



HUMAN HEALTH RESEARCH PROGRAM

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# Research Progress to Benefit PUBLIC HEALTH

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FOR MORE INFORMATION, CONTACT:

**Hugh A. Tilson**  
Director, Human Health Research Program  
919-541-4607 • [tilson.hugh@epa.gov](mailto:tilson.hugh@epa.gov)

U.S. Environmental Protection Agency  
Office of Research and Development  
Research Triangle Park, NC 27711



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EPA's human health researchers are **answering vital public health questions** and solving environmental problems.



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Protecting the public from environmental health threats is integral to the mission of the U.S. Environmental Protection Agency. Researchers in EPA's Office of Research and Development (ORD) are supplying the science to improve the ability to assess public health risks from environmental pollutants.

### Solving Environmental Problems with Research

EPA's Human Health Research Program uniquely integrates many environmental science disciplines to build a strong foundation for risk assessment and improve understanding of toxic chemical exposure and health effects. The program involves coordination of fundamental research to fill gaps in scientific knowledge to improve assessment of public health risks and solve environmental problems.

Human health researchers are working together to answer vital public health questions to solve environmental problems. By understanding how pollutants affect our lives, we are able to make knowledgeable decisions to protect the public health.

Our research program is evaluated through extensive independent expert review by EPA's Board of Scientific Counselors. This evaluation assesses the development and application of new human health research knowledge, as well as the relevance, quality, and scientific leadership of the program.

### Improving Risk Assessment

The science of assessing risk involves evaluating all that is known – and unknown – about a toxic chemical. When scientific uncertainties exist, assumptions or simplified approaches are used to fill the gaps in knowledge. EPA researchers and their colleagues are advancing environmental science to add to our knowledge base and improve the quality of risk assessments.

Science that explains how laboratory findings can be applied to humans is critical to advancing risk assessments and enables EPA to adequately protect the public. Issues under study to improve risk assessment include understanding:

- The relationship between health effects from high-dose exposures in animals to low doses in the environment
- The difference between a single exposure to a toxic chemical and exposure over a lifetime
- The difference between exposures from a single chemical to mixtures of chemicals

Why are certain populations more sensitive to pollutants than others? What biological processes occur upon exposure to toxic chemicals? How does exposure affect our health?

## Research Contributions

EPA's Human Health Research Program has led to a more systematic understanding of the physical, chemical, and biological processes that underlie how humans can be affected by environmental pollutants.

**ASSESSING RISKS OF DIOXINS AND RELATED CHEMICALS:** Dioxins in the environment can result in a wide range of adverse health effects. Many studies have shown dioxins and related chemicals can lead to interruption of a receptor in the body called the aryl hydrocarbon (Ah) receptor, potentially affecting cell growth, form, and function. EPA research has been instrumental in demonstrating that this biological interference occurs at very low doses across a range of species, including humans. This research has helped EPA and international health organizations improve their risk assessments of dioxins and related compounds.

**DETERMINING RISKS OF CUMULATIVE EXPOSURES TO PESTICIDES:** Concerns have been raised about whether widely used pesticides result in cumulative risks to consumers through the food in their diets. EPA is required under the Food Quality Protection Act to regularly re-evaluate human tolerances for pesticides in current use and consider the health impacts from exposure to multiple pesticides. Ongoing research has led to improved cumulative assessment of pesticides which serves to protect the public health. This research has enabled local governments, grower associations, and produce shippers to reduce the risks of exposure to multiple pesticides. Studying cumulative risks has been extended to drinking water contaminants as a result of these successes.

**UNDERSTANDING ENVIRONMENTAL IMPACTS ON ASTHMA:** Asthma is a serious and growing health problem affecting more than 20 million Americans. EPA research is focusing on environmental issues that may cause or exacerbate asthma, with particular attention paid to mold and air pollutants such as particulate matter, ozone, and diesel emissions. For example, researchers have discovered a biomarker that can predict the severity of an asthmatic response in susceptible people, resulting in new protocols for improving indoor air quality, and providing the scientific basis for public education policies and risk management strategies involving exposure to molds.



**ASSESSING POPULATION EXPOSURES TO POLLUTANTS:** Accurately determining total human exposures to environmental pollutants within a community is critical for EPA to assess and manage human health risks. To this end, EPA has developed a model of how populations are exposed to airborne toxins. The model, called the Stochastic Human Exposure and Dose Simulation Model or SHEDS, estimates an individual's exposure to benzene, a known air toxin, while indoors, outside, and in vehicles. It also provides independent estimates of population exposures that allow EPA and state governments to improve assessments of mobile source and urban air toxics exposure. This research has led to improved risk assessment and management through more realistic exposure assessment methods.

**PROTECTING SUSCEPTIBLE POPULATIONS:** Exposure to environmental pollutants can have a greater impact on the very young and adults over age 65. EPA's human health research program has improved understanding of how and why these groups are more vulnerable to some pollutants. Research has supported the application of safety estimates in risk assessments to protect children from high-use pesticides such as chlorpyrifos. Scientists have conducted research that identifies wide population variability in a gene that produces enzymes for detoxifying organophosphate pesticides. These findings show that some people, especially young children, are more sensitive to the adverse health effects of these pesticides. Researchers also are supporting Native American Tribes by conducting the science to determine potential risks unique to their populations because of their customs, occupations and lifestyles.

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### Future Directions

EPA's Human Health Research Program is strategically aimed at providing the methods, tools, and data needed to improve risk assessments to protect public health. The primary goal of the program is to reduce reliance on default assumptions and simplified approaches used in risk assessments in the absence of conclusive data. Research will be conducted in areas where there are the greatest uncertainties in the science and where the science can address the real-world needs of the Agency. Four main research areas are:

- **BIOLOGICAL (MECHANISTIC) RESEARCH:** Understand underlying biological processes triggered when people are exposed to environmental contaminants.
- **SUSCEPTIBLE SUBPOPULATION RESEARCH:** Protect the aging population, children, and those with chronic diseases by providing new insights into how pollutants may affect their health.
- **CUMULATIVE RISK RESEARCH:** Provide clues to what happens when we are exposed to the many chemical mixtures in our environment.
- **TOOLS FOR EVALUATING RISK MANAGEMENT DECISIONS:** Develop measurement tools and biological indicators to assess the impact of regulatory decisions on public health.

