AMERICAN HEALTHY HOMES SURVEY: A NATIONAL STUDY OF RESIDENTIAL RELATED HAZARDS

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Abstract

The US Environmental Protection Agency's (EPA), National Exposure Research Laboratory (NERL) and the US Department of Housing and Urban Development's (HUD), Office of Healthy Homes and Lead Hazard Control conducted a national survey of housing related hazards in US residences. The collaborative study, the American Healthy Homes Survey (AHHS), was designed to assess environmental concentrations of lead, allergens, mold, pesticides, and arsenic in and around US residences. The questionnaire and environmental data were collected from a stratified, nationally representative sample of approximately 1,100 US residences. The data collected in this study are being used to develop new distributions of residential concentrations and estimate potential risk, and to produce a high quality database for examining changes in the occurrence and magnitude of these environmental concentrations and risks over time.

The mold data collected are being used by EPA to assess the occurrence and concentration of specific molds and to characterize spatial trends in indoor mold concentrations. The arsenic data are being used by EPA to assess concentrations of arsenic in indoor house dusts, soil immediately outside the residence, and soil near wood structures located outside the homes.

The pesticides residue data are being used to provide EPA with nationally representative data characterizing current-use pesticide residue concentrations related to applicator and/or homeowner applied pesticides and to reported use of household products. The data will be the foundation of a dataset for future pesticide residue trend analyses. Preliminary findings based on the chemical analysis of 15% of the total hard surface wipe samples for residential use insecticides showed that the concentration of 25 insecticides ranged from below the limit of detection to 102 ng/cm2. Concentrations of organophosphate, organochlorine and pyrethroid insecticides were measured. Compounds long removed from the consumer market (e.g. DDT, chlordane) and other recently deregistered compounds (e.g. chlorpyrifos, diazinon) were detected.

The real-world data collected from AHHS will be used as input variables to evaluate and improve EPA's exposure and dose modeling tools. Results from this study will be used by HUD, EPA, and risk assessors from other organizations to identify areas for future research, develop improved mitigation/risk reduction strategies, and reduce future health risks from environmental hazards.

Overview

Environmental Protection Agency's (EPA) National Exposure Research Laboratory (NERL) and the U.S. Department of Housing and Urban Development's (HUD) Office of Healthy Homes and Lead Hazard Control conducted a national survey of housing related hazards in US residences from May 2005 to March 2006. Collaboration between EPA and HUD was designed to:

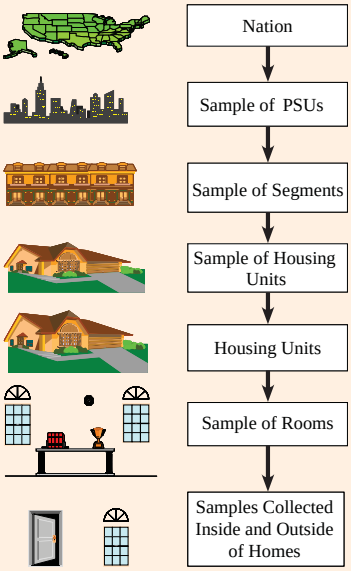
- Produce a nationally representative database that will provide environmental concentrations of lead, allergens, mold, pesticides, and arsenic in and around US residences
- Assess selected residential concentrations and housing characteristics for the general population
- Produce first ever national estimates of levels of additional housing related hazards besides lead and allergens
- Develop new distributions of residential concentrations Produce a high quality database for examining changes in the occurrence and magnitude of these environmental concentrations over time
- Save significant funds, reduces public burden, and reduces time needed to get data necessary for both agencies for ongoing primary and secondary prevention activities

AHHS Objectives

- Results will be used to address a number of EPA and HUD research objectives, including improving our understanding of current environmental concentrations in US residences and the key factors influencing these concentrations
- The data produced will be used to monitor the change in level of health hazards in homes over time, where baseline data are available, and in refining the understanding of certain patterns identified in the HUD's National Survey of Lead and Allergens in Housing (NSLAH) of 1999-2001
- Produce (remove - first ever) national estimates of the levels of additional housing related hazards including:
  - Specific molds in house dusts
  - Residential use pesticides
  - Arsenic concentrations in indoor house dusts and soils
- Relate environmental data to resident questionnaires, which includes specific housing and occupancy characteristics

Study Design

- Data collected from participants in private & public residences
- Nationally representative data reflective of real-world environmental contaminants commonly found in and around the nation's residences
- EPA sample collection included surface wipe samples from a common living area, homeowner vacuum bags, and soil samples from outside of the home
- Samples and survey information were collected during a single day



EPA Sample Collection and Analysis

Standard EPA protocols used for sample collection and analysis

Hard surface floor wipes (pesticides):

- Surface wipe procedure was used to collect pesticide deposits and residues from hard floor surfaces
- Pesticide residue data will provide EPA with nationally representative data characterizing current-use pesticides and household products
- Residential use pesticides will be related to resident questionnaires, which contains information about applicator and/or homeowner applied pesticides and household products
- The data will be the foundation of a dataset for future pesticide residue trend analyses

Vacuum dust bags (mold):

- Homeowner vacuum cleaner bags or dust from bagless vacuums were collected from residences
- Mold-Specific Quantitative Polymerase Chain Reaction (MSQPCR) was used to identify and quantify molds from dust samples (Vesper 2006)
- Homeowner vacuum cleaner mold results were compared with results from a highly standardized HUD MiTest (see NSLAH for additional information) sampling dust protocol from the same home
- Mold will be related to observed water damage
- EPA will use the mold data to characterize spatial and temporal trends in indoor mold concentrations

Vacuum dust bags (arsenic):

- Homeowner vacuum cleaner bags or dust from bagless vacuums were collected
- Homeowner vacuum cleaner bag dusts are being analyzed for arsenic
- EPA will use arsenic data to assess concentrations of arsenic in indoor house dusts, soil immediately outside of the residences, and soil near wood structures located outside of residences

Soil collection (arsenic):

- Soil sampling protocol designed for soil collection around existing wooden decks, wooden play-sets, wooden stairs, and wooden landscape timbers

- Arsenic soil concentrations will provide EPA with occurrence of arsenic in soil near wood structures located outside of homes
- Arsenic soil concentrations will be compared with arsenic concentrations in indoor house dusts
- Arsenic bioavailability analyses will be performed on a sub-set of soils
- Arsenic data will provide EPA with a statistically representative estimate of arsenic levels in residential areas

Preliminary Findings

Hard surface floor wipes (pesticides):

- Chemical analysis of the hard surface floor wipes indicate detectable concentrations of almost all targeted insectides from the different classes (organophosphates, pyrethroids, organochlorines, and fripronil)
- Compounds long removed from the consumer market (e.g. DDT, chlordane) and other recently deregistered compounds (e.g. chlorpyrifos and diazinon) were detected in residences
- Current residential use pesticides such as permethrin, pyrethrins fipronil, allethrin, sumithrin, and deltamethrin were among the highest concentrations of insecticides measured

Vacuum dust bags (mold):

- Vacuum dust samples from 157 residences have been analyzed using mold-specific quantitative polymerase chain reaction (MSQPCR) to identify and quantify molds
- Homeowner vacuum cleaner bag mold results are consistent with the highly standardized HUD MiTest dust sampling protocol mold results to the extent that homes can accurately be divided into either above or below 50% relative moldiness (see Vesper 2006 for additional information on the EPA Relative Moldiness Index)
- EPA Relative Moldiness Index values range from -10 to 30 (low to high relative moldiness), with approximately 50% of homes below 0 and 50% above

Planned Products and Uses

- Abundance of data and information will result, including but not limited to manuscripts/reports on:
  - Overall study design and sampling methodology
  - Lead results and methodology
  - Allergen results and methodology
  - Mold results and methodology
  - Pesticide results and methodology
- Study results used by HUD, EPA, and others to:
  - Examine changes in the occurrence and magnitude of these environmental concentrations over time
  - Identify potential problems, need for follow-up
  - Develop and implement improved mitigation/risk reduction strategies
  - Reduce future health risks from environmental hazards

References

Vesper, Steve. Developing the EPA Relative Moldiness Index Based on Mold-Specific Quantitative PCR. The Synergist. April, 2006: 39-43.

1999-2000 National Survey for Lead and Allergens in Housing (NSLAH)

Disclaimer

Although this work was reviewed by EPA and HUD and approved for publication, it may not necessarily reflect official Agencies' policy.