

# *Translating Science to Policy*

## *Protecting Children's Environmental Health*

### ABSTRACTS

#### **Case Study 1: Air Pollution and Climate Change**

#### **“Impact of Prenatal Exposure to Air Pollution from Traffic and other Fossil Fuel Combustion Sources on Children’s Health and Development”**

*Frederica Perera, Dr. P.H., Director, Columbia Center of Children’s Environmental Health, Professor of Environmental Health Sciences*

The CCCEH conducts cohort studies in New York City, Poland, and China to identify the environmental and social contributors to childhood disease and developmental disorders. CCCEH has been following a cohort of over 700 Dominican and African-American mothers and children in Northern Manhattan and the South Bronx since 1998. The participants were enrolled during the mother’s pregnancy; exposures were determined by personal air and home monitoring, questionnaire, and biomarkers in blood, urine, and other biological samples. The purpose is to determine the contribution of prenatal exposure to common urban pollutants (air pollutants from fuel burning by vehicles, industry, etc., environmental tobacco smoke, residential pesticides, phthalates and BPA, allergens, and metals) to cognitive development, asthma, and cancer risk in children. Our findings show that prenatal exposures to polycyclic aromatic hydrocarbons (PAHs) produced by vehicular traffic and other combustion sources are associated with significantly reduced fetal growth and increased risk of developmental and behavioral problems. Prenatal exposure to PAHs has also been linked to epigenetic alterations associated with reported asthma in children. Exposure to multiple pollutants leads to more detrimental health outcomes in children. For example, combined prenatal exposure to PAHs and ETS further reduced fetal growth and increased precursor symptoms to asthma. Encouragingly, policy changes supported by these and other findings have resulted in cleaner air in NYC: investigators at CCCEH have documented significant decreases in concentrations of airborne PAHs between 1998 and 2006 in the cohort. From its inception, the Center has worked in close partnership with WE ACT for Environmental Justice (WE ACT) and other community and public interest groups to translate the science into policy protective of children’s health. Finally, CCCEH’s related studies in China showed that exposure to PAHs declined and significant adverse effects on child development were no longer seen after the government closed a polluting coal-fired power plant. Thus, reduction of fossil fuel burning not only benefits children’s health directly but reduces the threat of adverse health effects associated with global warming.

## **“Fossil Fuels, Climate Change and Children’s Health: Impacts and Opportunities”**

Patrick Kinney, Sc.D., Associate Professor and Director, Program in Climate and Health, Columbia University

Fossil fuels include gasoline and diesel used for transport, oil and natural gas for heating buildings, and coal used in generating electricity at large power plants. When fossil fuels are burned, out of the exhaust comes carbon dioxide (CO<sub>2</sub>), the main greenhouse gas responsible for climate change. Climate change is likely to impact children’s health in a variety of ways, including worsening summer heat and air quality, earlier and more intense allergy seasons, and greater risks of mosquito-borne diseases like West Nile virus. But fossil fuel combustion isn’t just the main cause of climate change. It’s also the main source for air pollutants like fine particles, ozone, and polycyclic aromatic hydrocarbons (PAHs) that have direct adverse health effects on children, as shown by the research of the CCCEH. Because of the close linkages between CO<sub>2</sub> and other air pollutant emissions, policies aimed at mitigating global climate change will also affect local and regional air quality. Similarly, policies to address air quality will influence global climate. Thus, an integrated policy approach is clearly needed if we are to identify and capitalize on win-win opportunities for climate and health. This approach must also take account of and pay special attention to populations that are made more vulnerable to the health impacts of both climate change and air pollution by having inadequate access to health-care services, quality housing, financial resources, and social support networks.

\* \* \* \* \*

## **Environmental Justice: Leveraging Research to Policy**

### **“Translating Community-Based Research into Policy and Public Health Action”**

Peggy Shepard, Executive Director, WE ACT for Environmental Justice

Community-academic partnerships have demonstrated potential for improving community and environmental health. This presentation will highlight the evolution, research and policy processes and outcomes of a community-based participatory research partnership that has had multi-level impacts on health policy concerning diesel emissions, healthy homes and related environmental justice issues. The partnership between WE ACT and the Columbia Mailman’s Center for Children’s Environmental Health and the NIEHS Center for Environmental Health in Northern Manhattan is discussed. The conversion of New York City’s bus fleet to clean diesel and the installation by the EPA of permanent air monitors in Harlem and other “hot spots” are among the outcomes for which the partnership’s research and policy work has been given substantial credit.

\* \* \* \* \*

## Case Study 2: Pesticides and Integrated Pest Management

### **“Prenatal Chlorpyrifos Exposure and Neurodevelopment: How Exposure to a Common Pesticide Can Damage the Developing Brain”**

*Virginia Rauh, Sc.D., Professor and Deputy Director, Columbia Center for Children’s Environmental Health*

The organophosphate pesticide chlorpyrifos (CPF) is a known neurodevelopmental toxicant in animals, yet until recently, its adverse effects on human development have gone largely undetected. Despite a recent regulatory ban on residential use, agricultural applications continue in the U.S. and abroad. As part of a prospective cohort study in an inner-city minority population, the developmental effects of prenatal exposure to CPF were evaluated in 254 children through age 7 years. Prenatal CPF exposure was measured in umbilical cord blood plasma. Analyses were adjusted for race/ethnicity, sex, length of gestation, maternal education, maternal IQ, prenatal secondhand smoke exposure, quality of the home environment, and prenatal lead exposure (in a subset). High prenatal exposure (CPF levels greater than 6.17 picograms/gram plasma) was associated with: (1) significant deficits in birth weight and birth length, and increased risk of small size-for-gestational age; (2) 3.5 to 6-point adjusted mean decrement in 36-month development scores on the Bayley Scales, resulting in 2-fold risk of developmental delay (< 80) on the Bayley mental Development Index, and a 5-fold risk of delay on the Psychomotor Index; (3) increased risk for ADHD problems, attention problems, and pervasive developmental disorder problems as measured by the Child Behavior Checklist at 3 years; and (4) decrements in verbal comprehension and working memory performance at 7 years, as measured by the Wechsler Intelligence Scale for Children. Taken together, these findings suggest that residential use of CPF at pre-ban levels, resulting in prenatal exposure as measured by biomarkers in umbilical cord blood, was associated with functional impairment in neurodevelopment in a sample of urban children through 7 years of age. Based on the presentation of these findings on 9/16/2008 at a public hearing before the Scientific Advisory Panel, Federal Insecticide, Fungicide and Rodenticide Act ("Scientific Issues Associated with Chlorpyrifos and PONI"), the Panel unanimously recommended that the U.S. Environmental Protection Agency (EPA) accept the epidemiologic evidence that chlorpyrifos may act as a neurotoxicant in human beings. The panel cited the Columbia data as epidemiologically-sound and recommended that EPA continue to collaborate with the Columbia researchers in analyzing these data. Further, the Panel recommended that the Agency should attempt to use the cohort data to inform the risk assessment process for bounding exposure levels, address current human exposures, and determine the final reference dose or reference concentrations.

## **“A Collaborative Effort to Evaluate the Impact of Integrated Pest Management in New York City Public Housing”**

*Daniel Kass, M.S.P.H., Assistant Commissioner, Environmental Surveillance and Policy, New York City Department of Health and Mental Hygiene*

Cockroaches and mice are common in urban homes, and are sources of allergens capable of triggering asthma symptoms. Traditional pest control involves the use of scheduled applications of pesticides by professionals, and pesticide use by residents. In contrast, integrated pest management (IPM) involves sanitation, building maintenance and limited use of least toxic pesticides. Columbia University CCCEH, the NYC Housing Authority, and the NYC Department of Health and Mental Hygiene jointly implemented and evaluated IPM, compared to traditional practice, for its impact on pests, allergens, pesticide use and resident satisfaction in several representative public housing developments.

We assigned IPM or control status to 13 buildings in five housing developments, and evaluated conditions at baseline, three and six months in 280 apartments in Brooklyn and Manhattan. We measured cockroaches and mice populations, collected cockroach and mouse urinary protein allergens in dust, and interviewed residents. Compared to controls, apartments receiving IPM had significantly lower counts of cockroaches at three months, and greater success in reducing or sustaining low counts of cockroaches at three and six months. IPM was associated with lower cockroach allergen levels in kitchens at three months, and in beds and kitchens at six months. Pesticide use was reduced in IPM relative to control, apartments. Residents of IPM apartments also rated building services more positively.

\* \* \* \* \*

### **Case Study 3: Endocrine Disruptors**

#### **“The Health Effects of Endocrine Disruptors on the Growth and Development of Children”**

*Sandra Steingraber, Ph.D., Scholar in Residence, Division of Interdisciplinary and International Studies, Ithaca College*

Endocrine disruption by chemical agents interferes with far more than just transitory hormonal signals. When exposures occur in early life, infant and child development itself can be sabotaged in ways that can affect intelligence, pubertal timing, fertility, and risks for obesity. This talk describes evidences from the emerging science of endocrine disruption as it affects pediatric health and also explores the challenges this evidence poses for parents. In the absence of a rational chemical regulatory system that is responsive to the new data on endocrine disruption, individual parents have stepped into the breach, as consumers, in an attempt to protect the hormonal integrity of their children (as, for example, when breast milk is stored in glass bottles rather than polycarbonate plastic). The power and limitation of a consumer-based approach to the problem of endocrine disruption will receive special attention.

\* \* \* \* \*

## **Roundtable 1: Addressing Urban Air Pollution and Climate Change**

*Rachel Miller, M.D., Associate Professor of Medicine and Environmental Health Sciences, Columbia University College of Physicians and Surgeons; Deputy Director, Columbia Center for Children's Environmental Health*

Exposure to air pollution continues to be associated with asthma exacerbations. Exposures occurring both prenatally and during early childhood appear to be the most deleterious. These effects often are observed at pollutant concentrations below ambient standards, suggesting that current regulations may be insufficient or may not be targeting the responsible sources and pollutants. Furthermore, the effects of climate change on the growth of pollens, which are common asthma triggers, appear greater in urban areas where carbon dioxide and temperatures are higher. Approaches to air pollution reduction need to be multifaceted, and include legislation directed at controlling city bus, school bus, and truck emissions and idling, and continued aggressive anti-smoking campaigns and regulation. Efforts to study and tackle the effects of global warming and other climate changes are necessary as well.

*John Balbus, M.D.,M.P.H., Chief Health Scientist, Program Director, Environmental Defense Fund*

New Yorkers as a group have some of the smallest carbon footprints in America, but they also breathe some of the most polluted air East of California. Much of that pollution wafts in from coal power plants and industrial facilities to the West, but much of a child's exposure comes from very local sources: school buses, highways, building chimneys.

As the country embarks on finding and implementing the solutions to the climate and energy crises, we are going to have to deal with a major challenge: creating dense, multi-use neighborhoods and towns that encourage more walking, bicycling and transit use and more efficient use of land and energy, while at the same time avoiding increasing exposures to vehicle and building-related pollution that can go with denser development.

Meeting this challenge will require many actions, some of which can be considered low-hanging fruit, some of which will be more difficult. Reducing diesel pollution in cities through idling restrictions and retrofits of critical diesel fleets like school buses is straightforward and cost-effective. More complex but still necessary is fundamentally reforming transportation systems to be both environmentally and financially sustainable.

Actions need to take place at all levels of government: local, state and federal. And we need to emphasize that there are many win-win situations for children's health and climate change. Protecting not just the health of today's children, but the planet that tomorrow's children will inherit, can be done effectively and simultaneously.

*Michel Gelobter, Ph.D., Chief Executive Office, Cooler ,Inc.*

Dr. Gelobter will discuss the benefits to urban children and families of addressing global warming. Policies aimed at cutting greenhouse gas emissions have direct beneficial effects not

just on air pollution, but also on urban residential patterns. These in turn promote greater activity, income, and overall public, social, and economic health.

*Rohit Aggarwala, Ph.D., Director, Office of Long-Term Planning and Sustainability, Mayor's Office of Operations, City of New York*

*PlaNYC* addresses the physical barriers to maintaining and improving New Yorker's public health and quality of life over the next 25 years. These barriers include three key challenges that the City will face in the future: 1) The City's population is expanding. By 2030, the City's population is projected to expand by one million people. 2) The City's infrastructure is aging. By 2030 nearly all of the City's major infrastructure networks will be more than a century old. 3) The City's environment is increasingly at risk, and has already experienced the effects of global warming, including rising sea levels and temperatures.

*PlaNYC* addresses these challenges in six key areas: land, water, transportation, air quality, energy and climate change. Each section of *PlaNYC* will combine to provide a roadmap to achieve a 30% reduction in greenhouse gasses as well as improve our air quality, water quality and increase our transportation options. In this way, addressing climate change will also decrease urban air pollution and improve public health.

The plan holistically addresses the three pillars of sustainability – economic development, the environment, and social justice – by setting forth 127 initiatives to improve the physical environment of the City to achieve tangible improvements in all three of these aspects of sustainability. The planning process was also comprehensive, with over 20 City agencies, hundreds of City staff, local universities and research institutions, a range of stakeholder groups, and a seventeen member Sustainability Advisory Board, contributing to the plan.

*Cecil D. Corbin- Mark, M.Phil., Deputy Director, WE ACT for Environmental Justice*

The election of President Obama has, we hope, ushered in a return of the time where Environmental Justice is considered a key policy and ethical frame for environmental matters in the United States. Multiple studies have documented the disproportionate burden of poor air quality suffered by communities of color across the country. In many instances, the poor air quality experienced by these communities can be linked to the presence of noxious facilities in their neighborhoods (for example, diesel bus depots, chemical plants, and power plants) and the absence of environmental benefits such as green roofs, parkland, energy efficient homes and renewable power sources. The dirty air that residents in communities of color have to breathe contributes to a plethora of poor health outcomes like epidemic rates of asthma, other respiratory illnesses and low birth weight to name a few. These inequities are the result of policy choices reflected in current environmental laws and regulations as well as other socio-economic forces.

The link between climate change and air pollution is clear and communities of color already on the frontline of poor air quality are also going to be the hardest hit by climate change. Climate change policy is currently being debated and all of the policies under discussion could potentially further exacerbate the inequities experienced by communities of color or work to eliminate them. This presentation focuses on how the collaboration between WE ACT for Environmental Justice

and the Columbia University Mailman Children’s Environmental Health Center has enhanced our advocacy on addressing both the problems of air pollution and climate change from an environmental justice perspective.

\* \* \* \* \*

## **Roundtable 2: Healthy Homes – Controlling Residential Pesticides and Consumer Products**

*Jay Feldman, M.S., Executive Director, Beyond Pesticides*

Pesticides are associated with adverse health effects from cancer to nervous and immune system damage, reproductive disorders (including infertility) and hormonal problems to birth defects, attention deficit disorder and learning disabilities to respiratory diseases. Over 25,000 different pesticide products, totaling five billion pounds, are in the marketplace and neither the federal nor state governments are adequately regulating them. Yet, exposure to multiple pesticides in air, water and food is widespread. Despite this, the Environmental Protection Agency (EPA) does not calculate the effect of exposure to numerous chemicals, both the additive and synergistic effects, and utilizes a deficient risk assessment process, preferring attempts to mitigate ill-defined risks over precautionary measures. The laws that regulate pesticides contain an assumption that toxic pesticides are necessary tools in pest management, despite the availability of cost-effective “green” practices and products. As a result, toxic substances have become a basic ingredient in residential pest control and food production. Pesticides are the only toxic chemicals (with the exception of chemical warfare agents) that are produced for intentional uncontrolled release into the environment. The outcome is widespread environmental and human exposure and a resulting toxic body burden. For example, the Centers for Disease Control’s (CDC) *Third National Report on Human Exposure to Environmental Chemicals* (2005) documents widespread exposure to synthetic pyrethroid pesticides, commonly used in the residential setting. The report finds that more than 50 percent of the population carries residues of the metabolite (3-Phenoxybenzoic acid) for the pyrethroid insecticides permethrin, cypermethrin and deltamethrin. While permethrin is a possible carcinogen, all the pyrethroids are closely associated with respiratory illness and asthma, an illness of increasing concern affecting growing numbers of people, especially children.

*Philip Landrigan, M.D., M.Sc., Director, Center for Children’s Health and Environmental, Mount Sinai School of Medicine*

EPA estimates that in 2001 (the most recent year for which national data are available) the United States spent \$11 billion for over 1.2 billion pounds of pesticide active ingredients used in more than 20,000 commercial pesticide formulations. Very heavy residential use of pesticides has been found to occur in inner-city neighborhoods for the control of roaches, rats, and other urban vermin. In 2005, the 5 counties that comprise New York City used 270,337.44 gallons of legal chemical pesticides.

Infants and children are significantly more vulnerable to pesticides than adults due to their disproportionately heavy exposure coupled with their inherent biological vulnerability. This heightened vulnerability is greatest for infants exposed *in utero* and during early neonatal life. The Centers for Children's Environmental Health and Disease Prevention Research at Mount Sinai, Columbia and UC Berkeley have shown negative effects of prenatal exposures to pesticides on neurobehavioral development.

To assess efficacy and cost-effectiveness of integrated pest management (IPM) as a means of reducing residential exposure to pesticides in an urban setting, Mount Sinai's "Growing Up Healthy in East Harlem" project, in partnership with two neighborhood health centers evaluated IPM in two groups of East Harlem homes - one group received IPM, while the other used standard chemical pest control. In the IPM homes we observed a reduction of organophosphate use and a simultaneous reduction in cockroach infestation. The costs of adopting building-wide IPM in a typical East Harlem apartment building were calculated to be \$46-69 per unit in the first year (including repairs) and \$24 per unit per year in subsequent years. In comparison, the costs of traditional, chemically based pest control are estimated to be \$24-46 per unit per year.

Protection of American children, and particularly inner-city children, against the developmental hazards of pesticides requires a comprehensive strategy that monitors patterns of pesticide use on a continuing basis, assesses children's actual exposures to pesticides, uses state-of-the-art developmental toxicity testing, and establishes societal targets for reduction of pesticide use.

Both the Mount Sinai Center for Children's Environmental Health and Disease Prevention Research and the recently launched National Children's Study are actively searching for the undiscovered effects of pesticides and means of preventing these exposures.

*Robin Whyatt, Dr.P.H., Professor and Deputy Director, Columbia Center for Children's Environmental Health*

Phthalates are a class of chemicals widely used in cosmetic and other consumer products. Exposures are ubiquitous, with > 75% of the U.S. population exposed. A number of phthalates are endocrine disruptors and prenatal exposures have been associated with adverse reproductive effects in both experimental and preliminary epidemiologic studies. We have been measuring six phthalates among women enrolled in the longitudinal birth cohort study at the Columbia Center for Children's Environmental Health. To date, of the > 300 women evaluated during pregnancy, 100% were exposed simultaneously to all six phthalates in their personal air and 85%-100% had residues of all six phthalates in their bodies. Our data show that use of perfume and other personal care products are among the sources contributing to this exposure. Further, we have found a highly significant inverse association between maternal exposures to one of the phthalates (di-2-ethylhexyl phthalate) during pregnancy and gestational age of their newborn at delivery. Phthalates have been subject to relatively little regulation in the United States. Further, there are no requirements that phthalates be included among the ingredients on labels of consumer products. Thus there is no way for women to avoid use of products containing phthalates during pregnancy. The European Union (EU) has already banned two phthalates from cosmetic products and placed restriction on the use of six phthalates in children's toys since 1999. In August 2008 the U.S. has taken the important step of placing similar limitations on uses

in children's toys and legislating for a new assessment of exposure and health effects to consider cumulative and total exposure to phthalates. It is strongly recommended that the U.S. follow the EU example and ban phthalates from cosmetics. Further, there should be requirements passed expeditiously in the U.S. to require that any consumer product containing phthalates be clearly labeled.

*Gina Solomon, MD, MPH, Senior Scientist, Natural Resource Defense Council*

A major portion of children's exposures to toxic chemicals occurs in the home. Indoor air has been shown to contain household pesticides and other pollutants; carpet dust is a reservoir for flame retardants, lead, and pesticides; toys and other consumer products are subject to concern from phthalates, and other endocrine disrupting chemicals that are hazardous to normal development. Despite notable progress reducing exposure to certain hazardous chemicals, the public health community is faced with a recurring pattern: chemicals of known toxicity are replaced with others of unknown or less-known hazard. The pesticide registration process is intended to address this problem, but is only partially successful. There are regulatory and non-regulatory approaches for moving toward safer products. This presentation focuses on two very different examples: a green label standard for structural integrated pest management, and the ban on phthalates in toys. The former is a market-driven approach to change an industry sector, whereas the latter is a narrow legislative approach to the problem. There are advantages and disadvantages to each approach that can be discussed in light of the introduction of the Kids Safe Chemicals Act in Congress and the looming debate over chemical policy reform.

*Erik D. Olson, Director of Chemical and Food Safety Programs, The Pew Charitable Trusts*

Mounting evidence confirms that certain pesticides and toxic chemicals in consumer products can cause a variety of health problems in children, including cancer, impaired brain development, and disruption of reproductive development. Experts including the National Academy of Sciences and the Government Accountability Office (GAO), Congress' nonpartisan investigative arm, have noted serious flaws in our regulatory system for toxic chemicals. For example, most chemicals—even many of those widely used in consumer products—have not undergone basic toxicity testing or regulatory reviews to demonstrate their safety. Even when chemicals are found to present health hazards to children, the Environmental Protection Agency often has been unable to take effective regulatory action. Recent experience with the Food Quality Protection Act of 1996, which while imperfect has reduced allowable levels of certain pesticides in foods and in some cases in the environment, has demonstrated that regulatory actions can help to protect children. Peer-reviewed published literature by investigators from the Columbia Center for Children's Environmental Health working in collaboration with WE ACT for Environmental Justice, and data collected by other researchers, demonstrates that public health benefits can be achieved by effective regulatory intervention. The GAO and EPA's new Administrator Lisa Jackson have recently said that reform of EPA's troubled regulatory system under the Toxic Substances Control Act is one of a handful of top priority issues that faces EPA. Legislation such as the Kids Safe Chemicals Act would begin the process of improving protection of children from toxic chemicals.

\* \* \* \* \*