

Children at Risk from Indoor Air Pollution

- With respect to determining the risk of exposure to industrial chemicals, researchers emphasize: "Children are not little adults." Physical differences, socioeconomic status and activity patterns are among the key reasons why children are more vulnerable to exposure and face greater health risks from industrial chemicals than adults.
- On average, children spend 85% of their time indoors: 70% at home, 15% at other indoor locations, 4% in enclosed transit, 1% outdoor transit and 10% outdoors.
- 73 million children in the United States are under the age of 18.
- 14.7 million children in the United States live in high poverty, with more children living in poverty than any other age group.
- Children living in poverty are more likely to live in public housing or blue-collar neighborhoods in close proximity to industry — a primary source of outdoor air pollution, which can be brought indoors via heating, ventilating and air-conditioning (HVAC) system.
- Higher outdoor concentrations of volatile organic compounds (VOCs) in urban areas contribute to higher VOC concentrations in urban homes.
- Children living in urban settings are at increased risk for asthma.
- The youngest children in the poorest urban communities have the highest rates of asthma hospitalizations.
- 2.5 million children in the United States have chronic and/or high-risk medical conditions, which places them at higher risk from indoor air pollution.

Green Schools Reduce Children's Risk from Indoor Air Pollution and Improve Learning and Test Scores

- The health of children and adults, teacher productivity and student learning can be affected by the air quality in a school.
- More than 50% of K-12 schools in the United States were built more than 45 years ago, with 30% built before 1950 and another 21% built between 1950 and 1959. The average time lapse between renovations of a K-12 school is 42 years.
- Seventeen separate studies found positive health impacts (reduction in prevalence of asthma, flu, headache and respiratory symptoms) from improved indoor air quality (IAQ) in green schools, ranging from nearly 14% to 87% improvements, with an average improvement of 41%.
- Student test scores improved (14.7% increase in math and 13.7% in reading) as the physical condition of school buildings improved, and students in buildings in better condition had higher test scores than students in buildings in poor condition.
- A recent review by Carnegie Mellon of five separate studies found an average reduction of nearly 39% in asthma in school buildings with good IAQ. A 25% reduction in the number of children with asthma in 900-student new school translates into 20 fewer children a year with asthma. Lower prevalence of asthma results in an annual direct and indirect cost savings of \$33,000 to schools due to reduced need for nurse care and staff time — and to families/larger community through reduced healthcare needs.

Lifestyle Choices That Put Children at Risk from Indoor Air Pollution

- Between 16% and 33% of children and adolescents are obese.
- In 2007, more than 25% of adolescents in grades 9 to 12 spent three or more hours per day using computers outside of school (25%) or watching television (35%).
- In 2007, nearly 24% of white males and 23% white females reported smoking cigarettes; 15% black males and 8% black females reported smoking cigarettes; and 19% Hispanic males and 15% Hispanic females reported smoking cigarettes.
- Nearly 60% (22 million) of children ages 3 to 11 years are exposed to secondhand smoke and about 25% of those children live with at least one smoker.
- Children who are exposed to environmental tobacco smoke (ETS) are more likely to develop lower respiratory tract infections, asthma, bronchitis, pneumonia, middle ear disease, sudden infant death syndrome (SIDS) and respiratory symptoms.
- The U.S. Surgeon General has determined there is no risk-free level of exposure to ETS.

Health Risks Associated with Indoor Air Pollution

- Airborne pollutants, including potential carcinogens, reproductive toxins and human irritants, are 2 to 10 times higher indoors when compared with outdoor levels and can be as much as 1,000 times higher in newly constructed and renovated indoor spaces.
- Indoor air in the United States is 2 to 5 times more polluted than outdoor air.
- People received their highest personal exposures to VOCs in homes (42% to 73%), followed by outdoors (18% to 34%) and offices (2% to 38%).
- Volatile organic compounds are among the most prevalent of all indoor air, with as many as 100 to 1,000 different VOCs in the air where children can easily inhale them.
- More than 200 commonly used industrial chemicals are able to damage the human brain; about 50% of these chemicals are considered high-volume production chemicals.
- A wide range of chemicals may cause adverse reproductive, developmental and neurotoxic effects, including metals (lead, mercury, manganese, arsenic and cadmium); organic solvents (methylene chloride, glycol ethers and trichloroethylene); pesticides (DDT, atrazine, chlorpyrifos, parathion and lindane); ETS and nicotine; and polychlorinated biphenyls (PCBs).
- Chemicals identified as endocrine disruptors include dioxins, PCBs, alkylphenols, bisphenol A, phthalate esters and various pesticides.
- Some chemicals may have health impacts at extremely low levels, which are not seen at higher levels, including genital changes, asthma and allergies in children.
- Exposure to very small traces of VOCs and some industrial chemicals in homes and schools can disrupt the endocrine system, gene activation and brain development.
- Children exposed to high levels of VOCs were 4 times more likely to develop asthma than adults.

- Damp buildings and exposure to mold bioaerosols are risk factors for developing asthma in children and not just in making asthma symptoms worse.
- The risk for developing asthma appears higher for, but is not limited to, children who are sensitive to mold allergens or who have parents with asthma.

Health Problems Linked to Indoor Air Pollution

Asthma

- Asthma is the most common chronic disorder in childhood, with more than 6.7 million children (9.1%) affected, one-half of which have allergic asthma.
- Nine million children under the age of 18 have been diagnosed with asthma at some point in their lifetime.
- Approximately 40% of children who have one or both parents with asthma also will develop asthma.
- Asthma accounts for 12.8 million missed school days each year.
- From 1980 to 1994, the proportion of Americans with asthma increased by 75%. In children under the age of 5, the proportion grew by 160%.
- Nearly 4 million children suffered an asthma attack in the previous year.
- Since 1980, the number of deaths among children with asthma under 19 years old has increased by nearly 80%.

Allergies

- Allergic rhinitis affects as many as 40% of children.
- As of 2006, 9% of children had been diagnosed with allergic rhinitis in the past 12 months.

Autism Spectrum Disorders

- Although there are currently no links between autism spectrum disorders (ASD) and chemical exposure, a recent review of scientific literature on the causes of neurodevelopmental disorders implicated a number of industrial chemicals including lead, methylmercury, polychlorinated biphenyls, arsenic and toluene.
- Estimates suggest around 6 in 1,000 people in the world have ASD, with more boys affected than girls.
- In the United States, 560,000 people ages 0 to 21 years have ASD.
- Autism spectrum disorder occurs in about 1 in 500 births in the United States, compared with Down Syndrome, which occurs in 1 in 800 births; juvenile diabetes, which occurs in about 1 in 400 or 500 children; and cancer, which occurs in 1.5 per 10,000 children.

Cancer

- Children undergoing treatment for cancer have suppressed immune systems, which make them more susceptible to adverse health effects from indoor air pollutants.
- In 2005, nearly 15 per 100,000 children ages 0 to 14 years and 17 per 100,000 children ages 0 to 19 years had cancer.

Developmental Disabilities

- Developmental disabilities affect 3% to 8% of the 4 million children born each year.
- Exposure to environmental toxins causes 3% of developmental disabilities.
- Interactions between environmental factors and individual genetic susceptibility cause 25% of developmental disabilities.
- About 10% of neurobehavioral disorders are caused by environmental toxins, excluding those caused by maternal alcohol, tobacco and drug abuse.
- One in six children experiences some form of neurodevelopmental delay, in many cases due to maternal alcohol, tobacco or drug use. In some children, the delays may be attributed to environmental toxins, such as lead, mercury, pesticides and solvents, or to nutritional deficiencies.

Learning Disabilities and Attention Deficit Hyperactivity Disorder

- In 2007, 4.6 million (8%) of children ages 3 to 17 years had a learning disability; 10% of boys compared with 5% of girls.
- About 4.5 million children, ages 3 to 17 years, had Attention Deficit Hyperactivity Disorder (ADHD). Boys are more than twice as likely as girls (10% and 4%, respectively) to have ADHD.
- White children (8%) and black children (8%) were twice as likely to have learning disabilities than Asian children (4%).
- In families with income of less than \$35,000, the percentage of children with a learning disability was twice that of children with a family income of \$100,000 or more (10% and 5%, respectively).
- Children in fair or poor health were almost 5 times more likely to have a learning disability than children in excellent health (28% and 6%, respectively), and more than twice as likely to have ADHD (16% and 7%, respectively).