



HUMAN HEALTH RESEARCH PROGRAM

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EPA RESEARCHERS DEVELOP MODEL TO ESTIMATE CUMULATIVE EXPOSURES TO CHEMICALS

Issue:

On a daily basis people encounter a variety of chemicals that enter the body through food, water, air, and skin. Scientists are developing the tools necessary to estimate how we are exposed to different chemicals and to understand better the human health risks from daily exposure to mixtures of chemicals. New and sophisticated computer models are needed to simulate the concentrations of pollutants that people come in contact with during their daily activities. The need for reliable probabilistic models of human exposure is critical as the U.S. Environmental Protection Agency considers cumulative exposures in its risk assessments.

Science Objective:

The Stochastic Human Exposure and Dose Simulation (SHEDS) Multimedia Model developed by EPA's Office of Research and Development is the primary tool used for simulating exposures to a variety of chemicals that enter the body in multiple ways. This model predicts, for specified populations, human exposures to chemicals from eating, drinking, and breathing, as well as from contacting surface residues and from hand-to-mouth and object-to-mouth

ingestion. To perform these calculations, the model combines information on chemical use, human activities, environmental residues and concentrations, and other important exposure factors, using probabilistic sampling methods. The model enables decision makers to address questions like:

- How do chemicals distribute into the air and on to surfaces under real-world use or application scenarios?
- What are populations' real-world exposures for different chemicals/chemical classes?
- Which exposure pathways are the most important?

Application and Impact:

The dietary (food and drinking water) component of the SHEDS-Multimedia model has been applied to support EPA's cumulative risk assessment for n-methyl carbamate pesticides. The SHEDS-Multimedia dietary module can be used to answer regulatory-related questions regarding the contribution of different foods and number of eating occasions. The SHEDS-Multimedia algorithm for simulating children's exposures via hand-to-mouth contact

was used in EPA's final n-methyl carbamate assessment.

Ongoing modeling research is focused on developing a publicly available, state-of-the-science modeling tool for improving estimates of human exposure to multimedia, multipathway chemicals. This research is identifying critical exposure routes, pathways and factors to help guide future field study measurements and is expected to provide probabilistic exposure assessments that can help reduce uncertainty in risk assessments and enhance risk management decisions.

REFERENCES:

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