INFORMATION COLLECTION REQUEST FOR OMB REVIEW

Supporting Statement for Paperwork Reduction Act Submissions: "American Healthy Homes Survey II"

U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
Office of Lead Hazard Control and Healthy Homes
Washington, D.C. 20410

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1.0 JUSTIFICATION (Part A)

The following text provides information on the U.S. Department of Housing and Urban Development's (HUD's) planned American Healthy Homes Survey II (AHHS II), to be conducted in partnership with the U.S. Environmental Protection Agency (EPA). The information is organized to respond directly to the 18 itemized subsections of Section A (Justification) of the Supporting Statement for Paperwork Reduction Act Submissions (Supporting Statement). For reviewers interested only in items in the Supporting Statement, please go to HUD's specific responses to Part A, and to Part B, both below.

This represents a new Information Collection Request (ICR), with Office of Management and Budget (OMB) approval requested for up to three years for data collection that will begin in early 2018.

Background and General Scope of Work

HUD's Office of Lead Hazard Control and Healthy Homes (HUD OLHCHH) and the EPA's Office of Research and Development (EPA ORD) conduct research designed to identify, characterize, and reduce human exposures and risks to key hazardous environmental contaminants commonly found in and around the nation's residences, among other functions. In recent years, HUD's research has focused on characterizing and reducing risks from lead, indoor allergens (i.e., allergy-producing substances), and other household hazards in support of the Residential Lead-Based Paint Hazard Reduction Act of 1992, and the HUD Healthy Homes Initiative which began in 1999 and which is authorized by the HUD Act of 1970. Since the 1990s, EPA's human health research conducted both in the ORD and the Office of Pollution Prevention and Toxics (OPPT) has focused on assessing risks to children and other susceptible and highly vulnerable subpopulations. EPA's current research programs address key agency pesticides mandates outlined in the Food Quality Protection Act of 1996 and key air toxics mandates outlined in the Clean Air Act as amended in 1990.

In 2005-2006, HUD OLHCHH, in partnership with EPA ORD, sponsored the American Healthy Homes Survey (AHHS),[1] OMB No. 2539-0021. The AHHS was a follow-up to the

[1] Dewalt FG, Cox DC, O'Haver R, Salatino B, Holmes D, Ashley PJ, Pinzer EA, Friedman W, Marker D, Viet SM, Fraser A. Prevalence of Lead Hazards and Soil Arsenic in U.S. Housing. Journal of Environmental Health. 78(5); 22-29. December 2015. www.neha.org/node/6429. HUD Office of Healthy Homes and Lead Hazard Control. American Healthy Homes Survey. Lead and Arsenic Findings. Washington. April 2011. http://portal.hud.gov/hudportal/documents/huddoc?id=AHHS_REPORT.pdf.

1998-1999 National Survey of Lead and Allergens in Housing (NSLAH),[2] conducted by HUD OLHCHH in partnership with EPA and the National Institute of Environmental Health Sciences (NIEHS). The primary objectives of both surveys were to estimate the prevalence of lead-based paint (LBP), LBP hazards, and allergens in housing. Data were collected on lead in house paint, dust, and residential soil, in a nationally representative sample of the housing stock in which children may reside, in order to estimate the prevalence of lead hazards in these homes. The prevalence of a variety of mold and common residential allergens were also assessed in dust from these homes. Additionally, in AHHS, soil samples were analyzed for arsenic levels. The surveys included a questionnaire administered to an adult resident to gather information related to these home health and safety issues.

HUD OLHCHH is interested in regularly monitoring changes in the levels of lead-based paint hazards and other health hazards/conditions in homes over time, and in refining its understanding of certain patterns that were identified in the earlier national studies. EPA ORD and other Federal Agencies are also interested in gaining nationally representative data that are reflective of real-world indoor levels of a wide variety of environmental contaminants, including mold and pesticides in dust, lead in drinking water, and formaldehyde in indoor air. For these reasons, and because the AHHS data are over a decade old, it is necessary for HUD, and its Federal Agency collaborators, to conduct a follow-up to these earlier studies.

Comparing the estimates obtained from the proposed AHHS II to similar estimates from the earlier AHHS and NSLAH, where practical, will provide an indication of progress toward closely related Federal goals. Estimates and comparisons are also desired for important subpopulations of housing, which are categorized by variables such as presence of children; single-family versus multi-family; owner- versus renter-occupied; housing age and geographic location; socioeconomic status, race and ethnicity of the household; urbanization; and resident behavior.

The specific objectives of the AHHS II are to:

1. Estimate the number and percent of homes with LBP and LBP hazards, and evaluate any changes in their distribution patterns since NSLAH and the first AHHS.

2. Estimate the prevalence of LBP hazards and other residential hazards among different subgroups, with a particular focus on disadvantaged populations (e.g., low income, racial and ethnic minorities).

3. Determine the distribution pattern of specific mold species in a representative sample of homes and assess the relationship between the current mold index and that from the AHHS.

[2] Jacobs DE, Clickner RP, Zhou JY, Viet SM, Marker DA, Rogers JW, Zeldin DC, Broene P, Friedman W. The Prevalence of Lead-Based Paint Hazards in U.S. Housing. Environmental Health Perspectives 110(10): A 599 – A 606, October 2002; www.ncbi.nlm.nih.gov/pmc/articles/PMC1241046/. HUD Office of Healthy Homes and Lead Hazard Control. Clickner RP, Marker D, Viet SM, Rogers J, Broene P. National Survey of Lead and Allergens in Housing. Final Report. Volume I: Analysis of Lead Hazards. Westat, Inc., Rockville, MD. April 18, 2001. www.hud.gov/offices/lead/library/hhi/HUD_NSLAH_Vol1.pdf.

4. Produce national estimates (in some cases, the first ones) of the levels of additional conditions and housing-related health hazards, including the following:
    a. The prevalence of visible mold and moisture damage.
    b. Pesticide residues (particularly persistent pesticides) on specific surfaces.
    c. Formaldehyde levels in the air.
    d. Levels of lead in drinking water, and presence of lead service lines.
    e. Potential for unintentional injuries (e.g., falls, fires, burns, carbon monoxide poisoning.)
    f. Relative humidity and temperature.
    g. The presence of lead service lines.

Study Overview

The proposed AHHS II will update the estimates from the AHHS, as well as include new analyses. HUD OLHCHH proposes that this national household survey be conducted from March through October of 2017. AHHS II will draw a nationally-representative sample of approximately 1,800 housing units[3] (HUs) in 78 geographic clusters called Primary Sampling Units (PSUs). Data will be collected from each of the approximately 800 HUs in which children may live that are screened and recruited from the sample. The 800 HUs will be drawn from two subsamples: (1) approximately 544 HUs selected via Address-Based Sampling; and (2) approximately 256 pre-1978 HUs (which may have lead-based paint) selected from those that participated in the AHHS. The HUs will be recruited and the data will be collected by two-person field teams that include one Interviewer and one licensed LBP Inspector/risk assessor (Technician) certified in the State where the PSU is located.

Data collection for each of the HUs screened and recruited from the sample will involve:

- A resident questionnaire;
- An interior visual assessment for the presence of visible mold, moisture, and risks to resident safety and an exterior assessment of deteriorated housing conditions and safety risks;
- Testing of painted surfaces for LBP, using nondestructive means;
- Collection of soil and household dust to identify LBP hazards and collection of a drinking water sample to test for lead levels;
- Indoor air sampling to assess levels of formaldehyde in a frequently-used location, commonly the living room; and
- Wipe samples of the dust for molds and pesticide residues and collection of resident's vacuum cleaner bags (the entire bag) for subsequent analyses.

Appendix A includes the summary protocols, surveys, and forms to be used in the study.

Tables 1 and 2 provides a brief overview of the data collection plan and data collection instruments to be used. Part B of the Supporting Statement provides details on the statistical approaches and procedures.

[3] A housing unit is defined as a house, apartment, mobile home, a group of rooms, or a single room that is occupied as separate living quarters. Separate living quarters are those in which the occupants live and eat separately from any other persons in the building and which have direct access from the outside or through a common hall.

Table 1. Recruitment			
Activity	**Description**	**Instrument Name**	**Appendix A Pages**
Respondent Contact	1. The field team in each Primary Sampling Unit (PSU – typically one or more counties or a major metropolitan area) will consist of a trained Interviewer and a Technician certified as a LBP Inspector/Risk Assessor in the State where the PSU is located. 2. All HUs identified for recruitment will be mailed an advance letter on HUD letterhead in a HUD envelope, signed by Dr. Warren Friedman, Senior Advisor to the Director, HUD OLHCHH, approximately one week before the Interviewer travels to the PSU. There are two versions of the advance letter, one for HUs that were sampled in the previous AHHS and one for HUs that were not.	1. Protocol G2 2. Advance Letter - Longitudinal 3. Advance Letter – New	2-12
Respondent Screening	1. **Determination of eligibility**: The Interviewer will begin the first contact with each selected HU by administering a short Recruitment Questionnaire to any adult resident of the household. Ineligible HUs include institutional housing (e.g., prisons or hospitals), housing where children are not permitted to live, or vacation housing. The interviewer will ascertain if the HU is vacant by visual inspection or by proxy response from a neighboring resident. If the HU is not eligible, the Interviewer will thank the householder for his/her time and terminate the interview. 2. **Respondent screening and scheduling of interview:** The Interviewer will continue to administer the Recruitment Questionnaire in each HU that is found to be eligible. The questionnaire will invite the adult respondent to participate in this very important national study, recruit the respondent, and schedule an appointment for a data collection visit by that same Interviewer joined by a Technician for the following week. The Interviewer will use the information from the Frequently Asked Questions to respond to respondent's questions. The data collection visit will be scheduled for a date and time convenient to the respondent. The Interviewer will provide a reminder card.	1. Protocol I2 2. Reminder Card 3. Appointment Control Log and In-Person Contact Record 4. Recruitment Questionnaire, 5. Appointment Reminder Card 6. Frequently Asked Questions	23-45
Respondent Recruitment	The Interviewer will introduce the team members and assure that the Informed Consent Form is completed. After this, the Interviewers and Technicians will have separate responsibilities for activities, as identified in Table 3.	1. Protocol I3 2. Introduction 3. Informed Consent Form	46-59

Table 2. Estimated Time for Activities in Each Housing Unit					
Onsite Time (Minutes)	**Interviewer**	**Appendix A Pages**	**Technician**	**Appendix A Pages**	**Samples Collected**
1-10	I3- Conduct Introduction and obtain Informed Consent	I3, 43-46	Participate in Introduction T2- LBP testing - Initiate minimum of 5 minute warm up of XRF.	T2, 134-145	
11-15	I4- Conduct Room Inventory - Select rooms for testing - Pass copy to Technician. - Do quick walk-through with Technician to communicate agreement on the rooms to be tested. -Retrieve water sample from resident	I4, 53-57	T1- Set up and initiate collection of formaldehyde in air sample. T2 - LBP testing - test incoming drinking water service line.	T1, 118-133 T2, 134-145 includes testing lead in service line	Interviewer: 1 water sample Technician: 1 formaldehyde samples - collection continues until end of interior onsite activities by the Interviewer
16-190	I5- Administer Resident Questionnaire I6- Conduct Interior Walkthrough observations, collect vacuum bag sample I7-Conduct Room Observation and Building Moisture measurements I8- Collect vacuum dust samples for fungi I9- Collect dust wipe (dry electrostatic cloth) sample for fungi.	I5, 58-80 I6, 82-89 I7, 90-99 I8, 100-104 I9, 105-107, 108-111	T2- Conduct LBP testing of interior rooms T3- Collect dust wipe samples for lead T4- Collect wipe samples for pesticides T1 - Complete collection of formaldehyde in air samples when Interviewer has completed all their indoor activities.	T3, 146-154 T4, 155-161	Interviewer: 0-1 vacuum bag 1 vacuum dust Technician: 10 lead dust wipe 2-3 pesticide wipe 0-6 lead soil 1 formaldehyde air
191-210	I11- Conduct Exterior Walkthrough observations – general building condition observations and exterior temperature/humidity measurements. Perform collected sample and data review - store and package samples –conduct closeout with resident	I11, 111-113	T5- Collect Soil Samples for lead T2- Conduct LBP testing of exterior Perform collected sample and data review - store and package samples –conduct closeout with resident	T5, 162-166	Technician: 0-6 lead soil
Offsite		Perform daily off-site activities (sample and data handling)			
Offsite		Perform end-of-PSU activities (equipment, leftover supplies, data and sample shipments)			
		I# and T# numbers above refer to specific written protocols for conduct of the tasks.			

Field Staff Qualifications and Organization

Two-person teams are planned for field data collection, with each team consisting of an Interviewer and a Technician. All activities will be split between the two field team members in a manner that reduces the time spent in the HU. Communication with the HUD Contractor's (QuanTech's) Field Supervisors will be maintained daily by cell phone.

Since the study findings will have national implications, the field team members will have the following credentials and qualifications:

- Technicians will have conducted at least 20 LBP inspections or LBP risk assessments without supervision, have successfully completed an EPA- or State-approved training course, be certified as a LBP risk assessor in at least one State (for further information, see 40 CFR 745, subparts L and Q, and the associated Federal Register (FR) preamble, at 61 FR 45777-45830), and be approved by HUD for this survey based on their qualifications and experience.

- Technicians will be certified in States without reciprocity (States that do not run their own program), either by recruiting team members with the requisite certification(s) or by assisting the team member in obtaining the necessary certification(s) (e.g., by passing the State examination).

- Interviewers will be experienced field personnel competent in recruitment, interview techniques and communication with study subjects (i.e., the residents). Interviewers will also have at least three months' experience in the field.

- Some of the interviewers and technicians will be bilingual to accommodate Spanish-speaking respondents. If a respondent has difficulty communicating in spoken English, attempts will be made to speak with another adult in the household or a neighbor, nearby friend or relative to assist with the questionnaire.

- References will be obtained and work history verified for all potential field personnel. Background checks will be performed to ensure that the field staff members have no criminal records.

All interviewers and technicians will receive comprehensive study-specific training as a group, which will include practice house visits with supervisory review. A team that includes senior project staff, X-ray fluorescence portable lead-in-paint analyzer (XRF) manufacturer technical representatives, and environmental testing subject matter experts will provide the training. Typically, any additional field issues that arise during the training will be addressed and resolved for the entire group, so that all teams are following the same protocols for various scenarios. The use of practice sessions in classroom training and practice house visits will allow team members to become familiar with team dynamics and interaction and to conduct all tasks required in an efficient manner. The detailed study procedures (protocols) are written so that subjective judgment by team members is minimized. Robust attempts will be made to employ ethnically diverse staff as appropriate to the regions, and gender-balanced staff.

The study-specific training session is expected to last approximately five working days to allow adequate time for the Technicians and Interviewers to learn and practice all the field procedures, and to develop close working relationships.

Field Work Schedule

The fieldwork is planned to occur between April and October of 2017. The combination of geographical area and time to complete study tasks at each HU will control the scheduling of home visits (e.g., how many HU can be visited per day and per week). It is estimated that the technician will be at each PSU for approximately two weeks, and the interviewer for approximately three weeks, as displayed in Table 3.

Table 3. Team Activity at each PSU

Team member	Week 1	Week 2	Week 3	Week 4 (if needed)
Interviewer	Recruiting	Data collection, Recruiting	Data collection, recruiting	Data collection
Technician	[Not active at this PSU during this week]	Data collection	Data collection	Data collection

QuanTech's (HUD's Contractor) Deputy Project Director and two Field Supervisors will schedule, coordinate, and support all field team activities. To minimize travel expenses, personnel will be recruited from areas of the country with the higher densities of PSUs and from different broad geographical areas. Team members will be recruited and paired by geographical area to the extent possible. Field supplies and materials will be provided by the Contractor. The field staff will use survey materials checklists to ensure all materials are available for each data collection activity. Table 4 summarizes the data collection and sample analysis schedule.

Table 4. Project Data Collection Schedule

Task Name	Start Date	End Date
OMB Approval of ICR	11/8/2017	1/5/2018
Finalize automation (pending ICR-based edits)	11/29/2017	12/29/2017
Quality Assurance Plan Draft (pending ICR-based edits)	11/29/2017	12/29/2017
Quality Assurance Plan final (re ICR-based edits)	2/19/2018	3/19/2018
Sample Design draft	11/29/2017	12/28/2017
Sample Design final (re ICR-based edits)	2/12/2018	2/23/2018
Training manuals and materials	12/29/2017	2/23/2018
Train office and field staff	3/26/2018	4/19/2018
Communicate with and recruit residents	3/26/2018	9/21/2018
Enroll housing units and collect field data	3/26/2018	9/21/2018
Pay incentives	4/9/2018	10/19/2018
Provide evidence of training, local certifications, and sample collection and storage	3/26/2018	10/19/2018
Monthly electronic delivery of survey data and data dictionary updates	3/26/2018	10/19/2018
Perform lead dust and soil laboratory analysis	3/26/2018	10/26/2018
Perform Additional Environmental Assays	3/26/2018	10/26/2018

1.1 NEED FOR INFORMATION COLLECTION

Explain the circumstances that make the collection of information necessary. Identify any legal or administrative requirements that necessitate the collection. Attach a copy of the appropriate section of each statute and regulation mandating or authorizing the collection of information.

Lead-Based Paint Hazards

Section 501 of the Housing and Urban Development Act of 1970 ("HUD Act of 1970, 12 USC 1701z-1) provides that the Secretary "is authorized and directed to undertake such programs of research, studies, testing, and demonstration relating to the missions and programs of the Department as he determines to be necessary and appropriate." Section 1011 of the Residential Lead-Based Paint Hazard Reduction Act of 1992--Title X authorizes the Secretary to provide grants to eligible applicants to evaluate and reduce lead-based paint hazards in priority housing that is not federally assisted housing, federally owned housing, or public housing. Title X's Section 1052(10) (42 U.S.C. 4854a(10)), states that "The Secretary…shall conduct research to assess the effectiveness of hazard evaluation and reduction activities funded by this Act" as the authorization for finding out the information on LBP and LBP hazards in US housing in order to target the LHC grants, as suggested above, on a data-driven basis. It is therefore entirely necessary and appropriate to conduct regular monitoring of lead-based paint and lead-based paint hazards as in NSLAH, AHHS and AHHS II.

Lead is a highly toxic heavy metal that adversely affects virtually every organ system in the body. Young children are particularly susceptible to its effects, with nervous system development and lower IQ the most serious effects. Lead poisoning remains one of the top childhood environmental health problems today. The most current national survey of young children's blood lead levels, the National Health and Nutrition Examination Survey (NHANES) conducted by the Centers for Disease Control and Prevention (CDC) (2007-2010), shows that about 500,000 young children (ages 1 – 5) in the U.S. have blood lead levels of 5 µg/dL or higher. These levels were found in 2.5% of the population of children, which CDC established as the basis for its reference value (also called its reference range value) for young children's blood lead levels to identify those who have been exposed to lead and require case management.[4] At the same time, CDC set 5 µg/dL as the children's blood lead level that should prompt environmental investigation and, if necessary, mitigation. HUD has adopted this approach of the CDC regarding environmental investigations and mitigation (clinical case management is outside of HUD's authority) in establishing the elevated blood lead level (EBLL) definition for its Lead Safe Housing Rule (LSHR; 24 CFR 35, subparts B – R; see § 35.110 as revised by its EBLL amendment)[5]. CDC also pledged to review its

[4] CDC. CDC Response to Advisory Committee on Childhood Lead Poisoning Prevention Recommendations in "Low Level Lead Exposure Harms Children: A Renewed Call of Primary Prevention." Atlanta, June 7, 2012. www.cdc.gov/nceh/lead/acclpp/cdc_response_lead_exposure_recs.pdf.

[5] HUD. Requirements for Notification, Evaluation and Reduction of Lead-Based Paint Hazards in Federally Owned Residential Property and Housing Receiving Federal Assistance; Response to Elevated Blood Lead Levels. 82 FR 4151-4172. January 13, 2017. www.federalregister.gov/documents/2017/01/13/2017-00261/requirements-for-notification-evaluation-and-reduction-of-lead-based-paint-hazards-in-federally

guidance periodically based on the changes in the population-based children's blood lead surveys; CDC is conducting this review. If, during the AHHS II, CDC changes its blood lead reference range value or the level at which it recommends environmental investigations and mitigation, HUD will review the changes and, as appropriate, adjust the narrative of its reports; the survey's data analyses would not be affected, because the survey is not collecting blood lead samples.

The most common source of lead exposure for children today is deteriorating lead paint in older housing and the contaminated dust and soil it generates. The National Survey of Lead and Allergens in Housing (NSLAH), conducted by HUD and the National Institute of Environmental Health Sciences in 1998-2000, estimated that 37.9 million homes had lead-based paint (LBP) and 24.0 million homes had significant LBP hazards; the American Healthy Homes Survey (AHHS, 2005-6), conducted by HUD and the Environmental Protection Agency (EPA), found that 37.1 million homes had LBP, and that 23.2 million homes had significant LBP hazards.

Because the AHHS is over a decade old, the American Healthy Homes Survey II (AHHS II) will provide the new information needed to identify the extent of progress toward achieving the goal of the President's Task Force on Environmental Health Risks and Safety Risks to Children of eliminating LBP hazards in housing where children under age six live, and help target control strategies toward achieving the goal.

Survey results will be used to assess progress in achieving specific Healthy People 2020 goals related to reducing the prevalence of residential LBP hazards in U.S. housing (i.e., see goal "EH-18 Reduce the number of U.S. homes that are found to have lead-based paint or related hazards"). In addition, survey findings will provide current data that may be of use to HUD and other agencies who recommend levels of lead in dust and soil.

Lead in Drinking Water

Although the CDC sets a reference level for lead in a child's blood, it is not regarded as a health-based benchmark because CDC notes that there is no safe level for lead exposure. Similarly, EPA sets standards for lead in drinking water under the Lead and Copper Rule (40 CFR Part 141 Subpart I); EPA also states that the standard (currently 15 ppb) is not a health-based standard.

Exposure to lead in drinking water can be an important contributor to a child's overall exposure as evidenced by the recent events in Flint, MI. The AHHS II will provide a valuable picture of lead concentrations in drinking water among a representative sample of U.S. homes, in addition to the other major sources of children's housing-related lead exposures (i.e., deteriorated LBP, lead in dust, and lead in soil).

Lead Service Lines

The AHHS II also provides the opportunity to check for lead service lines that supply drinking water from water mains to individual residential buildings. While inside the home, the team will observe whether the water service line is visible and available for testing. If available, the technician will test the line to see if it is a lead service line by using the XRF or by gently scratching the surface of the pipe.

Mold

The AHHS II will collect dust samples for mold analysis44, which will allow comparison with the results of AHHS in which the same dust collection and analytical protocol was used for mold. The mold data from AHHS was used to create an index value for each home (the Environmental Relative Moldiness Index, ERMI). Higher ERMI values have been found to be associated with children's asthma symptoms and the development of asthma in young children. It will be of considerable value to see if the distribution of ERMI values in the AHHS II is similar to that identified in AHHS.

Pesticides

Insecticides are commonly applied in and around homes to control a variety of insect pests. In the U.S., insecticides representing multiple chemical classes and different formulations are available for purchase by consumers or professionals. Data are required to assess the potential for human exposure in homes and, in particular, better to understand human exposures within communities. In the AHHS, hard surface wipe data were collected to evaluate insecticide surface loadings. These data provided the first nationally representative distribution of indoor insecticide loadings measured on hard surface floors of residential housing. Results indicated that most floors in occupied U.S. homes have measurable levels of insecticides that may serve as sources of exposure to occupants.[6] These findings represented a first step to providing baseline data for understanding the types of pesticides found in residences and temporal changes in chemical loadings. However, the popularity and availability of residential-use insecticides have transitioned over the last 30 years through the different classes of organochlorine, organophosphate, carbamate, and pyrethroid insecticides.

Changes in availability and consumer preference contribute to an ongoing need to survey homes to obtain current and high-quality measurement data to assess risk and evaluate mitigation efforts. The specific objective for collecting hard surface wipe samples in the AHHS II is to measure changes over time in residential-use pesticides and relate these estimates to homeowner or applicator applied pesticides.

Other Environmental and Safety Exposures

Airborne contaminants such as carbon monoxide and formaldehyde, chemicals on surfaces such as pesticides, and unintentional injury factors such as housing conditions

[6] Stout DM, Bradham KD, Egeghy PP, Jones PA, Croghan CW, Ashley PA, Pinzer E, Friedman W, Brinkman MC, Nishioka MG, Cox DC. American Healthy Homes Survey: a national study of residential pesticides measured from floor wipes. Environmental Science and Technology. 43 (4): 294-4300. June 15, 2009

associated with falls, fires and poisons, are known health and safety risks. National residential prevalence estimates for these factors are generally unavailable, limiting the ability of HUD and other agencies to develop data-driven control strategies and to track changes in these factors over time

Formaldehyde is a human carcinogen that has received much interest and publicity. It first came to general notice in the 1980's in homes insulated with sprayed-in urea-formaldehyde foam insulation (UFFI), and is also associated with irritation allergic responses. More recently, it has made news headlines related to the Federal Emergency Management Agency's (FEMA) use of trailers for temporary housing after Hurricane Katrina in 2005 and to off-gassing from composite wood products. It is now the subject of a regulation of the California Air Resources Board (CARB) and, as mandated by Congress, the subject of a new regulation from EPA concerning formaldehyde in composite wood products such as flooring[7]. Some sampling of formaldehyde has been conducted in local studies, with the results varying from study to study. The AHHS II will be the first nationally representative study of formaldehyde concentrations in indoor air samples from U.S. homes. The results will be valuable for establishing a baseline that can be used to help interpret the results of local/regional studies or research on specific types of housing (e.g. manufactured homes, emergency housing). It may also inform EPA on its implementation of the regulation. HUD has a formaldehyde standard for manufactured housing, and, in accordance with Title VI of the Toxic Substances Control Act, HUD is similarly considering a revision of its standard to be in accord with the EPA standard.

Under the AHHS II, HUD will collect, store, use, and release data in accordance with OMB's May 9, 2013, Memorandum M-13-13, Open Data Policy-Managing Information as an Asset and its attached implementation guidance,[8] in particular, section 4 of the guidance, Strengthen measures to ensure that privacy and confidentiality are fully protected and that data are properly secured. HUD will also comply with the Department's April 30, 2014, memorandum, Open Data Policy — Managing HUD's Data as a Strategic Information Asset,[9] creating information in ways that allow for easy access and reuse by the public only when the data does not contain information that would restrict sharing it publicly, such as personally identifiable information. As part of this personal privacy protection effort, HUD will review the information collected or created for valid restrictions to release to determine whether it can be made publicly available, i.e., conduct a nondisclosure review.

Thus, results from the AHHS II will provide current information needed for policy decisions (e.g., the targeting of programmatic resources), and enable an assessment of progress in reducing health and safety hazards in the U.S. housing stock. This information will be used to revise policy and guidance targeting housing with the greatest needs for evaluation and control of lead

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[7] 40 CFR 770, Formaldehyde Emission Standards for Composite Wood Products, effective February 10, 2017. Rule published December 12, 2016, 81 FR 89674, pages 89674-89743. https://www.federalregister.gov/documents/2016/12/12/2016-27987/formaldehyde-emission-standards-for-composite-wood-products

[8] http://www.whitehouse.gov/sites/whitehouse.gov/files/omb/memoranda/2013/m-13-13.pdf

[9] https://project-open-data.cio.gov/assets/docs/Memo_from_the_Acting_Deputy%20Secretary_et_alia_Open_Data_Policy.pdf

and additional housing-related safety and health concerns and potentially inform the development of regulations.

1.2 USE OF THE INFORMATION

Indicate how, by whom, and for what purpose the information is to be used. Except for a new collection, indicate the actual use the agency has made of the information received from the current collection.

HUD will use the information collected in the AHHS II to meet its Congressional mandate to evaluate and reduce LBP hazards in the Nation's housing stock, as stated in the Residential Lead-Based Paint Hazard Reduction Act of 1992, which is Title X of the Housing and Community Development Act of 1992 (P.L. 102-550; see Appendix B). Title X's fundamental purpose is prevention (i.e., to find and mitigate lead-based paint (LBP) hazards in homes before children experience elevated blood lead levels). The statutory purpose for the AHHS II comes from Section 1003(2), "to reorient the national approach to the presence of lead-based paint in housing to implement, on a priority basis, a broad program to evaluate and reduce lead-based paint hazards in the Nation's housing stock." HUD has been assigned major responsibility for meeting this mandate. Failure to conduct this data collection effort would prevent HUD from meeting this requirement.

Lead and Safety

The AHHS II will characterize lead levels in dust, soil, paint and drinking water in the nation's housing by age, type, geographical location, and exposed populations. In addition, the survey of LBP dust hazards in homes will estimate the number and percent of homes with dust and soil lead levels at or above selected thresholds, especially those in the Toxic Substances Control Act (TSCA) 403 Rule (40 CFR Part 745.65); evaluate the sources of lead in dust in housing (e.g., paint and soil); permit future analysis of lead hazard control strategies and costs (e.g. quantities of deteriorated, friction and impact painted surfaces); and permit future analysis for regulation, policy and guidance which minimize regulatory burden. Specifically, survey results will be used by the EPA and HUD to assess the impact of potential changes to the current lead hazard standards for dust, soil, and for the definition of LBP. The EPA has also expressed interest in using AHHS II data to conduct additional modeling of lead exposure in children (see discussion below). Results will also be used by HHS for assessing progress in achieving specific Healthy People 2020 goals and for establishing new national goals.

Data from the AHHS were used by HUD to assess patterns in the distribution of LBP hazards and any changes in these patterns from the earlier NSLAH survey. HUD also used AHHS data to conduct preliminary modelling of the impact of lowering the current dust-lead standards and the definition of "lead-based paint".

The EPA's Office of Research and Development used AHHS data to conduct probabilistic multimedia modeling analysis to advance scientific understanding of the relationship between drinking water lead concentrations and blood lead levels in children, and guide development of a health-based benchmark for lead in drinking water and other media

("Children's Lead Exposure: A Multimedia Modeling Analysis to Guide Public Health Decision-Making," Zartarian et al., submitted journal manuscript). EPA researchers have indicated the need to use data from AHHS II to track temporal changes in model inputs (i.e., soil and dust lead concentrations) to further evaluate model predictions against recent US data on children's blood lead levels from CDC's NHANES. The EPA also used AHHS and NSLAH data in their 2013 report "America's Children and the Environment, Third Edition."[10]

The data collected through the proposed AHHS II will also promote the 2013 Federal Interagency Healthy Homes Working Group's (HHWG) *Advancing Healthy Housing: A Strategy for Action* goal to "support research that informs and advances healthy housing in a cost-effective manner." The HHWG represents a collaboration between HUD, EPA, the Centers for Disease Control and Prevention (CDC), the Department of Energy (DOE), the Department of Labor (DOL), the Department of Commerce's National Institute of Standards and Technology, and the Department of Agriculture (USDA) to efficiently coordinate national research and policy. The strategy recommends: (1) development of an interagency strategic research agenda, with priority given to acquiring "greater knowledge of the significance and prevalence of residential hazards and exposures. Research is needed on chemicals found in the home, especially those that have adverse outcomes in infants and children, including known toxicants, and cumulative and aggregate exposures" and (2) "development and implementation of national surveys to collect surveillance data on critical healthy homes indicators." The strategy highlights both AHHS and NSLAH as nationally representative surveys that have contributed to this effort.[11]

HUD will share the data and/or results of all aspects of the AHHS II with interested parties through its website, publications, and journal articles. EPA will distribute the results of the pesticide and mold testing through similar channels.

Mold

The AHHS collected data on molds in homes will support continued efforts to better understand the occurrence and co-occurrence of specific mold types in U.S. residences, link this information with the other survey data, and provide support for developing educational and outreach programs. The AHHS II will enable the comparison of the current occurrence and concentration of specific molds to the AHHS baseline and will be used in the future to characterize spatial and temporal trends in indoor mold concentrations and align these results with key housing characteristics.

In the AHHS, dust samples were collected for mold analysis, allowing the EPA and HUD to create the Environmental Relative Moldiness Index (ERMI, Vesper et al., 2007).[12] This DNA-

[10] EPA. *America's Children and the Environment, Third Edition*. EPA 240-R-13-001. January 2013. www.epa.gov/sites/production/files/2015-06/documents/ace3_2013.pdf

[11] Federal Interagency Healthy Homes Working Group. *Advancing Healthy Housing: A Strategy for Action.* 2013. https://portal.hud.gov/hudportal/HUD?src=/program_offices/healthy_homes/advhh

[10] Vesper S, Wymer L. The relationship between Environmental Relative Moldiness Index values and asthma. International Journal of Hygiene and Environmental Health. 2016; 219:233-8.

[12]

based method of mold identification and quantification is now used by many mold inspectors to more accurately estimate the level of mold contamination in U.S. homes for more than 100 mold species. By collecting dust samples for ERMI analysis in AHHS II, we will be able to test the stability and reproducibility of the ERMI metric, and allow comparisons to the AHHS's nationally representative sample of homes, critical for wider acceptance. In AHHS II, mold samples will also be collected by the original AHHS method and a simpler, faster electrostatic cloth method (Swiffer ®). If shown to be comparable to the vacuum dust collection, the cloth method is likely to increase the application of the ERMI metric because home inspectors are more likely to use a simpler, faster dust collection method. Expanding the use of the ERMI metric is important because higher ERMI values in homes have been linked to occupant asthma (Vesper and Wymer, 2016).[13]

The AHHS II data also will be used to improve educational outreach and homeowner training programs, designed to inform homeowners and assist them in implementing remediation activities. The answers to these questions will help us to someday provide vital information to homeowners.

Pesticides

The AHHS II pesticides residue data will provide a nationally representative data set that characterizes pesticide residue concentrations currently found in U.S. residences, and support future pesticide residue trend analyses. Nationally representative distributions of pesticide occurrence, pesticides co-occurrence, and the magnitude of pesticide concentrations from these residential residue samples will be generated. These distributions and pesticide concentrations will be used to examine residential pesticide residue levels by individual home and by temporal/spatial areas within the US, and identify where each home and area falls within this distribution. EPA will compare the AHHS II residential pesticide residue data with the nationally representative pesticide residue data previously measured in the AHHS and the HUD/EPA childcare center study to assess similarities and/or differences in the pesticide residue results from these two important indoor environments. The pesticide residue occurrence, co-occurrence, and magnitude data will be particularly useful for evaluating and improving EPA's modeling tools using the real-world data as input variables, and for determining which pesticides should be considered for use in future cumulative risk assessments supporting the Food Quality Protection Act mandates.

1.3 USE OF TECHNOLOGY TO REDUCE BURDEN

Describe whether, and to what extent, the collection of information involves the use of automated, electronic, mechanical, or other technological collection techniques or other forms of information technology, e.g., permitting electronic submission of responses, and the basis for the decision for adopting this means of collection. Also describe any consideration of using information technology to reduce burden.

[13] Vesper SJ, McKinstry C, Haugland RA, Wymer L, Ashley P, Cox D, Dewalt G, Friedman W. Development of an environmental relative moldiness index for homes in the U.S. Journal of Occupational and Environmental Medicine. 2007; 49:829-833.

In order to assure comparability with the data collection methods used in the American Healthy Homes Survey (AHHS) and the National Survey of Lead and Allergens in Housing (NSLAH), and because the data collection visit requires physical samples and a visual assessment of conditions in the Housing Unit (HU), as well as administration of a questionnaire, the U.S. Department of Housing and Urban Development (HUD) has determined that alternative means of data collection, such as by mail, telephone or Internet, would not be appropriate for the American Healthy Homes Survey II (AHHS II).

For the AHHS II, burden will be reduced in several ways. First, two field staff (an Interviewer and a Technician) will conduct the home visit to complete all the required data and environmental sample collection as quickly and efficiently as possible.

In addition, interviewers and technicians will use computerized systems that integrate data collection functions, including administration of the respondent interviews, selection of the study area within the home, sample chain of custody tracking, recording of XRF readings and the collection of environmental observations, and tracking the issuance of respondent incentives.

HUD's AHHS II implementation Contractor, QuanTech, and its field interviewers and technicians who will collect data for the AHHS II, routinely use computerized systems for interviews of study subjects and for administrative purposes. The Resident Questionnaire will be programmed on a Samsung Galaxy Tab A 8.0™ (8-inch) tablet with the Android 6.0 operating system using the SurveyToGo™ Computer Assisted Personal Interviewing (CAPI) software (version 1.32). This will increase the efficiency and quality of the data collected as well as reduce the burden on respondents. Interviewers will read questions directly to the respondents, and enter their responses into the tablet. Lead in paint will be measured using the Heuresis Pb 200i™ XRF instrument. This instrument electronically stores all readings and related data (e.g., component tested, substrate, location). XRF data will be downloaded to the Samsung tablet on completion of testing in each HU and emailed to QuanTech. Data will also be downloaded and stored by Heuresis staff at the end of testing in each PSU.

Electronic transmission will facilitate daily transmission of the data to QuanTech's Field Supervisors and enable them to conduct timely study management, track the status of incomplete cases and closely monitor the quality and timeliness of data collection. Results of laboratory analyses will be submitted electronically into the system in a timely manner.

1.4 EFFORTS TO IDENTIFY DUPLICATION

Describe efforts to identify duplication. Show specifically why any similar information already available cannot be used or modified for use for the purposes described in Item 2 above.

With the American Healthy Homes Survey (AHHS) being over a decade old, new information is needed to identify the extent of progress toward achieving the goal of the *President's Task Force on Environmental Health Risks and Safety Risks to Children*[14] of

[14] See https://ptfceh.niehs.nih.gov/about/index.htm.

eliminating lead-based paint (LBP) hazards in housing where children under age six live, and helping target control strategies toward achieving the goal.

As noted in 1.2, the data collection effort is consistent with the goals of the 2013 Federal Interagency Healthy Homes Working Group's (HHWG) *Advancing Healthy Housing: A Strategy for Action*. In addition, as discussed in more detail in Part B, the design of the AHHS II is intended to maximize efficiency and reduce costs to the government by:

1. Reducing the number of post-1978 units that are surveyed (38 percent of AHHS I units were post-1978 and the fraction in this survey would be greater if random selection were used).

2. Including a longitudinal component in AHHS II that includes resurveying pre-1978 units that were surveyed in the AHHS. Preliminary analyses indicated that an appropriate goal is to recruit approximately 250 units for this survey component. The longitudinal component will improve the accuracy of comparisons of change across time in LBP hazards.

3. Using a more efficient Address-Based Sampling (ABS) approach to identify and recruit new units into the survey.

The AHHS II design strategy was reviewed by the following individuals, many of whom collaborated on the AHHS and NSLAH, to assure lack of duplication with other surveys:

Name	Affiliation
Warren Friedman, Ph.D.	HUD/Office of Lead Hazard Control and Healthy Homes
Peter Ashley, Dr.P.H.	HUD/Office of Lead Hazard Control and Healthy Homes
Eugene Pinzer, M.S.	HUD/Office of Lead Hazard Control and Healthy Homes
Chris Trent, M.S.	HUD/Office of Lead Hazard Control and Healthy Homes
Karen Bradham, Ph.D.	EPA/Office of Research and Development/ National Exposure Research Laboratory
Daniel Stout, Ph.D.	EPA/Office of Research and Development/ National Exposure Research Laboratory
Stephen Vesper, Ph.D.	EPA, Cincinnati
Joanna Matheson, Ph.D.	Consumer Product Safety Commission
Jack Anderson, B.A.	Healthy Housing Solutions, Inc. (HUD's design Contractor)
Carol Kawecki, M.A.	Healthy Housing Solutions, Inc.
Susan Marie Viet, Ph.D.	Westat (a subcontractor to Healthy Housing Solutions)
David Marker, Ph.D.	Westat
Jill DeMatteis, Ph.D.	Westat
Pam Broene, M.S.	Westat
Jonathan Wilson, M.P.P.	National Center for Healthy Housing (a subcontractor to Healthy Housing Solutions)
David Cox, Ph.D.	QuanTech (HUD's implementation Contractor)
Gary Dewalt, Ph.D.	QuanTech

1.5 IMPACT ON SMALL BUSINESSES

If the collection of information impacts small business or other small entities (Item 5 of OMB Form 83-I), describe any methods used to minimize burden.

The collection of this information does not directly impact small businesses or small entities.

1.6 POLICY IMPLICATIONS IF INFORMATION IS NOT COLLECTED

Describe the consequence to Federal program or policy activities if the collection is not conducted or is conducted less frequently, as well as any technical or legal obstacles to reducing burden.

If this information is not collected, the assessment of progress in making the U.S. housing stock healthy and safe will not be based on current information, specifically related to targeting the housing with the greatest needs for evaluation and control of lead and additional housing-related safety and health hazards.

Although we have made significant progress in reducing childhood lead exposure, exposure to lead remains the most significant environmental health hazard for children in the U.S. This is reinforced by the consensus among medical and public health researchers that there is no safe level of lead exposure in children. Biological monitoring of children's blood-lead levels is conducted continuously and reported biennially by CDC through administration of the National Health and Nutrition Examination Survey (NHANES). It is also important to conduct periodic monitoring of the major sources of lead exposure in U.S. housing. This allows the tracking of progress in reducing residential LBP hazards, the identification of important trends, and the creation of a current data set for exposure modeling, regulatory impact analysis, etc. If this information is not collected it will not be possible to assess national progress in reducing LBP hazards. It would also result in a lack of current data for use in exposure modelling and regulatory impact analysis.

HUD is working with our federal partners to leverage the opportunity to collect data on other important residential health hazards/conditions (e.g., mold, water damage, airborne formaldehyde concentrations). This allows for a better understanding of the national distribution of these items, permits longitudinal tracking of changes in their distribution, and supports the development of targets for reducing the prevalence of unhealthy exposures in U.S. housing. If the data were not collected, there would be an important gap in our knowledge of these important exposures in the U.S. housing stock.

1.7 SPECIAL CIRCUMSTANCES

Explain any special circumstances that would cause an information collection to be conducted in a manner:

- *Requiring respondents to report information to the agency more often than quarterly.*
- *Requiring respondents to prepare a written response to a collection of information in fewer than 30 days after receipt of it;*
- *Requiring respondents to submit more than an original and two copies of any document;*
- *Requiring respondents to retain records, other than health, medical, government contract, grant-in-aid, or tax records, for more than three years;*

These sections are not applicable. Information is collected only once and respondents are not required to prepare a written response, submit any documents, nor retain any records.

- *Regarding a statistical survey, that is not designed to produce valid and reliable results than can be generalized to the universe of study;*

This study is designed to produce valid and reliable results that can be generalized to the universe of the study (i.e., permanently occupied U.S. housing where children may live).

- *Requiring the use of a statistical data classification that has not been reviewed and approved by OMB;*

Part B (Section 2.0) of this document describes "Collection of Information Employing Statistical Methods." In this section, the statistical data classification scheme is outlined. These statistical techniques are being submitted with this Information Collection Request (ICR) for approval by the Office of Management and Budget (OMB) for this study. A very similar approach was approved for the American Healthy Homes Survey (AHHS) and for the National Survey of Lead and Allergens in Housing (NSLAH).

- *That includes a pledge of confidentiality that is not supported by authority established in statute or regulation, that is not supported by disclosure and data security policies that are consistent with the pledge, or which unnecessarily impedes sharing of data with other agencies for compatible confidential use;*

Disclosure and data security policies are outlined in Section 1.10. There is no pledge of confidentiality that is not supported by the authority established in statute or regulation. The assurance of privacy given to respondents in the Informed Consent Form (ICF, see Appendix A) is consistent with this regulation. Respondents are assured that the data they provide will be kept private to the extent that the law allows. HUD will use this information only for statistical research and reports. The participants are further informed that their answers will combined with

others, so that no one can identify which answers are theirs. Respondents are assured that their reports on lead paint or lead hazards will not be given to HUD, the EPA or State or local government agencies.

- *Requiring respondents to submit proprietary trade secrets, or other confidential information unless the agency can demonstrate that it has instituted procedures to protect the information's confidentiality to the extent permitted by law.*

No information collected will require respondents to submit proprietary trade secrets or other confidential information.

1.8 SUMMARY OF CONSULTATIONS AND COMMENTS RECEIVED

If applicable, provide a copy and identify the date and page number of publication in the Federal Register of the agency's notice, required by 5 CFR 1320.8(d), soliciting comments on the information collection prior to submission to OMB. Summarize public comments received in response to that notice and describe actions taken by the agency in response to these comments. Specifically address comments received on cost and hour burden.

The text of the 60 Day Notice of Proposed Information Collection Federal Register Notice for this information collection, published in *Federal Register* volume 81, pages 88700-88701, on December 8, 2016, Docket No. 5914-N-03, is provided in Attachment C.

No public comments were received.

Describe efforts to consult with persons outside the agency to obtain their views on the availability of data, frequency of collection, the clarity of instructions and record-keeping, disclosure, or reporting format (if any), and on the data elements to be recorded, disclosed, or reported.

HUD has consulted with the following private sector experts, many of whom were engaged in the design of the AHHS and NSLAH, in order to assure that the AHHS II continues to meet federal needs and avoids duplication.

David Cox	QuanTech
Gary Dewalt	QuanTech
Susan Marie Viet	Westat
David Marker	Westat
Jill DeMatteis	Westat
Jonathan Wilson	National Center for Healthy Housing
Jack Anderson	Healthy Housing Solutions, Inc.
Carol Kawecki	Healthy Housing Solutions, Inc.

Consultation with representatives of those from whom information is to be obtained or those who must compile records should occur at least once every 3 years - even if the collection of

information activity is the same as in prior periods. There may be circumstances that may preclude consultation in a specific situation. These circumstances should be explained.

Since the period of performance on this data collection effort spans less than one year, this requirement is not applicable to this project.

1.9 INCENTIVES FOR RESPONDENTS

Explain any decision to provide any payment or gift to respondents, other than remuneration to contractors or grantees.

HUD has decided to provide potential respondents with a $1 upfront cash incentive and an additional incentive payment of $130 upon completion of data collection in their Housing Unit (HU). Respondents will also have the option of receiving test results for their HU. The monetary incentive for the American Healthy Homes Survey II (AHHS II) was chosen after review of data from other recent federal national household surveys, and statistical analysis of for the American Healthy Homes Survey (AHHS) and the National Survey of Lead and Allergens in Housing (NSLAH).

The proposed $130 is the same incentive as was used in the AHHS. The AHHS had a 58.9 percent response rate. The AHHS incentive, in turn, reflected analysis conducted for the NSLAH about the impact of different incentives on response rates. In NSLAH, low initial response rates led to the decision to increase the incentive level. The incentive level was first increased from $50 to $100, and then again to $200. Table 5 shows the response rates at each incentive level. The unit of analysis was the NSLAH Primary Sampling Unit (PSU), since all households within a PSU received the same incentive to participate. On the assumption that incentive-related changes affecting the response rate were an approximately linear function of the incentive, a logistic regression was fit to the data to establish a relationship between the incentive (or related changes in procedures) and the response rate. The increase in response rate with an increase in incentive was statistically significant ($p = 0.001$). However, some portion of the difference may be due to other factors that changed at the same time as the incentive changed. Based on these data, and consultation with an OMB survey methodology expert, an incentive of $130 for participation was selected for the AHHS.

Table 5. NSLAH Response Rates by Incentive Level

Incentive	PSU's (N)	Response Rate Mean	Response Rate Std Dev	Response Rate Min	Response Rate Max
$50	15	0.454	0.022	0.354	0.596
$100	32	0.504	0.016	0.349	0.663
$200	28	0.569	0.029	0.125	0.840

1.10 CONFIDENTIALITY OF INFORMATION

Describe any assurance of confidentiality provided to respondents and the basis for the assurance in statute, regulation, or agency policy.

The text of 5 CFR 1320.9 and related provisions of 5 CFR 1320.8(b) (3) provide regulatory provisions guiding the nature and extent of confidentiality. The assurance of privacy given to respondents in the Informed Consent Form (ICF, see Appendix A) is consistent with this regulation. Respondents are assured that the data they provide will be kept private to the extent that the law allows. HUD will use this information only for statistical research and reports. The participants are further informed that their answers will be combined with others, so that no one can identify which answers are theirs. Respondents are assured that their reports on lead-based paint (LBP) or other lead hazards will not be given to HUD, EPA or State or local government agencies.

In order to prevent any possibility of identifying specific units when the data and results are reported to HUD and made publicly available, no street addresses will be provided, and only 3-digit ZIP codes will be provided. Furthermore, HUD will conduct a non-disclosure risk analysis before making decisions about what specific data elements to release publicly.

1.11 QUESTIONS OF A SENSITIVE NATURE

Provide additional justification for any questions of a sensitive nature, such as sexual behavior and attitudes, religious beliefs, and other matters that are commonly considered private. This justification should include the reasons why the agency considers the questions necessary, the specific uses to be made of the information, the explanation to be given to persons from whom the information is requested, and any steps to be taken to obtain their consent.

As determined by Human Subjects Review, Chesapeake Institutional Review Board, Protocol 00019737, approved December 6, 2016, there are no sensitive questions in AHHS II. A copy of the Resident Questionnaire can be found in Appendix A. However, Interviewers will be trained to be sensitive to any discomfort on the part of the respondent, who will be informed of his/her right to refuse to answer any interview question.

1.12 ESTIMATED TIME AND COST TO RESPONDENTS

Provide estimates of the hour burden of the collection of information. The statement should:

- *Indicate the number of respondents, frequency of response, annual hour burden, and an explanation of how the burden was estimated. Unless directed to do so, agencies should not conduct special surveys to obtain information on which to base hour burden estimates. Consultation with a sample (fewer than 10) of potential respondents is desirable. If the hour burden on respondents is expected to vary widely because of differences in activity, size, or complexity, show the range of estimated hour burden, and explain the reasons for the variance. Generally, estimates should not include burden hours for customary and usual business practices.*

- *If this request for approval covers more than one form, provide separate hour burden estimates for each form and aggregate the hour burdens in Item 13 of OMB Form 83-I.*
- *Provide estimates of annualized cost to respondents for the hour burdens for collection of information, identifying and using appropriate wage rate categories. The cost of contracting or paying outside parties for information collection activities should not be included here. Instead, this cost should be included in Item 13.*

All costs to respondents are associated with the time required for cooperation with the information collection (i.e., hour burden) as displayed in Table 6 There are three major activities that will require respondent's time. These are:

1. Recruitment Questionnaire: Time to respond to the initial recruitment interview is based on experience in the American Healthy Housing Survey (AHHS) and the prior National Survey of Lead and Allergens in Housing (NSLAH). The AHHS II recruitment questionnaire is very similar to those used for AHHS and NSLAH. It is estimated that the recruitment questionnaire will take approximately 15 minutes to complete, including explaining the survey and answering the resident's questions.

2. Resident Questionnaire: The estimated time required to complete the AHHS interview was approximately 60 minutes. The AHHS II questionnaire is similar to that used for AHHS and will take approximately the same amount of time to complete

3. Environmental Sampling: The environmental sampling in AHHS II, while different in some respects from that in the AHHS, is expected to require a similar amount of time. Based on the experience with the AHHS, the resident questionnaire and the environmental sampling should total 3.5 hours, with the environmental sampling overlapping with the administration of the Resident Questionnaire.

4. Follow-on Questionnaire: The follow-on questionnaire is new for AHHS II and will be performed using the mail. It will be used to evaluate and discuss non-response bias; it is relatively short and has been designed to take no longer than 30 minutes.

In the table below, the Hourly Cost Per Response is taken from a National Bureau of Labor Statistics, Preliminary Average hourly earnings, November 2016, Table A-1, Current and real (constant 1982-1984 dollars) earnings for all employees on private nonfarm payrolls, seasonally adjusted. https://www.bls.gov/news.release/pdf/realer.pdf. The 1800 represents the calculation of oversampling for the longitudinal and ABS samples to achieve the 800, assuming a roughly 50% response rate.

Table 6. Estimated Time and Costs to Respondents

Information Collection	Number of Respondents	Frequency of Response	Responses Per Annum	Burden Hour Per Response	Annual Burden Hours	Hourly Cost Per Response	Annual Cost
Recruiting Questionnaire	1800	1	1	0.25	450	$10.68	$4,806

Resident Questionnaire	800	1	1	1.0	800	$10.68	$8,544
Environmental Sampling	800	1	1	2.5	2000	$10.68	$21,360
Follow-on Questionnaire	264	1	1	0.5	132	$10.68	$1,410
Total	800 *			**1.88**	**3,382**		**$36,120**

* Of the 1800 homes recruited, 800 will be participants, and have the questionnaire and environmental sampling conducted. Non-respondents will be sent the Follow-on Questionnaire; we expect 200 responses.

Total Cost	**$36,120**
Total Hours	**3,382**
Total Respondents	**1800**
Hours/Respondent	**1.88 (average)**
Total Responses	**1,800**

1.13 ESTIMATED ANNUAL BURDEN

Provide an estimate for the total annual cost burden to respondents or recordkeepers resulting from the collection of information. (Do not include the cost of any hour burden shown in Items 12 and 14).

- *The cost estimate should be split into two components: (a) total capital and start-up cost component (annualized over its expected useful life) and (b) a total operation and maintenance and purchase of services component. The estimates should take into account costs associated with generating, maintaining, and disclosing or providing the information. Include descriptions of methods used to estimate major cost factors including system and technology acquisition, expected useful life of capital equipment, the discount rate(s), and the period over which costs will be incurred. Capital and start-up costs include, among other items, preparations for collecting information such as purchasing computers and software; monitoring, sampling, drilling and testing equipment; and record storage facilities.*
- *If cost estimates are expected to vary widely, agencies should present ranges of cost burdens and explain the reasons for the variance. The cost of purchasing or contracting out information collection services should be a part of this cost burden estimate. In developing cost burden estimates, agencies may consult with a sample of respondents (fewer than 10), utilize the 60-day pre-OMB submission public comment process and use existing economic or regulatory impact analysis associated with the rulemaking containing the information collection, as appropriate.*
- *Generally, estimates should not include purchases of equipment or services, or portions thereof, made: (1) prior to October 1, 1995, (2) to achieve regulatory compliance with requirements not associated with the information collection, (3) for reasons other than to provide information or keep records for the government, or (4) as part of customary and usual business or private practices.*

There is no anticipated cost burden to respondents resulting from the collection of information, except the costs associated with the respondents' hour burden during the home visit. Respondents will not be required to incur (a) capital or start-up costs; or (b) operation and maintenance and purchase of services costs. Respondents will not be asked or required to keep any records.

1.14 ESTIMATED ANNUAL COST TO THE FEDERAL GOVERNMENT

Provide estimates of annualized costs to the Federal government. Also, provide a description of the method used to estimate cost, which should include quantification of hours, operational expenses (such as equipment, overhead, printing, and support staff), and any other expenses that would not have been incurred without this collection of information. Agencies may also aggregate cost estimates from Items 12, 13, and 14 in a single table.

The field work and reporting for the AHHS II will be conducted by HUD's Contractor, QuanTech. Support for the sample design and coordination of Institutional Review Board and OMB submissions will be provided by HUD's Contractor, Healthy Housing Solutions, Inc., and their subcontractor, Westat. The estimated cost to the Government, for these contracts and for HUD personnel to oversee the Contractors' work, coordinate with other Federal Agencies (e.g., EPA), including incentives to residents, travel and laboratory analyses, is $4,433,826 over the approximately two-year period. The annualized cost is $2,216,913.

Original TO Design Concepts	$90,000
AHHS II Design	$296,750
Field Work and Data Analysis	$4,300,000
Laboratory Analyses	$1,230,000
Total	**$5,916,750**

1.15 REASONS FOR PROGRAM CHANGES

Explain the reasons for any program changes or adjustments reported in Items 13 or 14 of the OMB Form 83-I.

This is an initial request; there are no changes or adjustments to Items 13 or 14.

1.16 PLANS FOR PUBLICATION

For collections of information whose results will be published, outline plans for tabulation and publication. Address any complex analytical techniques that will be used. Provide the time schedule for the entire project, including beginning and ending dates of the collection of information, completion of report, publication dates, and other actions.

Reports associated with the American Healthy Homes Survey II (AHHS II) will include separate reports for lead hazards, and other environmental hazards. In addition to those content reports, there will be an Overall Survey and Analysis Methodology Report, as well as a Documentation Report. Table 7 shows the projected schedule of publication milestones for AHHS II.

Table 7. Schedule of Publication Milestones

Task Name	Start Date	End Date
Develop Lead Report	3/25/2018	6/18/2019
Perform lead dust and soil laboratory analysis	3/26/2018	10/26/2018
Lead Report: draft data table shells	4/24/2018	5/24/2018
Lead Report: 1st complete draft	12/20/2018	1/19/2019
Lead Report: draft #2, for peer review	2/2/2019	2/16/2019
Lead Report: peer review draft final	2/17/2019	4/18/2019
Lead Report: final	4/19/2019	6/18/2019
Develop Additional Environmental Findings Report	3/26/2018	7/18/2019
Perform Additional Environmental Assays	3/26/2018	10/26/2018
Additional Environmental Findings Report: draft data table shells	4/24/2018	5/24/2018
Additional Environmental Findings Report: 1st complete draft	12/20/2018	2/18/2019
Additional Environmental Findings Report: draft #2, for peer review	3/19/2019	3/26/2019
Additional Environmental Findings Report: peer review draft final	3/19/2019	5/18/2019
Additional Environmental Findings Report: final	5/19/2019	7/18/2019
Develop Overall Survey and Analysis Methodology Report	3/26/2018	9/18/2019
Overall Survey and Analysis Methodology Report: outline	3/26/2018	3/30/2018
Overall Survey and Analysis Methodology Report: 1st complete draft	3/26/2018	5/6/2019
Overall Survey and Analysis Methodology Report: draft #2, for peer review	5/20/2019	6/3/2019
Overall Survey and Analysis Methodology Report: peer review draft final	6/4/2019	8/3/2019
Overall Survey and Analysis Methodology Report: final	8/4/2019	9/18/2019
Develop Documentation Report	3/26/2019	7/23/2019
Documentation Report: first draft data tables	3/26/2019	4/18/2019
Documentation Report: 1st complete first draft	4/19/2019	4/21/2019
Documentation Report: first draft #2, for peer review	4/22/2019	5/22/2019
Documentation Report: peer review first draft final	5/23/2019	6/22/2019
Documentation Report: final	6/23/2019	7/23/2019
Issue final data and data dictionary on CD-ROM	7/23/2019	7/23/2019
Deliver unused samples to HUD	7/24/2019	9/7/2019

It is likely that, as with AHHS, pesticide and mold results will first be reported in peer-reviewed journal articles. HUD also plans to publish the data on formaldehyde concentrations and the prevalence and distribution of LBP hazards in peer-reviewed journals.

1.17 EXPIRATION DATE FOR OMB APPROVAL

If seeking approval to not display the expiration date for OMB approval of the information collection, explain the reasons that display would be inappropriate.

Not applicable; HUD will display the expiration date of OMB approval.

1.18 EXCEPTIONS TO THE CERTIFICATION STATEMENT

Explain each exception to the certification statement identified in Item 19, "Certification for Paperwork Reduction Act Submissions," of OMB Form 83-I.

HUD is not requesting any exceptions to the certification statement of OMB form 83-I.

2.0 COLLECTIONS OF INFORMATION EMPLOYING STATISTICAL METHODS (Part B)

The following text provides information on HUD's planned American Healthy Homes Survey II (AHHS II). The information is organized to respond directly to the 5 itemized subsections of Section B (Collections of Information Employing Statistical Methods) of the Supporting Statement for Paperwork Reduction Act Submissions.

2.1 RESPONDENT UNIVERSE AND SAMPLING PLAN

Describe (including a numerical estimate) the potential respondent universe and any sampling or other respondent selection methods to be used. Data on the number of entities (e.g. establishments, State and local government units, households, or persons) in the universe covered by the collection and in the corresponding sample are to be provided in tabular form for the universe as a whole and for each of the strata in the proposed sample. Indicate expected response rates for the collection as a whole. If the collection had been conducted previously, include the actual response rate achieved during the last collection.

The estimates described will be generated for the full national housing stock of occupied housing units in the United States where children may reside.[1],[2] The number of occupied housing units is estimated by the American Housing Survey, 2013 (AHS) as roughly 118 million. The AHS does not subtract out housing where children are not permitted to live, so the 118 million housing units includes housing that is ineligible for AHHS II. In addition, estimates will be generated for subpopulations of the housing stock, including:

- HUs occupied/not occupied by children under age 6 years, and under age 18 years.
- Single family and multi-family HUs.
- Owner-occupied and renter-occupied HUs.
- HUs built in selected ranges of years. Year-of-construction cuts for reporting include at 1940 (i.e., pre-1940, and similarly for other cuts), 1950, 1960, 1970, 1978, 1990, and 2017. Year ranges may be aggregated for reporting, depending on the sub-sample sizes, upon approval by the Government.
- HUs occupied by households of different socio-economic status as defined by income levels (with household income cut points at $35,000; and at 30%, 50%,

[1] AHS estimates are available at www.census.gov/programs-surveys/ahs/data/interactive/ahstablecreator.html#?s_areas=a00000&s_year=n2015&s_tableName=Table1&s_byGroup1=a1&s_byGroup2=a1&s_filterGroup1=t1&s_filterGroup2=g1

[2] A housing unit is defined as a house, apartment, mobile home, a group of rooms, or a single room that is occupied as separate living quarters. Separate living quarters are those in which the occupants live and eat separately from any other persons in the building and which have direct access from the outside or through a common hall.

80% and 100% of area median income; and at the federal poverty level), HU market value and/or monthly rent, using Census and HUD criteria.

- HUs in different Census regions of the country.

- Measures of urbanization (e.g., urban, suburban, and rural) or measures of different types of urban environments based on population density; housing stock age; or, income levels, using Census and HUD criteria.

When it is known in advance of conducting a survey that certain subpopulations are especially important, it is advantageous to try to incorporate them into the design. This helps to ensure adequate numbers of the subpopulations in the sample and, consequently, the efficiency of the resultant estimates and significance tests. This also requires that information on respondents' membership in the subpopulations be available before conducting the survey. As will be detailed later in this section, prior information is available on a number of important respondent characteristics, and this information is utilized to construct an efficient design.

2.1.1 Exclusions and Inclusions

As stated above, the target population for this study is the national housing stock of approximately 118 million occupied housing units (HUs). In field household surveys, it is common to examine certain subsets of the U.S. population to determine whether or not they should be included in the study. The decision to include or exclude a subset is usually based on such factors as relevancy to the study objectives, availability of data from other sources, and effort required to obtain the study data.

Based on these considerations, the following subsets of the housing stock will be excluded from the survey:

- Housing where children are not permitted to live (elderly housing, nursing homes, college dormitories, etc.).

- Group housing, both institutional (e.g., prisons or jails, detention centers, hospitals, military housing) and non-institutional (e.g., dormitories, fraternities, orphanages, rooming houses, missions, work camps, convents). There are a number of reasons for excluding this type of housing. Some of the sub-types (e.g., prisons and hospitals), tend to exclude children as long-term residents. The Department of Defense has active Lead Hazard Control (LHC) programs for military housing. Many of HUD's programs do not apply to these types of housing. Finally, the nature of the institutions that own and manage this housing makes gaining access to this housing more difficult than typical owner-occupied or renter-occupied housing.

- Vacant housing. To gain access to vacant housing, the homeowner or manager must be identified, located, contacted, and persuaded to permit access to the vacant HUs. All of these tasks are more difficult and less certain of success than with occupied housing. Consequently, the response rates will be lower for vacant

housing than for occupied housing. Nationally, of the total of approximately 135 million US HUs, the 2015 AHS estimates approximately 13.6 million units are vacant and 2.9 million are seasonal[15]. Therefore, exclusion of these units will not cause serious biases in the study.

- Short-term housing. This category includes homes which are not the resident's sole or permanent home, and in which the resident present at the time of field data collection spends less than three months per year. This includes seasonal, occasional use, recreational, and second homes, as well as homes for migrant workers.

- Hotels and motels. While some hotels and motels have long term occupants, including families, the average stay at these type of accommodations is typically less than one to two months.

The following subsets of the housing stock were reviewed because they have sometimes been excluded from prior studies. However, they will be included in the AHHS II for the reasons stated here.

- Housing built after 1977. These homes will be included for a variety of reasons. Even though interior LBP was no longer available, this does not mean that lead-contaminated dust, soil, or drinking water will not be present. Also, HUD and EPA need reliable data for excluding these homes from possible future regulations. Finally, these homes may actually have *higher* mold levels due to environmental factors that promote their growth (e.g., more tightly sealed HUs may retain moisture). There is also value in assessing possible differences in airborne formaldehyde concentrations by housing age.

- HUs in multi-family buildings. These HUs will be included since they comprise a significant portion of the homes in which people live. Also, characteristics of multi-family housing which may impact lead, mold, pesticide, and safety levels may be different than single-family housing (e.g., multi-family housing may be more often rented rather than owned, and is more likely to be professionally maintained).

- Manufactured HUs (e.g.., mobile homes and trailers). These homes comprise five to six percent of U.S. homes, and are no more difficult to access than other categories of housing. Thus, they should not be excluded.

[15] AHS estimates are available at www.census.gov/programs-surveys/ahs/data/interactive/ahstablecreator.html#?s_areas=a00000&s_year=n2015&s_tableName=Table0&s_byGroup1=a1&s_byGroup2=a1&s_filterGroup1=t1&s_filterGroup2=g1

2.1.2 Respondent Selection Method

To improve estimates of change in lead hazards, HUD proposes to use for the AHHS II a subsample of the primary sampling units (PSUs) that were selected for the AHHS. In addition, one-third of the sample will be housing units included in the AHHS that were built before 1978, the year that residential use of lead-based paint was banned. This will greatly improve HUD's ability to estimate change in lead hazard levels since the previous survey. The other two-thirds will be a new sample of housing units from the same PSUs.

The AHHS II has a three-stage, stratified clustered design that is based on the sample design for the AHHS. For the AHHS, the first stage of sampling was to select geographic PSUs from a frame of PSUs covering the entire U.S. Each PSU consisted of a county or group of contiguous counties such that the PSUs meet certain minimum population and maximum distance criteria. The PSU frame was stratified by Census division, population size class, metro status (i.e., MSA versus non-MSA), and three population characteristics (i.e., percent Hispanic, percent non-Hispanic black, and per-capita income), to ensure a representative sample. One hundred PSUs were selected with probability proportional to population using 2000 Census data.

Within each AHHS PSU, a frame of segments was constructed, where a segment consists of a Census block or group of geographically contiguous blocks. The second stage of sampling was to select a sample of, on average, five segments from each PSU with probability proportional to the total number of HUs in the segment. In extremely large certainty PSUs, the number of segments was increased to reduce variation in the final housing unit weights. The Los Angeles County PSU had 12 segments and the Chicago PSU had seven. There are four PSUs with six segments: Queens, NY; Philadelphia, PA; and Dallas and Houston, TX. Likewise, only four segments were selected in the 13 smallest PSUs. County, block group, and block level 2000 Census demographic and housing data were used in stratifying or sorting the segment frames to ensure the sample of HUs was representative with respect to housing age, household race/ethnicity, and income levels.

In each AHHS sampled segment, all the eligible housing units were listed to create a sampling frame of housing units. At the third stage of sampling, HUs were selected with equal probability. The initial sample size was set to be large enough to obtain the target number of responding, eligible HUs for AHHS.

For the AHHS II, HUD will retain the 16 certainty PSUs and subsample with equal probabilities 62 of the 84 noncertainty PSUs. Within the 78 PSUs retained for AHHS II, all HUs built before 1978 for which an AHHS interview was completed will be included in the AHHS II sample. This is expected to yield about 511 longitudinal pre-1978 sample HUs. Within each of the 78 PSUs, an address based sample (ABS) will also be selected, and will include both HUs built before 1978 and those built in 1978 or later. The ABS sample will also be clustered within PSUs, with three to five segments (comprising groups of contiguous census blocks) sampled per PSU. Within each sampled segment, addresses will be sampled from the ABS frame maintained by Marketing Systems Group (MSG). The overall sample size for the ABS component is 1,295.

By selecting a subset of the PSUs included in the AHHS, and then re-visiting participating pre-1978 housing in those PSUs, estimates from AHHS II will be better able to measure change in lead hazards in the national housing stock. There is a trade-off, in that these PSUs were selected based on their characteristics in 2000. If we took an independent sample of PSUs based on characteristics from the 2010 Census we could produce slightly more efficient (slightly better precision, no anticipated bias) estimates of current levels of lead hazards, due to slightly smaller weighting adjustments when post-stratifying the results to the most recently reported American Housing Survey totals. We believe the improved estimates of change in hazards over time more than outweigh the reduced precision for current hazard levels.

2.1.3 Expected Response Rates

Section 1.9 presented a statistical analysis of response rates for the NSLAH and the AHHS. Meyer et al.[16] shows that response rates have gone down between four and 11 percent for many high-quality government surveys from 2005 to 2013.The sample design for AHHS II accounts for this by assuming a 50% response rate. Additionally, for the ABS sample, an expected 16 percent rate of loss to ineligibility (i.e., 11 percent non-deliverable addresses, based on Healthy Housing Solution's Subcontactor Westat's extensive experience using ABS, plus another five percent of HUs not meeting the eligibility criteria). Taking into account each of these sources of sample loss, 50 percent of HUs in the longitudinal sample and 42 percent of HUs in the ABS sample are expected to be completed for the AHHS II.

2.2 PROCEDURES FOR COLLECTION OF INFORMATION

Describe the procedures for the collection of information including:

- *Statistical methodology for stratification and sample selection,*
- *Estimation procedure,*
- *Degree of accuracy needed for the purpose described in the justification,*
- *Unusual problems requiring specialized sampling procedures,*
- *Any use of periodic (less frequent than annual) data collection cycles to reduce burden.*

2.2.1 Statistical Methodology for Stratification and Sample Selection

The most cost-effective method of sampling for a national survey requiring in-person visits is some form of multistage sampling with clustering at one or more stages. For example, a simple random sample of 800 HUs in the U.S. might result in housing units (HUs) selected in several hundred counties. A multistage design, on the other hand, might use clusters of HUs in a much smaller number of counties, such as 50 to 100, thereby concentrating the household visits in a smaller number of areas, decreasing the time and travel cost of the field visits. A complex, multistage design would, however, result in loss of precision relative to a simple random sample

[16] Meyer, B. D., Mok, W.K.C., and Sullivan, J. X. 2015. Household Surveys in Crisis. Journal of Economic Perspectives 29(4): 199-226.

because the HUs are likely to be correlated to some extent within these clusters. A multistage, clustered design would therefore require more HUs in the sample to achieve the same precision as a simple random sample. However, this tradeoff is necessary in large-scale, national surveys with in-person data collection, in order to contain travel costs.

While some form of multistage, clustered sampling is required for national in-person surveys, the degree of clustering employed is open to choice. For instance, a sample of 800 HUs could be spread across 100 counties with an average of 8 households per county, or it could be concentrated in 50 counties with an average of 16 households each. The optimum degree of clustering in the survey will depend on how homogeneous the HUs are with respect to lead and other factors of interest within the clusters, and also on the cost of travel, listing, and screening relative to the cost of collecting measurements and laboratory processing. As a rule, survey variables exhibit some degree of homogeneity within clusters, but the extent of homogeneity can vary greatly from one variable to another. This homogeneity, or correlation between individuals in the cluster has the effect of reducing the precision of the survey estimates, compared to a simple random sample of the same size. On the other hand, clustering allows a larger sample of HUs to be taken for the same survey budget. When this increase in sample size more than offsets the loss of precision caused by clustering, then clustering should be used.

For the AHHS II, as for the NSLAH and AHHS, the three stages of sampling are (Figure 1):

- Selection of PSU's which are *Metropolitan Statistical Areas* (MSAs), counties or groups of counties;
- Selection of segments within sampled PSUs;
- Selection of housing units within sampled segments.

The stages of sampling are described in more detail in the sections below.

First-Stage: Sampling PSUs

As shown in Figure 1, the first stage of selection was geographic PSUs. The PSUs for AHHS II will comprise a subsample of the AHHS PSUs. The AHHS PSUs consist of Metropolitan Statistical Areas (MSAs), counties, or groups of counties. Because of their size, larger MSAs were divided into multiple PSUs along Primary Metropolitan Statistical Area (PMSA) boundaries. PMSAs are based on commuting patterns within an MSA[17], and are therefore a useful tool in creating PSUs with manageable driving times between segments for the field teams.

The AHHS sample of PSUs was drawn from a sampling frame, or list, of PSUs created by grouping contiguous counties to create PSUs with a minimum population of 15,000 that do not cross state boundaries. Most PSUs have a limited geographic size of 100 miles end-to-end or less. Beginning with the approximately 3,100 counties (or county-equivalents) in the U.S., the

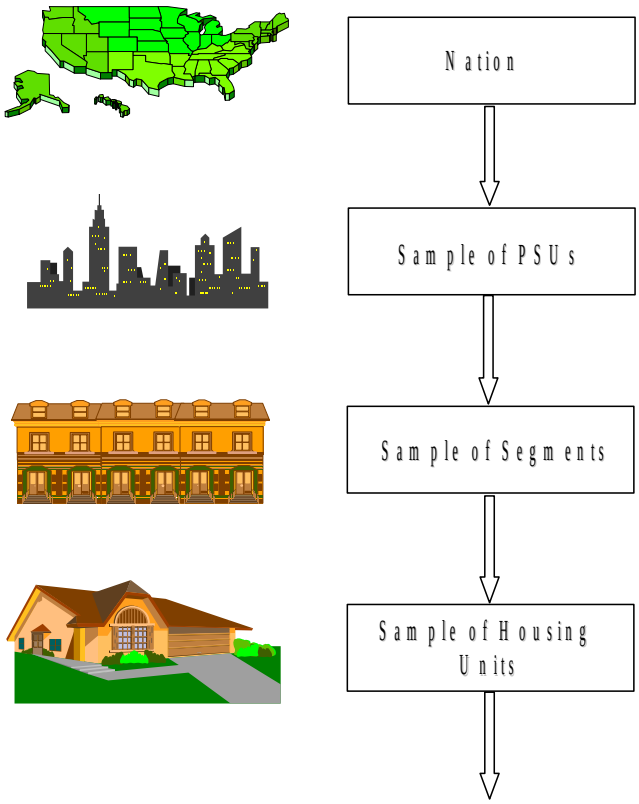
[17] The PMSA designation applies to Census 2000 data, but was discontinued in 2003.

grouping process led to the construction of 1,884 PSUs. Every area in the 50 states and the District of Columbia was assigned to a PSU, providing every area in the country a non-zero probability of selection. The importance of this is that the sample drawn represents the entire United States; coverage of the housing unit population is complete.

The frame of 1,884 PSUs was stratified by Census division, MSA vs. non-MSA status, population size class, percent non-Hispanic Black or African-American, percent Hispanic or Latino, and Per Capita Income, using county-level data from the 2000 Census and the Bureau of Economic Analysis. The Census data file provides county-level population counts by race and Hispanic origin, while the Bureau of Economic Analysis file provides per capita income. The largest 16 PSUs in the nation formed their own stratum because their populations were so large that their probability of selection was one; hence they were selected with certainty into the sample. Table 8 shows the sample of 100 PSUs selected for AHHS.

For AHHS II, the 16 certainty PSUs will be retained, and 62 of the 84 noncertainty PSUs will be subsampled with equal probabilities; as a result, a total of 78 PSUs will be included in the AHHS II sample.

Figure 1. Multi-Stage Area Probability Sample-I



Continued in Figure 2,
Multi-Stage Area Probability
Sampling Strategy

Table 8: AHHS First-Stage (PSU) Sample		
Census Division	**PSU Name**	**County Name**
1	Sufflk-Norflk-Bristl-Plymth Cnty, MA	Bristol County
1	Sufflk-Norflk-Bristl-Plymth Cnty, MA	Norfolk County
1	Sufflk-Norflk-Bristl-Plymth Cnty, MA	Plymouth County
1	Sufflk-Norflk-Bristl-Plymth Cnty, MA	Suffolk County
1	Essex-Middlesex-Worcester Cnty, MA	Essex County
1	Essex-Middlesex-Worcester Cnty, MA	Middlesex County
1	Essex-Middlesex-Worcester Cnty, MA	Worcester County
1	York Cnty, ME	York County
1	Manchester-Rochester, NH	Hillsborough County
1	Manchester-Rochester, NH	Rockingham County
1	Manchester-Rochester, NH	Strafford County
1	Providence, RI	Bristol County
1	Providence, RI	Kent County
1	Providence, RI	Providence County
1	Providence, RI	Washington County
2	Paterson, NJ	Bergen County
2	Paterson, NJ	Passaic County
2	Newark, NJ	Essex County
2	Newark, NJ	Morris County
2	Newark, NJ	Sussex County
2	Newark, NJ	Union County
2	Newark, NJ	Warren County
2	Albany-Schenectady-Troy, NY	Albany County
2	Albany-Schenectady-Troy, NY	Montgomery County
2	Albany-Schenectady-Troy, NY	Rensselaer County
2	Albany-Schenectady-Troy, NY	Saratoga County
2	Albany-Schenectady-Troy, NY	Schenectady County
2	Albany-Schenectady-Troy, NY	Schoharie County
2	Bronx-Westchest-Rocklnd-Put, NY	Bronx County
2	Bronx-Westchest-Rocklnd-Put, NY	Putnam County
2	Bronx-Westchest-Rocklnd-Put, NY	Rockland County
2	Bronx-Westchest-Rocklnd-Put, NY	Westchester County
2	Buffalo-Niagara Falls, NY	Erie County
2	Buffalo-Niagara Falls, NY	Niagara County
2	Rochester, NY	Genesee County
2	Rochester, NY	Monroe County
2	Rochester, NY	Orleans County
2	Kings-Richmond Cnty, NY	Kings County
2	Kings-Richmond Cnty, NY	Richmond County
2	Livingston-Ontario-Wayne Cnty, NY	Livingston County
2	Livingston-Ontario-Wayne Cnty, NY	Ontario County
2	Livingston-Ontario-Wayne Cnty, NY	Wayne County
2	Suffolk-Nassau Cnty, NY	Nassau County
2	Suffolk-Nassau Cnty, NY	Suffolk County
2	Queens-New York Cnty, NY	New York County
2	Queens-New York Cnty, NY	Queens County

Table 8: AHHS First-Stage (PSU) Sample		
Census Division	**PSU Name**	**County Name**
2	Philadelphia, PA	Bucks County
2	Philadelphia, PA	Chester County
2	Philadelphia, PA	Delaware County
2	Philadelphia, PA	Montgomery County
2	Philadelphia, PA	Philadelphia County
2	Lancaster, PA	Lancaster County
2	Clearfield, PA	Clearfield County
3	Lake-Kane-McHenry-DeKalb, IL	DeKalb County
3	Lake-Kane-McHenry-DeKalb, IL	Kane County
3	Lake-Kane-McHenry-DeKalb, IL	Lake County
3	Lake-Kane-McHenry-DeKalb, IL	McHenry County
3	Springfield, IL	Menard County
3	Springfield, IL	Sangamon County
3	Chicago, IL	Cook County
3	Mercer Cnty, IL	Mercer County
3	Elkhart, IN	Elkhart County
3	Indianapolis, IN	Boone County
3	Indianapolis, IN	Hamilton County
3	Indianapolis, IN	Hancock County
3	Indianapolis, IN	Hendricks County
3	Indianapolis, IN	Johnson County
3	Indianapolis, IN	Madison County
3	Indianapolis, IN	Marion County
3	Indianapolis, IN	Morgan County
3	Indianapolis, IN	Shelby County
3	Dearborn-Ohio Cnty, IN	Dearborn County
3	Dearborn-Ohio Cnty, IN	Ohio County
3	Gary, IN	Lake County
3	Gary, IN	Porter County
3	Noble Cnty, IN	Noble County
3	Lansing, MI	Clinton County
3	Lansing, MI	Eaton County
3	Lansing, MI	Ingham County
3	Flint, MI	Genesee County
3	Flint, MI	Oakland County
3	Tuscola Cnty, MI	Tuscola County
3	Cincinnati, OH	Brown County
3	Cincinnati, OH	Clermont County
3	Cincinnati, OH	Hamilton County
3	Cincinnati, OH	Warren County
3	Dayton-Springfield, OH	Clark County
3	Dayton-Springfield, OH	Greene County
3	Dayton-Springfield, OH	Miami County
3	Dayton-Springfield, OH	Montgomery County
3	Columbus, OH	Delaware County
3	Columbus, OH	Fairfield County
3	Columbus, OH	Franklin County

Table 8: AHHS First-Stage (PSU) Sample		
Census		
Division	**PSU Name**	**County Name**
3	Columbus, OH	Licking County
3	Columbus, OH	Madison County
3	Columbus, OH	Pickaway County
3	St Croix-Pierce Cnty, WI	Pierce County
3	St Croix-Pierce Cnty, WI	St. Croix County
4	Topeka, KS	Shawnee County
4	Wichita, KS	Butler County
4	Wichita, KS	Harvey County
4	Wichita, KS	Sedgwick County
4	Minneapolis, MN	Carver County
4	Minneapolis, MN	Dakota County
4	Minneapolis, MN	Hennepin County
4	Minneapolis, MN	Scott County
4	Minneapolis, MN	Wright County
4	Steele Cnty, MN	Steele County
4	Farmngton, MO	Iron County
4	Farmngton, MO	St. Francois County
4	Omaha, NE	Cass County
4	Omaha, NE	Douglas County
4	Omaha, NE	Sarpy County
4	Omaha, NE	Washington County
4	Antelope-Boone-Greeley-Wheeler, NE	Antelope County
4	Antelope-Boone-Greeley-Wheeler, NE	Boone County
4	Antelope-Boone-Greeley-Wheeler, NE	Greeley County
4	Antelope-Boone-Greeley-Wheeler, NE	Wheeler County
5	Sussex Cnty, DE	Sussex County
5	Ft Lauderdale, FL	Broward County
5	Naples, FL	Collier County
5	Miami-Dade Cnty, FL	Miami-Dade County
5	Tampa-St Petersburg, FL	Hernando County
5	Tampa-St Petersburg, FL	Hillsborough County
5	Tampa-St Petersburg, FL	Pasco County
5	Tampa-St Petersburg, FL	Pinellas County
5	Orlando-Lakeland, FL	Lake County
5	Orlando-Lakeland, FL	Orange County
5	Orlando-Lakeland, FL	Seminole County
5	Atlanta, GA	Barrow County
5	Atlanta, GA	Clayton County
5	Atlanta, GA	Coweta County
5	Atlanta, GA	DeKalb County
5	Atlanta, GA	Fayette County
5	Atlanta, GA	Gwinnett County
5	Atlanta, GA	Henry County
5	Atlanta, GA	Newton County
5	Atlanta, GA	Rockdale County
5	Atlanta, GA	Spalding County
5	Atlanta, GA	Walton County

Table 8: AHHS First-Stage (PSU) Sample		
Census Division	**PSU Name**	**County Name**
5	Fulton-Cobb-Cherokee-Forsyt, GA	Bartow County
5	Fulton-Cobb-Cherokee-Forsyt, GA	Carroll County
5	Fulton-Cobb-Cherokee-Forsyt, GA	Cherokee County
5	Fulton-Cobb-Cherokee-Forsyt, GA	Cobb County
5	Fulton-Cobb-Cherokee-Forsyt, GA	Douglas County
5	Fulton-Cobb-Cherokee-Forsyt, GA	Forsyth County
5	Fulton-Cobb-Cherokee-Forsyt, GA	Fulton County
5	Fulton-Cobb-Cherokee-Forsyt, GA	Paulding County
5	Fulton-Cobb-Cherokee-Forsyt, GA	Pickens County
5	Macon, GA	Bibb County
5	Macon, GA	Houston County
5	Macon, GA	Jones County
5	Macon, GA	Peach County
5	Macon, GA	Twiggs County
5	Baltimore, MD	Anne Arundel County
5	Baltimore, MD	Baltimore County
5	Baltimore, MD	Harford County
5	Baltimore, MD	Queen Anne's County
5	Baltimore, MD	Baltimore city
5	Winston-Salem, Greensboro, NC	Alamance County
5	Winston-Salem, Greensboro, NC	Davidson County
5	Winston-Salem, Greensboro, NC	Davie County
5	Winston-Salem, Greensboro, NC	Forsyth County
5	Winston-Salem, Greensboro, NC	Guilford County
5	Winston-Salem, Greensboro, NC	Randolph County
5	Winston-Salem, Greensboro, NC	Stokes County
5	Winston-Salem, Greensboro, NC	Yadkin County
5	Catawba-Burke-Caldwell-Alex, NC	Alexander County
5	Catawba-Burke-Caldwell-Alex, NC	Burke County
5	Catawba-Burke-Caldwell-Alex, NC	Caldwell County
5	Catawba-Burke-Caldwell-Alex, NC	Catawba County
5	Raleigh-Durham, NC	Chatham County
5	Raleigh-Durham, NC	Durham County
5	Raleigh-Durham, NC	Franklin County
5	Raleigh-Durham, NC	Johnston County
5	Raleigh-Durham, NC	Orange County
5	Raleigh-Durham, NC	Wake County
5	Halifax Cnty, NC	Halifax County
5	Augusta, SC	Aiken County
5	Augusta, SC	Edgefield County
5	Charleston, SC	Berkeley County
5	Charleston, SC	Charleston County
5	Charleston, SC	Dorchester County
5	DC-Fairfax-Prince Will-Arlington, VA	District of Columbia
5	DC-Fairfax-Prince Will-Arlington, VA	Arlington County
5	DC-Fairfax-Prince Will-Arlington, VA	Fairfax County
5	DC-Fairfax-Prince Will-Arlington, VA	King George County

Table 8: AHHS First-Stage (PSU) Sample		
Census		
Division	**PSU Name**	**County Name**
5	DC-Fairfax-Prince Will-Arlington, VA	Prince William County
5	DC-Fairfax-Prince Will-Arlington, VA	Spotsylvania County
5	DC-Fairfax-Prince Will-Arlington, VA	Stafford County
5	DC-Fairfax-Prince Will-Arlington, VA	Alexandria city
5	DC-Fairfax-Prince Will-Arlington, VA	Fairfax city
5	DC-Fairfax-Prince Will-Arlington, VA	Falls Church city
5	DC-Fairfax-Prince Will-Arlington, VA	Fredericksburg city
5	DC-Fairfax-Prince Will-Arlington, VA	Manassas city
5	DC-Fairfax-Prince Will-Arlington, VA	Manassas Park city
5	Virginia Beach, VA	Gloucester County
5	Virginia Beach, VA	Isle of Wight County
5	Virginia Beach, VA	James City County
5	Virginia Beach, VA	Mathews County
5	Virginia Beach, VA	York County
5	Virginia Beach, VA	Chesapeake city
5	Virginia Beach, VA	Hampton city
5	Virginia Beach, VA	Newport News city
5	Virginia Beach, VA	Norfolk city
5	Virginia Beach, VA	Poquoson city
5	Virginia Beach, VA	Portsmouth city
5	Virginia Beach, VA	Suffolk city
5	Virginia Beach, VA	Virginia Beach city
5	Virginia Beach, VA	Williamsburg city
5	Marion Cnty, WV	Marion County
5	Ritchie-Wirt Cnty, WV	Ritchie County
5	Ritchie-Wirt Cnty, WV	Wirt County
6	Houston-Dale Cnty, AL	Dale County
6	Houston-Dale Cnty, AL	Houston County
6	Morgan-Lawrence, AL	Lawrence County
6	Morgan-Lawrence, AL	Morgan County
6	Louisville, KY	Bullitt County
6	Louisville, KY	Jefferson County
6	Louisville, KY	Oldham County
6	Logan-Todd Cnty, KY	Logan County
6	Logan-Todd Cnty, KY	Todd County
6	Memphis, TN	Fayette County
6	Memphis, TN	Shelby County
6	Memphis, TN	Tipton County
6	Fayetteville, TN	Lincoln County
6	Rhea Cnty, TN	Rhea County
7	Little Rock, AR	Faulkner County
7	Little Rock, AR	Lonoke County
7	Little Rock, AR	Pulaski County
7	Little Rock, AR	Saline County
7	Baton Rouge, LA	Ascension Parish
7	Baton Rouge, LA	East Baton Rouge Parish
7	Baton Rouge, LA	Livingston Parish

Table 8: AHHS First-Stage (PSU) Sample		
Census		
Division	**PSU Name**	**County Name**
7	Baton Rouge, LA	West Baton Rouge Parish
7	Enid, OK	Garfield County
7	Le Flore Cnty, OK	Le Flore County
7	Harlingen, TX	Cameron County
7	Dallas, TX	Collin County
7	Dallas, TX	Dallas County
7	Dallas, TX	Denton County
7	Dallas, TX	Hunt County
7	Dallas, TX	Rockwall County
7	Houston, TX	Fort Bend County
7	Houston, TX	Harris County
7	Houston, TX	Montgomery County
7	Houston, TX	Waller County
7	Ft Worth, TX	Hood County
7	Ft Worth, TX	Johnson County
7	Ft Worth, TX	Parker County
7	Ft Worth, TX	Tarrant County
7	Corpus Christie, TX	Nueces County
7	Corpus Christie, TX	San Patricio County
7	Livingston, TX	Polk County
7	Young-Throckmorton Cnty, TX	Throckmorton County
7	Young-Throckmorton Cnty, TX	Young County
8	Phoenix, AZ	Maricopa County
8	Tucson, AZ	Pima County
8	Denver, CO	Adams County
8	Denver, CO	Arapahoe County
8	Denver, CO	Denver County
8	Boise, ID	Ada County
8	Boise, ID	Canyon County
8	Coeur d' Alene, ID	Kootenai County
8	Santa Fe-Los Alamos Cnty, NM	Los Alamos County
8	Santa Fe-Los Alamos Cnty, NM	Santa Fe County
8	Deming, NM	Luna County
9	Los Angeles, CA	Los Angeles County
9	Merced Cnty, CA	Merced County
9	Orange Cnty, CA	Orange County
9	Riverside Cnty, CA	Riverside County
9	San Diego, CA	San Diego County
9	San Jose, CA	Santa Clara County
9	Oakland, CA	Alameda County
9	Oakland, CA	Contra Costa County
9	Sacramento, CA	El Dorado County
9	Sacramento, CA	Placer County
9	Sacramento, CA	Sacramento County
9	Tehama Cnty, CA	Tehama County
9	Honolulu, HI	Honolulu County
9	Seattle, WA	King County

Table 8: AHHS First-Stage (PSU) Sample		
Census Division	**PSU Name**	**County Name**
9	Benton - Franklin Cnty, WA	Benton County
9	Benton - Franklin Cnty, WA	Franklin County
9	Snohomish-Island Cnty, WA	Island County
9	Snohomish-Island Cnty, WA	Snohomish County
9	Skagit, WA	Skagit County

Master Segment Frame

For the longitudinal component of the AHHS II sample, the full set of HUs in the 78 PSUs that completed the AHHS will be included. These HUs were sampled from segments constructed for the second stage of sampling in the AHHS. In each of the PSUs, a frame of segments was created electronically from Census block files, where a segment consists of a block or a group of geographically close blocks. Blocks were generally combined until a preset minimum number of HUs was included. Segments did not cross county boundaries. To reduce listing costs, segments exceeding 300 HUs were split into "chunks" of approximately equal size. One chunk was then sub-sampled with probability proportional to size to represent the segment.

For the ABS component of the AHHS II sample, in each of the 78 PSUs, a frame of segments will be created electronically from Census block files, where a segment consists of a block or a group of geographically close blocks. Blocks will generally be combined until a preset minimum number of housing units is included. Segments will not cross county boundaries.

Second-Stage: Sampling Segments

To further reduce travel costs and the cost of listing HUs within the sampled PSUs, segments were chosen as the second stage of selection. In the AHHS, five segments were sampled per PSU, except in extremely large certainty PSUs where the number of segments was increased, and in the smallest PSUs where only four segments were selected (see Section 2.1). This was done to reduce variation in the final HU weights. County, block group, and block level 2000 Census demographic and housing data were used in stratifying or sorting the segment frames to ensure the sample of HUs was representative with respect to housing age, household race/ethnicity, and income levels.

For the ABS component of the AHHS II, three to five segments will be selected in each PSU (five in the large certainty PSUs, three in the smallest noncertainty PSUs, and four in other PSUs).

Third-Stage: Selecting Housing Units

For the AHHS, in each sampled segment all the eligible HUs were listed to create a sampling frame of HUs. At the third stage of sampling, an equal probability sample of HUs was drawn from each list using systematic sampling. The initial sample size was designed to be large enough to obtain the target number of responding, eligible HUs. Within each segment, six HUs

per segment were therefore sampled, with four initially released to the field to be worked, on the assumption that a 54 percent participation rate would produce an average of 2.16 responding HUs per segment and 1,080 completed HUs overall. All responding HUs in the AHHS sample that were built before 1978 will be included in the longitudinal component of the AHHS II sample. The 78 PSUs to be subsampled for AHHS II are expected to contain about 511 HUs that completed the AHHS survey and were built before 1978; with an assumed 50 percent response rate for AHHS II, these 511 HUs are expected to yield 256 completed AHHS II interviews.

For the ABS component of the AHHS II sample, the sampling frame will be constructed by forming a list of all addresses in the ABS frame that geocode to a location within the segments sampled for this component. In order to complete 544 interviews in this component of the sample (for a total of 800 completed AHHS II interviews), a sample of 1,295 addresses is expected to be needed, assuming an ineligibility rate of 16 percent and a response rate of 50 percent. This corresponds to a sample of about four addresses per sampled segment in the ABS component.

2.2.2 Statistical Objectives

In order to develop the statistical sampling design and data collection procedures, the general study objectives were translated into specific statistical objectives (i.e., specific parameters to be estimated from the data). The following parameters are of interest to HUD and EPA in meeting the stated objectives (see Table 9).

Table 9. Statistical Objectives	
Lead	1. Population characteristics of the homes in the survey 2. The estimation of the mean, median, 75th percentile, 90th percentile, and 95th percentile of house dust lead levels on floors and window sills; 3. The percentage of Housing Units (HUs) with dust lead levels above selected thresholds; 4. Similar estimates shall be derived for soil and paint lead levels. 5. Cross tabulations of HUs with levels of lead in one matrix above the selected thresholds against homes with levels of lead in a second matrix above the selected thresholds for each of the pairs of matrices, and correlations between the loadings for each of the pairs of lead matrix combinations. 6. Number and percentage of persons who engage in selected behaviors potentially affecting their exposures to lead such as by their occupations or hobbies. 7. Comparisons of the presence of LBP and the presence and severity of LBP hazards between government assisted and non- assisted housing. 8. Biases and standard errors of these estimates shall be included. All of these shall also be compared with the findings of AHHS.
Lead	a. Estimates of the prevalence of LBP and LBP hazards in HUs for selected subsets of housing. Tests of significance shall be performed to compare these sub-populations on the key parameters described above. The sub-populations to be separately compared and estimated include: b. HUs occupied/not occupied by children under 3 years, under 6 years, and under 18 years. c. Single family and multi-family HUs. d. Owner-occupied and renter-occupied HUs. e. HUs built in selected ranges of years. Year-of-construction cuts for reporting include at 1940 (i.e., pre-1940, and similarly for other cuts), 1960, 1978, and the survey year. Year ranges may be aggregated for reporting, depending on the sub-sample sizes, upon approval by the Government. f. HUs occupied by households of different socio-economic status as defined by income levels (with household income cut points at $35,000 and at the federal poverty level), housing unit market value and/or monthly rent, using Census and HUD criteria. g. Government-supported and non-Government-supported housing. h. HUs in different Census regions. i. Measures of urbanization (e.g., urban, suburban, and rural); or measures of different types of urban environments based on population density, housing stock age, or income levels, using Census and HUD criteria. j. Demographic status. Separate estimates for ethnic and socioeconomic subgroups such as whites and (non-white) minorities, lower-income households, and households with and without children under 6 years of age, and under 18 years of age. k. Resident behavior information, including occupation, smoking patterns, and other elements defined in the survey design protocol. l. The results of the multivariate analyses as described above (i.e., predictors of the presence of LBP hazards).
Lead in drinking water	Estimation of the mean, median, 75th percentile, 90th percentile, and 95th percentile percentage of HUs with drinking water lead concentrations above selected thresholds in the Safe Drinking Water Act in incremental draw water samples.

Table 9. Statistical Objectives	
Other environmental	1. Estimation of the mean, median, 75th percentile, 90th percentile, and 95th percentile of the additional numerical environmental contaminant levels including molds, pesticides, and formaldehyde; the percentage of homes in which children can live with additional environmental levels above selected thresholds; and the biases and standard errors of these estimates. 2. Prevalence of occupant reporting of smoking patterns. 3. Prevalence of evidence of pest infestation. 4. Prevalence of evidence of visual mold and moisture damage (broken into various categories of severity). 5. Results of multivariate analysis of factors predicting the occurrence of individual hazards/conditions and the co-occurrence of multiple hazards. 6. Biases and standard errors of these estimates shall be included. 7. Estimates of the prevalence of the additional environmental factors in housing for the same selected subsets of housing as used in the lead discussion above.

For each of these items, the analysis will provide:

1. Estimates of the potential biases in the above estimates.
2. Estimates of impact of measurement error on above estimates.

2.2.3 Data Collection Procedures

Overview

The field team in each PSU (typically one or more counties or a major metropolitan area) will consist of a trained Interviewer and a Technician certified as a LBP Inspector/Risk Assessor in the State where the PSU is located (see Table 8). The interviewer will travel to the PSU first and spent five to seven days locating and visiting the approximately 19-27 HUs identified for recruitment in the PSU. The average number of HUs to be recruited and completed is 10.3 per PSU; one-third of these will be pre-1978 housing that participated in AHHS, with the remainder being newly selected HUs. Initially, all of the longitudinal sample in the PSU will be released to the interviewers. On average there will be approximately seven longitudinal HUs, but the number will vary from one PSU to another. For each PSU, a base draw of three or four HUs in each segment (typically 19-27 HUs per PSU) will be released to the Interviewer for recruitment.

At each HU, the field team will inventory rooms in the HU, ask the householder or other adult resident questions about the HU, make observations and measurements, and collect environmental samples. The protocols and forms prepared for these tasks have been modified from those in the AHHS, the 2012 HUD *Guidelines for the Evaluation and Control of Lead-Based Paint Hazard*s, the 1999-2000 NSLAH, and the First Environmental Survey of Child Care Centers, as well as developed and modified from protocols provided by the EPA, and the American Society for Testing and Materials (ASTM).

The questionnaire data will elicit information needed to: 1) perform data analysis for LBP hazards and other environmental contaminants or hazard levels by subpopulation, and 2) assess

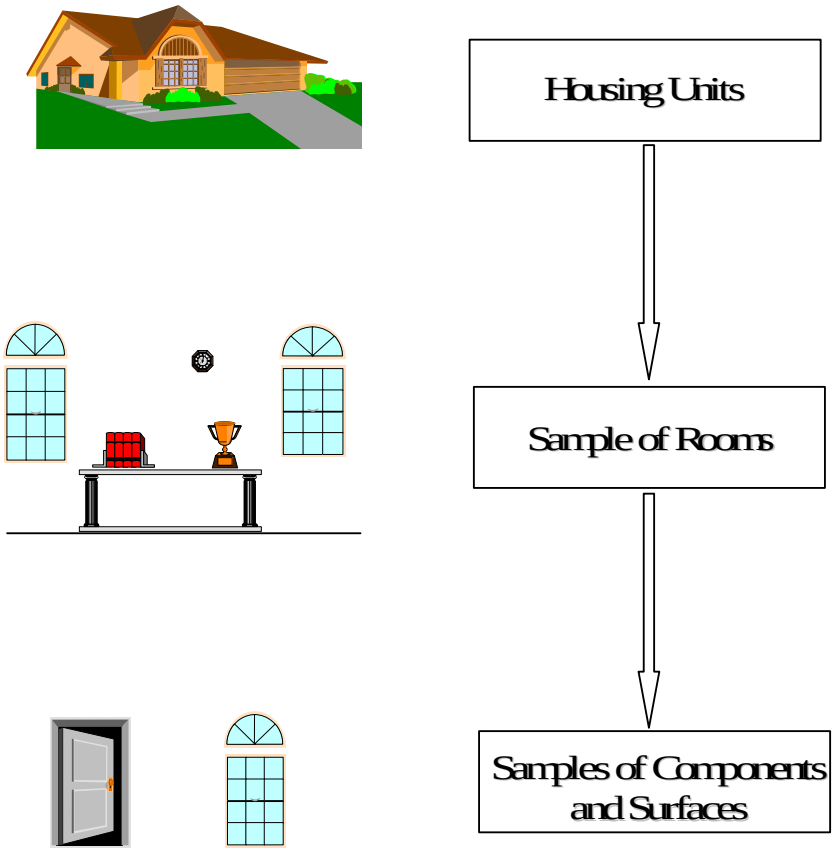
the potential hazard(s) that may result from high lead or other environmental contaminant or hazard levels found in the HU.

Relevant information will be recorded about each environmental sample and measurement, including location of the sample or measurement, total surface area represented by the sample, presence of damaged paint, carpeting, building condition and cleanliness, evidence of moisture, cockroaches, rodents, and pets, and, temperature/humidity in the sampled rooms. Paint surfaces will be tested using an Heuresis non-destructive, portable X-Ray Fluorescence (XRF) Lead-in-Paint Analyzer. Soil, water, dust, and wipe samples will be collected and sent to accredited laboratories for lead, mold, and pesticide analyses.

There are a variety of broad selection strategies for random collection of environmental samples and measurements in each HU. Each sample selection strategy begins with a determination of either which rooms, or which surfaces/components, will be included in the sampling scheme as illustrated in Figure 2. Because the purpose of the AHHS II is to assess hazard and contaminant levels in the nation's homes irrespective of the current occupants, room selection will not depend on behavioral characteristics of the occupants. This room selection strategy will provide statistically valid inferences for specific rooms as well as for average levels within HUs. The proposed rooms for random sampling are:

- Kitchen (KIT).
- Common living area (CLA, living room, den or family room). If multiple common living areas are present, one will be randomly selected.
- One bedroom (BR). If one or more children age 17 and younger reside in the HU, one bedroom will be randomly selected from among the bedrooms in which the children sleep. If no such children reside in the HU, one bedroom will be selected randomly from all the regularly occupied bedrooms (i.e., not a guest bedroom). Bedrooms are rooms currently arranged for people to sleep (i.e., there is a bed present in the room). Rooms that were designed as bedrooms, but are being used for another purpose (e.g., as an office or storage room, will not be included as bedrooms).
- Other random room (OTHER). This fourth room will be randomly selected from among the remaining rooms in the HU. This includes bathrooms, dens, home offices, utility rooms, etc. It also includes bedrooms occupied only by adults, if the HU has one or more bedrooms occupied by children. This ensures every room in the HU has a chance of being included in the study.

Figure 2. Multi-Stage Area Probability Sampling Strategy



Tables 10, 11, and 12 summarize the rooms, components, and environmental samples or measurement types to be included in the survey. Table 13 provides more detail on the field data collection procedures.

Table 10. Summary of Environmental Sampling						
ID[a]	**Information Captured or Target Analyte**	**Data Collection Method or Sampling Media**	**Tests or Samples per DU**	**Special Handling Requirements**	**Maximum Media Count**	**Notes**
Collected by Interviewer						
I2	Lead in water (incremental)	Small additions – total about 1 liter	1	acidified at lab and wait >24 hours before analysis	800	wide mouth LDPE bottle
I6	Mold by PCR	Vacuum dust (resident vacuum bag)	0-1	none	800	
I8	Mold (by PCR)	Vacuum dust	1	none	800	
I9	Mold (by PCR)	Dust wipe (Swiffer™)	1	frozen after collection	156	2 per PSU (58 PSUs)
Collected by Technician						
T1	Formaldehyde in air	Absorption tube	1 plus 1 blank/PSU	frozen after collection	956	Count includes 1 spiked QC/PSU
T2	Lead based paint	XRF	>40 readings plus QC	not applicable	not applicable	Testing of water supply line for Pb included here, if it can be accessed.
T3	Lead in dust	Dust wipe	9 plus 1 blank	none	8800	Count includes 10% QC
T4	Pesticides	Dust wipe	2 plus 1 blank/PSU	frozen after collection	1678	
T5	Lead in soil	Soil	0 to 6	dried at room temperature and sieved to <2 mm, sub-sampled, then sent to EPA	3520	Count assumes mean of 4 samples/DU and, for lead in soil, includes 10% QC.
	Bioavailable lead			sieved to <250 µm	3520	
[a]Identifies the protocol containing detailed instructions for the tests or sample collection.						

Table 11. Summary of Analytical Methods				
ID[a]	**Information Captured or Target Analyte**	**Sample Preparation**	**Analytical Method**	**Detection Limits**
Collected by Interviewer				
I2	Lead in water (incremental)	Acidified at lab to pH<2 with 1:1 nitric acid and wait >24 hrs before analysis	SM[b] 3113B (GFAA) or ICP/MS	Pb: 3 µg/L
I6	Mold by PCR	Sieved to 300 µm and extracted in neutral buffer and shaken in the bead beater to release the DNA. The mold DNA is purified using the DNA-EZ extraction kit.	MSQPCR developed by EPA (US Patent No.6,387,652).	not defined
I8	Mold (by PCR)			
I9	Mold (by PCR)			
Collected by Technician				
T1	Formaldehyde in air	none	modified NIOSH 2016 (HPLC- UV detection)	0.12 ppb for 3-hour sample at 1.5LPM
T2	Lead based paint by XRF	none	Direct field measurement using field portable XRF	Meets HUD EPA PCS requirements
T3	Lead in dust	EPA 3050B-M	EPA 6010C (ICP)	Pb: 20 mg/kg (RL)
T4	Pesticides	Extracted in dichloromethane and concentrated using solid-phase extraction cartridge[b]	GCMS[b]	variable depending on pesticide
T5	Lead in soil	EPA 3050B-M	EPA 6010C (ICP)	Pb: 20 mg/kg (RL)
	Bioavailable lead	EPA Method 9200.2-86: Buffered leach (pH 1.5) mimicking stomach acid conditions	EPA Method 3051A	not defined

[a]Identifies the protocol containing detailed instructions for the tests or sample collection.
[b]Stout, D.M., et.al. American Healthy Homes Survey: A National Study of Residential Pesticides Measured from Floor Wipes; Environ. Sci. Technol., **2009**, 43, 4293-4300

Table 12. Pesticide Wipe Sample Analytes	
Pyrethroids	**Organochlorines**
Allethrin	Chlordane: alpha and gamma
Bifenthrin	Heptachlor
Cyfluthrin (isomers and total)	p,p'-DDT
λ-Cyhalothrin	p,p'-DDE
Cypermethrin (isomers and total)	**Organophosphates**
Deltamethrin	Chlorpyifos
Esfenvalerate	Diazinon
Fenpropathrin	Malathion
Imiprothrin	**Phenyl-Pyrazole**
Permethrin (isomers and total)	Fipronil
Pyrethrin I	**Other**
Resmethrin	Piperonyl butoxide
Sumithrin	
Tetramethrin (isomers and total)	
Prallethrin	

Table 13. Field Procedures	
Procedure	**Description**
Resident Contact	All HUs identified for recruitment will be mailed an ***Advance Letter*** on HUD letterhead in a HUD envelope, signed by Dr. Warren Friedman, Senior Advisor to the Director, HUD OLHCHH, approximately one week before the Interviewer travels to the PSU. The advance letter will explain the purpose of AHHS II and will contain a $1 bill as a small token of appreciation to attract the interest of the recipient and increase the likelihood that the letter will be read. The letter will introduce the study, explain the need for it, indicate the importance and advantages of participation (including an additional $130 at the end of full data collection, along with reports of testing results if the household requests them), briefly outline the data collection procedures, and advise them that an Interviewer will be visiting them in the near future. The letter is worded to invite participation in this very important national study. There are two versions of the advance letter, one for HUs that were sampled in the previous AHHS and one for HUs that were not. (See Appendix A, pp. 4-5.) For each PSU, a field Interviewer will be given the list of HUs in the sample (see ***PSU Summary Sheet***, Appendix A, Page 12). She/he will be instructed to attempt to contact, screen, and recruit all sampled HUs. She/he will also be given instructions about how many times to attempt to contact the household, how to space the attempted contacts over the days of the week and the times of the day, and how to screen and recruit the household. At least four attempts will be made to contact a resident at each HU. Attempts will be made at different times of the day and on different days of the week. For example, if the first contact during the day on a weekday is unsuccessful, the second attempt might be made on a weekday evening, followed by a third attempt on the weekend, etc. The recruiting effort for a HU will be considered complete only if contact is made and a data collection visit is agreed to or refused, or if four unsuccessful attempts are made to contact a resident. If nobody is home when the Interviewer first visits a HU, and the home is not obviously vacant, the copy of the Advance Letter will be hung in a clear plastic *doorknob hanger* bag on the main entry door of the HU. This copy will explain that the Interviewer stopped by and will return soon (see Appendix A, pages 6-7). Interviewers will be provided with official study Photo-ID Badges and copies of the introductory letter previously sent to the HU. These measures will help to ensure that the sample, which was a probability sample when drawn, will continue to be a probability sample throughout the fieldwork period. It is estimated that about 5-7 days of recruitment will be required per PSU to produce an adequate sample of recruited HUs to begin field data collection. Subsequently, assuming a minimum number of HUs have been recruited, the data collection Technician will arrive at the site and the team will begin field and environmental data collection, as described below. During this time, the Interviewer in addition to collecting field data from recruited HUs, will also continue to recruit the remaining HUs in the PSU. Field data will typically be collected from the remaining households during the third week at the site.
Respondent Screening	Respondent screening is the process of determining if households are eligible for the study. The Interviewer will begin the first contact with each selected household by administering a short ***Recruitment Questionnaire*** (see Appendix A, pages 28-34) to any adult resident of the household. Ineligible HUs include institutional housing (e.g., prisons or hospitals), housing where children are not permitted to live, or vacation housing. The Interviewer will ascertain if the HU is vacant by visual inspection or by proxy response from a neighboring resident. If the HU is not eligible, the Interviewer will thank the householder for his/her time and terminate the interview. If the HU is eligible, the Interviewer will immediately proceed to recruit the household for the study.

	Table 13. Field Procedures
Respondent Recruitment	The Interviewer will continue to administer the Recruitment Questionnaire in each HU that is found to be eligible. The questionnaire will invite the adult respondent to participate in this very important national study, recruit the respondent and schedule an appointment for a data collection visit, by the same Interviewer joined by a Technician, for the following week. The data collection visit will be scheduled for a date and time convenient to the respondent. It is anticipated that many of these visits will take place in the evenings and on weekends. The Interviewer will record the respondent's name and telephone number (if available). The respondent will be offered $130 in addition to the $1 included with the Advance Letter. These incentives are expected to positively influence the respondent's willingness to participate in the study. At the end of the data collection visit, the respondent will sign a receipt to acknowledge receiving the incentive. As an additional benefit, the respondent will be offered the opportunity to request a report of results of lead testing for their HU. The respondent will fill out a request for results that is part of the ***Informed Consent form*** (see Appendix A, pages 54-59). If lead hazards are found, the respondent will automatically be sent the lead hazards portion of the Hazards-Found Report unless they check the box not to receive it "**EVEN IF LEAD PAINT OR LEAD HAZARDS ARE FOUND IN [THEIR] HOME**." [Boldfaced capitals in Consent form.] Sample reports are presented in Appendix A, pages 17-20. At the time of recruitment into the study, an ***Appointment Reminder Card*** (see Appendix A, page 34) identifying the study and documenting the date and time of the appointment will be left with the respondent. This card will provide a toll-free number to call for further questions about the study, and a telephone number where the Interviewer can be reached in case the appointment time needs to be rescheduled. The respondent will be reminded not to vacuum, dust, or mop floors for at least two days before the appointment since the fieldwork team will be collecting dust samples. He/she will also be provided with the supplies and an instruction card about how to collect a drinking water sample in preparation for the scheduled interview (see ***Figure I2-1 - Bottle label for the drinking water sample***, Appendix A, page 37). The Interviewer will explain that the respondent is being requested to collect the sample on the day of the interview to minimize the burden for multiple visits to the HU. Although asked to collect this sample the morning of the scheduled interview, the Interviewer will not take custody of the sample until the informed consent is completed. In addition, the Interviewer will confirm the data collection appointment by calling the respondent a day before the scheduled appointment. The Interviewer will confirm the data collection appointment in person for respondents without telephones. In cases where a respondent is reluctant to participate, the Interviewer will use standard refusal avoidance techniques by answering any questions the respondent may have, providing additional details about the data collection procedures, and emphasizing confidentiality and the importance of representing the respondent's household in the study. If the respondent still refuses, a ***Refusal Letter*** (see Appendix A, pages 10-11) will be sent to the respondent further informing her/him of the importance of the study and the benefits they will receive from participation. The Interviewer will refer to the responses in the ***Frequently Answered Questions*** as needed to answer the respondent's questions (see Appendix A, pages 38-42). A second visit will then be made to the household at a later date. The Interviewer will use the ***Control Log and In-Person Contact Record*** (see Appendix A, page 29) to record all contact attempts and their outcomes, either in-person or by telephone. For those households where no one has been found to be home at several times of the day and days of the week, a ***No Contact*** letter will be sent by FedEx asking the household to consider participation and to call either of two toll-free numbers (one with the survey contractor and the other with the Federal Information Relay Service for people with speech or hearing disabilities) for an appointment time (see Appendix A, pages 8-9).

Table 13. Field Procedures	
Informed Consent	After introduction of the team members, the first activity at each HU will be to complete the Room Inventory and administer the Resident Questionnaire to the householder or other responsible adult resident. The questionnaire directs the respondent to first read and sign the ***Informed Consent Form*** (see Appendix A, pages 54-59) before continuing with the inventory and interview. If the resident is disabled (e.g., auditory or visual disability) or has difficulty communicating in English, the Interviewer will ask for permission to get a neighbor, nearby friend or relative to assist and to assure that the resident understands and agrees to signing the form. This is the same procedure that was successfully used in the AHHS. Team members will answer any questions the respondent has regarding the study and the activities to be conducted in their HU.
Room Inventory	Once consent is obtained, the Interviewer will complete the ***Room Inventory*** to list all rooms in the HU (see Appendix A, pages 56-57). The information will be used to randomly select the rooms in which environmental sampling will be conducted. The Interviewer will discuss the rooms selected with the respondent; if one of the rooms is unavailable for sampling, a second room in the same room stratum will be selected, if possible. The Room Inventory will also determine which is the most-used entrance/exit and in which areas of the yard children most often play.
Resident Questionnaire	The Interviewer will then continue to administer the ***Resident Questionnaire*** to collect the following information (see Appendix A, pages 67-88): ▪ Building-related questions: housing unit age, how long the respondent has lived in the HU, whether the unit had been tested for lead in the past, the number of stories, type of heating and air conditioning, instances of water damage or dampness in the past, presence of a dehumidification system, presence of pets, presence of cockroaches and rodents, source of water for the HU, insecticide application, cleaning schedules, etc. ▪ Resident-related questions: number of people in the household, household income, and smoking patterns. ▪ Lead-related occupations or hobbies, and pesticide-related occupation or hobbies (e.g., veterinarian, exterminator, farm worker). If the respondent refuses to participate or fails to complete the questionnaire, the Interviewer will complete the ***Respondent Refusal/Break-Off Report*** (see Appendix A, pages 89-90).
Interior Walkthrough Observations, Room Observations, and Moisture Measurements	After the Resident Questionnaire has been completed, the Interviewer will perform data collection using the ***Interior Walkthrough Observations*** form programmed into the tablet (see Appendix A, pages 91-96). These efforts include cleanliness and clutter observations, safety observations, ***collection of the resident vacuum bag*** (see Appendix A, page 97), and the ***Room Observation Measurements form and the Building Materials Moisture Testing Log*** (see Appendix A, pages 103-108). These efforts include measurement of room dimensions, temperature and humidity from all the primary rooms designated on the Room Inventory form and building moisture testing in three rooms. These efforts are conducted on a room-by-room basis. Making room observations and building measurements while in the same room is designed to save time. It is more efficient than going back to the three rooms targeted for moisture measurements after collecting room observation measurements in all.

Table 13. Field Procedures	
Fungi Vacuum Dust Sampling	The Interviewer will next perform vacuum dust sampling for mold using the **Fungi Vacuum Dust Sample Collection Log** form (see Appendix A, page 112). These efforts include using the DustStream sampler connected to a vacuum cleaner to collect one composite dust sample from the floors of two primary rooms, the Common Living Area (CLA) and the Bedroom (BR) (as designated in the selection column of the Room Inventory form).
Dust Wipe Swiffer® Sampling	After collection of the vacuum dust sample, the Interviewer will collect a dust wipe composite sample from two rooms (CLR and BR) using dry Swiffer™ dusters. The dusters are removed from a re-sealable bag and are used to wipe the tops of structures that are not often cleaned. The Swiffer™ dusters are then returned to the re-sealable bag and stored temporarily with other collected samples until they can be placed in a freezer (see Appendix A, page 115)
Incremental Water Sample and Water Temperature	The Interviewer will also ensure that the composite (incremental) water sample retrieved from the resident is properly labeled, a replicate of this label is placed on the Water Sample Log bound in the resident questionnaire form set for the HU, and a replicate label is placed on the Chain-of-Custody Form (see Appendix A, pages 111-112).
Exterior Walkthrough Observations	The Interviewer contacts the Technician to complete the collection of the formaldehyde sample. Once that equipment is removed, the Interviewer performs walkthrough observations of the exterior of the DU using the Exterior Conditions Log form (see Appendix A, page 117). This includes collection of outside temperature and humidity measurements, and observations on building conditions.
Formaldehyde in Air Sampling	Immediately after introductions are made between the Interviewer, respondent, and Technician, the Technician assembles and calibrates the sampling equipment (pump, tubing and sorbent tube) assembly and initiates air sample collection by attaching the calibrated assembly to the Interviewer's clothing. Air sampling for formaldehyde continues until the Interviewer has completed all interior activities. Once completed, the Interviewer has the Technician (while the Interviewer is still inside the HU) measure the end of sampling flow-rate of the air sampling assembly, disassemble the assembly, and store the collected sample. Relevant sampling data are collected on a form. For the AHHS II, the optimum flow-rate of air through the sorbent tube used to capture formaldehyde from the air is 1.5 liters per minute (LPM). This rate is at or near the maximum capability of the personal air sampling pump. (See Appendix A, T1 protocol, pages 118-130)

Table 13. Field Procedures	
Lead Paint Testing Using XRF	The Technician conducts LBP testing using combination of automated data collection programmed into the XRF instrument and a checklist (one for each room and the exterior). LBP testing will include selected surfaces on the interior and on the exterior. Paint will be evaluated in a non-destructive manner by XRF to determine if lead-based paint is present in the rooms sampled. The checklist contains a list all of the building components to be tested if present. The interior testing is to be done before the exterior and includes testing in the KIT, CLR, BR and OTHER rooms. Actual testing of any surfaces cannot be started until the Interviewer completes the Room Inventory (Protocol I4). In addition, the Technician must be present with the Interviewer for the Introduction. After this introduction is completed, the Informed Consent is signed, and collection of the air sample for formaldehyde has been started, the Technician will warm up the XRF and perform internal calibration and QC checks. By the time these checks are completed, the Interviewer should have completed the Room Inventory, which is needed to direct the Technician to the rooms selected for environmental sampling. The Interviewer and Technician will make a quick visit with the resident to each of these interior rooms to communicate agreement on the rooms that are selected for testing. During this quick visit, the drinking water service line will be tested for lead if it can be located and assessed. Once this is done, the testing of selected surfaces in the four selected rooms and the primary entryway will be performed. Testing on the exterior locations will be performed after completing collection of all of the interior samples. Exterior testing includes measurements on a porch area (if it exists), and on other selected exterior surfaces on one randomly selected side of the DU (designated as east, west, north or south as determined during the room inventory). (See Appendix A, T2 protocol, pages 134-144).
Dust Wipe Sample Collection for Lead	After the interior LBP testing has been completed, the Technician will perform lead wipe sample collection in the KIT, CLR, BR and OTHER rooms. These efforts include collection of two wipe samples in each of the rooms, one from a random windowsill and one from the center of the largest open area on the floor. Also included are collection of one field blank and one sample from the floor in the center of the doorway to the major entrance to the HU. One square foot templates will be used for floor samples. The entire interior sill area will be wiped for windowsill samples. The surface type wiped for floor and window samples, carpet pile depth (for carpeted surfaces), window treatments, surface area wiped, and proximity of floor samples to doors, windows, and traffic patterns will be recorded using a form. (See Appendix A, Protocol T3, pages 146-154).
Pesticide Wipe Sampling	After completing the collection of the dust wipe samples for lead, the Technician will collect two pesticide wipe sample(s) in the Kitchen. A field blank will also be collected in the first HU sampled in a PSU (1 per PSU). One square foot templates will be used for these floor samples. Relevant sampling data are collected on a form. (See Appendix A, Protocol T4, pages 155-161)
Soil Collection for Lead	After completing the collection of pesticide wipe samples, soil samples will be collected from the locations listed below. At each location, samples will be collected from bare soil, i.e., not covered with grass, concrete, asphalt, or other permanent covering, if possible. If no soil is bare, soil samples will be collected from covered surfaces, if possible. Thus, soil samples may be collected from soil covered by grass or mulch, but not concrete or asphalt. A maximum of six soil samples will be collected as shown below. • One (1) main entry composite sample. • Two (2) foundation/dripline composite samples. • One (1) mid-yard area composite sample. • One (1) or two (2) composite play area samples. In addition to the soil samples, an estimate will be made of the total bare soil on the property associated with the DU and recorded as <9 sq. ft. or >=9 sq. ft. (See Appendix A, Protocol T5, pages 162-166)

Data Collection Closeout

At the end of the data collection, the field staff will thank the respondent and give him or her the incentive check. They will then review their work as soon as possible after data collection is completed (while still at the home, if possible). They will also conduct a detailed review of all data collection forms and samples before sending them to the field office using the End of Day Onsite Checklist

Field Sample Handling and Shipping

Samples will be numbered in the field with unique identification numbers that incorporate the survey number assigned to the housing unit. Samples will be shipped to the contractor's office with all data forms, including the End of Day Onsite Checklist on a regular basis by FedEx. Pesticide samples will be kept frozen after sample collection and shipped on blue ice in Styrofoam shippers directly to EPA's analysis laboratory at the end of sampling in a PSU. Transmittal forms will be used to document the samples included in each shipment.

2.2.3 Estimation

Weights

Each HU will receive a weight that will permit the sample of HUs to be expanded to represent the population of all private, noninstitutional, non-vacant U.S. housing that allows resident children. The weight for a particular sampled HU is the number of HUs it represents. First, a weight will be calculated that is equal to the inverse of the HU's overall probability of selection in the component in which it was sampled (longitudinal or ABS). This is called the *base weight.* The HU's overall probability of selection in their component is the product of the probability of selection at each of the three stages; that is

$$p(HU) = p(PSU)*p(segment|PSU)*p(HU|PSU,segment)$$

where

HU = housing unit,

segment = a block or group of small blocks,

PSU = primary sampling unit,

p(HU) = final probability for the housing unit,

p(PSU) = probability of selection for the PSU,

p(segment|PSU) = probability of selection for the segment given the PSU was selected, and

p(HU|PSU,segment) = probability of selection for the housing unit given the segment and PSU were selected.

Note that p(PSU) will account for both the probability of the PSU being selected into the 100-PSU AHHS sample, and the probability of including the PSU in the AHHS II sample given that it was selected into the AHHS sample. Additionally, where applicable in the longitudinal component, p(HU|PSU, segment) accounts for the chunking of segments that was done during AHHS sampling.

There will be missing data at the HU level due to nonresponse. Reasons for nonresponse may be refusal to participate in the survey, or because nobody is at home to permit samples to be taken even after repeated contact efforts. This is known as *unit nonresponse.* A nonresponse adjustment will be performed to compensate for unit nonresponse by inflating the base weights of the eligible responding HUs so that they will represent the eligible nonresponding HUs sampled as well as the eligible nonsampled HUs.[18] This is necessary to permit estimation of total housing units from the sample. A responding HU will be defined as one in which any measurements are taken.

The base weights will be adjusted for unit nonresponse. For the longitudinal component of the sample, the AHHS unit nonresponse adjustment factors will first be applied to the base weights to account for AHHS nonresponse (since the longitudinal sample comprises only respondents to AHHS). Then, both samples will be adjusted separately for nonresponse to the AHHS II.

For AHHS II, classification tree analyses (separate analyses for each of the two components of the sample) will be conducted to identify characteristics associated with differential nonresponse, in order to control potential nonresponse bias caused by differential response rates among the different types of HUs. For these analyses, the variables race, ethnicity, presence of a child under age 6, socioeconomic status (in poverty or not), Census region, year of construction, single- versus multifamily, metropolitan status, and owned versus rented will be input to the classification tree algorithm. The adjustment cells identified by the algorithm will be used, and separate adjustment factors (equal to the reciprocal of the weighted response rate for the cell) will be computed and applied to the weights.

In the first AHHS, race, ethnicity, socioeconomic status, Census region and housing age were found to impact the response rate. Response rates were higher in African American, Hispanic and poor households, as well as homes built since 1978 and those not in the Northeast. None of the response rate differentials were statistically significant however. Nonresponse adjustment was carried out in two stages, first for unknown eligibility and then for nonresponse among eligible housing units. This resulted in a total of 64 adjustment factors for nonresponse ranging from 1.50 to 2.06. The nonresponse adjusted weights were then post-stratified to the 2005 American Housing Survey (AHS) on Census region, housing age, and presence of a child under age 6. Details on the nonresponse and poststratification adjustments for the AHHS can be

[18] Sarndal CE, Swensson B, and Wretman JH. *Model assisted survey sampling.* 1992: New York: Springer.

found in Appendix E. A follow-up questionnaire is described in 2.2.4 (below) and attached as Appendix F.

Population estimates of total housing units by age, Census region, metropolitan status, housing unit type, housing tenure, income, Government support, poverty status, race and ethnicity were calculated using the nonresponse post-stratified weights and compared to the 2005 AHS and the 2006 Current Population Survey (CPS). It was found that the nonresponse post-stratified AHHS sample very closely matched the AHS and CPS totals on all variables. Details are in Appendix E.

Due to the similarity between the AHHS and AHHS II designs, nonresponse adjustment will be conducted similarly for AHHS II. It is anticipated that the variables on which the AHHS sample and the AHS and CPS totals were compared and agreed closely include those important in controlling for potential nonresponse bias for lead in water, paint, dust and soil, pesticides, formaldehyde and mold. For lead, the most important variable is housing age, followed by housing type (single family or multifamily), region and race. For pesticides, evidence of cockroach infestation is the most common factor associated with high levels of most pesticides, but is in turn highly related to region (most common in the South), tenure (owner vs. renter), income and race. Formaldehyde is known to be related to housing age, with more recent homes being more likely to have higher levels. Finally, mold is related to housing age as well as condition, which in turn is related to income and housing type (multifamily housing is often professionally maintained and in better condition). Thus, the nonresponse adjustment and poststratification approach for AHHS II is designed to reflect the range of variables likely to be important for all the substances for which sampling will be carried out.

Next, compositing will be used to combine the longitudinal sample with pre-1978 HUs in the ABS sample, since HUs built before 1978 are represented by both samples. In this compositing step, the nonresponse adjusted weights of the longitudinal sample will be adjusted by a factor λ (where $0 < \lambda < 1$), and the nonresponse adjusted weights of pre-1978 HUs in the ABS sample will be adjusted by $(1- \lambda)$. For AHHS II, the compositing factor λ will be equal to the effective sample size of the longitudinal sample divided by the sum of the effective sample sizes of the each of the two samples (where these effective sample sizes are restricted to pre-1978 HUs). HUs in the ABS sample that were built after 1978 will receive a compositing factor of 1.

Finally, the composited HU weights will be poststratified[19] to 2015 American Housing Survey (AHS) HU totals by Census region, housing unit age, and presence of a child under age 6.

Because the AHHS II target population is smaller than the AHS population (since it excludes elderly housing, military housing for civilians, and permanently occupied hotels/motel rooms and suites), caution will be needed in post-stratifying AHHS II weights to AHS counts.

[19] For a description of post-stratification, see Cochran WG. *Sampling techniques.* 1977. *New York: John Wiley and Sons*: 134, 135; Kish L *Survey Sampling*.1965. New York: John Wiley and Sons, Inc.:90-92; Sarndal CE, Swensson B, and Wretman JH. *Model assisted survey sampling.* 1992. New York: Springer: 264-268)

Missing data will also be caused by failure to collect all the required samples and data in some HUs. This is known as *item nonresponse*. Imputation of missing data within a HU has the potential to reduce biases that would otherwise be included in the dataset. Imputation was carried out in AHHS for missing data on race, ethnicity, income, poverty status, age and tenure, using Census 2000 data (Appendix E). A similar approach, using Census 2010 data, will be used in AHHS II.

2.2.4 NONRESPONSE FOLLOW-UP QUESTIONNAIRE FOR AHHS II

A follow-up questionnaire of non-respondents to the AHHS II will be administered by mail to obtain information that can be used to compare non-respondents to respondents. The mail questionnaire was generated from the resident questionnaire by removing questions needed only to interpret the environmental testing performed in respondents' homes. That leaves a core set of 11 questions from which the following data on non-respondents will be collected:

- Census region (obtained from the address)
- MSA status (from the address)
- Housing age
- Housing type (single- vs. multifamily)
- Housing tenure (owned vs. rented)
- Rental housing ownership (public vs. private)
- Household income
- Poverty status
- Race
- Ethnicity
- Presence of children under ages 6 and 18.

The mail questionnaire will be administered according to current best practices:[20,21]

- Advance letter explaining the purpose of the survey and informing respondents to expect a questionnaire in approximately 1 week.
- Questionnaire package with cover letter, questionnaire, and Business Reply envelope, one week after advance letter.
- Postcard one week after questionnaire package, reminding respondents to return the questionnaire and thanking them if they have already done so.
- Approximately 4 weeks after the postcard, a second questionnaire package with cover letter, questionnaire and Business Reply envelope sent to all those who have not responded and whose mail has not been returned as undeliverable. The cover letter will stress the importance of hearing from the entire sample and that the survey will be closing soon.

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[20] Don A. Dillman, Jolene D. Smith and Leah M. Christian. *Internet, Phone, Mail and Mixed-Mode Surveys: The Tailored Design Method*, Wiley (2014). www.wiley.com/WileyCDA/WileyTitle/productCd-1118456149.html. Chapter 10.

[21] Leah M. Christian and Don A. Dillman. The Influence of Symbolic and Graphical Language Manipulations on Answers to Self-Administered Questionnaires: Results from 14 Experimental Comparisons. Public Opinion Quarterly 68(1):57-80. (2004). https://sesrc.wsu.edu/dillman/papers/2003/theinfluenceofsymbolic.pdf.

Research[20,21] shows clearly that a small cash "token of appreciation" that the recipient can keep whether the questionnaire is returned or not, has a strong effect on the response rate to a mail survey. Accordingly, we will include a $1 bill with the first questionnaire mailing. Some research[21] also indicates that, while "post-incentives" alone, i.e., promising recipients a gift if the questionnaire is returned, are much less effective than pre-incentives, the combination of the two can be very effective. Since the non-response follow-up survey will target mostly households that refused the in-person survey[22], a post-incentive in addition to the $1 bill will be employed. Specifically, we propose to promise a $10 check or debit card as an incentive for returning the questionnaire.

Well-designed mail surveys can have response rates from 30%-50% and even as high as 70% in exceptional cases. Since we will be targeting non-respondent to the in-person survey, we expect the response rate for the follow-up survey to be on the lower end of the range, even with the pre- and post-incentives. Our target response rate is 33%, resulting in a total of 264 responses from an expected sample of 800 non-respondents to the in-person survey.

The expected number of non-respondent to the in-person survey is 800/78 = 10.3 per Primary Sampling Unit (PSU). With a response rate of 33% to the follow-up survey, we expect an average of 3.4 respondents per PSU, with approximately 70 of the 78 PSUs having two or more respondents. For purposes of statistical analysis, each of the approximately 8 PSUs with 0 or 1 respondent to the follow-up survey will be combined with the closest PSU with two or more respondents to form a larger "PSU" for non-respondent analytical purposes.

Weighted estimates of the percent of non-respondent to the in-person survey will be calculated by Census Region, housing age, MSA status, housing type, housing tenure, household income, poverty status, race, and ethnicity. Variance estimation will be performed by the Jackknife method[23]. The estimates will be compared to those for the respondents to the in-person survey and to the comparable percentages from the most recent American Housing Survey and Current Population Survey. If significant differences are found between non-respondent and respondents to the in-person survey, additional nonresponse bias adjustments will be made if necessary.

We do not expect major differences between respondents and non-respondent on variables related to the major objectives of the survey, viz., estimation of the prevalence of lead-based paint, lead-based paint hazards and selected environmental contaminants. In the first AHHS, non-respondent to the field survey fell into two major categories; the larger consisted of households that refused the survey. We believe this was simply because they did not want the survey team in their home. The second major category of non-respondent was households we never succeeded in contacting, most likely because the residents were out of town during the 2-3 weeks our team was in the PSU. There is no reason to expect that either of these reasons for nonresponse is related to levels of lead or other environmental contaminants in the home.

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[22] Approximately 20-30% will be households that could not be contacted in the field.

[23] Kirk M. Wolter, *Introduction to Variance Estimation*, Springer (2007). www.springer.com/us/book/978-1-4419-2197-0.

2.2.5 Degree of Accuracy Needed

HUD is committed to reducing blood lead levels in children by the year 2020, as described in the report, *Eliminating Childhood Lead Poisoning: A Federal Strategy Targeting Lead Paint Hazards, f*rom the President's Task Force on Environmental Health Risks and Safety Risks to Children. A key part of HUD's strategy is the Lead Safe Housing Rule (24 CFR Part 35, subparts B-R), which went into effect September 15, 2000. The *Healthy People 2020* objectives include a reduction in the proportion of homes that are found to have lead-based paint or related hazards[1] (see Objective EH-18). The most important of HUD's objectives for the AHHS II is to measure progress towards the 2010 and 2020 goals since the completion of the AHHS and NSLAH, the latter of which was conducted shortly before the Lead Safe Housing Rule went into effect. The elimination of childhood lead poisoning as a public health problem requires continued efforts to reduce the percentage of housing units (HUs) with significant LBP hazards. AHHS found 22 percent of eligible HUs nationwide with significant LBP hazards in 2005-06.

Table 14 shows, for both two-sided and one-sided tests, the minimum decreases detectable with 80 percent probability for overall, regional, and age of housing breakdowns. The minimum detectable decrease was calculated using estimated design effects for AHHS II obtained by adjusting the AHHS design effects for the increased variation in weights expected due to adjusting the AHHS weights (for the longitudinal sample) for further nonresponse (to the AHHS II interview) and compositing of the two samples (longitudinal and ABS) together. AHHS II will provide improved estimates of how much progress has been made in the more than a decade since the last data were collected. For analytes whose occurrence may have increased or decreased over time (e.g., pesticide levels) the power associated with the two-sided test is appropriate; for those such as LBP hazards that are only expected to drop over time, the power associated with the one-sided test should be used.

The NSLAH ('98-'99) found a 25% rate of significant LBP hazards; AHHS ('05) found 21.9%. If we assume a constant rate of decrease, we should have approximately

$$21.9\%*(21.9/25)^{(12/6.5)} = 17.2\%$$

significant LBP hazards in AHHS II ('17), a 4.7% decrease from AHHS. This is generally consistent with the 4.8% for a one-sided test in Table 14, and with estimates of housing demolition ranging from 0.6% - 0.96% per year[24], i.e., 7% - 11% in 12 years.

Put another way, in the 6 years between NSLAH and AHHS, we saw a 3.1% decrease in the prevalence of LBP hazards. Assuming a constant rate of decrease, we should see a 6.2% decrease in the 12 years between AHHS and AHHS II, again entirely possible according to Table 14.

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[1] See https://www.healthypeople.gov/2020/topics-objectives/topic/environmental-health/objectives

[24] See *Validation of a Twenty-Year Forecast of U.S. Childhood Lead Poisoning: Updated Prospects for 2010.* D.E. Jacobs and R. Nevin. Environ Res 102(3) 352-364, Nov 2006.

Table 14. Minimum Decrease in Percent of HUs with LBP Hazards detectable with power of .80, alpha=0.05, Using Estimated Design Effects for AHHS II based on the AHHS			
	Percent of HUs with Significant LBP Hazards in AHHS I	Minimum Detectable Decrease for n=800 in AHHS II	
		Two-sided test	One-sided test
US	22%	5.4%	4.8%
Region[2]			
Northeast	37%	12.9%	11.6%
Midwest	27%	10.6%	9.5%
South	16%	6.4%	5.7%
West	14%	7.5%	6.8%
Construction Year			
1978- survey year	3%	2.3%	2.1%
1960-1977	11%	6.1%	5.6%
1940-1959	39%	13.5%	12.2%
Before 1940	67%	16.0%	14.2%

2.2.6 Unusual Problem Requiring Specialized Sampling Procedures

The data collection plan does not require any specialized sampling.

2.2.7 Use of Periodic Data Collection Cycles

The data collection plan requires only one collection cycle.

2.3 METHODS FOR MAXIMIZING RESPONSE RATES AND DEALING WITH NON-RESPONSE

Describe methods to maximize response rates and to deal with issues of non-response. The accuracy and reliability of information collected must be shown to be adequate for intended uses. For collections based on sampling, a special justification must be provided for any collection that will not yield "reliable" data that can be generalized to the universe studied.

[2] The four Census regions are:

Northeast: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont.

South: Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, Washington, D.C., West Virginia.

Midwest: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin.

West: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming.

2.3.1 Methods to Maximize Response Rates

As detailed in Section 1.0 (Justification (Part A)), response rates will be maximized by using a variety of techniques to recruit study participants, including an Advance Letter with a $1 cash, a recruitment interview, a No-Contact Letter, a Refusal Letter, a $130 incentive upon completion of data collection in a housing unit, and provision of reports of hazards, and the use of Interviewers trained in refusal conversion. For details, see the material on Respondent Contact, Screening and Recruitment in Section 1.0.

2.3.2 Dealing with Nonresponse

Nonresponse in national household surveys, such as the AHHS II, can be related to many different factors.[25] Therefore, a variety of techniques will be employed to minimize the different causes of nonresponse. Specifically, the design of the AHHS II has focused on nonresponse due to respondent burden, availability of respondents, and interviewer training. The approach to nonresponse adjustment after the fact is discussed in Section 2.2.3.

Respondent Burden

The design of AHHS II has targeted two strategies to overcome problems associated with respondent burden. First, as discussed in Section 2.4 below, much of the data collection replicates procedures used in the AHHS, and based on those used in NSLAH, to develop an efficient protocol that reduces the time in the respondent's home. This includes equally dividing the labor between the Interviewer and Technician and combining different data collections (e.g., room observation and building moisture measurements). Second, as discussed in Section 1.9, the respondent will receive a $130 incentive as well as reports that have been found to be adequate to the burden imposed on the respondent.

Availability of Respondents

As discussed in Table 13, the Interviewer will make a minimum of four attempts to contact the potential participants (additional attempts will be made in many cases in conjunction with sampling at other HUs in the same segment). The Interviewer will call on the potential participants at different times of the day, including the evening, and on the weekend. Also, the data collection will be scheduled at a time convenient to the potential participant. In addition to the Interviewer's recruitment techniques, if no contact is made, a potential participant will receive a letter giving them toll-free phone numbers to call to schedule the data collection (one for the survey contractor and one for the Federal Information Relay Service for people with speech or hearing disabilities).

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[25] Atrostic BK, Bates N, & Silberstein A. (2001). Nonresponse in US government household surveys: consistent measures, recent trends, and new insights. *Journal of Official Statistics*, *17*(2), 209; Groves RM and Couper MP. (1998). *Nonresponse in household interview surveys*. New York: John Wiley.

Interviewer Training

As discussed in Section 1.0, the data collection teams will receive study-specific training. This training will include refusal conversion, in which the Interviewer will work through role plays based on experience gained from the AHHS and NSLAH.

2.3.3 Adequacy of Accuracy and Reliability of Information Collected for Intended Purposes

As shown in Section 2.2.4, the AHHS II design provides HUD with the ability to detect changes from 2005 to 2017 of interest to the Department in the proportion of homes with important characteristics, such as presence of lead-based paint (LBP) hazards.

In addition, the AHHS II will provide comparable estimates to the AHHS and NSLAH for most key variables of interest to the Department. For example, for soil lead and non-LBP analytes, the AHHS II estimate will be only about 5 percent less precise than the AHHS estimates. Less clustering of the sample is expected (since, between the two samples, there will be more segments per PSU included in the sample, with fewer completes per segment, on average), and will compensate for the reduction in overall sample size (from 1,131 completes in AHHS to a target of 800 completes in AHHS II) and the increased variation in weights due to compositing the two samples. LBP-related analytes such as XRF readings will be about as precise as in AHHS because of the concentration of the AHHS II sample in pre-1978 housing and the inclusion of a longitudinal housing component among these older units.

2.3.4 Justification for Collection that Will Not Yield "Reliable" Data that Can Be Generalized to the Universe Studied

Not applicable. The AHHS II will provide estimates that can be generalized to the entire occupied U.S. housing population in which children are permitted to live.

2.4 TESTS OF PROCEDURES

Describe any tests of procedures or methods to be undertaken. Testing is encouraged as an effective means of refining collections of information to minimize burden and improved utility. Tests must be approved if they call for answers to identical questions from 10 or more respondents. A proposed test or set of tests may be submitted for approval separately or in combination with the main collection of information.

In order to increase the efficiency of data collection and comparability to earlier studies, this project replicates the AHHS data collection procedure. As such, no additional pilot tests were required for the data collection instruments used with the residents, since the actual time involved in administration will not change. Part A Table 2 reflects the average expected time involved in administration of the Informed Consent Form, Room Inventory, and Interior and Exterior Walk Through for the AHHS II. Similarly, the environmental sampling methods for lead (XRF, dust, and soil) are the same as those used in the AHHS, and based on those used in

the NSLAH. The procedures for the collection of vacuum bag samples for molds and pesticides are the same as for AHHS. HUD's Contractor, QuanTech, has used the procedures for pesticide and mold wipe sampling in other studies, and the time involved to complete those tests is incorporated into the Part A Table 2 estimates. Collection of the drinking water samples will take no more than five minutes, and used EPA and European Union approved methodology.

2.5 CONSULTATIONS AND THE PROJECT TEAM

Provide the name and telephone number of individuals consulted on statistical aspects of the design, and the name of the agency unit, contractor(s), grantees(s), or other persons(s) who will actually collect and/or analyze the information for the agency.

Individuals Consulted on Statistical Aspects of the Design

David C. Cox, Ph.D.	QuanTech	(240) 397-2993
David Marker, Ph.D.	Westat	(301) 251-1500
Jill DeMatteis, Ph.D.	Westat	(301) 251-1500
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Contractors Responsible for Collecting Information for the Agency

Contractor Name:	QuanTech, Inc.	Contact:	David Cox
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Contractor Name:	Rockville, MD 20852		

Contractors Responsible for Analyzing Information for the Agency

Contractor Name:	QuanTech, Inc.	Contact:	David Cox
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