



U.S. Department of Housing and Urban Development

Office of Lead Hazard Control and Healthy Homes

Healthy Homes and Lead Technical Studies Programs Pre-Application

FR-5800-N-06

Waverly Friedman

for _____
Matt L. Ammon, Acting Director
Office of Lead Hazard Control and Healthy Homes

5/22/2014

Date

Healthy Homes and Lead Technical Studies Programs Pre-Application

FR-5800-N-06

TABLE OF CONTENTS

Overview

- I. [Funding Opportunity Description.](#)
- II. [Award Information.](#)
- III. [Eligibility Information.](#)
 - A. Eligible Applicants.
 - B. Cost Sharing or Matching.
 - C. Other - (if applicable).
- IV. Application and Submission Information.
 - A. [Obtaining an Application Package.](#)
 - B. [Content and Form of Application Submission.](#)
 - C. [Application Submission Dates and Times.](#)
 - D. [Intergovernmental Review.](#)
 - E. [Funding Restrictions.](#)
 - F. [Other Submission Requirements.](#)
- V. [Application Review Information.](#)
 - A. Review Criteria.
 - B. Review and Selection Process.
 - C. Anticipated Announcement and Award Dates.
- VI. [Award Administration Information.](#)
 - A. Award Notices.
 - B. Administrative and National Policy Requirements.
 - C. Reporting.
- VII. [Agency Contact\(s\).](#)
- VIII. [Other Information.](#)

U.S. Department of Housing and Urban Development

Program Office: Office of Lead Hazard Control and Healthy Homes
Funding Opportunity Title: Healthy Homes and Lead Technical Studies Programs
Pre-Application
Announcement Type: Initial
Funding Opportunity Number: FR-5800-N-06
Primary CFDA Number: 14.902
Additional CFDA Number: 14.906
Due Date for Applications: **July 8, 2014**

This Notice solicits Pre-Applications only. Top-ranked submissions will be invited to submit a full application for funding in response to a second announcement (Healthy Homes and Lead Technical Studies Programs Full-Application).

Pre-applications must be received and validated by Grants.gov no later than 11:59:59 pm eastern time. The pre-application submission deadline is 11:59:59 eastern time on July 8, 2014.

Applicants need to be aware that following receipt, applications go through a validation process in which the pre-application may be accepted or rejected. Please allow time for this process to ensure that you met the time receipt requirements.

Please read the 2014 General Section instructions for timely receipt, including actions to take if the application is rejected. Applicants should carefully read the Section IV.

Additional Overview Information:

1. Incorporation of the General Section. HUD publishes a General Section each fiscal year that contains *mandatory requirements* for all applicants to HUD's competitive grant programs including this NOFA. Applicants must meet all of the requirements of the General Section in addition to the requirements of this NOFA to be considered and to receive funding. The full title of the General Section is General Section for Fiscal Year 2014 Discretionary Programs. It can be found on Grants.gov and on HUD's Funds Available webpage at http://portal.hud.gov/hudportal/HUD?src=/program_offices/administration/grants/fundsavail.

2. OMB Approval Number(s): 2539-0015

3. Purpose: To fund technical studies to improve existing methods for detecting and controlling key housing-related health and safety hazards; to develop new methods to detect and control these hazards; and to improve our knowledge of key housing-related health and safety hazards.

4. Summary of Changes: The following is a summary of major changes in this NOFA relative to the FY2013 Healthy Homes Technical Studies NOFA. This is not intended to be an exhaustive list, so applicants should be sure to read the entire NOFA.

a. The application process involves two stages. Applicants are first required to submit a pre-application for an initial review and rating in response to this notice. A full application will be requested only from those applicants that are pre-selected based on the initial review and rating. The full applications received under that request will then be subject to a full review and rating.

b. In FY 2014, approximately \$1 million is available in Lead Technical Study Program funding.

c. HUD has added new topics of particular interest as well as topics that the Department will not fund in FY 2014 (see sections III.C.1).

I. Funding Opportunity Description.

A. Program Description and Requirements.

The overall goal of both the Health Homes and Lead Technical Studies program is to gain knowledge to improve the efficacy and cost-effectiveness of methods for evaluation and control of housing-related health and safety hazards. This also supports HUD's Strategic Objective for Green and Health Homes, which is to "Increase the health and safety of homes and embed comprehensive energy efficiency and health homes criteria across HUD programs." (HUD's Strategic Plan for 2014-2018 is available at: <http://portal.hud.gov/hudportal/documents/huddoc?id=hudstrategicplan2014-2018.pdf>).

HUD is funding studies to improve HUD's and the public's knowledge of housing-related health and safety hazards and to improve or develop new hazard assessment and control methods, with a focus on key residential health and safety hazards. HUD is especially interested in applications which will advance our knowledge on key healthy homes issues, including lead-based paint hazards, by addressing important gaps in the science related to the accurate and efficient identification of hazards and cost effective hazard mitigation. Key hazards are discussed in Appendix A, *Key Residential Health and Safety Hazards*, of this NOFA. A list of references that serves as the basis for the information provided in this NOFA is provided as Appendix B, *Relevant Publications, Guidelines and Other Resources*.

Both the Healthy Homes and Lead Technical Studies programs are important for the achievement of research goals identified in both HUD's *Healthy Homes Strategic Plan* (available at: http://portal.hud.gov/hudportal/documents/huddoc?id=hhstratplan_7_9_09.pdf) and the federal healthy homes strategic plan, *Advancing Healthy Housing: A Strategy*

for Action (available at: http://portal.hud.gov/hudportal/HUD?src=/program_offices/healthy_homes/advhh).

1. General Goals

a. Healthy Homes Technical Studies

The overall goal of the Healthy Homes Technical Studies program is to advance the recognition and control of priority residential health and safety hazards and more closely examine the link between housing and health. The overall objectives of the Healthy Homes Technical Studies Program include, but are not limited to:

- (A) Development and evaluation of cost effective test methods and protocols for identification and assessment of housing-related hazards.
- (B) Development and assessment of cost-effective methods for reducing or eliminating housing-related hazards.
- (C) Evaluation of the effectiveness of housing interventions including educational interventions, and barriers and incentives affecting future use of the most cost-effective strategies.
- (D) Investigation of the epidemiology of housing-related hazards and illness and injuries associated with these hazards, with an emphasis on vulnerable populations (e.g., children, senior citizens, etc.).
- (E) Analysis of existing data or generation of new data to improve knowledge regarding the prevalence and severity of specific hazards in various classes of housing, with a focus on low-income housing.
- (F) Improved understanding of the relationship between a residential exposure and illness or injury of children or other vulnerable populations. Applicants that propose this type of study should discuss how the knowledge that is gained from the study could be used in a program to reduce these hazards in target communities.

HUD anticipates that the results of program-supported studies will help to develop evidence-based approaches that are cost-effective and efficient and result in the reduction of health threats for the maximum number of residents and, in particular, children and other vulnerable populations in low income households. Study results are also expected to improve our understanding of how specific aspects of indoor environmental quality can affect the health of residents.

The Healthy Homes Technical Studies Program is a component of HUD's Healthy Homes Program. A description of the Healthy Homes Program is available on the HUD website at <http://www.hud.gov/offices/lead/hhi/index.cfm>.

In addition to deficiencies in basic housing conditions that may impact health, other more subtle health hazards may exist in the residential environment (e.g., asthma triggers, volatile and semi-volatile organic compounds, pesticide residues, etc.). While some hazards will be found disproportionately in housing that is substandard (e.g., structural problems, lack of adequate heating and cooling, pest infestation, moisture infiltration, etc.), housing-related environmental hazards may also exist in housing that is otherwise of good quality. Appendix A of this Notice briefly describes the key housing-associated health and

injury hazards HUD considers targets for intervention. HUD has also developed resource papers on a number of topics of importance under the HH Program, including mold, environmental aspects of asthma, carbon monoxide, pesticides, residential assessment and unintentional injuries. These resource papers can be downloaded from <http://www.hud.gov/offices/lead/hhi/index.cfm>.

b. Lead Technical Studies

The overall goal of the Lead Technical Studies grant program is to gain knowledge to improve the efficacy and cost-effectiveness of methods for evaluation and control of residential lead-based paint hazards.

Through the Lead Technical Studies Program, HUD is working to fulfill the requirements of sections 1051 and 1052 of the Residential Lead-Based Paint Hazard Reduction Act of 1992 (Title X) (42 U.S.C. §§ 4854 and 4854a) which directs HUD to conduct research on topics which include the development of improved methods for evaluating and reducing lead-based paint hazards in housing, among others.

Brief descriptions of active and previously funded lead technical studies projects can be found on HUD's website at <http://www.hud.gov/offices/lead/researchers.cfm>. Where appropriate, you are encouraged to build your proposed study upon HUD-sponsored work that has been previously completed, in addition to other relevant research (i.e., reported in the published literature). The results of the applicable aspects of lead technical studies will be used in part to update HUD's Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing (Guidelines) and other HUD policy guidance. For supporting references, including where to find the Guidelines, see Appendix B.

2. Community Participation

HUD believes that it is important for researchers to incorporate some aspect of meaningful community participation in the development and implementation of studies that are conducted in communities and/or involve significant interaction with community residents. Community participation can improve study effectiveness in various ways, including the development of more appropriate research objectives, improving recruitment and retention of study participants, improving participants involvement in and understanding of a study, improving ongoing communication between researchers and the affected community, and more effectively disseminating study findings. HUD encourages applicants to consider using a community based participatory research (CBPR) approach, where applicable, in study design and implementation. (See, e.g., the report published by the National Institute of Environmental Health Sciences titled Successful Models of Community-Based Participatory Research at http://portal.hud.gov/hudportal/documents/huddoc?id=DOC_12485.pdf).

CBPR is characterized by substantial community input in all phases of a study (i.e., design, implementation, data interpretation, conclusions, and communication of results).

B. Authority.

The Healthy Homes Technical Studies program is authorized under sections 501 and 502 of the Housing and Urban Development Act of 1970 (12 U.S.C. §§ 1701z-1 and 1701z-2). The Lead Technical Studies program is authorized under sections 1051-1052 of the Residential Lead-Based Paint Hazard Reduction Act of 1992 (Title X of the Housing and Community Development Act of 1992, 42 U.S.C. § 4851 et seq.). Fiscal Year 2014 funds for both programs are authorized under the Department of Housing and Urban Development Appropriations Act, 2014 (Public Law 113-76), approved on January 17, 2014.

II. Award Information.

A. Available Funds.

HUD is making available through this NOFA **\$4,000,000** for Healthy Homes and Lead Technical Studies Programs Pre-Application.

Additional funds may become available for award under this NOFA as a result of HUD's efforts to recapture unused funds, use carryover funds, or because of the availability of additional appropriated funds. Use of these funds will be subject to statutory constraints. All awards are subject to the applicable funding restrictions described in the General Section and to those contained in this NOFA.

Approximately \$3 million in fiscal year 2014 funds are available for the Healthy Homes Technical Studies Program and approximately \$1 million in fiscal year 2014 funds are available for the Lead Technical Studies Program.

B. Number of Awards.

HUD expects to make approximately 10 awards from the funds available under this NOFA.

HUD anticipates that approximately 4 to 7 awards will be made for the Healthy Homes Technical Studies Program and that approximately 2-3 awards will be made for the Lead Technical Studies Program.

These award numbers may be modified subject to the availability of appropriations.

C. Maximum Award Information.

1. Awards will range from approximately \$300,000 to a maximum of \$750,000 for Healthy Homes Technical Studies and from approximately \$200,000 to a maximum of \$500,000 per award for Lead Technical Studies.

2. New Applicants. HUD anticipates that up to \$750,000 in Healthy Homes Technical Studies funding will be available for qualified "new applicants," i.e., organizations that have not been previously funded by the Office of Lead Hazard Control and Healthy Homes (OLHCHH) under the Healthy Homes Technical Studies Grant Program as the primary grantee. A "new applicant" may have previously been a sub-grantee under an award to another organization. If there are not enough qualified new applicants for funding, any remaining funds will be made available to other applicants based on the final ranking.

Estimated Total Funding: \$4,000,000

Minimum Award Amount: \$200,000 Per Project Period

Maximum Award Amount: \$750,000 Per Project Period

D. Period of Performance.

The start date will be determined during the period of negotiations with successful applicants. The period of performance cannot exceed 36 months from the time of award. The proposed performance period should include adequate time for such project components as the Institutional Review Board process, if required, the recruitment of study participants and/or new staff, and the development of methods (e.g., analytical methods), all of which have been found to delay projects in the past.

Estimated Project Start Date: 10/06/2014

Estimated Project End Date: 10/05/2017

36-month project with three 12-month budget periods

Additional Information on Project Periods

Period of performance extensions for delays due to **exceptional conditions beyond the grantee's control will be considered** for approval by HUD in accordance with 24 CFR 84.25(e)(2) or 85.30(d)(2), as applicable, and the OLHCHH Program Guide. If requested and determined to be appropriate and subsequently approved by OLHCHH, grantees will be eligible to receive a single extension of up to 12 months in length.

E. Type of Funding Instrument.

Funding Instrument Type: Cooperative Agreement

Awards will be made as cooperative agreements. Anticipated substantial involvement by HUD staff for cooperative agreements may include, but will not be limited to:

1. Review and suggestion of amendments to the study design, including: study objectives; field sampling plan; data collection methods; sample handling and preparation; and sample and data analysis.
2. Review and provision of technical recommendations in response to quarterly progress reports (e.g., amendments to study design based on preliminary results).
3. Review and provision of technical recommendations on the journal article(s) and final study report.

F. Supplementation.

Not Applicable

III. Eligibility Information.

A. Eligible Applicants.

Eligible applicants under this NOFA include:

State governments

County governments
City or township governments
Special district governments
Independent school districts
Public and State controlled institutions of higher education
Native American tribal governments (Federally recognized)
Public housing authorities/Indian housing authorities
Native American tribal organizations (other than Federally recognized tribal governments)
Nonprofits having a 501(c)(3) status with the IRS, other than institutions of higher education
Nonprofits without 501(c)(3) status with the IRS, other than institutions of higher education
Private institutions of higher education
For profit organizations other than small businesses
Small businesses
Others (see text field entitled "Additional Information on Eligibility" for clarification)

Additional Information on Eligibility:

1. Applications to supplement existing projects are eligible to compete with applications for new awards. Federal agencies are not eligible to submit applications. The 2014 General Section identifies threshold requirements that must be met for an organization to receive an award.
2. If your organization received an award under the FY2013 Healthy Homes Technical Studies Grant Program cycle, you are not eligible to apply to that program, unless you apply with a different Principal Investigator.

HUD does not award grants to individuals nor will HUD evaluate an application from an ineligible applicant. Additionally, if for-profit firms are eligible they are not allowed to earn a fee (i.e., make a profit from the project).

In accordance with 2 CFR 25.200, all applicants must have an active Data Universal Numbering System (DUNS) number (www.dnb.com) and have an active registration in the System for Award Management (SAM) (www.sam.gov) **before submitting an application**. Getting your DUNS number and SAM registration can take up to four weeks; therefore, you should start this process or check your status early.

B. Cost Sharing or Matching.

Federal sources are generally not allowed to be used as cost share or match unless otherwise permitted by a program's authorizing statute.

This Program does not require an applicant to leverage resources through cost sharing or matching.

However, under the full application NOFA (Healthy Homes and Lead Technical Studies - Full Application) to be published later, pre-selected applicants will receive additional points if they provide evidence of significant resource leveraging.

C. Other.

You must refer to Section III of the General Section for information on the following eligibility requirements. These requirements may, where applicable, determine whether your application is reviewed or make your application ineligible for funding:

- Resolution of civil rights matters;
- Compliance with nondiscrimination and other requirements, including but not limited to:
 - compliance with all applicable fair housing and civil rights laws;
 - affirmatively furthering fair housing;
- Delinquent Federal debts;
- Financial management systems that meet Federal standards;
- Debarment and/or suspension from doing business with the Federal Government;
- False statements;
- Do Not Pay review and compliance with the Improper Payments Elimination and Recovery Improvement Act of 2012;
- Standards of ethical conduct/code of conduct;
- Prohibition against lobbying activities; and
- Conflicts of interest.

1. Eligible Activities.

a. Healthy Homes Technical Studies

(1) HUD is particularly interested in the following topics:

(a) Assessing or improving the efficacy of current methods for residential Integrated Pest Management (IPM). (See e.g., *Integrated Pest Management, A Guide for Affordable Housing*, available at: www.Stoppests.org and the Centers for Disease Control's (CDC) IPM web page, <http://www.cdc.gov/nceh/ehs/eLearn/IPM.htm>).

Topics of interest include but are not limited to:

- (i) Identification and evaluation of specific practices and processes that help overcome current challenges/obstacles and enhance the adoption of IPM by multi-family housing owners and managers.
- (ii) Conducting applied research in identifying mechanisms through which human activities/behaviors influence bed bug infestations and control.
- (iii) Identifying new methods or evaluating existing methods for bedbug detection, prevention and control.

(b) Developing easily replicable, cost-effective methods for preventing and controlling mold and excess moisture in various types of residential buildings.

(c) Improving indoor air quality, such as through cost-effective approaches to upgrading residential ventilation or improving control/management of combustion appliances. This includes studies of practical approaches to mitigate the health impacts from infiltration of ambient air pollution (e.g., respirable particulate) due to motor vehicle emissions from roadways and transportation hubs such as bus terminals, etc.

Applicants proposing research on methods to reduce indoor concentrations of respirable particulates should refer to guidance that was published recently by the Lawrence Berkeley National Laboratory (Chan and Singer 2014).

(d) Evaluating the effectiveness of education and outreach methods designed to provide at risk families (including minority families and those with Limited English Proficiency (LEP)) with the knowledge to adopt self-protective behaviors with respect to residential health hazards. If you propose a study in this focus area you should describe, cite and discuss the theoretical basis for the education/outreach approach that you are proposing.

(e) Third Hand Smoke (THS): Some research has indicated that THS (i.e., the residue from tobacco smoke that collects on interior surfaces) could result in significant exposure to toxic substances. Additional research is needed to improve our understanding of exposure to these residues and their potential health impact and the efficacy of cleaning techniques in reducing THS residue from surfaces in homes.

(f) Conducting cost-benefit or cost-effectiveness studies on the health benefits of healthy homes interventions in high risk populations (e.g., implementation of smoke-free housing policies, reductions in the incidence of injuries among children or the elderly, savings from using an integrated healthy homes assessment and intervention approach). Applicants are encouraged to team with existing projects or studies through which the housing interventions are being conducted.

(g) Injury Prevention Measures: HUD is interested in demonstrating the feasibility and cost-effectiveness of incorporating injury prevention measures into residential programs, including green renovation and rehabilitation programs. Such measures (e.g., grab bars in showers, anti-scald devices, lockable medicine cabinets, etc.) are not typically included in green building programs but could be incorporated to enhance the effects of the program on resident safety and health.

(h) Radon Test Protocols in Multifamily Housing: Current guidance and requirements for radon testing in multifamily housing differ with respect to protocols for the selection and testing of units for radon. For example, one entity may require a minimum of 25% of randomly selected ground level units in covered properties be tested to determine baseline radon levels, while another may require a minimum of 10%. This differs from the consensus standard developed by the American Association of Radon Scientists and Technologists that requires testing of 100% of ground level units in multifamily properties (ANSI-AARST MAMF-2012). State testing requirements also exist which rely on industry standards to varying degrees. The ANSI-AARST testing standard and the various multifamily testing requirements are based on professional judgment. Research is needed to develop a cost effective, evidence-based testing protocol for multifamily housing that is sufficiently protective (i.e., with respect to the ability to identify units with elevated levels) without being

overly burdensome to property owners.

(i) Application for additional work related to ongoing HUD-funded technical studies (i.e., for work outside of the scope of the original agreement) are eligible to compete with applications for awards on new subjects. These applications will be evaluated in the same manner as applications on new subjects. Brief descriptions of current and recently completed Healthy Homes Technical Studies projects and grantee contact information can be found on the HUD website at http://portal.hud.gov/hudportal/HUD?src=/program_offices/healthy_homes/hhi/hhts.

(j) Other Focus Areas that are Consistent with the Overall Goals of HUD's Healthy Homes Technical Studies Program. HUD will consider funding applications for technical studies on other topics that are consistent with the overall goals and objectives of the Healthy Homes Technical Studies program, as described above. In such instances, for an applicant to receive an award, it is necessary that the applicant describe in sufficient detail how the proposed study is consistent with the overall program goals and objectives.

(2) HUD **will not** fund applications on the following topics:

(a) Studies that focus on the effects of retrofits to existing housing for the purpose of improving energy efficiency on indoor air quality or other measures of indoor environmental quality or on occupant health.

(b) Studies that focus on the effects of the rehabilitation of existing housing using "green" construction methods (e.g., the use of low emission materials, improved ventilation) on measures of indoor environmental quality or occupant health.

(c) Studies that focus on determining the effectiveness of housing interventions on improving the health of adults with COPD.

b. Lead Technical Studies. HUD is particularly interested in the following topics:

(1) Effectiveness of Ongoing Maintenance Activities in Controlling Lead-Based Paint Hazards. HUD supported research has demonstrated that interim controls can be effective in significantly reducing dust-lead levels for periods of up to six years following intervention (see e.g., Wilson et al., 2006; in the text box at <http://dx.doi.org/enter/10.1016/j.envres.2006.04.007>). Outside of the intensity of the intervention and baseline conditions, however, few factors have been identified that are predictive of the effectiveness of the lead hazard control interventions in reducing dust-lead levels over the long term. The frequency and thoroughness of ongoing maintenance is one factor that is expected to be of significance with respect to the long term effectiveness of interim controls. HUD is interested in evaluating the effectiveness and feasibility of ongoing lead-based paint maintenance programs, identifying program components for which particular implementation difficulties exist, and evaluating proposed measures for overcoming those difficulties. Such an evaluation of program components could address whether and how technically-acceptable and cost-effective work practices are selected and implemented, how effectively supervisors monitor work activities to ensure that lead-based paint hazards are controlled and that dust and debris are contained and cleaned up during and after work, and how well clearance procedures

(including necessary re-cleaning) are integrated into the maintenance program, among other factors. HUD is particularly interested in evaluating outcomes based on actual environmental measurements and activities, such as use of appropriate work practices and measurement of dust-lead loadings.

(2) Training persons in lead-safe work practices is important with respect to preventing contamination of the work environment and reducing occupant and worker lead exposures. New renovators and workers lack experience with lead-safe work practices.

Much of the lead-safe work practices training has been delivered in urban areas in order to reach the maximum numbers of persons possible, with less emphasis on training individuals in rural areas. Barriers to training in rural locations include low enrollments, physical distance from the training location, travel costs and other factors. HUD will consider applications that investigate strategies designed to reach affected persons closer to where they live and work through technology-based instructional alternatives or structured on-the-job training solutions. (Structured on-the-job training (SOJT) includes planning, breaking down jobs into their component tasks and providing instructors with lesson plans and materials. It produces consistent training outcomes of predictable quality. Information on SOJT is readily available in the body of training and education literature). Proposed training solutions must be suitable for the delivery of training that can be shown to be effective at giving workers the skills and ability they need to complete projects that pass independent third-party clearance examinations in target housing. HUD will consider funding applications that evaluate current existing technologies and infrastructure possibilities that appear to be suitable for delivery of such training. For either of these evaluations on the effectiveness of training projects, it would be of particular value to evaluate the outcomes based on actual observation of trained workers in the field, environmental measurements such as dust-lead loadings, etc. including at time intervals greater than immediately following training.

(3) Evaluation of the effectiveness of interim controls for various time periods following intervention is a topic that has been primarily covered through HUD's Evaluation of the HUD Lead Hazard Control Grant Program (referred to as the National Evaluation) (see, e.g., <http://www.nchh.org/Research/Archived-Research-Projects/HUD-Lead-Hazard-Control-Grant-Program.aspx>) that assessed the impact of interventions conducted by 14 programs that were among the first recipients of HUD lead hazard control grants. Follow-up research on a subset of the original study participants demonstrated that dust-lead levels generally remained low (particularly on floors) six years following interventions (Wilson et al., 2006). Although this research has demonstrated that interim controls can be effective in reducing dust-lead levels over an extended period, there may still be more effective and much durable specific interventions or combinations of interventions that warrant additional study. For example, HUD has supported research that focused on the benefits of window replacement in reducing floor dust-lead levels (Dixion et.al., 2012). Furthermore, the fact that there is no safe level of lead exposure for children, which is reflected by the action of the U.S. Centers for Disease Control and Prevention in adopting a "reference level" for lead in children's blood, the ability of interim controls to maintain low dust-lead levels in treated homes has assumed even greater importance. Research

supports the need to achieve and maintain low dust-lead levels to adequately protect children with respect to the current reference value of 5 µg/dL (Dixon et al., 2009); however, previous research on interim controls was not conducted with the goal of keeping children's blood-lead levels below 5 µg/dL.

(4) Analysis of Available Data and Databases. HUD is interested in supporting research using existing data to address key scientific issues related to the identification and control of lead-based paint hazards. Research efforts often generate large data sets that are analyzed to address primary research objectives; however, there is often important information to be gained by conducting additional analyses of the collected data. Such analyses can generally be conducted at low cost relative to the cost of the initial research. Applicants submitting proposals in this area should explain how the analyses would address one or more important issues and likely result in improvements in lead hazard assessment and control methods. HUD is also interested in the creative use of existing databases (e.g., Census data, blood-lead screening data, etc.) to improve the efficacy of lead hazard control programs (e.g., by improved targeting of the highest risk homes and neighborhoods), assess the effectiveness of enforcement and lead hazard control activities and regulations, and other uses of these data that further the goal of improving methods for the identification and control of residential lead-based paint hazards.

(5) Other Focus Areas that are Consistent with the Overall Goals of HUD's Lead Technical Studies Program. HUD will consider funding applications for technical studies on other topics that are consistent with the overall goals and objectives of the Lead Technical Studies program, as described above. In such instances, for an applicant to receive an award, it is necessary that the applicant describe in sufficient detail how the proposed study is consistent with the overall lead technical studies program goals and objectives.

NOTE: A limited amount of lead hazard control activities, which involve construction rather than research, may be conducted as part of a project (see Section IV.E.8).

2. General Information. You may address one, or more than one, of the above technical studies topic areas within your proposal, or submit separate applications for different topic areas. In proposing to conduct a study on a particular topic, applicants should consider:

- a. The ability of the study to generate definitive results. Since the size of the awards under the NOFA for the full application to be issued in conjunction with this NOFA for the pre-application limits the ability of applicants to design and implement research on health outcomes using the strongest methodology (i.e., a randomized controlled trial), applicants should consider focusing on important indoor environmental quality (IEQ) measures instead of health outcomes in studies where this is appropriate. A focus on environmental outcomes is generally expected to produce more definitive results as opposed to a health outcomes focus, and the impact of improvements to IEQ on health outcomes can be inferred where the evidence base is sufficient.
- b. The "fit" of the proposed hazard assessment and/or control methods within the overall goal of addressing "priority" health and safety hazards in a cost-effective manner;
- c. The expected efficacy and cost effectiveness of the proposed methods for hazard control

and risk reduction. Questions to consider include the degree to which interventions would be accepted by occupants, ease and cost of implementation, the length of time the intervention would stay effective, and the cost effectiveness of the intervention in preventing illness or injury or in improving the health of residents with existing illness;

d. Where and how these methods would be applied and tested, and/or perform demonstration activities; and

e. The degree to which the study will help develop practical, widely applicable and accepted methods and protocols or improve our understanding of a residential health hazard.

Applicants should consider the efficiencies that might be gained by working cooperatively with one or more recipients of HUD's Healthy Homes Production grants or Lead-Based Paint Hazard Control or Lead Hazard Reduction Demonstration grants, which are widely distributed throughout the United States. Information on current grantees is available at http://portal.hud.gov/hudportal/HUD?src=/program_offices/healthy_homes/lbp/lhc.

NOTE: A limited amount of hazard control activities, which involve construction rather than research, may be conducted as part of a Healthy Homes and Lead Technical Studies project (see Section IV.E.8).

3. Program Requirements.

a. Program Performance. Grantees shall take all reasonable steps to accomplish all activities within the approved period of performance. HUD reserves the right to terminate the cooperative agreement prior to the expiration of the period of performance if the grantee fails to make reasonable progress in implementing the approved program of activities or fails to comply with the terms of the cooperative agreement.

b. Regulatory Compliance. Grantees must comply with all relevant federal, state, and local regulations regarding exposure to and proper disposal of hazardous materials.

c. Blood Lead Testing. Any blood lead testing, blood lead level test results, medical referral, or follow-up for children under 6 years of age must be conducted according to the recommendations of the CDC, Preventing Lead Poisoning in Young Children (see Appendix B of this NOFA).

d. Restricted Use of Funds. HUD technical studies grant funds will not replace existing resources dedicated to any ongoing project.

e. Laboratory Analysis for Lead. Laboratory analysis covered by the EPA's National Lead Laboratory Accreditation Program (NLLAP) must be conducted by a laboratory recognized under the program, unless approved by HUD.

f. Laboratory Analysis for Mold. Samples to be analyzed for mold (fungi) must be submitted to a laboratory accredited through the Environmental Microbiological Laboratory Accreditation Program (EMLAP), administered by the American Industrial Hygiene Association (AIHA), unless approved by HUD.

g. Human Research. Human research subjects will be protected from research risks in conformance with Federal Policy for the Protection of Human Subjects, required by HUD at 24 CFR 60.101, which incorporates the Department of Health and Human Services (DHHS) Protection of Human Subjects regulation at 45 CFR part 46.

h. OSHA Compliance. The requirements of the Occupational Safety and Health Administration (OSHA) (e.g., 29 CFR parts 1910 and/or 1926, as applicable) or the state or local occupational safety and health regulations, whichever are most stringent, will be met.

i. Civil Rights. The institution administering the grant must comply with all nondiscrimination requirements as set forth in section III.C.3 of the FY 2014 **General Section**.

j. Disclosure. All test results and other information in pre-1978 housing related to lead-based paint or lead-based paint hazards must be provided to the owner of the unit, together with a statement describing the owner's legal duty to disclose the knowledge of lead-based paint and its hazards to prospective tenants (before initial leasing, or before lease renewal with changes) and buyers (before sale) (24 CFR Part 35, subpart A). Disclosure of other identified housing-related health or safety hazards to the owner of the unit, for purposes of remediation, is encouraged but not required by HUD.

k. Privacy. Submission of any information to databases (whether website, computer, paper, or other format) of addresses of housing units identified, treated or cleared under these studies is subject to the protections of the Privacy Act of 1974, and shall not include any personal information that could identify any household member. You should also check to ensure you meet state and local privacy regulations.

l. Community Involvement. Applicants must incorporate meaningful community involvement into any study that requires a significant level of interaction with a community during implementation (e.g., projects being conducted within occupied dwellings or which involve surveys of community residents). The term community refers to a variety of populations comprised of persons who have commonalities that can be identified (e.g., based on geographic location, ethnicity, health condition, common interests). Applicants should identify the community that is most relevant to their particular project. Meaningful community involvement also requires that recipients ensure that information provided to the community during these activities is provided in a manner that is effective for persons with disabilities (See 24 CFR § 8.6) and gives meaningful access to persons with LEP.

There are many different approaches to involving the community in the conception, design, and implementation of a study and the subsequent dissemination of findings. Examples include but are not limited to: establishing a structured approach to obtain community input and feedback (e.g., through a community advisory board); including one or more community-based organizations as study partners; employing community residents to recruit study participants and collect data; and enlisting the community in the dissemination of findings and translation of results into improved policies and/or practices. A discussion of community involvement in research involving housing-related health hazards can be found in Chapter 5 of the Institute of Medicine publication titled "Ethical Considerations for Research on Housing-Related Health Hazards Involving Children" (see Appendix B for more information on this report).

m. Economic Opportunities for Low- and Very Low-Income Persons (Section 3). Section 3 of the Housing and Urban Development Act of 1968 (12 U.S.C. § 1701u) applies to this program when activities conducted pursuant to this NOFA include housing construction or rehabilitation (including reduction and abatement of lead-based paint hazards). Section 3

requires that, to the greatest extent feasible, training, employment, contracting, and other economic opportunities to low- and very low-income persons, particularly those who are recipients of government assistance for housing, and to business concerns that provide economic opportunities are directed to low- and very low-income persons in the area in which the project is located. For more information on these requirements, see 24 CFR Part 135 and section VI.B. of the FY 2014 **General Section**.

n. Standardized Dust Sampling Protocol and Quality Control Requirements. Grantees collecting samples of settled dust from participant homes for environmental allergen analyses (e.g., cockroach, dust mite) will be required to use a standard dust sampling protocol, unless the grantee provides compelling justification to use an alternate protocol (e.g., the study involves the development of an alternative sampling method). The HUD protocol can be found on the OHHLHC website at: <http://www.hud.gov/offices/lead/hhi/hhiresources.cfm>. Grantees conducting these analyses may also be required to include quality control dust samples, provided by OHHLHC at no cost to the grantee, with the samples that are submitted for laboratory analyses.

o. Requirements for peer review of scientific data in accordance with the Office of Management and Budget Information Quality Guidelines. All HUD-sponsored research is subject to the OMB Final Information Quality Bulletin for Peer Review (70 FR 2664-2677, January 14, 2005) prior to its public dissemination. In accordance with paragraph II.2 of the Bulletin, HUD will not require further peer review conducted on information that has already been subjected to adequate peer review.

p. Principal Investigator (PI). The PI for the proposed study must directly represent and be directly employed by the applicant for the proposed role in the grant application. If the proposal includes co-PIs, the lead co-PI must represent and be directly employed by the applicant.

q. Environmental Requirements.

(1) Eligible Construction and Rehabilitation Activities. A FY 2014 Healthy Homes Technical Studies or Lead Technical Studies award does not constitute approval of specific sites where activities that are subject to environmental review may be carried out. The provisions of section 305(c) of the Multifamily Housing Property Disposition Reform Act of 1994, implemented by HUD regulations at 24 CFR part 58, “Environmental Review Procedures for Entities Assuming HUD Environmental Responsibilities,” are applicable to properties assisted with Healthy Homes Technical Studies or Lead Technical Studies funds. Therefore, recipients conducting eligible construction and rehabilitation activities must comply with 24 CFR part 58. Recipients that are States, units of general local government or Native American tribes must carry out environmental review responsibilities as a responsible entity under part 58. Recipients who are academic, not-for-profit, or for-profit institutions, or specialized units of local government, must contact and partner with a non-recipient responsible entity, usually the unit of general local government or Native American tribe, to assume the environmental review responsibilities for construction or rehabilitation activities funded (in whole or in part) under this NOFA. Reasonable expenses incurred for compliance with these environmental requirements are eligible expenses under this NOFA. Under 24 CFR 58.11, where the recipient is not a State, unit of general local

government or Native American tribe, if a responsible entity objects to performing the environmental review, or the recipient objects to the responsible entity performing the environmental review, HUD may designate another responsible entity to perform the review or may perform the environmental review itself under the provisions of 24 CFR part 50. When HUD performs the review itself, following grant award execution, HUD will be responsible for ensuring that any necessary environmental reviews are completed. See paragraph (iii) below for additional assistance.

(2) For all cooperative agreements under this NOFA, recipients and other participants in the project are prohibited from undertaking, or committing or expending HUD or non-HUD funds (including leveraged funds) on, a project or activities under this NOFA (other than activities listed in 24 CFR 58.34, 58.35(b) or 58.22(f)) until the responsible entity completes an environmental review and the applicant submits and HUD approves a Request for the Release of Funds and the responsible entity's environmental certification (both on form HUD-7015.15) or, in the case where the recipient is not a State, unit of general local government or Native American tribe and HUD performs the environmental review under part 50, HUD has completed the review and notified the grantee of its approval. The results of the environmental reviews may require that proposed activities be modified or proposed sites rejected. For Part 58 procedures, see <http://www.hud.gov/offices/cpd/environment/index.cfm>. **For assistance, contact Karen Griego, the Office of Lead Hazard Control and Healthy Homes Program Environmental Clearance Officer at (213) 534-2458 (this is not a toll free-number) or the HUD Environmental Clearance Officer in the HUD Field Office serving your area.** If you are a hearing- or speech-impaired person, you may reach the telephone number via TTY by calling the toll-free Federal Relay Service at 1-800-877-8339. Recipients of a grant under this program will be given additional guidance in these environmental responsibilities.

(3) All other activities not related to construction or rehabilitation activities are categorically excluded under 24 CFR 50.19(b)(1), (3), (5) and (9) from the requirements of the National Environmental Policy Act of 1969 (42 U.S.C. § 4321) and are not subject to environmental review under the related environmental laws and authorities at 24 CFR 50.4.

IV. Application and Submission Information

A. Obtaining an Application Package.

An electronic copy of the Application Package and Application Instructions for this NOFA can be downloaded from Grants.gov at <http://www.grants.gov/applicants/apply-for-grants.html>.

An applicant demonstrating good cause may request a waiver from the requirement for electronic submission. If you receive a waiver, your paper application must be received by HUD before the deadline of this NOFA. To request a waiver and receive a paper copy of the application materials, you should contact:

Dr. J Kofi Berko Jr

Office of Lead Hazard Control & Healthy Homes
US Department of Housing & Urban Development
451 7th Street, S.W. Rm 8236
Washington, DC 20410
Phone: 2024027696
Email: j.kofi.berko@hud.gov

Applicants should submit their waiver requests in writing via email. Waiver requests must be submitted no later than 15 days prior to the application deadline date and should be submitted to: OHHLHCNOFAreview@hud.gov.

B. Content and Form of Application Submission.

To assure you have the correct Application Package and Application Instructions, you must check that the CFDA number, the Opportunity Title, and the Funding Opportunity Number on the first page of your Application Package match those listed in the Overview of this NOFA. Your application will only be considered for the competition indicated on your submission.

Preliminary Applications. This preliminary application shall consist of a cover sheet with the name and contact information for the applicant and **must not exceed 5 pages in length** excluding the cover sheet. In addition, the application must be submitted and formatted to fit an 8 ½ by 11-inch paper, with one-inch margins (for the top, bottom, left, and right sides of the document) and in standard Times New Roman 12-point font. Please number the pages. Note that although submitting pages in excess of the page limit will not disqualify the pre-application, HUD will not consider the information on any page beyond the page limit. Applicants should also submit the following as part of the pre-application package: biographical sketches (maximum length of 1 page per person) for a maximum of 3 key personnel; a list of references that are cited in the responses to the rating factors; the estimated total amount that would be requested in a full application, and an abstract of 200 words or less. The abstract should list the study objectives, identify partner organizations, identify the target population/community, and clearly identify the knowledge gap that the study will address. The pre-application package should also include Form SF424_Application_for_Federal_Assistance (be sure to correctly identify the NOFA title, Funding Opportunity Number and CFDA number). Applicants must also include the nine digit zip code (zip code plus four digits) associated with the applicant address in box 8d of the Form SF424.

HUD will use the response to the factors below to rate, rank, and invite a subset of eligible applicants to submit a full application. The responses provided to the factors in your preliminary application are the only source of information that will be utilized to invite an applicant to submit a full application. See Section IV.A, Obtaining an Application Package, for information on the requirement for submitting an application.

HUD Facsimile Transmittal (HUD96011) Third Party Documentation Acknowledgement of Application Receipt (HUD2993) if applicable

Forms for your package include the HUD standard forms outlined below:

See instructions above.

C. Application Submission Dates and Times.

Application Deadline.

Submit your application to Grants.gov unless a waiver has been issued allowing you to submit your application in paper form. Instructions on submitting your application to Grants.gov are contained within the Application Package you downloaded from Grants.gov.

The application deadline is 11:59:59 p.m. Eastern time on July 8, 2014. Applications must be received no later than the deadline. Please refer to the General Section for more information about timely receipt of applications.

Applications must be received no later than the deadline. Please refer to the General Section for more information about timely receipt of applications.

Your application must be **both received and validated** by Grants.gov. Your application is “received” when Grants.gov provides you a confirmation of receipt and an application tracking number. **If you do not see this confirmation and tracking number, your application has not been received.**

After your application has been received, your application still must be validated by Grants.gov. During this process, your application may be “validated” or “rejected with errors.” To know whether your application was rejected with errors and the reason(s) why, you must log into Grants.gov, select “Applicants” from the top navigation, and select “Track my application” from the drop-down list. If the status is “rejected with errors,” you have the option to correct the error(s) and resubmit your application before the Grace Period ends. **If your application was “rejected with errors” and you do not correct these errors, HUD will not review your application.** If your status is “validated” your application will be forwarded to HUD by Grants.gov.

Grace Period for Grants.gov Submissions: If your application is received by Grants.gov before the deadline, but is rejected with errors, you have a grace period of one day beyond the application deadline to submit a corrected application that is received and validated by Grants.gov. Any application submitted during the grace period that does not meet the criteria above will not be considered for funding. There is no grace period for paper applications. See the General Section for more information about the grace period.

If you are required to submit supporting documentation you may either scan and attach these documents to your electronic application package or submit them via fax. If supporting documents are submitted by fax, you must use the HUD-96011 Facsimile Transmittal Form as a cover page; this form is located in your Application Package. You must send any faxes to the toll-free number **800-HUD-1010**. If you cannot access the toll-free number or experience problems using that number you may use **215-825-8798** (this is not a toll-free number). If you or any other parties submitting documents for this

application do not use the form HUD-96011 that came with your application as the fax cover page, the documents cannot be matched to the application. Consequently, these documents will not be considered when the application is evaluated. Additionally, if your fax machine creates a cover page, you must turn this feature off.

Amending a Validated Application: If you resubmit an application that was previously validated by Grants.gov, all documents faxed in support of the application must be faxed again using the form HUD-96011. You must fax the materials after the resubmitted application has been validated by Grants.gov. All faxed materials must be received by the applicable deadline.

All pre-applications in paper format must be received by HUD no later than 3:59:59 PM eastern time on the pre-application deadline date.

D. Intergovernmental Review.

This program is not subject to Executive Order 12372, Intergovernmental Review of Federal Programs.

E. Funding Restrictions.

1. Indirect Costs. An indirect cost rate that is no greater than the approved rate negotiated with the applicant's federal cognizant agency (2 CFR 220, Appendix A, section G.11, or 2 CFR 230, Appendix A, section E.1.a, as applicable) shall be used. When required (by 2 CFR 220, Appendix A, section G.6, or 2 CFR 230, Appendix A, section E.1.e, as applicable), the provisional rate established by the cognizant agency shall be used pending the establishment of a final rate for that period. (OMB relocated its cost principles Circulars A-21, regarding educational institutions, A-87, regarding governments, and A-122, regarding nonprofits, to title 2 of the Code of Federal Regulations; the regulations supersede the circulars effective December 26, 2014 (70 Federal Register 51880, 51910, and 51927, respectively, August 31, 2005).) Please see <http://www.hud.gov/offices/adm/grants/funds/avail.cfm> for reference to the Indirect Cost requirements.

2. Purchase of Real Property. The purchase of real property is not an allowable cost under this program.

3. Purchase or Lease of Equipment. The purchase or lease of equipment having a per unit cost in excess of \$5,000 is not an allowable cost, unless prior written approval is obtained from HUD.

4. Medical Treatment. Medical treatment costs are not allowable under this program.

5. Profit. For profit institutions are not allowed to earn a profit.

6. You must comply with the Coastal Barrier Resources Act (16 U.S.C. § 3501).

7. You may not conduct lead-based paint or healthy home hazard control activities or related work that constitutes construction, reconstruction, repair or improvement (as referenced in Section 3(a)(4) of the Flood Disaster Protection Act of 1973 (42 U.S.C. §§ 4001-4128)) of a building or mobile home which is located in an area identified by the

Federal Emergency Management Agency (FEMA) as having special flood hazards unless:

- a. The community in which the area is situated is participating in the National Flood Insurance Program in accordance with the applicable regulations (44 CFR parts 59-79), or less than a year has passed since FEMA notification regarding these hazards; and
- b. Where the community is participating in the National Flood Insurance Program, flood insurance on the property is obtained in accordance with section 102(a) of the Flood Disaster Protection Act (42 U.S.C. § 4012a(a)). You are responsible for assuring that flood insurance is obtained and maintained for the appropriate amount and term.

8. Construction Activities. The amount of HUD Healthy Homes and Lead Technical Studies grant funds used for construction activities, i.e. to support or supplement a new housing construction or substantial rehabilitation project, may not exceed 20% of the total HUD funds awarded. Furthermore, the majority of any funds dedicated to construction activities supported by a Healthy Homes and Lead Technical Studies grant shall be spent for interventions not intended for lead hazard control.

9. Costs related to animal testing are not allowable under this program.

F. Other Submission Requirements.

Lead Based Paint Requirements

When providing housing assistance funding for purchase, lease, support services, operation, or work that may disturb painted surfaces, of pre-1978 housing, you must comply with the lead-based paint evaluation and hazard reduction requirements of HUD's lead-based paint rules (Lead Disclosure; and Lead Safe Housing (24 CFR part 35)), and EPA's lead-based paint rules (e.g., Repair, Renovation and Painting; Pre-Renovation Education; and Lead Training and Certification (40 CFR part 745)).

When providing education or counseling on buying or renting housing that may include pre-1978 housing, when required by regulation or policy, inform clients of their rights under the Lead Disclosure Rule (24 CFR part 35, subpart A), and, if the focus of the education or counseling is on rental or purchase of HUD-assisted pre-1978 housing, the Lead Safe Housing Rule (subparts B, R, and, as applicable, F - M).

V. Application Review Information

A. Review Criteria.

A.1. Rating Factors.

Threshold Requirements. Pre-applications that meet all of the threshold requirements will be eligible to be scored and ranked, based on the total number of points allocated for each of the rating factors described below in this section. The 2014 General Section identifies threshold requirements that must be met for an organization to receive an award.

Award Factors. Each of the four factors is weighted as indicated by the number of points that are assigned to it. The maximum score that can be attained is 100. Applicants should

be certain that each of these factors is adequately addressed in the project description and accompanying materials. To the extent feasible, include all of the needed information within your response to each rating factor. If your response to a particular rating factor cites information provided in your response to another rating factor, clearly indicate where the information is located so that the reviewer can easily locate it.

a. Capability and qualification of key personnel

Maximum Points: 20

- (1) Brief description of the academic qualifications and relevant professional experience of key study personnel (15 points).
- (2) Concise description of the qualifications and relevant professional experience of any partner organizations included in your proposal (note: these points will be redistributed to subfactor V.A.1.a.i. if no partner organizations are included in your application) (5 points).

b. Need for proposed research

Maximum Points: 35

- (1) Key Research Gap Addressed and Importance of Study Focus Area (20 points). Clearly and succinctly discuss the need for the proposed research based on the extent that it addresses a key research gap on a priority lead or healthy homes issue, as applicable, and as discussed in section III.C.1, citing published literature where possible. Explain why the knowledge gap that your proposed study will address is considered key (based on identified gaps in the literature and/or well documented knowledge from professional practice). The importance of the specific topic that your proposed study addresses can be demonstrated by factors such as (but not limited to): the severity of the illness/injury that is addressed; the prevalence of the housing condition or operation; the economic impact of the issue that is addressed, the impact of the illness/injury on vulnerable populations, etc.
- (2) Strategic Value in Informing Policy or Practice (15 points). Describe the strategic value of your proposed research with respect to its potential impact in informing policy or practice within the focus area of your proposed healthy homes or lead technical study. Describe the potential application of your expected study findings in advancing the field of healthy homes or lead hazard control.

c. Soundness of research design

Maximum Points: 35

- (1) Study Design and Objectives (20 points). Clearly and succinctly describe the design of your proposed technical study, identifying major study milestones. Include sufficient detail to demonstrate feasibility and the likelihood that you will achieve the stated objectives. Identify the major objectives of your proposed study and any hypotheses to be tested (if testable hypotheses are appropriate for the proposed research). If appropriate, describe your plans for community involvement and for obtaining Institutional Review Board

approval.

(2) Efficiency of Design and Statistical Basis (8 points).

Describe why your proposed study design is an efficient approach to achieving your objectives (i.e., in the context of other study design options). Discuss the statistical basis for the design (including the statistical power if appropriate).

(3) Data Collection and Analysis (7 points).

Describe your plans for ensuring the accuracy and validity of the data that will be collected. Briefly describe the type of statistical analysis that will be conducted and your plans for the publication of study findings.

d. Proposed schedule and management plan

Maximum Points: 10

(1) Submit a timeline for the completion of major research activities and tasks and a description of actions that will be taken to ensure timely completion of the study. It is expected that the study, including drafting and submission of at least one article to a peer-reviewed journal, will be completed within three years of award, the maximum period of the cooperative agreement (5 point).

(2) Provide a brief description of your plan for managing and coordinating study activities (5 points).

A.2. NOFA Priorities.

This NOFA does not award NOFA priority points.

A.3. Bonus Points

This Program chooses not to award bonus points.

B. Reviews and Selection Process.

Rating and Ranking Criteria. Invitations to submit full application will be made in rank order. Full applications will be solicited from up to 20 Healthy Homes Technical Study Program applicants and up to 10 Lead Technical Studies Program applicants whose pre-applications scored at least 75 points. If more than the respective maximum number of pre-applications receives scores of 75 or greater, the 20 highest scoring Healthy Homes Technical Studies pre-applicants and/or the 10 highest scoring Lead Technical Studies pre-applicants, as applicable, will be invited to submit full applications. HUD may increase the number of full applications solicited for either program following the scoring of pre-applications if additional funds become available or if an unexpectedly large number of highly qualified pre-applications are received.

C. Anticipated Announcement and Award Dates.

Anticipated announcement date of successful pre-applicants is 49 days from the pre-application submission deadline date.

VI. Award Administration Information.

A. Award Notices.

1. Solicitation for Full Applications. A solicitation for full application from successful pre-applicants will be made through a second Notice (Healthy Homes and Lead Technical Studies Grant Program Full-Application) published on www.grants.gov. Successful applicants will also be contacted through the email addresses of the contact person and the authorizing official provided on Form SF 424. Eligibility will be limited to only applicants whose pre-applications meet the rating and ranking criteria as described above in section V.B.

2. Debriefing. Debriefing requests should be submitted via email to the Agency Contact identified in Section VII of this NOFA, following the procedures outlined in the FY 2014 **General Section**. Unsuccessful pre-applicants who request debriefing will be offered a brief written debriefing.

B. Administrative and National Policy Requirements.

Certain Administrative and National Policy Requirements apply to all HUD programs, including this NOFA. For a complete list of these requirements, see Section VI.B. of the General Section.

This Notice solicits pre-applications only. No awards will be made on the basis of this notice alone. An invitation to submit a full application is in no way a guarantee that the full application will ultimately be awarded. Post-award requirements will be published in the second announcement (Healthy Homes and Lead Technical Studies Grant Program Full-Application).

C. Reporting.

Please refer to Section VI of the General Section for a description of the general reporting requirements applicable to this NOFA.

Not applicable at this time.

VII. Agency Contact(s).

HUD staff will be available to provide clarification on the content of this NOFA. Please note that HUD staff cannot assist applicants in preparing their applications.

Questions regarding specific program requirements should be directed to the point of contact listed below.

For programmatic questions on the Healthy Homes and Lead Technical Studies Grant Program, you may contact Dr. Peter Ashley, Office of Lead Hazard Control and Healthy Homes, at 202-402-7595 or via email at Peter.J.Ashley@hud.gov. For grants administrative questions, you may contact Ms. Nadine Heath, Office of Lead Hazard Control and Healthy Homes, at telephone 202- 402-7680 or via email at Nadine.L.Heath@hud.gov. If you are a hearing- or speech-impaired person, you may reach the above telephone numbers through

TTY by calling the toll-free Federal Relay Service at 1-800-877-8339.

Questions concerning the General Section should be directed to the Office of Strategic Planning and Management, Grants Management and Oversight Division at 202-708-0667 (this is not a toll-free number).

Persons with hearing or speech impairments may access these numbers via TTY by calling the toll-free Federal Relay Service at 800-877-8339.

VIII. Other Information.

HUD is required to comply with the Paperwork Reduction Act of 1995 (44 U.S.C. 3501-3520). This Act governs the collection of information from the public including responses to this NOFA. HUD may not collect this information, and you are not required to complete these forms unless they display current, valid OMB control number(s). The results of this collection will not be published or be used for statistical purposes.

A Finding of No Significant Impact (FONSI) with respect to the environment has been made for this NOFA in accordance with HUD regulations at 24 CFR Part 50, which implement section 102(2)(C) of the National Environmental Policy Act of 1969 (42 U.S.C. 4332(2)(C)). The FONSI is available for inspection at HUD's Funds Available web page at http://portal.hud.gov/hudportal/HUD?src=/program_offices/administration/grants/fundsavail.

Appendix.

FY 2014 Healthy Homes and Lead Technical Studies

Notice of Fund Availability

APPENDIX A: Key Residential Health and Safety Hazards

The following briefly describes the residential health and injury hazards HUD considers key targets for intervention:

1. Allergens and Asthma: In 2005, the CDC estimated that over 22.2 million Americans have asthma with an associated annual cost of more than \$13 billion. Asthma is now recognized as the leading cause of school and work absences, emergency room visits, and hospitalizations. For sensitized children, exposure to antigens from dust mites, certain pets, and cockroaches has been associated with more severe asthma. There is a preponderance of evidence showing a dose-response relationship between exposure and prevalence of asthma and allergies; some evidence also indicates that exposure to antigens early in life may predispose or hasten the onset of allergies and asthma. Dust mites have been identified as the largest trigger for asthma and allergies. A recently published study of children with atopic (allergic) asthma from seven major U.S. cities reported that over half of the children were allergic to cockroach and dust mite allergen (approximately 70% and 63%, respectively), with approximately 50% of the children allergic to mold (Morgan et al. 2004). Significant fractions of children also tested positive for allergy to cat, rodent and dog allergens. This is consistent with other studies that have found that cockroach tends to be the

dominant allergen among asthmatic children living in the inner-city, whereas allergy to dust mite allergens appears to dominate among children living in most suburban environments. While children are the population most at risk for developing asthma, there is a growing need to address the onset of new cases in older adults, and to examine how their risk factors might differ from those of children (Selgrade et al. 2006).

HUD-funded researchers recently reported a significant association between a measure of mold exposure (i.e., an index composed of DNA-based measurement of specific fungi in house dust samples) during the 1st year of life and the diagnosis of asthma at age 7 (Reponen et al., 2011). In a follow-up paper, the researchers identified three specific mold species that were significantly associated with asthma development among the study cohort at age 7 (Reponen et al., 2012).

Interventions known to have beneficial effects include the installation of impervious mattress and pillow covers, which can reduce allergen exposure by 90 percent. Other dust mite control measures include dehumidification, laundering bedding in hot water, specialized cleaning (dry steam or use of a HEPA vacuum), and removal of carpets and other materials that accumulate dust and are difficult to clean (e.g., dust sinks). Providing residents with education and instruction on cleaning with repeat visits by outreach workers has been shown to result in significant reduction in levels of dust mite and cockroach allergens in floor dust (Takaro et al. 2004; Morgan et al. 2004). For these same studies, researchers also reported significant reductions in asthma symptoms among children living in the intervention group when compared to the control group. A recent meta-analysis found that dust control interventions can also have a preventative effect. Based on five longitudinal studies, the researchers reported an approximately twenty percent decrease in risk of physician-diagnosed asthma for individuals in homes with dust control interventions, compared to those in control homes (Russell et al. 2007).

Interventions emphasizing the mitigation of mold and moisture problems in the homes of asthmatic children have also been shown to be effective. In one HUD-supported study, asthmatic children living in homes in which nontrivial mold growth was identified, were randomized into two groups, with one group receiving interventions to address the residential mold/moisture problems. The remediation group showed statistically significant reductions in symptom days, symptom score, and the need for acute care (Kercsmar et al. 2006). The mean cost of home interventions was \$3,458 per home, including the cost of addressing lead-based paint hazards.

Moving families with an asthmatic child into new housing designed to reduce exposure to asthma triggers has also been shown to be effective. HUD-supported research conducted by Takaro et al. (2010) demonstrated improvements in asthma symptoms and other indicators for subjects who lived in asthma-friendly Breathe-Easy Homes in addition to receiving traditional in-home asthma education and outreach. Breathe-Easy Homes address multiple asthma triggers by incorporating comprehensive enhancements into the physical structure, including moisture-reduction features, low dust-generating and chemical-emitting finishes, and advanced fresh-air ventilation systems. The authors reported significant improvements in primary (e.g., symptom-free days, FEV₁) and secondary (days rescue medicine used, nights with symptoms) outcomes among BEH occupants.

2. Asbestos: Asbestos is a mineral fiber that has been used commonly in a variety of

building construction materials and household products for insulation and as a fire-retardant. The Environmental Protection Agency (EPA) and the Consumer Product Safety Commission (CPSC) have banned most asbestos products. Manufacturers have also voluntarily limited uses of asbestos. Today, asbestos is most commonly found in older homes in pipe and furnace insulation materials, asbestos shingles, millboard, textured paints and other coating materials, and floor tiles. Elevated concentrations of airborne asbestos can occur when asbestos-containing materials (ACMs) are disturbed by cutting, sanding or other remodeling activities. Improper attempts to remove these materials can release asbestos fibers into the air in homes, increasing asbestos levels and endangering the people living in those homes. The most dangerous asbestos fibers are too small to be visible. After they are inhaled, they can remain and accumulate in the lungs. Asbestos can cause lung cancer, mesothelioma (a cancer of the chest and abdominal linings), and asbestosis (irreversible lung scarring that can be fatal). Most people with asbestos-related diseases were exposed to elevated concentrations on the job; some developed disease from exposure to clothing and equipment brought home from job sites. As with radon, dose-response extrapolations suggest that lower level exposures, as may occur when asbestos-containing building materials deteriorate or are disturbed, may also cause cancer.

Intact asbestos-containing materials are not a hazard; they should be monitored for damage or deterioration and isolated if possible. Repair of damaged or deteriorating ACMs usually involves either sealing (encapsulation) or covering (enclosure) it. Repair is usually cheaper than removal, but it may make later removal of asbestos more difficult and costly. Repairs should only be done by a trained professional certified to handle asbestos safely and can cost from a few hundred to a few thousand dollars; removal can be more expensive.

3. Combustion Products of Heating and Cooking Appliances: Burning of oil, natural gas, kerosene, and wood for heating or cooking purposes can release a variety of combustion products of health concern. Depending upon the fuel, these may include carbon monoxide (a chemical asphyxiant), oxides of nitrogen (respiratory irritants), polycyclic aromatic hydrocarbons (e.g., the carcinogen benzo[a]pyrene), and airborne particulate matter. Exposure to carbon monoxide, an odorless gas, can be fatal. Nitrogen dioxide can irritate or damage the respiratory tract, and sulfur dioxide can irritate the eyes, nose and respiratory tract. Improper venting and poor maintenance of heating systems and cooking appliances can dramatically increase exposure to combustion products. As the principles of green construction and rehabilitation become more popular, and homes become increasingly airtight to improve energy efficiency, there are concerns about potential indoor air quality trade-offs (Selgrade et al. 2006).

Experts recommend having combustion heating systems inspected by a trained professional every year to identify blocked openings to flues and chimneys, cracked or disconnected flue pipes, dirty filters, rust or cracks in the heat exchanger, soot or creosote build-up, and exhaust or gas odors. Installing a carbon monoxide detector is also recommended; however, such a detector will not detect other combustion by-products.

4. Environmental Tobacco Smoke (ETS): ETS (also known as secondhand smoke) results from the combustion of tobacco products and exhalation of inhaled tobacco smoke by active smokers. Tobacco smoke contains as many as 7000 individual compounds, including formaldehyde, carbon monoxide, nicotine, nitrosamines and polyaromatic

hydrocarbons, with nearly 70 compounds identified as carcinogens (US DHHS, 2010; IARC, 2004). Exposure to ETS has been associated with numerous adverse health effects, including multiple types of cancer, coronary heart disease, asthma, respiratory tract infections and others. Additionally, exposure to ETS has been estimated to cause approximately 50,000 excess deaths annually in the U.S., including sudden infant death syndrome (Cal EPA, 2005). Children are particularly vulnerable to the effects of SHS. The U.S. Surgeon General's office reported that approximately 22 million children may be exposed to ETS in the U.S. (US DHHS, 2006).

Exposure to ETS can be a problem even in rooms or units where smoking does not occur. Van Deusen et al. (2009) reported that levels of particulate matter (an indicator of tobacco smoke) were elevated in rooms within a home that were distant from the primary room where smoking occurred. In addition, ETS also migrates between units in multi-unit buildings. Kraev et al. (2009), measured nicotine in air and air exchange rates in individual units of a lower-income multi-unit building in the Boston area and found measurable levels of nicotine in units where no smoking occurred; King et al. (2010) reported similar results in nonsmoking units and hallways as part of a study in Buffalo. Wilson et al. (2010) analyzed measurements of cotinine exposure in children (an indicator of ETS exposure) and found that those living in multifamily housing had higher levels than children in detached housing, indicating the contribution from ETS migrating between units of multifamily housing.

5. Infiltration of Ambient Pollutants: Personal exposure to airborne contaminants is a function of indoor and outdoor exposures. For people living in areas that are near roadways or a point source generating hazardous pollutants, for example, the infiltration of ambient pollutants has the potential to dominate personal exposures. Logue et al. (2010, 2011) identified a number of pollutants that present significant health risks in indoor environments; however, many of those pollutants are found also in the ambient environment suggesting infiltration of ambient air pollution may be of concern when identifying exposure risks to occupants of a home. Meng et al. (2009) reported in the Relationships of Indoor, Outdoor, and Personal Air (RIOPA) study across three U.S. cities that approximately 60% of indoor PM_{2.5} originated from the outdoors. Allen et al. (2012) identified the frequency of air conditioner use and the opening of windows as predictors of ambient pollution infiltration during the summer months, while temperature and the use of forced air heat were predictors during winter months. Studies on practical control technologies and to reduce the infiltration of outdoor air pollutants into homes are needed.

6. Insect and Rodent Pests: The observed association between exposure to cockroach allergen and asthma severity has already been noted above. In addition, cockroaches may act as vehicles to contaminate environmental surfaces with certain pathogenic organisms. Rodents can transmit a number of communicable diseases to humans, either through bites, arthropod vectors, or exposure to aerosolized excreta. In addition, humans can become sensitized to proteins in rodent urine, dander and saliva. Such sensitization may contribute to asthma severity among sensitized individuals. Insect and rodent infestations are frequently associated with substandard housing that make them difficult to eliminate. Even though studies have shown that bedbugs do not transmit any human diseases, CDC, EPA and USDA have declared bedbugs as pest of significant public health importance. They are known to have several negative physical and mental health effects as well as economic

consequences. Research indicates that the presence of bedbugs and their bites can result in adverse physical and mental health effects (e.g., infections, anxiety, insomnia, etc.) as well as economic consequences. These include allergic reactions to their bites, secondary infections and expensive control measures. Treatment of rodent and insect infestations often includes the use of toxic pesticides that may present hazards to occupants (see below). Integrated pest management (IPM) for rodents and cockroaches is recommended by federal agencies, including the U.S. EPA, HUD, and the CDC because it minimizes the use of toxic pesticides and instead emphasizes environmental controls such as elimination of harborage and removing access to food and water. This recommendation was recently confirmed by an expert panel that systematically reviewed the literature on this topic (Sandel et al., 2010). According to the expert panel, sufficient evidence was available to support the implementation of an IPM approach as a way of reducing pesticide residues in the home. A reduction in residential pesticide exposure subsequently would ultimately lead to a reduction in the prevalence of pesticide-associated health issues.

7. Lead-Based Paint and its Hazards: Exposure to lead, especially from deteriorating lead-based paint, remains one of the most important and best-studied of the household environmental hazards to children. Although blood lead levels (BLLs) have fallen nationally, a large reservoir of lead remains in housing. Recent results from CDC's Fourth National Health and Nutrition Examination Survey (NHANES 2002) demonstrate that the national geometric mean blood lead concentration of children aged 1-5 years has decreased from 2.3 g/dL in 1991 to 1.6 g/dL in the period 1999-2002 (CDC 2005). During the 1999-2002 survey period, children aged 1-5 years had the highest prevalence of elevated BLLs (1.6%), so that approximately 310,000 children aged 1-5 years remained at risk for exposure to harmful lead levels. Overall, by race/ethnicity, non-Hispanic blacks and Mexican Americans had higher percentages of elevated BLLs (1.4% and 1.5%, respectively) than non-Hispanic whites (0.5%). Among subpopulations, non-Hispanic blacks aged 1-5 years and aged >60 years had the highest prevalence of elevated BLLs (3.1% and 3.4%, respectively). As BLLs have dropped over the years, recent analyses have examined the relationship between relatively low blood lead concentrations (<10g/dL) and cognitive functioning in representative samples of U.S. children and adolescents, and have found evidence that suggests that deficits in cognitive and academic skills associated with lead exposure have no threshold (Lanphear et al., 2000; Canfield et al., 2003). These findings clearly support the importance of primary prevention with respect to childhood lead exposure.

Despite dramatic reductions in blood lead levels over the past 15 years, lead poisoning continues to be a significant health risk for young children. Based on results from the HUD- and NIEHS-funded National Survey of Lead and Allergens in Housing (Jacobs et al., 2002), it is estimated that approximately 40 percent of housing units (38 million) in the United States contain lead-based paint. It is further estimated that 25 percent of the nations housing stock (24 million housing units) have one or more significant lead-based paint hazards (i.e., deteriorated lead-based paint, lead-contaminated dust, or lead-contaminated soil). 1.2 million housing units were found to pose the highest risk of lead poisoning because they housed low-income families with children less than six years of age.

Among HUD grantees, lead hazard control (LHC) costs tend to range from \$500 to \$15,000 per unit, with a median cost of \$5,960. Corrective measures include paint stabilization,

enclosure and removal of certain building components coated with lead paint, cleanup and "clearance testing," which ensures the unit is safe for young children. In addition, acute injuries to children have been well documented, most notably in instances involving sanding or stripping of lead-based paint or visible deterioration of lead-based painted residential building components combined with children who exhibit pica tendencies.

Evaluation of lead hazard control interventions conducted by recipients of HUDs lead hazard control grants found that interventions were effective in significantly reducing pre-intervention dust-lead levels on floors and window surfaces up to six years following intervention (Wilson et al. 2006). More intensive treatments were found to significantly reduce dust lead loadings on window sills and troughs compared to lower level treatments, however, no significant differences in dust-lead loadings on floors were reported. Sandel et al. (2010) confirmed these general findings, citing that lead hazard control interventions were effective in reducing exposures to lead exposures. The authors concluded that the evidence was sufficient to promote lead hazard control interventions as a means of reducing lead exposure and associated health effects, particularly in children.

8. Mold and Moisture: An analysis of several pulmonary disease studies estimates that 25 percent of airways disease, and 60 percent of interstitial lung disease may be associated with moisture in the home or work environment. Moisture is a precursor to the growth of mold and other biological agents, which is also associated with respiratory symptoms. An investigation of a cluster of pulmonary hemosiderosis (PH) cases in infants showed PH was associated with a history of recent water damage to homes and with levels of the mold *Stachybotrys atra* (SA) in air and cultured surface samples, although this association could not be considered a causal relationship. Associations between exposure to SA and "sick building" symptoms in adults have also been observed. Other related toxigenic fungi have been found in association with SA-associated illness and could play a role. For sensitive individuals, exposure to a wide variety of common molds may also aggravate asthma. A review by an expert committee convened by the Institute of Medicine found sufficient evidence for an association between exposure to mold and other agents in damp indoor environments and asthma symptoms in sensitized persons, upper respiratory tract symptoms, cough, and wheeze (IOM 2004). The committee also found limited or suggestive evidence for an association between damp indoor environments and the development of asthma.

Addressing mold problems in housing requires coordination among the medical, public health, microbiological, housing, and building science communities. Krieger et al., (2010) report that an expert panel review of relevant literature on this topic found that a combined approach of eliminating active leaks and moisture intrusion into the home while also removing moldy items already in place was an effective intervention strategy for reducing exposure to mold and associated respiratory health effects. The panel concluded that there was sufficient evidence to support implementation of a coordinated intervention strategy for mold and moisture problems.

The cost of mold/moisture-related intervention work (e.g., IPM, clean and tune furnace, remove debris, vent clothes dryer, cover dirt floor with impermeable vapor barrier) is a few hundred dollars, unless major modification of the ventilation system or structural repairs is needed. For example, in Cleveland, mold interventions, including repairs to ventilation systems and basement flooring, in the most heavily contaminated homes range from \$500 to

\$5,000, with some costs also being dedicated to LHC simultaneously through its lead and asthma program.

9. Pesticide Residues: According to the EPA, 75 percent of U.S. households used at least one pesticide product indoors during the past year. Products used most often are insecticides and disinfectants. Another study suggests that 80 percent of most people's exposure to pesticides occurs indoors and that measurable levels of up to a dozen pesticides have been found in the air inside homes. The amount of pesticides found in homes appears to be greater than can be explained by recent pesticide use in those households; other possible sources include contaminated soil or dust that migrates in from outside, stored pesticide containers, and household surfaces that collect and then release the pesticides. Pesticides used in and around the home include products to control insects (insecticides), termites (termiticides), rodents (rodenticides), molds and fungi (fungicides), and microbes (disinfectants). In 2005, the American Association of Poison Control Centers reported that some 1.6 million children were involved in common household pesticide poisonings or exposures (AAPCC 2005). In households with children less than five years of age, almost half stored at least one pesticide product within the reach of children. Exposure to high levels of cyclodiene pesticides, commonly associated with misapplication, has produced various symptoms, including headaches, dizziness, muscle twitching, weakness, tingling sensations, and nausea. In addition, the EPA is concerned that cyclodienes might cause long-term damage to the liver and the central nervous system, as well as an increased risk of cancer. A recent expert panel review (Sandel et al., 2010) found that implementation of an integrated pest management approach was an effective intervention for reducing pesticide residues in the home and should be implemented in lieu of pesticide application for reducing pests.

There are available data on hazard evaluation methods and remediation effectiveness regarding pesticide residues in the home environment.

10. Radon: The National Academy of Sciences estimates that approximately 15,000 cases of lung cancer per year are related to radon exposure. Epidemiologic studies of miners exposed to high levels of radon in inhaled air have defined the dose response relation for radon-induced lung cancer at high exposure levels. Extrapolation of these data has been used to estimate the excess risk of lung cancer attributable to exposure to radon gas at the lower levels found in homes. These estimates indicate that radon gas is an important cause of lung cancer deaths in the U.S. Excessive exposures are typically related to home ventilation, structural integrity and location.

Radon measurement and remediation methods are well developed, and the EPA recommends that every home be measured for radon. Sandel et al. (2010) conducted a review of the literature and concluded that active soil depressurization beneath the foundation of the structure was an effective method for reducing radon exposures in the home. EPA estimates that materials and labor costs for radon reduction in an existing home are \$800-\$2,500. Including radon resistant techniques in new home construction costs \$350-\$500, and can save up to \$65 annually in energy costs, according to the EPA.

11. Semi-Volatile Organic Compounds (SVOCs): Several SVOCs are emerging as potential health risks in the home due to their ubiquitous nature in consumer and building products that are produced in high volume and used worldwide. SVOCs exist partially in

the gas-phase and emit their respective chemical gradually over time, particularly in the presence of increased temperatures. Two compounds of increasing concern are phthalates and polybrominated diphenyl ethers (PBDE). During recent years, phthalate and PBDE compounds have received increased scrutiny due to their potential cumulative health risks and increased use in consumer products. PBDE are found in flame retardants, plasticizers, flexible foams and may also be found in childrens products. Phthalates are used as plasticizers and are most notable for their use in childrens products, such as teething rings, food contact items and other flexible polyvinyl chloride (PVC)-based products. The health effect most widely associated with phthalates exposures are reproductive effects, while PBDE have shown toxicity potential in liver, thyroid and neurodevelopment systems.

Exposure to phthalates may occur via many different routes inhalation, ingestion, water, soil and may occur in various environments from the home to a place of work. Children are reported to have the highest exposures to pthalates among all age groups (CDC, 2005), along with lower socioeconomic status households (Zota et al., 2008). Both phthalates and PBDE have been found in house dust; exposure to dust has been reported as the primary route of exposure for PBDE (Wilford et al., 2005; Zota et al., 2008). The presence of both phthalates and PBDE in house dust presents potential risks particularly to young children. Several house characteristics, including older age of house, water leakage and use of PVC in flooring materials, have been identified as significant indicators for potential phthalates exposures (Bornehag et al., 2005). The increased concern over phthalates and PBDE has led to increased regulatory scrutiny. In 2008, the U.S. Consumer Product Safety Commission issued a prohibition on the use of several phthalate compounds above threshold levels in childrens' toys and items used for childcare. Furthermore, PBDE have been banned at the state level, including in California and Washington.

12. Take-Home Hazards from Work/Hobbies and Work at Home: When the clothing, hair, skin, or shoes of workers become contaminated with hazardous materials in the workplace, such contaminants may inadvertently be carried to the home environment and/or an automobile. Such "take-home" exposures have been demonstrated, for example, in homes of lead-exposed workers. In addition, certain hobbies or workplaces located in the home may provide an especially great risk of household contamination.

Control methods include storing and laundering work clothes separately, and showering and changing clothes before leaving work or immediately after arriving home. Once a home becomes contaminated, cleaning floors and contact surfaces and replacing furnishings may be necessary to reduce exposures.

13. Third Hand Smoke (THS): Adverse health effects from exposure to active smoking and passive smoking (ETS or secondhand smoke) are well documented. Tobacco smoke contains as many as 7000 individual compounds, including formaldehyde, carbon monoxide, nicotine, nitrosamines and polyaromatic hydrocarbons, with nearly 70 compounds identified as carcinogens (US DHHS, 2010; IARC, 2004). Thirdhand smoke refers to residual pollutants originating from tobacco smoke that persist in dust and adsorb onto surfaces, ultimately re-emitting pollutants into the gaseous phase over time after the smoke has dissipated (Hoh et al., 2012). Pollutants that are re-emitted also have the potential to interact with the local atmosphere resulting in physical and chemical transformation of original contaminants into secondary pollutants, some of which may be

more hazardous than the original pollutant (Matt et al., 2011). HUD-funded research also found that the presence of smokers in a home was a significant predictor of both children's blood-lead levels and surface dust-lead loading (Dixon et al., 2009; Gaitens et al., 2009). Exposure to THS occurs most often by inhalation, but may also occur through ingestion of contaminated dust, or through dermal contact with surfaces that have residual contamination. While this is an emerging area of research with relatively sparse information to date, there is initial evidence to suggest that THS may be a concern, particularly for children who have a higher frequency of hand-to-mouth activity that might increase their exposure by ingestion and dermal routes, in addition to inhalation. Matt et al. (2010) reported that THS residue persisted in homes even after they had been cleaned and prepared for the next tenant.

14.Unintentional Injuries/Fire: In 1997, nearly 7 million persons in the U.S. were disabled for at least one full day by unintentional injuries received at home; for children younger than 15 years of age, unintentional injury is now the leading cause of death and disability. A recent HUD-supported study of deaths among US children and adolescents from 1985 to 1997 found that an average of 2,822 unintentional deaths occurred annually from residential injuries (Nagaraja et al., 2005). The highest death rates were attributable to fires, submersion or suffocation, and poisoning. Black children were two times more likely to die from residential injuries than white children. The elderly are also at an elevated risk for residential injuries. Home visitation protocols have been shown to be effective in reducing exposure to injury hazards. The "add-on" cost of injury prevention measures, when combined with other housing interventions are estimated at about \$100 per unit. This includes the cost of some injury prevention devices (e.g., smoke alarms, electrical socket covers, etc.). DiGuseppi et al. (2010) reported on an expert panel review of seventeen interventions intended to reduce injuries due to residential deficiencies. Installed and properly working smoke detectors were determined to be an effective intervention that should be implemented for reducing fire-related injuries. This panel deemed four-sided pool enclosures efficacious and pre-set safe hot waters heaters sufficient for reducing residential-based injuries.

APPENDIX B: Relevant Publications, Guidelines and Other Resources

The sources below are provided for informational purposes only. By inclusion in this Appendix, HUD is not necessarily endorsing any of the research, findings, or policies. To secure any of the documents listed, call the telephone number provided. If you are a hearing-or speech-impaired person, you may reach the telephone numbers through TTY by calling the toll-free Federal Relay Service at 800-877-8339. A number of these references are provided on HUD's CD, Residential Lead Desktop Reference, 3rd Edition. This CD can be obtained at no charge by calling the National Lead Information Clearinghouses (NLICs) toll free number, 800-424-LEAD. Several of these references can be downloaded from the Internet without charge from the HUD Office of Healthy Homes and Lead Hazard Control's Internet site, www.hud.gov/offices/lead.

1. REGULATIONS:

a. Worker Protection: Occupational Safety and Health Administration (OSHA) publications listed below can be purchased by calling either OSHA Regulations at 202-693-1888 (OSHA Regulations) (this is not a toll-free number) or the Government Printing Office (GPO) at 202- 512-1800 (this is not a toll-free number). OSHA standards and other publications can be downloaded or purchased (as applicable) from OSHA's publication web page, <http://www.osha.gov/pls/publications/pubindex.list>. A broad range of information on construction and other worker protection requirements and guidelines is available from OSHA's home page, <http://www.osha.gov/> and from <http://www.osha.gov/SLTC/lead/>.

b. Waste Disposal. A copy of the EPA regulations at 40 CFR parts 260-268 can be purchased by calling 800-424-9346, or, from the Washington, DC, metropolitan area, 703-412-9810 (this is not a toll-free number). The regulations can also be downloaded without charge from the EPA website at <http://www.epa.gov/lead/pubs/fslbp.htm>.

c. Lead.

i. Requirements for Lead-Based Paint Activities in Target Housing and Child-Occupied Facilities; Final Rule: 40 CFR part 745 (EPA) (Lead Hazard Standards, Work Practice Standards, EPA and State Certification and Accreditation Programs for those engaged in lead-based paint activities) can be purchased by calling the Toxic Substances Control Act (TSCA) Assistance Service at 202-554-1404 (this is not a toll-free number). The rule and guidance can be downloaded from the Internet without charge at <http://www.epa.gov/lead/pubs/leadcert.htm>.

ii. Requirements for Notification, Evaluation and Reduction of Lead-Based Paint Hazards in Federally Owned Residential Property and Housing Receiving Federal Assistance; Final Rule: 24 CFR part 35, subparts B through R, published September 15, 1999 (64 FR 50201) (HUD) can be purchased by calling the NLICs toll-free number (800-424-LEAD) or downloaded without charge from the HUD website at <http://www.hud.gov/offices/lead/library/enforcement/LSHRFinal21June04.pdf>.

iii. Requirements for Disclosure of Information Concerning Lead-Based Paint in Housing, 24 CFR Part 35, Subpart A (HUD, Lead-Based Paint Disclosure Rule) by calling the NLICs toll-free number (800-424-LEAD). The rule, guidance, pamphlet and disclosure formats can be downloaded from the HUD website at http://www.hud.gov/offices/lead/library/enforcement/24CFR35_SubpartA.pdf.

iv. U.S. Environmental Protection Agency. Lead; Identification of Dangerous Levels of Lead; Final Rule at 66 FR 1205-1240 (January 5, 2001). This rule and guidance can be obtained without charge by calling the NLICs toll-free number (800-424-LEAD) or by calling the TSCA Assistance Service at: 202-554-1404 (this is not a toll-free number). The rule and guidance can be downloaded from the EPA website at <http://www.epa.gov/lead/pubs/leadhaz.htm>.

v. U.S. Environmental Protection Agency. Lead; Renovation, Repair, and Painting Program; Final Rule at 73 FR 21692- 21769 (April 22, 2008). As of April 22, 2011, the rule was fully implemented. This rule and guidance can be obtained without charge by calling the NLICs toll-free number (800-424-LEAD) or by calling the TSCA Assistance Service at: 202- 554-1404 (this is not a toll-free number). The rule and guidance can be downloaded

from the EPA website at <http://www.epa.gov/lead/pubs/renovation.htm>.

2. GUIDELINES AND OTHER RESOURCES:

a. Lead

Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing; HUD. The Guidelines can be downloaded from the HUD website without charge at <http://www.hud.gov/offices/lead/lbp/hudguidelines/index.cfm>.

Preventing Lead Poisoning in Young Children; Centers for Disease Control, August, 2005. These guidelines can be obtained without charge by calling the CDC toll free number at 888- 232-6789. The guidelines can also be downloaded from <http://www.cdc.gov/nceh/lead/publications/PrevLeadPoisoning.pdf>.

Screening Young Children for Lead Poisoning: Guidance for State and Local Public Health Officials, November 1997; Centers for Disease Control and Prevention (CDC). These guidelines can be obtained without charge by calling the CDC toll free number at 888-232-6789 or they can be downloaded from <http://www.cdc.gov/nceh/lead/publications/screening.htm>.

b. Green Building

American Lung Association of the Upper Midwest. *Health House Builder Guidelines*. Available: http://www.healthhouse.org/build/2008HHbuilder_guidelines.pdf.

U.S. Department of Energy. *Builders Challenge: Requirements for Builders*. Available: <http://www1.eere.energy.gov/buildings/challenge/requirements.html>.

Enterprise Community Partners. *Green Communities Criteria*. Available: <http://www.greencommunitiesonline.org/>.

National Association of Home Builders. *Green Building Program*. Available: <http://www.nahbgreen.org/>.

U.S. Environmental Protection Agency. *Indoor air PLUS Program*. Available: <http://www.epa.gov/indoorairplus/>.

U.S. Green Building Council. *LEED for Homes*. Available: <http://www.usgbc.org/DisplayPage.aspx?CMSPageID=147>.

c. IPM

IPM: A Guide for Affordable Housing:
<http://www.stoppests.org/what-is-ipm/guide/>

d. Bed Bugs

Draft Federal Bed Bug Strategy developed by the Federal Bed Bug Work Group:
<http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OPP-2013-0537-0002>

3. REPORTS:

a. **Lead**

Putting the Pieces Together: Controlling Lead Hazards in the Nation's Housing, (Summary and Full Report); HUD, July 1995. A copy of this summary and report can be purchased by calling 800-245-2691 toll free or downloaded from <http://archives.hud.gov/funding/2005/appendices/appendixc-hhd.doc>.

President's Task Force on Environmental Health Risks and Safety Risks to Children. *Asthma and The Environment: An Action Plan to Protect Children*. Washington, DC 1999.

Preventing Lead Poisoning in Young Children, A Statement by the Centers for Disease Control and Prevention, Atlanta, GA, August, 2005. This can be downloaded from the Internet without charge at <http://www.cdc.gov/nceh/lead/publications/prevleadpoisoning.pdf>.

b. **Healthy Homes**

Healthy Housing Reference Manual; HUD/CDC, 2006. A copy of this manual can be downloaded from the CDC website without charge at <http://www.cdc.gov/nceh/publications/books/housing/housing.htm>.

The Healthy Homes Initiative: A Preliminary Plan (Summary and Full Report); HUD, July 1995. A copy of this summary and report can be downloaded from the HUD website without charge at www.hud.gov/offices/lead.

Institute of Medicine. *Damp Indoor Spaces and Health*. The National Academies Press. Washington, D.C. 2004.

Institute of Medicine. *Indoor Allergens. Assessing and Controlling Adverse Health Effects*. The National Academies Press. Washington, D.C. 1993.

National Research Council and the Institute of Medicine. *Ethical Considerations for Research on Housing-Related Health Hazards Involving Children*. The National Academies Press. Washington, D.C. 2005.

Natural Resources Defense Council. *Our Children at Risk*. Washington, D.C. 1997. This can be ordered from the Internet from www.nrdc.org.

Pleis Jr., Lucas JW, Ward BW. *Summary health statistics for U.S. adults: National Health Interview Survey, 2008*. National Center for Health Statistics. Vital Health Stat 10(242). 2009.

Bloom B, Cohen RA, Freeman G. *Summary health statistics for U.S. children: National Health Interview Survey, 2008*. National Center for Health Statistics. Vital Health Stat 10(244). 2009.

U.S. Department of Health and Human Services. *How Tobacco Smoke Causes Disease: The Biology and Behavioral Basis for Smoking-Attributable Disease: A Report of the Surgeon General*. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health

Promotion, Office on Smoking and Health, 2010.

U.S. Department of Health and Human Services. U.S. Department of Health and Human Services. *The Health Consequences of Involuntary Exposure to Tobacco Smoke: A Report of the Surgeon General*. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, Coordinating Center for Health Promotion, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2006.

U.S. Environmental Protection Agency. 2009. Phthalates Action Plan. http://www.epa.gov/oppt/existing_chemicals/pubs/actionplans/phthalates_ap_2009_1230_final.pdf. Accessed August 4, 2011.

California Environmental Protection Agency. 2005. *Proposed Identification of Environmental Tobacco Smoke as a Toxic Air Contaminant. Part B: Health Effects*. Sacramento

(CA): California Environmental Protection Agency, Office of Environmental Health Hazard Assessment.

CDC. 2005. Centers for Disease Control and Prevention. *Third National Report on Human Exposure to Environmental Chemicals*. <http://www.cdc.gov/exposurereport/>. July 2005.

International Agency for Research on Cancer. *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans: Tobacco Smoke and Involuntary Smoking*. Vol. 83. Lyon (France): International Agency for Research on Cancer, 2004.

4. PAPERS

Allen RW, Adar SD, Avol E, Cohen M, Curl CL, Larson T, Liu LJ, Sheppard L, Kaufman JD. 2012. *Modeling the residential infiltration of outdoor PM(2.5) in the Multi-Ethnic Study of Atherosclerosis and Air Pollution (MESA Air)*. *Environ Health Perspect*. 120(6):824-30.

Binns HJ, Gray KA, Chen T, Finster ME, Peneff N, Schaefer P, Ovsey V, Fernandes J, Brown M, Dunlap B. 2004. *Evaluation of landscape coverings to reduce soil lead hazards in urban residential yards: The safer yards project*. *Environ Res*. 96(2): 127-38.

Bornehag CG, Lundgren B, Weschler CJ, Sigsgaard T, Hagerhed-Engman L, Sundell J. 2005. *Phthalates in indoor dust and their association with building characteristics*. *Environ Health Perspect* 113(10):1399-404.

Canfield RL, Henderson CR, Cory-Slechta DA, Cox C, Jusko TA, Lanphear BP. 2003. *Intellectual impairment in children with blood lead concentrations below 10 g per deciliter*. *N Engl J Med*. 348: 1517-26.

Centers for Disease Control and Prevention, *Blood Lead Levels United States, 1999-2002*, Morbidity and Mortality Weekly Reports, 2005, Can be accessed on the web at <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5420a5.htm>.

Chen WR, and Singer BC. Measurement-based evaluation of installed filtration system

- performance in single-family homes. Lawrence Berkeley National Laboratory, Environmental Energy Technologies Division. April, 2014; LBNL-6607E.
- Digenis-Bury EC, Brooks DR, Chen L, Ostrem M, Horsburgh CR. 2008. *Use of a Population-Based Survey to Describe the Health of Boston Public Housing Residents*. Amer. J. Pub. Health, 98(1): 85-91.
- DiGuseppi C, Jacobs DE, Phelan KJ, Mickalide AD, Ormandy D. 2010. *Housing interventions and control of injury-related structural deficiencies: a review of the evidence*. J Public Health Manag Pract. 16(5 Suppl):S34-43.
- Dixon, S. L., et al., *Window replacement and residential lead paint hazard control 12 years later*. Environ. Res. (2012), doi:10.1016/j.envres.2012.01.005
- Dixon SL, Gaitens JM, Jacobs DE, et al. 2009. *Exposure of U.S. children to residential dust lead, 1999-2004: The contribution of lead-contaminated dust to childrens blood lead levels*. 117(4): Environ Health Perspect. 461-467.
- Gaitens, JM, Dixon, SL, Jacobs D E. 2009. *Exposure of U.S. children to residential dust lead, 1999-2004: I. Housing and demographic factors*. 117(4): Environ Health Perspect. 468-474.
- Galke W, Clark S, Wilson J, Jacobs D, Succop P, Dixon S, Bornschein B, McLaine P, Chen M, 2001. *Evaluation of the HUD lead hazard control grant program: Early overall findings*. Environ. Research. 86, 149-156.
- Guo Y, Kannan K. 2011 *Comparative Assessment of Human Exposure to Phthalate Esters from House Dust in China and the United States*. Environ Sci Technol. 2011 Mar 24.
- Hoh E, Hunt RN, Quintana PJ, Zakarian JM, Chatfield DA, Wittry BC, Rodriguez E, **Matt GE**. 2012. *Environmental tobacco smoke as a source of polycyclic aromatic hydrocarbons in settled household dust*. Environ Sci Technol. 46(7):4174-83.
- Imm P, Knobeloch L, Buelow C, Anderson HA. 2009. *Household exposures to polybrominated diphenyl ethers (PBDEs) in a Wisconsin Cohort*. Environ Health Perspect. 117(12):1890-5.
- Jacobs DE, Clickner RP, Zhou JY, Viet SM, Marker DA, Rogers JW, Zeldin DC, Broene P, Friedman W. 2002. *Prevalence of Lead-Based Paint in U.S. Housing*. Environmental Health Perspectives. 110(10): A599-A606.
- Kercsmar, CM, Dearborn DG, Schluchter M, Xue L, Kirchner HL, Sobolewski J, Greenberg SJ, Vesper SJ, Allan T. 2006. *Reduction in asthma morbidity in children as a result of home remediation aimed at moisture sources*. Environ Health Perspect. Oct;114(10):1574-80.
- King BA, Travers MJ, Cummings KM, Mahoney MC, Hyland AJ. 2010. *Secondhand smoke transfer in multiunit housing*. Nicotine Tob Res. 12(11):1133-41.
- Kraev TA, Adamkiewicz G, Hammond SK, Spengler JD. 2009. *Indoor concentrations of nicotine in low-income, multi-unit housing: associations with smoking behaviours and housing characteristics*. Tob Control. 18(6):438-44.
- Krieger J, Jacobs DE, Ashley PJ, Baeder A, Chew GL, Dearborn D, Hynes HP, Miller JD,

- Morley R, Rabito F, Zeldin DC. 2010. *Housing interventions and control of asthma-related indoor biologic agents: a review of the evidence*. J Public Health Manag Pract. 16(5 Suppl):S11-20. Review
- Krieger, JW, Takaro TK, Song L, and Weaver M. 2005. *The Seattle-King County Healthy Homes Project: A randomized, controlled trial of a community health worker intervention to decrease exposure to indoor asthma triggers*. Amer. J. Pub. Health, 95(4): 652-659.
- Lai MW, Klein-Schwartz W, Rodgers GC, Abrams JY, Haber DA, Bronstein AC, Wruk KM. 2006. *2005 Annual Report of the American Association of Poison Control Centers National Poisoning and Exposure Database*. Clinical Toxicology, 44: 803-932.
- Lanphear, BP, Dietrich, K, Auinger, P, Cox C. 2000. *Cognitive deficits associated with blood lead concentration*. Public Health Reports. 115(6): 530-1.
- Logue JM, McKone TE, Sherman MH, Singer BC. 2011. *Hazard assessment of chemical air contaminants measured in residences*. Indoor Air. 21(2):92-109
- Logue JM, Price PN, Sherman MH, Singer BC. 2012. *A method to estimate the chronic health impact of air pollutants in U.S. residences*. Environ Health Perspect. 120(2):216-22
- MacDonald C, Sternberg A, Hunter PR. 2007. *A systematic review and meta analysis of interventions aimed at reducing exposure to house dust on the development and severity of asthma*. Environ Health Perspect 115:1691-1695.
- Matt GE, Quintana PJ, Zakarian JM, Fortmann AL, Chatfield DA, Hoh E, Uribe AM, Hovell MF. 2010. *When smokers move out and non-smokers move in: residential thirdhand smoke pollution and exposure*. Tob Control. 20(1):e1.
- Matt GE, Quintana PJ, Destailats H, Gundel LA, Sleiman M, Singer BC, Jacob P, Benowitz N, Winickoff JP, Rehan V, Talbot P, Schick S, Samet J, Wang Y, Hang B, Martins-Green M, Pankow JF, Hovell MF. 2011. *Thirdhand tobacco smoke: emerging evidence and arguments for a multidisciplinary research agenda*. Environ Health Perspect. 119(9):1218-26.
- Meng QY, Turpin BJ, Korn L, Weisel CP, Morandi M, Colome S, Zhang JJ, Stock T, Spektor D, Winer A, Zhang L, Lee JH, Giovanetti R, Cui W, Kwon J, Alimokhtari S, Shendell D, Jones J, Farrar C, Maberti S. 2005. *Influence of ambient (outdoor) sources on residential indoor and personal PM2.5 concentrations: analyses of RIOPA data*. J Expo Anal Environ Epidemiol. 15(1):17-28.
- Mielke HW, Powell ET, Gonzales CR, Mielke PW Jr, Ottesen RT, Langedal M, 2006. *New Orleans soil lead (Pb) cleanup using Mississippi River alluvium: need, feasibility, and cost*. Environ Sci. Technol., 40(8): 2784- 9.
- Mielke, HW, Powell ET, Gonzales CR, Mielke PW. 2007. *Potential lead on play surfaces: Evaluation of the PLOPS sampler as a new tool for primary lead prevention*. Environ. Res. 103(2): 154-9.
- Morgan WJ, Crain EF, Gruchalla RS, O'Connor GT, Kattan M, Evans R 3rd, Stout J, Malindzak G, Smartt E, Plaut M, Walter M, Vaughn B, Mitchell H; Inner-City Asthma Study Group. 2004. *Results of home-based environmental intervention among urban children with asthma*. N Engl J Med. 351: 1068-80.

- Nagaraja, J, Menkedick J, Phelan KJ, Ashley P, Zhang X, Lanphear BP. 2005. *Deaths from residential injuries in US children and adolescents, 1985-1997*. Pediatrics. 116(2): 454- 461.
- Northridge J, Ramirez OF, Stingone JA and Claudio L. 2011. *The Role of Housing Type and Housing Quality in Urban Children with Asthma*. J Urban Health. 2011 Mar;87(2):211-24.
- Reponen T, Vesper S, Levin L, et al. 2011. *High environmental relative moldiness index during infancy as a predictor of asthma at 7 years of age*. Ann Allergy Asthma Immunol. 107(2): 120.
- Reponen T, Lockey J, Bernstein J, et al. 2012. *Infant origins of childhood asthma associated with specific molds*. J Allergy Clin Immunol. 130:639-644. PMID: 22789397
- Reponen T, Levin L, Zheng S, Vesper S, Ryan P, Grinshpun SA, Lemasters G. (2013) *Family and home characteristics correlate with mold in homes*. Environ Res. 124:67-70. PMID:23683889.
- Sandel M, Baeder A, Bradman A, Hughes J, Mitchell C, Shaughnessy R, Takaro TK, Jacobs DE. 2010. *Housing interventions and control of health-related chemical agents: a review of the evidence*. J Public Health Manag Pract. Sep-Oct;16(5 Suppl):S24-33. Review.
- Selgrade MK, Lemanske RF Jr, Gilmour MI, Neas LM, Ward MD, Henneberger PK, Weissman DN, Hoppin JA, Dietert RR, Sly PD, Geller AM, Enright PL, Backus GS, Bromberg PA, Germolec DR, Yeatts KB. 2006. *Induction of asthma and the environment: what we know and need to know*. Environ Health Perspect. 114(4):615-9.
- Singh, N., C. Wang, R. Cooper, and C. Liu. 2012. *Interactions among carbon dioxide, heat and chemical lures in attracting the bed bug, Cimex lectularius L. (Hemiptera: Cimicidae)*. Psyche. doi:10.1155/2012/273613
- Singh, N., C. Wang and R. Cooper. 2013. *Effect of trap design, chemical lure, carbon dioxide release rate, and source of carbon dioxide on efficacy of bed bug monitors*. J. Econ. Entomol. 106(4): 1802-1811 (2013); DOI: <http://dx.doi.org/10.1603/EC13075>
- Sternthal MJ, Jun HJ, Earls F, Wright RJ. 2010. *Community Violence and Urban Childhood Asthma: A Multilevel Analysis*. European Respiratory Journal. 36(6): 1400-9.
- Takaro TK, Krieger JW, Song L. 2004. *Effect of environmental interventions to reduce exposure to asthma triggers in homes of low-income children in Seattle*. Journal of Exposure Analysis and Environmental Epidemiology, 14, S133-S143.
- Takaro TK, Krieger J, Song L., Sharify D, Beaudet J. *The breath-easy home: the impact of asthma-friendly home construction on clinical outcomes and trigger exposure*. Amer J Public Health. 2011; 101: 55-62.
- Van Deusen A, Hyland A, Travers MJ, Wang C, Higbee C, King BA, Alford T, Cummings KM. 2009. *Secondhand smoke and particulate matter exposure in the home*. Nicotine Tob Res. 11(6):635-41.
- Wang, C., and R. Cooper. 2012. *The future of bed bug monitoring*. Pestworld 2012 (January/February): 1-6.

Wang, C., and R. Cooper. 2011. Detection tools and technologies. *Pest Control Technology* 39(8): 72, 74, 76, 78-79, 112.

Wang, C., W. Tsai, R. Cooper, and J. White. 2011. Effectiveness of bed bug monitors for detecting and trapping bed bugs in apartments. *Journal of Economic Entomology* 104: 274-278.

Wilford, B H, Shoeib M, Harner T, Zhu J, Jones KC. 2005. *Polybrominated diphenyl ethers in indoor dust in Ottawa, Canada: implications for sources and exposure*. *Environ Sci Technol.* 39. 70277035.

Wilson J, Pivetz T, Ashley P, Jacobs D, Strauss W, Menkedick J, Dixon S, Tsai HC, Brown V, Friedman W, Galke W, Clark S. 2006. *Evaluation of HUD-funded lead hazard control treatments at 6 years post-intervention*. *Environ Res.* 102(2): 237-48.

Wilson KM, Klein JD, Blumkin AK, Gottlieb M, Winickoff JP. 2011. *Tobacco-smoke exposure in children who live in multiunit housing*. *Pediatrics.* 127(1):85-92.

Wilson SE, Kahn RS, Khoury J, Lanphear BP. 2007. *The role of air nicotine in explaining racial differences in cotinine among tobacco-exposed children*. *Chest.* 131(3):856-62.

Wright R. 2006. Health Effects of Socially Toxic Neighborhoods: The Violence and Urban Asthma Paradigm. *Clinics in Chest Medicine.* 27. 413-21.

Zota AR, Rudel RA, Morello-Frosch RA, Brody JG. *Elevated house dust and serum concentrations of PBDEs in California: unintended consequences of furniture flammability standards?* *Environ Sci Technol.* 42(21):8158-64.