

DUST: A METRIC FOR USE IN RESIDENTIAL AND BUILDING EXPOSURE ASSESSMENT AND SOURCE CHARACTERIZATION

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**EOH 2504: Principles of Environmental Exposure
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INTRODUCTION

- Why Dust?
- Contaminated dust can be a route to exposure.
- House dust might contain textile fibers, decomposing insect parts, human and animal hair, food, pollens, mold spores, skin flakes, dust mite and its fecal material.



OBJECTIVE OF THE STUDY

- To review:
 - Types of information available on dust in residential settings.
 - The metrics used for exposure and source characterizations.
 - The composition of dust.



MATERIAL

- House Dust
 - Can acquire information on the distribution of particular toxicants that accumulate on rugs and carpets in residences.
 - Provide general types of materials that can be found in households.



HOUSE DUST AS A TOOL FOR QUANTITATIVE EXPOSURE ANALYSIS AND ASSESSMENT

- 1st step: Identify the types, locations, and surfaces an individual contacts during the day.
- 2nd step: Develop a list of potential indoor and outdoor sources that could contribute to the dust levels and any associated toxicant levels in the house.



SAMPLING METHODS AND THEIR USE

Surface wipe sampling

Vacuum sampling

Other sampling



SURFACE WIPE SAMPLING

- Long period of time deposits:
 - Undisturbed surfaces(e.g., top of a refrigerator)
- Most recent deposits:
 - Frequently cleaned surfaces(e.g., Kitchen countertops)
- Adult: Work Surfaces
- Children: Play Surfaces
- Windowsills: materials carried from outdoors to indoors



WIPE SAMPLERS

- Liroy-Weisel-Wainman(LWW)
 - Quantitatively collect all materials deposited on flat surfaces.
 - First wipe sampler that could quantitatively establish both the concentration in dust and the surface loading of dust from the same sample.
 - Operates as a wet or dry collection substrate for sampling specific surfaces.



WIPE SAMPLERS (CONT.)

- Edwards and Liroy(EL)
 - Designed specifically to mimic the collection efficiency for the size distributions of particles on the surface of the human hand.
 - It had an application pressure coincident with the pressure placed on a surface by a human.
 - Determine types of loading could be transferred from the floor to a hand .
- The Department of Housing and Urban Development(HUD):
 - The baby wipe sampler
 - Designed specifically to determine the surface loading of lead and other heavy metals in micrograms per square foot.



VACUUM SAMPLING

- Target:
 - Rug or carpet surface and accessible layers of carpet fibers.
 - The base that binds the carpet or rug fibers together.
- Determine the levels and types of material that are accessible or available for contact with human body.
- An indicator of a potential dermal contact and nondietary intake by adults or children.
- Provide a record of indoor and outdoor sources that have contribute to the overall levels of dust and components of dust from different sources.



VACUUM SAMPLERS

- HVS3
 - Designed specifically to collect house dust from a floor using various cyclone collectors for particles $> 5\mu\text{m}$ and a final HEPA filter for collection of smaller particles.
- Vacuum cleaner can provide the investigator with a large quantity of mass
- The concentration or loading can be compared to the values used for residential cleanup of soil or for determining potential exposures that may cause a specific health effect.
- Different designs of device will capture different mass fractions.
- Determining the presence or absence of a toxicant



OTHER SAMPLING

○ Attic Sampling

- Contain a record of undisturbed archived deposited particles.
- Particles would have infiltrated the residence by diffusion and advection through the eaves or other passive ventilation portals, and then settled on surfaces.
- Has been used periodically to examine the deposition of radionuclides from nuclear fallout and nuclear power plant emissions.



OTHER SAMPLERS

- The attic dust sampler, the surface deposition plate, mats, microscope, slide plates, or sticky tapes and rollers
 - Attic sample: Represent the long-term dynamic accumulation of material.
 - Floor mats: Used to quantify the dust or toxicant levels that are tracked into the residence from outdoors and accumulate on the mat over a specified period of time. (e.g., Older homes has higher lead loading)
 - Surface soil
 - Obtain the scientific date for estimates of dermal contact and incidental ingestion by collecting soil in the yard
 - Teflon or other non-background laden pan and using a brush to sweep the surface soil into the pan.



OTHER ISSUES

- Collection Issue:
 - Quantity
 - Particle size
 - Morphology



ASSESSMENT OF DATA OBTAINED FROM RESIDENTIAL DUST

- Information on activities and lifestyles needed to assess residential exposure to dust and other media requires the application of survey instruments to record home and occupant histories before determining the exact location of dust sampling.
- An exposure-based investigation first requires information on the who, what, where, when, and why associated with a particular problem.
- These information can be gathered by questionnaires, videotaping, diaries, and interview.



CONCLUSION

- The uses of house dust and residential samples to identify sources of indoor contaminants and to provide improved estimates of residential total human exposure.
- The challenge for the future is to continue the evolution of reliable techniques for wipe, surface, and vacuum samples.



REFERENCE

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