (such as carbon monoxide, mold, lead, radon, secondhand smoke and pest allergens), inadequate ventilation, moisture and condensation problems, general safety issues, and thermal comfort.

PRIORITY ACTIONS

2.1 Obtain Commitments from Agencies to Advance Healthy Housing

Federal agency representatives from the HHWG will work with senior management in their respective agencies to champion a Healthy Homes Initiative through communications with all employees and by including healthy homes in key agency planning, budget preparation, demonstration pilots, and management activities, as appropriate.

HHWG participating agencies will identify the best means to emphasize healthy homes concepts into the work of their agencies. Participating agencies will build on prior

successful activities related to the promotion of healthy homes environments. As noted previously, the HHWG will work with the agencies' management to establish performance-based indicators related to annual and long-term healthy homes activities.

2.1.1 Leverage Current Federal Programs and Activities through Intra-agency Coordination and Inter-agency Agreements

The HHWG agency representatives will identify means for their agencies to align their activities to promote the healthy homes model into ongoing programs and activities, address barriers and disincentives, support coordinated delivery of healthy housing services, and conduct program evaluations. These initial arrangements and agreements could also be used to support program evaluations. One example includes encouraging partnerships between current CDC-sponsored Comprehensive Cancer Control Programs and EPA-sponsored Radon Programs in States Tribes and Territories. New partnerships have allowed programs to leverage resources and cooperatively address radon exposure through education, testing, and non-government policy efforts. Goal 5.3 discusses additional program evaluation efforts to be used to identify effective healthy homes practices.

2.1.2 Support Pilot Projects to Incorporate Healthy Homes Concepts into Existing Federal Programs

The HHWG will encourage pilot projects demonstrating commitment and feasibility to add appropriate healthy homes elements to existing federal programs, within current statutory authorities and existing funding streams.

A number of existing non-federal housing initiatives and programs already address housing hazards and have objectives that align well with the Healthy Homes Initiative. Examples include the National Center for Healthy Housing activities, including their widespread training network, the Housing Assistance Council's Green Building/Healthy Homes Initiative, and the Coalition to End Childhood Lead Poisoning's Green and Healthy Homes Initiative. By incorporating healthy homes concepts into programs that do not currently integrate these concepts into their programs, these and other existing initiatives and programs can complement and advance the objectives of the HHWG by efficiently and effectively reaching more housing units.

2.1.3 Strategically Align Healthy Homes with Green Housing Efforts

The HHWG will leverage existing green housing programs at the national level (e.g., USGBC's LEED for Homes and Enterprise Green Communities programs) and at the state

and local levels (e.g., Washington's BuiltGreen, California's GreenPoint Rated, and Austin's GreenBuilder Programs) to create opportunities to integrate the healthy homes model into these programs. Examples of early successes include the inclusion of the EPA Indoor airPLUS program as an optional compliance pathway in the USGBC LEED for Homes program, and elements of the program have been incorporated into the National Association of Home Builders Green Building Certification program.¹³³

EPA has also developed Healthy Indoor Environment Protocols for Home Energy Upgrades, in conjunction with the DOE Guidelines for Home Energy Professionals project, for voluntary adoption by weatherization assistance programs, federally funded housing programs, private sector home performance contracting organizations, and others working on residential upgrade or remodeling efforts. Together, the complementary documents may promote occupant and worker health and safety and with effective outreach, may help drive consumer demand for integrated healthy homes and energy efficiency (i.e., green) retrofit services.

2.1.4 Strategically Align Healthy Homes with Efforts to Expand Jobs that Improve Housing

The HHWG will leverage existing or newly developed green building or energy efficiency training to incorporate modules addressing healthy homes and workplace activities. In many cases, healthy homes training does not need to be presented as a separate module or training program. It may be more effective to integrate healthy homes concepts into existing training programs and encourage adoption of training as part of practices used by home inspectors, weatherization staff, home performance contractors, and other energy and healthy homes professionals.

2.1.5 Strategically Target Healthy Homes Activities to Support the Needs of Underserved Populations

The HHWG will work with state and local governments, and non-government organizations to actively promote the implementation of healthy homes practices in underserved communities. Furthermore, the HHWG will promote job training and job opportunities for local workers to weatherize and retrofit neighborhood homes using related practices.

For example, specific actions to address the severe problems of housing within American Indian and Alaska Native communities might include incorporating healthy homes criteria into HUD programs targeting American Indian and Alaska Native individuals and communities (e.g., block grants and loan guarantees), as well as the Department of

Interior's Bureau of Indian Affairs' Housing Improvement Program and programs offered through the Indian Health Service at HHS.

2.1.6 Acknowledge and incorporate work promoting approaches that support health equality

Underserved and under-resourced communities and populations are often at higher risk for adverse environmental, social, and economic impact on their efforts to create healthy homes. Strategies and actions recommended in this plan should be community centered/guided, culturally tailored, and prevent unintended negative consequences. All partners should try to assure that supportive health equality approaches are a consistent and integral part of the planning and action processes.

2.2 Strengthen Federal Efforts to Reduce Public Health Risks in Housing

The public health impacts from housing-related issues are widespread and comprehensive. The HHWG believes that a coordinated and collaborative effort is the most efficient and effective approach to addressing these problems. Examples of coordinated initiatives that could be undertaken to address these needs include:

- Research to improve understanding of the intervention effectiveness for unintentional injuries in the home (e.g., falls, poisonings, fires, etc.);
- Endorsement and engagement in activities that support implementation of the Federal Radon Action Plan;
- Support for the implementation of interagency initiatives aimed at reducing exposure to secondhand smoke, particularly in the home;
- Encourage implementation of Integrated Pest Management practices in housing;
- Reduce risks related to lead paint and other housing-related hazards through regulations, enforcement and other mechanisms, under statutes such as the Residential Lead Paint Hazard Reduction Act;
- Develop and coordinate the delivery of healthy homes outreach that addresses issues of particular concern to residents of rural communities, including the importance of ensuring the quality of well water and ensuring the integrity of septic systems.

2.3 Explore Ways to Leverage Funding across Federal and Non-Federal Programs

Under HUD's Lead-Based Paint Hazard Control Grant Program, authorized by Section 1011 of the Residential Lead-Based Paint Hazard Reduction Act of 1992 (Title X of the

Housing and Community Development Act of 1992, Public Law 102-550), funds must be used primarily to reduce lead-based paint hazards. Starting in 2009, under HUD's Healthy Homes Initiative, applicants were able to request funding to assist in the promotion and development of programs to concurrently address multiple housing-related health hazards in conjunction with lead hazard control interventions. This flexibility has allowed programs to address housing-related health hazards where previously they were limited to addressing just lead-based paint hazards.

Efficiencies may also be gained by exploring the possibility of greater standardization of eligibility criteria between the housing programs of different federal agencies. For example, HUD's Lead Hazard Control Program funding uses area median income (AMI) as a threshold for calculating eligibility of participants, whereas DOE's Weatherization Assistance Program uses the federal poverty level for eligibility. Exploring the ability of agencies' housing programs to recognize other agencies' eligibility criteria could result in reduced enrollment barriers and help provide better integrated housing interventions (e.g., both improved energy efficiency and mitigation of health and safety hazards).

Through EPA mechanisms, increased flexibility might be attained by highlighting healthy homes as a fundable activity in existing grant programs focused on community-based environmental health. At HUD, this could include identifying and highlighting best practices for the use of Community Development Block Grant funds (distributed on a formula basis to state and local governments) to fund healthy homes rehabilitation activities.

In addition, the HHWG will explore opportunities for coordinating various funding sources to increase opportunities for healthy homes activities to be included in projects that receive federal assistance. For example, the Green and Healthy Homes Initiative (GHHI) – a pilot HUD partnership with CDC and the National Coalition to End Childhood Lead Poisoning – seeks to address substandard housing by effectively braiding categorically separate (both in terms of funding streams and responsible government agencies) but mission-related programs by bringing together several programs across multiple government agencies, state and local governments, and the private sector, to pool resources and make integrated improvements to a home. Rather than making smaller separate investments, GHHI is able to address health, safety, and energy inefficiency problems in the home simultaneously.

Finding creative solutions to allow flexibility across federal funding programs that have differing eligibility requirements may be helpful to the work ahead. ▲



GOAL 3

Create and Support Training and Workforce Development to Address Health Hazards



The HHWG believes that a professionally trained, qualified, and diverse work force is essential to achieving the vision of this *Strategy*.

Supporting strong state, tribal, and local collaborations and developing partnerships with public, private, and philanthropic entities may help to sustain a cadre of trained experts that deliver healthy homes services.

Federal leadership can be important in supporting and coordinating high quality training opportunities, and for ensuring accessibility of courses, tools, and resources. Federal leadership can also be helpful in building state, local, and tribal capacity and supportive to partnerships to advance healthy housing.

PRIORITY ACTIONS

3.1 Support Enhanced Healthy Homes Training and Workforce Development

The HHWG seeks to increase local and tribal capacity by encouraging the expansion of current healthy homes training efforts to reach a greater number of communities, and enhance healthy homes training curricula and tools to address audiences not served by existing training courses. These courses will address Occupational Safety and Health Administration (OSHA) components pertaining to healthy homes building projects, as well as other contaminant-specific training components required by regulation (i.e., lead in construction, 29 CFR 1926.62).

SUPPORTING STRONG STATE, TRIBAL, AND LOCAL COLLABORATIONS AND DEVELOPING PARTNERSHIPS WITH PUBLIC, PRIVATE, AND PHILANTHROPIC ENTITIES MAY HELP TO SUSTAIN A CADRE OF TRAINED EXPERTS THAT DELIVER HEALTHY HOMES SERVICES.

In addition, the HHWG will identify work force development opportunities by working with relevant labor unions and registered apprenticeship programs whenever possible.

3.1.1 Address Gaps in Training Content and Opportunities to Ensure Quality

To foster greater capacity to advance healthy homes at the local level, the HHWG will work with stakeholder organizations to assess existing training programs, determine what additional training could be beneficial, and identify where existing training can be refined, enhanced, or expanded. The HHWG will promote education on the healthy homes model and concepts in technical schools, community colleges, registered apprenticeship programs, community-based organizations, among public health and health care providers, and through the USDA land-grant universities' Cooperative Extension System (CES). As an example, HUD and USDA (National Institute of Food and Agriculture) have partnered to deliver outreach education programs that focus on ways to address housing deficiencies and reduce risks to prevent childhood diseases and injuries from housing-related hazards.

The HHWG will work to encourage the addition of healthy homes and workplaces components into training curricula for energy efficiency and building professionals.

3.1.2 Support Greater Coordination of Training Programs to Maximize Their Impact and Increase Accessibility

The HHWG will work to identify how it can help increase coordination across healthy homes training programs to maximize efficiency; reduce duplication; enhance cross-training for the workforce; extend training into areas and to individuals that are not currently served or are underserved; promote quality and consistency in training content; and share advances in knowledge and industry practices. The HHWG will support the development and delivery of training by the National Healthy Homes Training Center and its network of training partners that currently includes some Weatherization Training Centers (<http://www.waptac.org/Training-Resources/WAP-Training-Centers.aspx>) who offer technical assistance and training to individuals, contractors, state and local health and housing departments, nonprofit organizations, insurance companies, real estate developers, and others interested in methods for lead hazard control, IPM, radon education, and other healthy housing issues.

The HHWG will identify means to expand training activities by leveraging funding for course delivery and supporting development of on-line and distance learning programs, webinars, DVDs, and other innovative training tools that complement classroom training at convenient times and in accessible locations.



3.2 Accelerate Replication of Successful Local Healthy Housing Programs

There are existing local programs that are achieving success in terms of improving housing stock, equipping the local workforce, and improving environmental and health outcomes. The systematic capture and acceleration of the adoption of these successful programs is crucial for ensuring widespread use of the methods.

3.2.1 Identify Successful Local Program Models

The “Healthy Homes Program Guidance Manual,” recently developed by HUD in collaboration with federal partners and practitioners, captures several of these successful programs and incorporates their approaches into a comprehensive guidance document.

The HHWG will examine how it can build upon this effort to include replicable strategies for overcoming challenges in building sustainable local efforts (e.g., lead poisoning prevention programs and asthma intervention programs that have expanded to incorporate a healthy homes approach).

The HHWG will also seek to build upon successful public-private partnerships, such as programs funded by HUD, EPA, and DOE that have successfully partnered with other organizations to leverage their resources and otherwise optimize the investment of federal resources. Potential partnerships with the philanthropic community; community-based organizations; the workforce investment; and community college systems may also offer opportunities to capture successful local models and support their replication.

3.2.2 Identify Ways to Widely Communicate These Models to Community Leaders

The HHWG will explore ways to effectively share successful approaches, and make field tested tools and resources widely available. This approach has been used by the EPA to successfully engage a national network of community-based asthma programs to rapidly spread successful strategies and share tools and resources (www.AsthmaCommunityNetwork.org).

These outreach opportunities can be broadly disseminated using a variety of mechanisms (e.g., national conferences, webinars, web postings, and other technologies) to communicate the healthy housing model.

3.3 Encourage Pilots or Demonstration Programs that Advance Healthy Housing

3.3.1 Establish Mechanisms for Facilitating Joint Federal Pilot Projects

The HHWG will highlight opportunities for bringing the collective resources of several agencies together in supporting pilot projects. The HHWG will similarly highlight interagency agreements, memoranda of understanding, and other administrative and funding mechanisms to promote enhanced coordination in communities where more than one HHWG participating agency has invested resources.

Pilot or demonstration programs can be crucial in evaluating healthy homes concepts, testing various intervention models, providing experience for adjusting on-the-ground approaches as necessary, and addressing emerging issues. The HHWG will encourage descriptions of the mechanisms for publicizing the impacts of programs funded through demonstration and pilot programs. ▲

PILOT OR DEMONSTRATION PROGRAMS CAN BE CRUCIAL IN EVALUATING HEALTHY HOMES CONCEPTS, TESTING VARIOUS INTERVENTION MODELS, PROVIDING EXPERIENCE FOR ADJUSTING ON-THE-GROUND APPROACHES.

GOAL 4**Educate the Public about Healthy Homes**

Achieving the vision of healthier, more sustainable housing in America will be a long-term effort requiring the successful engagement of the occupants of homes who play a significant role in transforming and maintaining their homes and their health for the better.

To support broad adoption of healthy homes concepts and practices, the HHWG will need to connect with the public using an approach that makes healthy homes issues personally relevant to the target population. We will need to offer answers to such questions as: Why should I care about houses that are healthy? How will housing changes impact my family in a positive way?

The HHWG will explore opportunities to develop and implement a campaign, within the limits of available resources and authority, for delivering communications and educational outreach. The HHWG will develop coordinated communication materials to provide the context that links health and the home environment. The focus of these efforts will be to broaden the audience on the healthy

homes model, collaborate with a diverse set of partners, and to ensure the public and others have consistent and accurate information on housing-related health hazards.

The HHWG will promote the use of social sciences to conduct further research and to better understand the public's attitudes and beliefs, thereby allowing the HHWG to provide meaningful and tailored educational tools, interventions, resources, and incentives that address the public's needs and values. A clear and concise communications strategy will be the foundation for implementing a national healthy homes outreach campaign. Public education must be an on-going effort. New ways of thinking and living are more likely to be adopted if they are communicated widely from many sources, and are demonstrated regularly through a community of practice.

The HHWG will work to develop an outreach strategy based on rigorous research that defines the vision and a communications and marketing methodology to advance healthy homes. An ongoing implementation plan will also be developed and evaluated by the HHWG, and finally executed by each participating agency after their evaluation and adoption. The goal will be to merge these overarching plans with ongoing outreach performed by each agency, as well as communication activities undertaken through interagency initiatives. Both the communications strategy and the implementation plan will draw on formative research and community-based social engagement principles to communicate consistent HHWG messaging about what is a healthy home, along with actionable steps and resources to make a home healthy. The HHWG will leverage a wide range of opportunities to communicate and advance the importance of healthy homes to new audiences throughout a large and diverse housing stock. The HHWG will leverage other interagency efforts, such as the President's Task Force on Environmental Health Risks and Safety Risks to Children, to help anticipate and frame issues related to healthy homes.

PRIORITY ACTIONS

4.1 Develop a Communications Strategy on Healthy Homes

In order to refine and coordinate messages, highlight the interagency collaboration, and effectively communicate the healthy homes concept to the public and potential partners, the HHWG will explore opportunities to develop and implement a campaign, within the limits of available resources and authority, for delivering communications and educational outreach. The HHWG will develop coordinated communication materials to provide the context that links health and the home environment. A coherent and coordinated campaign would enable HHWG to provide consistent and accurate information to the public on the concept of a healthy home and how to avoid and mitigate exposure to various hazards in the home such as unintentional injuries (e.g., falls, poisonings, burns), radon, lead, mold, and formaldehyde. These campaign messages will be delivered through a variety of traditional and new media. Distribution vehicles could include mass media, public service announcements, contact centers, different components of social media, websites, printed materials, exhibits, and through other channels. Before disseminating any of these campaign messages, the HHWG will ensure that the message is based on rigorous evidence-based research.

4.1.1 Develop and Implement a Federal Healthy Homes Website

The HHWG will develop and launch a federal healthy homes website to serve as a core healthy homes communication vehicle. As a freestanding platform for diverse information relating to healthy homes, the site will be developed in phases. The website will be an easy-to-use, one-stop-shop for actionable healthy homes information and tools. Initially consumer-focused, the website will repackage existing information from HHWG members, as well as offer new content developed for the website. Metrics on the usability of the website will be a key feature. Goals are to increase awareness of “healthy homes,” promote health literacy, focus on prevention, and translate research into action by incorporating health education and best practices. The website will link to other federally supported healthy homes websites, such as DOE's Weatherization Plus Health website, www.wxplushealth.org.

Providing actionable information on a single and easily navigable website will promote the adoption and mainstreaming of the eight approaches to healthy homes.

4.1.2 Leverage Dissemination of Key Healthy Homes Messages throughout Agency Headquarters Program Offices and Field and Regional Networks

The HHWG will integrate and communicate core healthy homes messages through each agency's headquarters and affiliated field networks. These networks include but are not limited to headquarters, regional, and field personnel; healthy homes related grantees and contractors; community-based organizations; and others. Agencies will identify individuals in regional and field offices to facilitate interagency collaboration; provide technical advice and guidance; and serve as local resources for on-the-ground implementation of healthy homes pilot projects. Regional coordinators will help grantees and other entities involved in healthy homes-related efforts tap into the full range of technical guidance, healthy home materials, and support services available from members of the HHWG so that the federal government presents a united voice and message on healthy homes issues.

4.1.3 Communicate Key Healthy Homes Messages at Targeted Conferences and Exhibits

In addition to the National Healthy Homes Conference held every 2-3 years, the HHWG will compile a list of relevant conferences and identify suitable methods for communicating key healthy homes messages to help raise awareness with the public and various technical and/or stakeholder groups about healthy homes. These venues offer opportunities for educational sessions, keynote addresses, and interactions at the exhibit booths to help promote healthy homes. The HHWG's conference and exhibit effort includes participation at a wide range of venues for consumers and practitioners. These include the insurance industry, realtors, architects, home builders, public health professionals, etc.

4.2 Increase Public Awareness of the Healthy Homes Model

Currently, there is a lack of public awareness about many potential residential hazards, despite periodic news coverage about individual events related to exposures and hazards. Educating consumers on the concept of healthy homes may contribute to greater public awareness. The HHWG's efforts to increase public awareness will include the following activities:

4.2.1 Explore Labeling or Certification for Healthy Homes

The HHWG will explore how including additional healthy homes criteria into existing certification and labeling programs such as ENERGY STAR, Indoor airPLUS, GreenGuard, Gold Standard Radon Resistant Builder, and the Leadership in Energy and Environmental Design (LEED) program, and in new labeling requirements for particular products, such as pressed wood products containing formaldehyde may affect market demand. These and other green building and green product certification systems currently exist in the private or non-profit sectors to evaluate construction measures taken in homes and buildings and provide an opportunity to further examine the demand for healthy homes criteria. ▲

CURRENTLY, THERE IS A LACK OF PUBLIC AWARENESS ABOUT MANY POTENTIAL RESIDENTIAL HAZARDS, DESPITE PERIODIC NEWS COVERAGE ABOUT INDIVIDUAL EVENTS RELATED TO EXPOSURES AND HAZARDS. EDUCATING CONSUMERS ON THE CONCEPT OF HEALTHY HOMES MAY CONTRIBUTE TO GREATER PUBLIC AWARENESS.

GOAL 5

Support Research that Informs and Advances Healthy Housing in a Cost-Effective Manner



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The HHWG affirms the importance of expanding research on the benefits of healthy homes; the effectiveness of various interventions for making homes healthier and protections for making workers safer, and the costs and benefits of improving the nation's housing stock to ensure healthy homes for all.

Additional research activities will help to ensure that the actions taken to address residential health hazards are evidence-based, and will enhance the quality of the nation's housing and the health of its residents.

The HHWG will highlight key issues that require research, prioritize research topics, and work collaboratively to ensure that appropriate research is accomplished without redundancy or gaps.

Stakeholders are often impeded in their efforts to address healthy housing issues by having insufficient information. Without research targeted to critical healthy homes issues, decisions sometimes must be based on limited evidence. Additional research will enhance decision-making and reduce actions that have unintended consequences.

PRIORITY ACTIONS

5.1 Develop an Interagency Strategic Research Agenda

The HHWG has identified some areas in which rigorous research is needed and additional priority topics are expected to be identified in the completed research agenda:

- **Increase knowledge on the effectiveness of unintentional injury interventions.** While we have gained considerable information on the types of injuries that occur in the homes and the mechanisms that are at the root cause of many of those injuries, we still do not have a firm understanding of the breadth of effective interventions and the application of multiple interventions as part of a holistic approach.
- **The effectiveness of priority healthy homes interventions.** Research is needed on the effectiveness of interventions to mitigate residential hazards. A December 2007 CDC-sponsored workshop identified interventions that have been demonstrated to be effective, as well as those needing more formative and field-based evaluation. The HHWG will identify priority intervention research to pursue and will coordinate implementation with existing resources.
- **The health and economic costs and benefits of healthy homes.** While much is known, a more complete characterization of the health benefits of reducing hazards in homes is needed. Understanding health benefits will be crucial to informing the HHWG's work. This work would calculate the costs and benefits of healthy home improvements in various situations and in combinations of interventions.
- **Greater knowledge of the significance and prevalence of residential hazards and exposures. Research is needed on chemicals found in the home, especially those that may have adverse outcomes in infants and children, including known toxicants, and cumulative and aggregate exposures.** Further research is needed on the potential health effects of a variety of products used in the home.
- **Conduct premarket testing and quantify benefits of materials as new materials emerge in the market.** The potential health benefits or adverse effects of new materials being developed for disaster resistance (e.g., earthquakes, floods) or for improved energy efficiency should be identified and considered as those materials become available on the market.

5.1.1 Periodically Review and Synthesize Scientific Literature

To deploy resources most effectively, it is essential for healthy homes policies and programs to focus on evidence-based solutions. Literature reviews with periodic updates will help identify what is currently known about

healthy homes and where key knowledge gaps remain. Such reviews will serve as an important tool for informing the HHWG's research agenda. In addition, summarizing the scientific literature and making the summaries available to the healthy homes community will inform the decisions of policy makers and practitioners and help researchers build effectively on each other's efforts. The CDC-sponsored review of the scientific literature to identify effective housing interventions is an example of a recent review of key literature.¹³ HUD sponsored reviews and synthesis of scientific literature on key healthy homes issues in 2006 (e.g., mold, carbon monoxide, pesticides/IPM) and produced review papers on these topics. The HHWG will identify other key issue areas for which literature reviews are needed (e.g., ventilation and indoor air quality) and develop a plan for completion. The HHWG also will explore other opportunities to accelerate moving research to application.

5.1.2 Develop Methodology to Enhance the Tools Available to the Research Community

Healthy homes research is constrained by factors such as inadequate baseline information, the many variables associated with healthy homes, and ethical concerns related to conducting controlled studies when known hazards exist or are not completely understood. The HHWG will identify key methodological and ethical issues that require additional investigation and solutions, as well as appropriate sources for conducting the needed research.¹³⁵

5.1.3 Coordinate Research Efforts

Once the research agenda is identified, the HHWG will serve as a resource to facilitate collaborative research efforts, shared resources, and avoidance of duplication of effort. The HHWG will also explore whether collaboration with the GHHI's pilot sites; tribal, state and local efforts; and research conducted by federal agencies such as EPA, DOE, or other demonstration programs may offer concrete opportunities for collection of data on environmental exposures and hazards, and comparative analysis of interventions.

5.1.4 Disseminate Findings

The HHWG will develop strategies for ensuring that new research findings are disseminated to the healthy homes community, including through the shared website, publication of findings in scientific and professional journals, and through presentations at scientific conferences and workshops.



5.2 Support the Development and Implementation of National Surveys to Collect Surveillance Data on Critical Healthy Homes Indicators

In the past decade, HHWG partners have collaborated on two nationally-representative physical surveys of environmental health hazards in U.S. housing: the National Survey of Lead and Allergens in Housing¹³⁶ with HUD and NIEHS; and, the American Healthy Homes Survey¹³⁷ that involved HUD and EPA. HUD also sponsors the American Housing Survey (AHS), a questionnaire survey of housing and household characteristics that is administered by the U.S. Census Bureau every two years.¹³⁸ HUD has coordinated with the CDC to develop a module of healthy homes questions to be included in a future round of the AHS. There has also been successful coordination between agencies to collect environmental samples in conjunction with the National Health and Nutritional Examination Survey (NHANES) administered by the CDC's National Center for Health Statistics.¹³⁹ The HHWG will develop mechanisms to better coordinate, standardize, and make the data from these surveys more widely available. The HHWG will also coordinate on the planning for data collection in future surveys.

5.2.1 Make Data Sets Widely Available

The HHWG will promote public availability of data sets from national surveys of healthy homes indicators and other key federally-sponsored research on housing conditions. The intent will be to make these large data sets available for public use by a variety of researchers, while protecting privacy and respecting confidentiality of study participants.

The HHWG will encourage federal grantees, pilot project leaders, and other stakeholders involved in on-the-ground healthy homes interventions and programs to collect data using methods that will promote valid comparisons, evaluate the outcomes of healthy homes initiatives, and communicate those findings to inform others on the development of future healthy homes initiatives, without increasing the reporting burden on the public and businesses.

The HHWG recognizes the importance of making evidence-based decisions in developing healthy homes interventions. By supporting consistent and rigorous evaluation programs to collect baseline data and evaluate program effectiveness, the HHWG will help ensure that such evidence is readily available. The HHWG's efforts to support program evaluation efforts to identify effective healthy homes practices will include the following activities outlined under Priority Action 5.3.

5.3 Support Program Evaluation to Continue Identifying Cost-Effective Healthy Homes Practices

5.3.1 Identify Core Performance Measures and Encourage their Use

The HHWG will facilitate conversation among HHWG members and other stakeholders to identify a limited number of effective national surveillance measures. The HHWG will provide leadership in conceptualizing the performance measures that will be used to measure progress.

The HHWG will conduct outreach to encourage stakeholders to focus on these core measures and collect and report appropriate data to measure progress. While individual stakeholders may have particular goals that require additional measures, collecting core data for different interventions will help provide a national picture of the issue and advance progress in addressing it.

5.3.2 Encourage Ongoing Effectiveness Measurement and Communication of Measures

The HHWG will develop mechanisms to encourage those involved in the healthy homes building and maintenance industries to continue gathering data about the effectiveness of their activities, and to share that information with the federal healthy homes community. The HHWG will validate and post results on the research website as appropriate, so others might identify and emulate effective techniques. ▲

Conclusion

With additional research, the HHWG hopes to support healthy housing for all Americans regardless of their age, race, ethnicity, income level or geography.

The *Strategy for Action* is being published to focus attention on the public health impact of housing and to further the national dialogue on how we can promote healthy homes in the United States.

The *Strategy* urges a dynamic and coordinated effort to improve housing factors that affect health, and outlines a series of mutually supportive coordinated actions that may accomplish the vision of achieving substantial reductions in the number of American homes with residential health or safety hazards. It calls on federal agencies to be proactive and to consider taking the first steps in implementing priority actions. The *Strategy* also invites and encourages participation from many sectors to join in the discussion about healthy homes issues; to make informed and shared decisions; and to develop imaginative and realistic solutions that will help ensure that safe, healthy, and accessible homes are available to everyone in the United States.



Appendix A

Healthy Homes Illustration

NOTE: This Healthy Homes Illustration is based on an intervention conducted under a HUD-funded grant of \$875,000. The original case was modified to highlight a range of problems that may be encountered by healthy homes programs.

THE BURDEN OF AN UNHEALTHY HOME

A wide variety of health problems may be caused by hazardous conditions in the home. Some families may have more than one problem in their home, and multiple interventions are sometimes warranted to correct inadequate housing conditions and improve the health of the residents. The following example illustrates how challenging it can be to make a home healthy, and how important a holistic approach is when selecting interventions. On the other hand, this illustration is not meant to indicate that every home requires this level of intervention, nor that the federal partners will replicate this work in every home needing such serious effort.

The “Smith” family¹ was referred to their local health department’s Community Health Division (CHD) after a social programs case worker contacted the health department to share their knowledge that the Smiths had two children, ages 2- and 8-years old, with the older child suffering from poorly controlled asthma. The CHD had a program that focused on case-worker initiated in-home environmental health and safety assessments and interventions for qualifying households with children suffering from respiratory illnesses, including asthma, who were missing excessive days from school as a result of illness. The case worker informed the CHD that the older son was missing many days of school due to complications from asthma. Mr. and Mrs. Smith were contacted and enrolled in the CHD in-home program. According to Mrs. Smith, her son had been diagnosed with asthma at age six and was having many days of asthma symptoms, including wheezing, coughing, tightness in the chest, a runny nose, itchy watery eyes and eczema. He tired easily, had a difficult time sleeping at night, and was recently seen in the local hospital’s emergency room because of an asthma attack that couldn’t be controlled

using his inhaler. Even though the child was being seen regularly by the family’s pediatrician, and was taking asthma medications, the symptoms were persistent.

The Smiths’ home is a single-family home constructed in 1925 in a lower-income neighborhood. Mrs. Smith is a part-time clerk at a local store while Mr. Smith works in construction. The Smiths were the first members of their families to own a home.

Initial Findings

At the first visit, the CHD program staff identified numerous potential hazards during the comprehensive health and safety assessment:

- Lead-based paint hazards
- Close proximity of the house to roadways and traffic exhaust
- Evidence of mice infestation throughout the house
- Use of incense
- The child with asthma had an old and worn mattress with no mite-proof cover
- Bats nesting in the attic
- A leaking roof
- Residents report pooling of water in the basement following heavy rains
- Evidence of mold in the attic and water damage to some ceilings on the second floor
- Electrical hazards in the house and garage
- Two dogs in the home that sometimes slept in the children’s bedroom
- A single operational smoke alarm
- The home has not been tested for radon

1. Not their actual name.

[APPENDIX A: HEALTHY HOMES ILLUSTRATION]

Interventions Undertaken

CHD program staff, with support from local community organizations, identified and corrected the hazards below:

- The roof was repaired, including the gutters and downspouts to facilitate proper drainage. Water-damaged ceilings were repaired and all exterior openings were sealed to help control mice.
- The electrical hazards and the hand railing on the basement stairs were repaired.
- The family was referred to the local lead poisoning prevention program. Blood-lead tests were performed for both children, and all lead paint hazards within the home and yard were remediated.
- Both children's mattresses were replaced and mite-proof mattresses and pillow covers were provided.
- Case management services ensured that the home assessment findings and intervention steps were clearly explained to the family. The family was provided with a cleaning kit and a high efficiency particulate air (HEPA) vacuum, and were given clear and appropriate information on how to maintain a healthy home and reduce their son's exposure to asthma triggers (e.g., stopping the use of incense, keeping the dogs out of the children's bedroom).
- Information on the results of the home assessment and the resulting interventions were communicated back to the children's pediatrician.
- The furnace filter was replaced with a filter with greater filtering efficiency to improve indoor air quality; extra filters were provided.
- A window air conditioner was installed in the children's sleeping area to reduce humidity and help reduce mite levels.
- Three smoke detectors (with sealed lithium batteries), a fire extinguisher and a carbon monoxide alarm were installed.
- A pest management professional who used integrated pest management practices was contracted to address the mouse infestation. The family was provided with mouse traps, a covered trash can, and containers for storing food.
- Cabinet safety locks, outlet plug covers, pull cord wind-ups, and a safety gate were provided to prevent injuries to the two-year old.
- The bathroom tub and floor were caulked to reduce moisture damage.
- The father was given information on the potential hazards of wearing dirty work clothes into the home
- The home was tested for radon in the lowest living area of the home and was found to have a level of 10.0 pCi/L. A radon professional was contracted to install an active sub-slab depressurization system. Subsequent testing results by the radon professional indicated radon levels in the lowest living area went down to 1.4 pCi/L.

Outcome

The Smiths' son has not needed unscheduled medical care for asthma during the six months following the intervention by the CHD team, his symptoms are less frequent and severe, and he has been able to consistently sleep through the night. He is much more active and able to play outdoors with friends, according to his mother. Mr. Smith is more aware of the need to remove his work clothes before entering the home to minimize the transference of construction-related dust into the living areas of the home. The Smiths no longer burn incense and they report that the mice are gone and that there are no longer water leaks in the home. On bad air quality days as announced by local media outlets, the Smiths try to keep their windows closed and use their air conditioning to reduce infiltration of asthma exacerbating air pollution into the home. The Smiths believe their son's health has improved dramatically due to the completed interventions and the CHD staff teaching them how to reduce asthma triggers in their home. They feel more secure knowing that there are fewer injury hazards in their home. The doctor noticed a big improvement in the 8-year old's asthma symptoms since the CHD intervened. Moreover, by addressing the high radon level the family will have lower exposure to this known risk factor for lung cancer and hence lower likelihood of developing lung cancer from radon exposure in the home.

Take-Home Message

This example shows that creating a healthy home may require a multi-faceted holistic approach to truly be effective. While the breadth of the assessment and interventions described in this case study were extensive, the specific interventions needed to make a home healthy will depend on the conditions and behaviors that are present in each home and the availability of resources to implement effective interventions. This *Strategy for Action* is intended to promote collaboration to help make the type of program and interventions depicted in this example more widely recognized and accessible in the United States.

Appendix B

Selected Agency-Specific Healthy Homes Activities (as of 2010)

Center for Disease Control and Prevention

Individual Programs

- Lead
- Injury
- Asthma
- Drinking water
- Waste water systems
- Smoking/Secondhand smoke
- Radon

Training

- Major partner with HUD in providing training through the National Healthy Homes Training Center and Network (with NCHH)

Surveillance

- Individual programs
- Public Health Tracking
- National Health and Nutritional Evaluation Survey (NHANES)

Research

- Housing intervention effectiveness

Policy

- *The Surgeon General's Call to Action to Promote Healthy Homes*
- Funding of state Healthy Homes/Lead Poisoning Prevention Programs
- Partner with HUD on initiatives to encourage smoke free multifamily housing.
- Encouraging State, Tribal, and Territorial Comprehensive Cancer Control Programs to partner with EPA radon programs and address exposure.

U.S. Department of Energy

Individual Programs

- Weatherization Assistance Program
- Weatherization Innovation Pilot Program
- Weatherization Plus Health

Training

- Training and technical assistance
- Weatherization Assistance Program National Standardized Training Curricula Weatherization Training Centers

Surveillance

- Weatherization Assistance Program monitoring and evaluations

Research

- Indoor air quality and building materials research conducted through WAP network and national laboratories

Policy

- Guidelines for Home Energy Professionals Project
- Revised WAP, Health and Safety Guidance

[APPENDIX B: SELECTED AGENCY-SPECIFIC HEALTHY HOMES ACTIVITIES (AS OF 2010)]

United States Environmental Protection Agency

Individual Programs

- Lead
 - Grants for public education and community development
 - Funding for State and tribal programs
 - Certification for lead professionals and for lead-safe renovation and repair
- Indoor Air Quality
 - *Indoor airPLUS* new home label
 - Healthy Indoor Environments Protocols for Home Energy Upgrades
- Radon
- Asthma
- ETS programs
- IAQ info (mold, air toxics, etc.)
- Other green programs
- ENERGY STAR
- Sustainable Communities
- Brownfields
- Pesticides program
- Integrated Pest Management (IPM)
- Various pollutants
 - Asbestos
 - Vermiculite
 - Formaldehyde
 - PCBs
 - Drinking water contaminants
 - Household chemical safety
- Grant programs

Training

- Establishment of accredited network of trainers, criteria, and model courses for lead abatement, risk assessment, inspection, sampling, and lead-safe renovation
- Financial support for healthy homes training through National Healthy Homes Training Center (NCHH) network
- On-line pediatric home assessment training for health care providers
- IPM training

- On-line mold course
- Various IAQ & green home training program materials/support

Surveillance

- Compliance assistance and enforcement of lead, asbestos, pesticide, and PCB programs

Research

- IAQ research program
- Dust ingestion
- Exposure modeling
- Children's Environmental Health Research Centers

Policy

- Establishment of lead hazard levels
- Regulations on disclosure of lead issues & contractor certification
- EPA national radon action level
- Surgeon General radon health advisory
- Federal Radon Action Plan
- Healthy Indoor Environment Protocols for Home Energy Upgrades (single family and multifamily)
- Guidance on PCBs in fluorescent light ballasts and caulk
- Vapor Intrusion policy & guidelines
- IPM policy & guidelines
- Children's Environmental Health Task Force
- Various voluntary guidelines for IAQ and home health issues
- Guidance on Vermiculite in Attic Insulation
- Rulemaking on formaldehyde in composite wood products
- Spray Polyurethane Foam (SPF) (which contains isocyanates and other chemicals) and EPA chemical action plans on isocyanates

[APPENDIX B: SELECTED AGENCY-SPECIFIC HEALTHY HOMES ACTIVITIES (AS OF 2010)]

US Department of Housing and Urban Development

Individual Programs

- Lead hazard control and healthy homes grant programs
- Green and Healthy Homes Initiative
- Development of healthy homes program guidelines and assessment:
- Housing Quality Standards for assisted housing
- Development of Healthy Homes Rating System
- Radon Mitigation

Training

- Lead safe work practices training courses
- Grantees' healthy homes and workplace safety training courses
- Partner funding with the NCHH

Surveillance

- American Healthy Housing Survey
- Components of the American Housing Survey
- Ongoing monitoring by HUD of its grantee activities

Research

- Healthy homes and lead technical studies grant programs
- Focused lead and healthy homes contract research
- Extensive research on housing, economic, demographic and land use factors by HUD's Office of Policy Development and Research (see HUDuser.org)

Policy

- Lead-based paint regulations covering HUD assistance programs
 - Community Planning and Development
 - Federal Housing Administration
 - Public and Indian Housing
 - Lead Safe Housing Rule and Lead Disclosure Rule
- Housing codes
- Healthy Homes Strategic Plan
- Multifamily Housing and Public Housing Radon Policies

US Department of Agriculture

Individual Programs

- Cooperative Extension System
- Healthy Homes Initiative and Regional IPM Centers
- Rural Housing Service loan and grant programs for Single Family and Multifamily Housing in rural America

Training

- Radon
- Lead
- Smoke alarms
- Energy
- Home poison proofing
- Carbon monoxide
- Integrated pest management education
- Major training partner with the NCHH

Policy

- Notices of Funding Availability for multifamily housing program
 - Include incentive scoring points for participation in green building programs that include indoor air quality and healthy building materials criteria

Appendix C

Healthy Homes Rating System

What is the Healthy Homes Rating System (HHRS)?

In an effort to standardize the approach to identifying housing-related health hazards, the HUD Office of Healthy Homes and Lead Hazard Control (OHHLHC) developed an assessment methodology, the HHRS, to help identify risks from hazards to health and safety in dwellings so that they can be removed or minimized. The OHHLHC is piloting the HHRS with approximately 20 HUD Healthy Homes Production grantees around the country; the HHRS is only mandatory for these grantees and its use by others is entirely voluntary.

The HHRS uses a risk-assessment methodology and is a system developed to enable risks from hazards to health and safety in dwellings to be removed or minimized. The HHRS is not a “standard”, but rather an assessment tool.

The HHRS is categorized in accordance with the American Academy of Public Health’s 1938 publication entitled, “Healthful Principles of a Home.” The HHRS examines 29 hazards, or categories of hazards, summarized below:

Each of these hazards are assessed separately and weighted according to likelihood of occurrence and the possible outcomes should the hazard result in harm.

Physiological	Psychological	Infection	Safety
<ol style="list-style-type: none"> Dampness & Mold Growth Excess Cold Excess Heat Asbestos, asbestiform fibers, and man-made fibers Biocides Carbon Monoxide Lead-based paint Radiation Uncombusted fuel Volatile organic compounds 	<ol style="list-style-type: none"> Crowding and Space Entry by Intruders Lighting Noise 	<ol style="list-style-type: none"> Domestic Hygiene (e.g., pests) Food Safety Personal Hygiene Water Supply 	<ol style="list-style-type: none"> Falls in baths, etc. Falls on the level Falls on stairs, etc. Falls from windows, etc. Electrical hazards Fire hazards Hot surfaces, etc. Collision / Entrapment Ergonomics Explosions Structural collapse

[APPENDIX C: HEALTHY HOME RATING SYSTEM]

How are HHRS assessments carried out?

HHRS assessments are essentially carried out in the traditional fashion, i.e., a physical assessment of the whole property during which deficiencies (faults) are noted and recorded.

Once the assessment has been completed, the assessor judges:

- A) Whether there are any hazards;
- B) The likelihood of an occurrence; and,
- C) The range of possible outcomes for those hazards

How are HHRS assessments made?

The assessment process is not just a question of spotting defects, but is all about risk assessment, outcomes and effects.

When an assessor finds a hazard, two key tests are applied – what is the likelihood of a dangerous occurrence as a result of this hazard and if there is such an occurrence, what would be the likely outcome?

For example, a staircase that had a broken stair would represent a serious hazard in that an occupant could trip or fall down the stairs. However, a broken stair at the top of the staircase would obviously be more dangerous than one at the bottom.

Dwellings are assessed against the average for the type and age of building for the region or area in which the dwelling is located. The assessor also judges whether the condition increases or lowers the likelihood of an occurrence. The system provides information about the characteristics of average dwellings, as a basis for assessors' own assessments of the conditions they find. Assessors will normally concentrate on hazards that are likely to be worse than the average, but they will be able to assess any of the hazards on the basis of their observations or their knowledge of hazards that are specific to particular areas, such as radon gas.

Where a hazard is designated as particularly relevant to children and the elderly, hazards are assessed according to their likely impact on that group. For example, widely spaced balusters (spindles) on a staircase could be a hazard for a child who could squeeze through and fall down the stairs. Similarly a winding staircase with no handrail

could be a hazard for an elderly person. The action that needs to be taken to deal with a hazard will be influenced by who is occupying the residence.

How is the HHRS score calculated?

Each assessment of a hazard carried out using the HHRS results in a score. The score is a numerical representation of the degree of risk represented by a hazard. Although the calculation can be carried out on paper or using a handheld computer, most assessors will use a computer software program operated on a handheld computer or desktop computer back in the office to calculate the scores. All hazards are rated and scored individually. A formula is used which takes into account the nature of the hazard, the likelihood of an occurrence and the seriousness of the outcome (known as the spread of possible harms).

At its simplest, the formula is: *Risk (likelihood) x Outcome = Numerical Score*

The calculation includes a 'weighting' to reflect more serious outcomes, such as death. The assessor or surveyor simply enters the information into a handheld device or computer, and the software takes care of the calculations.

In simple terms, the greater the risk (likelihood) or the more serious the outcome the higher the overall score. An example of a high score would be a gas water heater leaking carbon monoxide – the risk is high and the outcome could be death.

Does the HHRS address all health and safety hazards in the home?

The HHRS was designed to identify and assess hazards associated with the physical characteristics of a home but does not address potentially important risks associated with occupant behaviors.

For more information on the HHRS, visit:

http://portal.hud.gov/hudportal/HUD?src=/program_offices/healthy_homes/hhrs

Appendix D

Relevant Objectives from Healthy People 2020

Environmental Health (EH)

EH-8	Reduce blood lead levels in children <i>EH-8.1 Eliminate elevated blood lead levels in children.</i> <i>EH-8.2 Reduce the mean blood lead levels in children.</i>
EH-13	Reduce indoor allergen levels <i>EH-13.1 Reduce indoor allergen levels: cockroach.</i> <i>EH-13.2 Reduce indoor allergen levels: mouse</i>
EH-14	Increase the percentage of homes with an operating radon mitigation system for persons living in homes at risk for radon exposure.
EH-15	Increase number of homes built with radon-reducing new home construction techniques
EH-18	Reduce homes with lead-based paint hazards <i>EH-18.1 Reduce the number of U.S. homes that are found to have lead-based paint.</i> <i>EH-18.2 Reduce the number of U.S. homes that have paint-lead hazards.</i> <i>EH-18.3 Reduce the number of U.S. homes that have dust-lead hazards.</i> <i>EH-18.4 Reduce the number of U.S. homes that have soil-lead hazards.</i>
EH-19	Reduce housing units with physical problems

Injury And Violence Protection (IVP)

IVP-12	Reduce unintentional injury deaths
IVP-28	Reduce residential fire deaths

Appendix E

Goals and Priority Actions Table

NOTE: For “All partners” projects, volunteer agencies need to be identified for coordination purposes. Participating agencies are listed alphabetically.

Priority Actions	Project	Key Agencies Involved
Goal 1 Establish Federally-Recognized Recommendations for Healthy Homes		
1.1	Establish Protocol for Assessing Health and Safety Hazards	CDC, EPA, HUD
Goal 2 Encourage Adoption of Healthy Homes Recommendations		
2.1	Obtain Commitments From Agencies to Advance Healthy Housing	
	2.1.1 Leverage Current Federal Programs and Activities through Intra-Agency Coordination and Interagency Agreements (All agencies)	All partners
	2.1.2 Support Pilot Projects to Incorporate Healthy Homes Concepts into Existing Federal Programs	CDC, DOE, EPA, HUD
	2.1.3 Strategically Align Healthy Homes with Green Housing Efforts	CDC, DOE, EPA, HUD
	2.1.4 Strategically Align Healthy Homes with Efforts to Expand Jobs that Improve Housing	All partners
	2.1.5 Strategically Target Healthy Homes Activities to Support the Needs of Underserved Populations	All partners
	2.1.6 Acknowledge and Incorporate Work Promoting Approaches that Support Health Equality	All partners
2.2	Strengthen Federal Efforts to Reduce Public Health Risks in Housing	All partners
2.3	Explore Ways to Increase Funding Flexibility across Federal and Non-federal Programs	All partners

[APPENDIX E: GOALS AND PRIORITY ACTIONS TABLE]

Priority Actions	Project	Key Agencies Involved
Goal 3 Create and Support Training and Workforce Development to Address Health Hazards in Housing		
3.1	Support Enhanced Healthy Homes Training and Workforce Development	
	3.1.1 <i>Gaps in Training Content and Opportunities to Ensure Quality</i>	All partners
	3.1.2 <i>Support Greater Coordination of Training Programs to Maximize Their Impact and Increase Accessibility</i>	All partners
3.2	Accelerate Replication of Successful Local Healthy Housing Programs	
	3.2.1 <i>Identify Successful Local Program Models</i>	All partners
	3.2.2 <i>Identify Ways to Widely Communicate These Models to Community Leaders</i>	CDC, DOE, HUD, USDA
3.3	Encourage Pilots or Demonstration Programs that Advance Healthy Housing	
	3.3.1 <i>Establish Mechanisms for Facilitating Joint Federal Pilot Projects</i>	DOE, HUD, USDA
Goal 4 Educate the Public about Healthy Homes		
4.1	Develop a Communications Campaign on Healthy Homes	
	4.1.1 <i>Develop and Implement a Federal Healthy Homes Website</i>	CDC, DOE, EPA, HUD, USDA
	4.1.2 <i>Leverage Dissemination of Key Healthy Homes Messages throughout Agency Headquarters Program Offices and Field and Regional Networks</i>	All partners
	4.1.3 <i>Communicate Key Healthy Homes Messages at Targeted Conferences and Exhibits</i>	All partners
4.2	Increase Public Awareness of the Healthy Homes Model	
	4.2.1 <i>Explore Labeling or Certification for Healthy Homes</i>	CDC, DOE, EPA, HUD

[APPENDIX E: GOALS AND PRIORITY ACTIONS TABLE]

Priority Actions	Project	Key Agencies Involved
Goal 5 Support Research that Informs and Advances Healthy Housing in a Cost-Effective Manner		
5.1	Develop an Interagency Strategic Research Agenda	
	5.1.1 Periodically Review and Synthesize Scientific Literature	All partners
	5.1.2 Develop Methodology to Enhance the Tools Available to the Research Community	All partners
	5.1.3 Coordinate Research Efforts	All partners
	5.1.4 Disseminate Findings	All partners
5.2	Support the Development and Implementation of National Surveys to Collect Surveillance Data on Critical Healthy Homes Indicators	
	5.2.1 Make Data Sets Widely Available	All partners
5.3	Support Program Evaluation to Continue Identifying Cost-effective Healthy Homes Practices	
	5.3.1 Identify Core Performance Measures and Encourage their Use	CDC, EPA, HUD
	5.3.2 Encourage Ongoing Effectiveness Measurement and Communication of Measures	CDC, EPA, HUD

Notes for Table:

- As this *Strategy for Action* is implemented, the scopes and performance measures for priority actions and projects may be realigned as efficiencies and opportunities for further improvement are identified, within financial and staffing limitations.
- Goals, Priority Actions and Projects are directly from the *Advancing Healthy Housing A Strategy for Action* document that agencies have reviewed. Each Goal will have at least one Priority Action and one Project. Each Project will have its own set of Performance Indicators that can be measured and used in evaluating progress on individual projects.
- Each Priority Action/Project will have a list of Key Agencies Involved. Any agency assignments currently listed in the Table are only suggestions and subject to re-ordering based on HHWG discussions. Those projects with "All Partners" listed currently need volunteer agencies.
- HUD will work with the Key Organizations Involved on all Projects to compile periodic status information across the five Goals and track the overall progress of the HHWG *Advancing Healthy Housing A Strategy for Action*.
- We will be developing Performance Measures/Indicators for each Project as determined by the participating agencies comprising each Project Team.

General notes on implementation:

- Projects shall be implemented consistent with applicable legal authorities and subject to the availability of appropriations.
- Upon approval of the *Strategy for Action* document by the partner agencies and OMB, Key Agencies Involved will be identified for each Priority Action/Project. Each Project team will determine the indicators and performance metric appropriate for assessing the progress of that specific project
- Our goal is complete all of the projects within 5 years.

Endnotes

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