

STAR REPORT

U.S. EPA Office of Research

and Development's Science

To Achieve Results (STAR)

Research in Progress

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CHILDREN'S EXPOSURE TO PESTICIDES

Children face an array of complex environmental health threats. They are more susceptible than adults to harmful health effects from some chemicals, including pesticides, because of their activities, and because their small, developing bodies are more sensitive to toxic stress. Because of this, EPA has made a special commitment to ensure that all children are protected against harm from pesticides and other chemicals.

The exposure of children to pesticides around their homes, and in public areas such as schools, playgrounds or day care centers, has been recognized as an important and inadequately understood problem. In conducting a 1993 review of potential risks due to pesticides in the diets of children, the National Research Council (NRC) determined that children, including infants, might be at greater risk than adults from harmful effects that pesticides can cause. Potential effects of pesticides on people of any age include central nervous system damage, cancer and respiratory illness. In addition, based on the

NRC report and other studies, EPA has taken steps to ensure that necessary additional testing will be undertaken to assess any special vulnerability of children to pesticide effects on development, the immune system, the reproductive system and the visual system.

Several factors may contribute to increased vulnerability of children to pesticides. The rapid development and immaturity of their body organs and systems makes them more susceptible than adults to toxic effects of any chemicals. For example, children's tissues may absorb chemicals more readily and be less able to break them down, and their organ systems may be less effective at passing some chemicals out of the body.



*The protection of children's health is one of the highest priorities
of the Environmental Protection Agency*



In addition, the amount of exposure to pesticides is quite different for children than for adults, because of differences in physical environment, activities and diet. The NRC study considered all of these factors, and concluded that differences in exposure between adults and children were more likely to account for differences in risk than were age-related differences in toxicity. Based on this, the NRC strongly recommended research to better understand the extent to which children are exposed to pesticides.

Responding to this need, EPA's major external research program, Science to Achieve Results (the "STAR program") allocated funds in fiscal year 1996 to research the most urgent issues regarding exposure of children to pesticides. The grants were awarded for three year time periods. Resulting findings, along with the results of some related research under other components of the STAR program, will provide a far more comprehensive understanding of children's pesticide exposures. Research currently underway in these STAR projects is summarized in this report. Results will be presented in future reports over the coming one to

three years, as findings are completed and peer reviewed.



Settings of Special Concern

Greater exposures of children to pesticides than is typical for the general population may occur in some settings. In some cases, but not all cases, these settings involve a disproportionate number of people of disadvantaged socioeconomic groups, such as migrant agricultural workers, or residents of older urban public housing complexes. Settings of particular concern including the following:

- *Urban homes subjected to frequent applications of insecticides and/or rodenticides;*
- *Homes of agricultural workers, or other rural homes, where children may be exposed to contaminated clothing or skin of adults, or to agricultural chemi-*

cals coming into the home in other ways;

- *Institutional settings such as day care centers in which infants and very young children have a high degree of exposure to carpets and other surfaces that may be treated with commercial pesticide applications; and*
- *Homes with pets treated with pesticides to control fleas or other pests, or that track in pesticides from outside the home.*

Children's Behavior

Behavioral factors that can make children, including infants, more likely to be exposed to pesticides include the following:

crawling, sitting and lying on contaminated surfaces such as carpets, floors and lawns;

transfers of contaminants from objects or surfaces through directly mouthing hands, objects or plants, and ingesting dust or soil,

greater time spent in household gardens, or in private or public play areas treated with pesticides.

General Information: The Environmental Protection Agency's STAR Research Program

Grants described in this report are part of EPA's Science to Achieve Results (STAR) program, a major research initiative designed to improve the quality of scientific information available to support environmental decision making. The STAR program is managed by EPA's Office of Research and Development (ORD) out of the National Center for Environmental Research and Quality Assurance. The program is expected to fund approximately 200 new grants every year, with the typical grant lasting three years. Funding levels vary from \$75,000 to \$500,000 per year, with FY 1997 funding levels expected to reach over \$100 million for grants to individual principal investigators or groups of investigators. Additional STAR funds are provided for a number of Research Centers specializing in scientific areas of particular concern to EPA, and for a fellowship program supporting graduate students conducting environmental research.

STAR Research Focusing on Children's Exposures to Pesticides

STAR research projects are collecting data on children's behavior and environment that will be used to assess exposure and risk. The extensive environmental and biological sampling proposed in the field studies will allow further refinement in sampling design, field study protocols, analytical techniques, human activity databases, and data interpretation for exposure assessments. The studies are looking at all types of exposure (touching, eating, crawling, etc.), and at seasonal and locational differences. When considered along with improved information on differences in toxicities of pesticides between children and adults, the improved exposure information will give a much more complete picture of the differences in overall pesticide risks. This will support regulations and public education efforts that are more fully protective of children, for example through revised use restrictions and labeling requirements, and improved training and public information materials.

Total Exposure Assessments

Three research projects are focusing on children's exposures in urban, suburban and suburban settings. A study led by the **University of Minnesota (1)** is assessing amounts of the principal types of pesticide that children encounter through all "exposure routes" (for example: touching surfaces in homes, schools and day care centers; from outdoor exposures; secondary contamination from family members; and contamination of foods or drinks.) The study will compare exposures in three types of neighborhood: central city, suburban, and rural. In Yuma County, Arizona, investigators from the **University of Arizona (2)** are assessing exposures of the children of seasonal and migrant laborers to agricultural pesticides. These families frequently live near the edges of fields. In eastern and western Washington state, the **University of Washington (3)** is assessing, on a comprehensive seasonal basis, children's exposures to organophosphorus pesticides. These are of particular concern

because they are widely used, and they can cause neurotoxic effects with high exposures.

Exposures of Children to Pets' Flea Control Chemicals. Complete information is not currently available on how much pesticide exposure children may experience from pets treated with flea control products. These products often contain or-

exposure through fur contact with skin, transfers from hands to mouth, etc.. A grant was awarded in FY 1996 to researchers at **Mississippi State University (4)**, who are determining how much active ingredient from the most common types of flea product is transferred to children through the kinds of interactions that can occur with family dogs.



Other Related STAR Research

In addition to the component of the STAR program exclusively focused on children and pesticides, several projects funded through other components of the STAR program will also contribute information about potential pesticide exposure or effects in children.

Potential Chromosome Damage in Male Pesticide Applicators. In the "Environmental Health" category of STAR research studies, a grant has been awarded to the **University of California, Riverside (5)**, for some relevant laboratory studies of cell cultures, and for field studies of male pesticide applicators. The study will assess whether laboratory expo-

ganophosphorus compounds, which are more readily absorbed into the body through ingestion, or hand-to mouth contact, than through skin contact alone. This study will help to determine whether there are greater exposures, and thus potential for greater risks, to children than adults, due to greater likelihood of

tures of human cells to cancer causing chemicals, or exposures of men to pesticides in agricultural work settings, are associated with chromosome damage in human cells, including sperm or lymphatic system cells. Findings of chromosome damage would not directly demonstrate what health or fertility impacts might be resulting in exposed men or their children. If chromosome changes were found in the laboratory studies with human cells, and were confirmed in studies of exposed people (for example through "exposure marker" techniques), it would suggest an important need for comprehensive health effects studies, to determine what relationships there are between specific pesticide exposures,

chromosome effects, and health effects in adults and their children.

Potential Endocrine Disruptor Effects due to Maternal Exposure in Rats.

Wildlife observations have found a number of initially unexplained incidents of reproductive disorders, deformities or other health effects related to the animals' endocrine (hormone) systems. Subsequent studies have found that some of these effects were caused by toxic chemicals in the environment, some of them pesticides. Concern has been raised that similar effects may occur in humans exposed to endocrine disruptor chemicals, including some pesticides and their breakdown products. The STAR

program includes a research area devoted to laboratory and field studies of potential endocrine disruptor effects relevant to people or wildlife.

One of the studies is looking at a pesticide that could pose risks to children. In this case the concern is based on potential exposures of mothers, rather than exposure of children due to their own activities. **Mississippi State University (6)** is using laboratory studies to assess the effects of the insecticide methoxychlor, as well as the industrial chemicals PCBs. They are testing the hypothesis that exposures of female rats to a breakdown product of methoxychlor may result in exposures of the young during pregnancy or while nursing, thereby causing abnormal sex hormone levels and developmental abnormalities in the young as they mature. Because exposures tested will include low levels that could occur in the environment, findings of harmful effects in rats would indicate a possibility of risks to humans due to maternal exposures. This would indicate a need for more work to thoroughly assess possible human exposure, and for consideration of the new information in regulating insecticide uses.

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Households' Choices in Chemical Uses for Gardening and Landscaping. One of the less well known aspects of pesticide exposure is the ways that families use pesticides in home gardening, and the information people take



into account in making choices about home chemical use. Under a component of the STAR program devoted to socio-economic research, investigators at the **University of California, Berkeley (7)**, are studying factors that affect the choices families make in garden landscaping and chemical use. The study will assess which types of garden and landscape are chosen based on maintenance time and costs, and whether having children in the household affects uses of garden pesticides. Results will be useful in evaluating regulatory, labeling, and public education strategies for reducing risks.



Related Research of EPA's In-House Laboratories

Related research relevant to children's exposures to pesticides is also conducted directly in the laboratories of EPA's Office of Research and Development (ORD). The Agency's historical work on pesticides and human development was summarized in a 1995 EPA report, "Pesticides in the Diets of Infants and Children". EPA's principal current research in this area is through the "National Human Exposure Assessment" program (NHEXAS), being performed by EPA/ORD, academic and other research institutions, and other federal agencies. Also, EPA is conducting special regional studies (complementing programs associated with the North American Free Trade Agreement), assessing children's exposures to pesticides in U.S.-Mexican border areas. There is on-going coordination be-

tween the STAR research projects conducted by external scientists and EPA's in-house research. In

addition, STAR researchers and EPA researchers are coordinating with research by state health agencies.

Find Out More About the STAR Research Program

Further information on the STAR program is available from the following sources:

Internet Website, managed by the ORD National Center for Environmental Research and Quality Assurance (NCERQA):
URL: <http://www.epa.gov/ncerqa>

Mailing Address:

**Office of Research and Development
National Center for Environmental Research and Quality Assurance
Office of the Director (8701 R)
401 M Street
Washington, DC 20460**

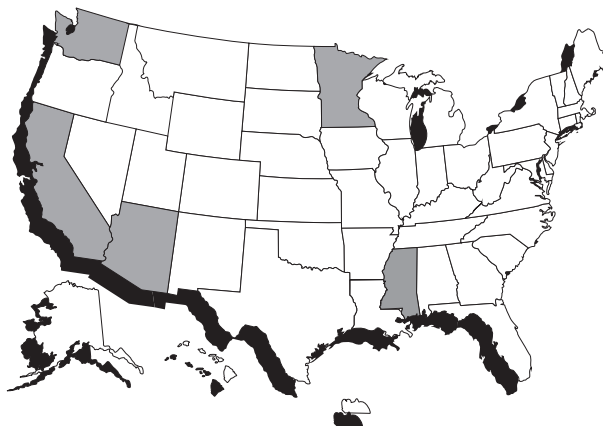
Or, use the Telephone Hotline, 1-800-490-9194, to leave messages and receive auto faxes of announcements.

Specific Research Projects Described in This Report

1) *Measuring and Apportioning Children's Exposure to Pesticides in Urban, Suburban, and Rural Communities.* School of Public Health, University of Minnesota.

2) *Exposure of Children to Pesticides in Yuma County.* Arizona College of Medicine, University of Arizona.

3) *Total Organophosphorus (Op) Pesticide Exposure among Children in Urban and Rural Environments.* Department of Environmental Health, University of Washington.



4) *Assessing Levels of Organophosphorus Insecticides Which Could Expose Children from Pets Treated with Flea Control Insecticides.* College of Veterinary Medicine, Mississippi State University.

5) *Development of Molecular Cytogenetic Techniques to Detect Chromosomal Aberrations in Human Sperm and Lymphocytes.* University of California, Riverside.

6) *Biochemical and Reproductive Effects of Gestational/Lactational Exposure to PCB's with Respect to Endogenous Sex Steroids and the Proestrogen, Methoxychlor.* Mississippi State University.

7) *The Microeconomy of Chemical Use on Residential Landscapes.* University of California, Berkeley.



United States
Environmental Protection Agency
Mail Code 8701R
Washington, D.C. 20460

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