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**Policy Directives Toward The Protection of  
Children's Health in School Environments  
Nsedu Obot Witherspoon**

**Children's Environmental Health Network  
110 Maryland Avenue NE, Suite 511  
Washington, D.C. 20002  
Phone: 202-543-4033 Ext: 14  
Fax: 202-543-8797  
e-mail: [nobot@cehn.org](mailto:nobot@cehn.org)**

Summit II National Office  
1612 K Street, N.W. Suite 904  
Washington, DC 20006  
Toll free: 800-736-0986  
Phone: 202-833-1333  
Fax: 202-833-9770  
e-mail: [ejsummit2@aol.com](mailto:ejsummit2@aol.com)  
Web Page: <http://www.summit2.org/>

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# **Policy Directives Toward The Protection of Children's Health in School Environments**

Nsedu Obot Witherspoon  
*Children's Environmental Health Network*

## **Abstract**

Currently, there are no Federal regulations protecting children from environmental health hazards at school, apart from lead, asbestos and radon guidelines. Children do not have a governing body like employees who are protected by the Occupational Safety and Health Administration (OSHA). No agency is officially responsible for assuring that schools offer a healthy environment. Children spend many hours in school environments, placing them at increased risk to multiple exposures. Indoor air quality remains a major problem in schools. Although a great number of schools in the United States are in very poor condition and contain a wide variety of environmental hazards that can be harmful to the health of both students and school employees, no statute is in place to look at the health risks of hazards on the students in schools.

Some small steps to protect children's environmental health in school have been taken. However, little is known about the incidence of health effects which may have a school-related environmental component, the substances to which children are exposed in school, and connections between these exposures and health effects. Our policies should, but usually do not, take into account children's unique vulnerabilities and exposures to environmental health hazards. School environmental health policies and activities should be based on medical, scientific, and public health concepts.

A number of states as well as the U.S. Congress have recognized that a high-quality learning environment is essential to educating the nation's children. To ensure that children have this type of high quality environment, it is crucial that children attend school in decent safe and healthy facilities. Education and training efforts provided by federal, non-profit, and community-based agencies have been helpful in making some initial progress in this field. However, little is known about exposures in the school environment. No research or data collection efforts currently exist. A network for identifying, investigating, responding to, and preventing environmental health problems in schools is needed to help protect children's health in school. Data systems that link environmental factors with health conditions need to be developed to obtain data for disease prevention and health promotion.

## **Protecting Children from Environmental Toxicants**

Every day, we are exposed to dozens, perhaps hundreds, of chemicals. The extent of such exposures is relatively new. Since World War II, thousands of new, primarily synthetic, chemicals have been discovered and introduced into commerce and our environment. In 1940, the annual production of synthetic chemicals was 1.3 billion pounds; in 1980, it was 320 billion pounds.<sup>1</sup> In 1999, more than 7 billion pounds of toxic chemicals were released into the nation's environment.<sup>2</sup> Chemicals are ubiquitous; traces of synthetic compounds are found in all humans and animals around the world.<sup>3</sup>

Both synthetic and natural chemicals, such as lead, once released into the environment, can harm the health of humans and wildlife.

The diverse and growing range of chemicals to which we are exposed means that today's children live in an environment vastly different from previous generations. Currently more than 70,000 chemicals are in use. For the majority of these chemicals, little is known about their health effects on children.<sup>4</sup>

Children, from the fetal stage through adolescence, are in a dynamic state of growth as their immature nervous, respiratory, reproductive, and immune systems develop. Because of these developing systems, growing organisms can be more vulnerable to permanent and irreversible damage from toxicants than mature organisms.

Children experience the world differently than adults, meaning that children's exposures to environmental toxicants and their levels of exposure can vary dramatically from those of adults. The primary task of infancy and childhood is growth and development. If growth and development are hampered, the chances of a healthy adulthood are dramatically decreased. Many different kinds of insults have the potential to damage these natural processes, potentially leading to lifetime harm. It is often impossible to repair damages that occur in childhood.

Studies of the impact of exposure to environmental toxicants on development make clear that not just the degree and route of exposure but also the timing of the exposure affects the response. Also, the type of defect seen is highly dependent on the timing of the exposure. For example, each vital step toward a healthy brain and nervous system can be disrupted by environmental agents, resulting in permanent injury or impairment.

Because of children's developing systems, children can be more susceptible to harm caused by environmental agents. Exposures that for an adult may have little or no consequence can result in life-long harm for a child. What we don't know about the effects and potential effects of environmental toxicants is far more than what we do know, not just for the nervous system but also for our reproductive, immune, and other critical systems, as well as our state of knowledge for carcinogenic, endocrine and other health effects.

Children are different from adults in other ways. Because biochemical systems are still developing in the fetus and the child, their ability to detoxify and excrete toxins differ from adults. This difference is sometimes to their advantage, but more frequently children are not as able to excrete toxins and thus are more vulnerable to them.<sup>5</sup>

### **Children Experience the World Differently**

Pound for pound, children eat more food, drink more water, and breathe more air than adults do. Young children breathe more rapidly and take in more air, have higher metabolic rates, and have higher proportionate food and liquid intakes than do adults.<sup>6</sup> When an infant drinks six ounces of formula or breast milk per kilogram of body weight daily, it is equivalent to an adult male drinking 35 cans of soda in a day.<sup>7</sup> Because children eat more fruits and vegetables and drink more liquids, per pound, than adults, potential exposure to toxins such as lead, pesticides, and nitrates is greater.

Exposure differences are also a result of locations where children spend time, the activities in which children indulge, and children's level of personal hygiene. Thus, in identifying how children may be exposed to a chemical and the level of exposure, it is inadequate to simply extrapolate from adult exposure.

Behavioral differences, because of age and developmental stages, means that opportunities for exposure to environmental chemicals such as pesticides also differ. These differences exist both between adults and children as well as between children of different ages.

Some examples of children's behavior and activities that lead to exposure differences include:

- Infants may mouth or lick any object, surface, or body part that they can reach.
- Very young children spend hours close to the ground where there may be more exposure to toxins in dust, soil, and carpets as well as to low-lying vapors such as radon or pesticides.
- Toddlers and primary school children may spend many hours sitting or lying on the floor while watching TV or playing games (2-3 hours/day). They place their fingers in their mouth frequently (9-10 times/hour); they are constantly touching their clothes (65 times/hour), objects (118 times/hour) and surfaces (97 times/hour). When they put their fingers in their mouth, whatever they have touched, they swallow.
- Children often eat snacks while sitting on the floor, thus whatever environmental chemicals are on the floor can adhere to both their hands and food and will be ingested through hand-to-mouth activities and through contamination of the food with dirty hands.

- Primary school children are likely to spend more time outdoors than toddlers or infants, typically in contact with dirt or grass and are also more likely to be outside barefoot than either older or younger children. They roll on the grass, tumble, and play games. They typically do not wash their hands after coming indoors and before eating. Whatever is on the grass may be absorbed through the skin on the body and feet or ingested when they put their hands in their mouth.
- Older children also spend a lot of time outdoors, typically playing organized games such as soccer or football, or hanging out. Their activities may include dermal contact with soil or grass.<sup>8</sup>

This type of behavior/exposure data do not exist for children older than 12, yet older children may have exposures similar to adults -- through their part-time jobs cutting grass or working on farms -- in addition to sources of exposure through their play activities. Adolescents can be exposed to workplace toxins in shop class, vocational-education settings, and in work settings, be they school-organized work placements or jobs that the adolescents take themselves.

The data that do exist show that children are more heavily exposed than adults to toxicants such as pesticides. For example, studies that looked at biomarker levels for a commonly used organophosphate pesticide, chlorpyrifos, in children and adults found that the levels of the pesticide in children were substantially higher than in the adult population.

### **Environmental Health In Schools**

America's public schools serve over 42 million students. School-aged children can spend between 35-50 hours per week in and around school buildings. There are many environmental hazards in schools that can be harmful to the health of both students and school employees.

A number of states as well as the U.S. Congress have recognized that a high-quality learning environment is essential to educating the nation's children. To ensure that children have this type of high quality environment, it is crucial that children attend school in safer and healthier facilities. A report by the U.S. Government Accounting Office, the *Condition of America's Schools*, notes that over half of the schools surveyed reported at least one environmental problem affecting indoor air quality.<sup>9</sup> The report states that public concern is growing that while laws require children to attend school, some school buildings may be unsafe or even harmful to children's health. The results of the report project that the nation's schools need about \$112 billion to repair or upgrade America's facilities to decent overall condition. One-third of America's schools reported that all buildings were not in overall adequate condition.

Chemical toxicants and biological agents in the classroom, on the playground, in the science lab, or in other school facilities can lead to health risks and adverse learning conditions. They can affect many different body systems and impact health, learning, productivity, and self esteem.<sup>10</sup> Although children spend hours every day in and around their school facilities, few steps have been taken to protect children from environmental toxicants in the school environment.

Other than lead<sup>11</sup>, asbestos<sup>12</sup> and radon<sup>13</sup>, the Federal government has not instituted requirements or guidelines that would protect children from the same chemical exposures that require employee notification and other worker protections. Although students may indirectly benefit from the Occupational Safety and Health Administration (OSHA) and National Institute for Occupational Safety and Health (NIOSH) activities that cover school employees, OSHA and NIOSH have no jurisdiction for investigating the health impact of exposure to students. Additionally, only 26 states have OSHA coverage for their public employees.<sup>14</sup>

When considering school siting issues, there are no current guidelines in place to assist school districts in the safe location of new schools<sup>15</sup>. In an effort to save money, school districts are often enticed by low-priced or donated property which, unknown to the district, is contaminated. Another large issue is that not many schools perform environmental assessments in the first place. The communities impacted the most by unsafe school locations are the communities of color and the poor.

Specific health effects and toxicants of concern in the school environment include:

## **Air Pollutants, Air Quality, and Asthma**

Children are especially susceptible to air pollutants. The airways of young children are smaller than those of adults. Inhalation of air pollutants that would produce only a slight response in an adult can result in a significant obstruction in the airways of a young child. Children have increased oxygen needs compared to adults, they breathe more rapidly and, therefore, inhale more pollutants per pound of body weight than adults, and they often spend more time engaged in vigorous outdoor activities than adults.

Asthma is the leading serious chronic illness among children.<sup>16</sup> The number of children with asthma in the United States is rapidly growing, increasing by 75 percent between 1980 and 1994.<sup>17</sup> Asthma is the number one cause of hospitalization among children under the age of 15.<sup>18</sup>

Asthma is the leading cause of school absenteeism due to a chronic illness.<sup>19</sup> The U.S. Environmental Protection Agency estimated that American children lost 17 million school days in 1997 due to the disease, and that parents lost 5 million work days in order to care for their children with asthma-related illness.<sup>20</sup> Nearly 1 in 13 school-age children has asthma.<sup>21</sup>

The impact of asthma falls disproportionately on African-American and certain Hispanic populations and appears to be particularly severe in urban inner cities.<sup>22</sup> These differences include both the incidence of asthma as well as mortality rates. In 1997, non-Hispanic Black children living in families with incomes below the poverty level were found to have the highest rates of asthma.<sup>23</sup> Between 1980 and 1993, death rates for asthma were consistently highest among blacks aged 15-24 years.<sup>24</sup>

Major indoor triggers of asthma attacks include irritants such as commercial products (paints, cleaning agents, pesticides, perfumes), building components (sealants, plastics, adhesives, insulation materials), animal and insect allergens, environmental tobacco smoke, and molds.<sup>25</sup> Many of these triggers can be found in schools.<sup>26</sup>

Air pollutants such as particulate matter<sup>27</sup> and ozone<sup>28</sup> also can trigger asthma attacks. Although the causes of asthma are not yet known, one recent 10-year study found that the ozone was linked to causing asthma, especially among physically active school-age children living in high ozone communities.<sup>29</sup> Nitrogen dioxide and sulfur dioxide decrease lung function in asthmatics.<sup>30</sup> Long-term exposure to air pollution (such as nitrogen dioxide and particulate matter) slows children's lung development over time.

Poor indoor air quality can reduce a person's ability to perform specific mental tasks requiring concentration, calculation, or memory.<sup>31</sup> Air quality problems inside school buildings can arise from a variety of sources, such as mold growth from excessive moisture, chemical emissions, insufficient fresh air supply, pollutants and high radon levels.<sup>32</sup> An EPA investigation of 29 schools across the country found inadequate ventilation in most of the schools.<sup>33</sup>

## **Learning Disabilities-- Developmental Disabilities**

Seventeen percent of children under 18 years of age have been diagnosed with one or more developmental disabilities. These disabilities include Attention Deficit-Hyperactivity Disorder (ADHD) and autism and are the result of complex interactions among genetic, environmental and societal factors that impact children during vulnerable periods of development.<sup>34</sup> A recent Centers for Disease Control and Prevention (CDC) report indicated that approximately 1.6 million elementary school-aged children (7 percent of children 6-11 years of age) have been diagnosed with ADHD, which is also known as Attention Deficit Disorder (ADD).<sup>35</sup>

A recent National Institute of Environmental Health Sciences (NIEHS) study indicated that the incidence of ADHD may be greatly underestimated by school and public health officials. In the study, parents reported more than 15 percent of boys in grades one through five had been diagnosed with ADHD. Overall, more than nine percent of all fourth and fifth grade children studied were taking medication to treat ADHD.<sup>36</sup>

Known or suspected causes of brain and nervous system disorders are exposure to lead, methylmercury, and some pesticides, therapeutic drugs and food additives.<sup>37</sup> Other chemical classes suspected of developmental neurotoxicity include cancer chemotherapy medications, polyhalogenated hydrocarbons, psychoactive drugs, and solvents.

### **Mercury**

Schools are places where mercury and children may come together via thermometers and barometers, in laboratory courses or “show-and-tell.” Mercury is a potent neurotoxicant and children are particularly susceptible to mercury’s dangers. Mercury interferes with brain development and more easily passes into the brains of fetuses and young children than into the brains of adults.

Nervous system disorders include memory problems, impaired vision, speech, hearing and coordination.<sup>38</sup> Mercury poisoning is linked to kidney and liver damage and reproductive disorders. In July 2000, the National Academy of Sciences concluded that every effort should be made to reduce the release of mercury into the environment.

### **Pesticides**

Pesticide exposure may result in symptoms ranging from relatively mild headaches and skin rashes to paralysis and death. Some long-term illnesses linked to pesticide exposure may be subtle -- such as neurological disorders or reduced cognitive skills.<sup>39</sup> Long-term illnesses and those with delayed onsets, such as cancer, which may appear years after exposure, can also occur. The symptoms of pesticide exposure can be misdiagnosed, which may mask the true extent of the illnesses caused by pesticides.<sup>40</sup>

Scientific reviews of the U.S. pesticide regulatory system identified important gaps in knowledge about the health effects of pesticides on children’s developing systems as well as children’s actual exposures to pesticides.<sup>41</sup> According to the American Academy of Pediatrics, “because the health effects of pesticide exposure on children are not well studied, an approach that reduces their exposure to these chemicals is desirable.”<sup>42</sup>

Pesticide use in schools can be widespread. It can include “routine spraying,” ostensibly to prevent the development of problems, in classrooms, hallways, the cafeteria, and other areas. This type of use may result in children being exposed to high levels of pesticides.<sup>43</sup> Additionally, pesticides can be used in the building when an infestation is noted and pesticides may also be used outside on lawns and playing fields.

Information about the amount of pesticides used in the nation’s 110,000 public schools is not available. The Federal government does not collect such data, and, as of 1999, only two states collected data on pesticide use in a manner that allows for identifying use in school facilities.<sup>44</sup> From 1993 through 1996, about 2,300 pesticide-related exposures involving individuals at schools were reported, according to the American Association of Poison Control Centers (although these data are not believed to be complete).<sup>45</sup>

### **Lead in Paint and Drinking Water**

Lead is a potent neurotoxin. Exposure to lead can cause a variety of health effects, including delays in normal physical and mental development in children, slight deficits in attention span, hearing, and learning disabilities of children. Long-term effects can include stroke, kidney disease, and cancer.<sup>46</sup>

Children of day-care-age who are in lead-contaminated buildings will be at highest risk of adverse outcomes from the exposure, but older children may be effected as well. A common source of lead exposure for children today is lead paint and the contaminated dust and soil it generates.<sup>47</sup> According to a report on the condition of the nation’s school facilities by the U. S. General Accounting Office, schools built before 1980 were painted with lead paint.<sup>48</sup>

Children may also be exposed to lead through drinking water that has elevated concentrations from lead plumbing materials. Lead contamination in drinking water occurs from corrosion of lead pipes and it

cannot be directly detected or removed by the water system.<sup>49</sup> According to the EPA, the longer water remains in contact with leaded-plumbing, the more the opportunity exists for lead to leach into water. As a result, facilities with on again/off again water use patterns, such as schools, may have elevated lead concentrations.<sup>50</sup> Some support was provided to schools through the Lead Contamination Control Act of 1988 to identify and correct lead-in-drinking-water problems at schools, especially water coolers with lead-lined tanks.<sup>51</sup>

### **School Buses and Diesel Exhaust**

According to the EPA, diesel engine emissions contribute to serious public health problems including: premature mortality, aggravation of existing asthma, acute respiratory symptoms, chronic bronchitis, and decreased lung function. These emissions have also been linked to increased incidences of various cancers in more than 30 health studies.

Diesel exhaust is known to be a major source of fine particles that can lodge deep in children's lungs, increasing the likelihood of asthma, chronic bronchitis, heart disease and even premature death.<sup>52</sup> In the United States, nearly 600,000 school buses transport 24 million students to school daily. Collectively, U.S. children spend 3 billion hours on school buses each year.<sup>53</sup>

Children who ride diesel school buses are exposed to an excessive amount of toxic diesel exhaust. The excess levels on the buses are 23 to 46 times higher than levels considered to be significant cancer risks according to the U.S. Environmental Protection Agency and federal guidelines. The diesel exhaust exposures are likely to result in an additional 23 to 46 cancer cases per million children exposed.<sup>54</sup>

### **Mold**

Mold grows on virtually any substance when moisture and oxygen are present, including ceiling tiles, carpets, wood and paper. Some molds, such as black molds or *Stachybotrys*, are known to produce potent toxins which can cause impaired breathing and cause allergies.<sup>55</sup>

Children can be exposed to mold in schools if the building has indoor air that is very damp or if there have been water leaks. Mold may grow within 48 hours if the building materials or furnishings are damp.<sup>56</sup> The common symptoms of mold toxin exposure include headache, fatigue, diarrhea, nausea and respiratory irritation.<sup>57</sup>

### **What is Currently Being Done in Schools?**

The Environmental Protection Agency (EPA) has a resource guide specifically for schools entitled, "Indoor Air Quality (IAQ) *Tools for Schools* Action Kit". This resource empowers schools to carry out a practical action plan to prevent and resolve indoor air quality problems using simple activities and in-house staff.<sup>58</sup> Extensive efforts are underway by EPA Regional Offices to distribute the IAQ Tools for Schools materials and assist schools in implementing an IAQ program. Many national advocacy organizations promote the kit as an effective program for minimizing adverse health effects. More than 20,000 kits have been distributed nationwide since 1996 to kindergarten through high schools and strong support for the program has been voiced by state departments of education and health. Several state legislatures are using the kit as a guide to develop indoor air quality standards in schools.

EPA also oversees a program to detect and reduce elevated radon levels in buildings and to inform the public about radon. Through partnerships with schools, non-profit organizations, and state agencies, EPA promotes: (1) radon awareness and testing programs for schools and homes; (2) radon-resistant building practices; (3) methods to lower radon levels; (4) training for school maintenance personnel on methods to lower radon levels; and (5) technical assistance in inspecting school buildings<sup>lviii</sup>.

In addition, the EPA provides education and technical assistance to school districts that inspect school buildings for asbestos-containing material and control asbestos contamination. This assistance is required by EPA's Asbestos-in-Schools Rule.<sup>59</sup> EPA has a mandatory training and accreditation program for

professionals who work in schools and public and commercial buildings to control asbestos. EPA has approved 27 states to administer the Asbestos Model Accreditation Plan (MAP) Rule and directly administers a federal program in the remaining states.<sup>lviii</sup> This program protects children and the general public by helping ensure that buildings are inspected or cleaned up only by properly trained and accredited personnel.

EPA is expanding its research program on pesticides in children as well. Scientists are surveying children's exposures to pesticides through air, water, food, and house dust in schools, daycare facilities, and other places children may encounter pesticides. Researchers are also studying children's activity patterns and examining how the health effects of pesticides differ for children and adults.

In 1997, President Clinton issued an Executive Order directing all federal agencies to take into account the special risks and disproportionate impact that standards and safeguards have on children. As a result, EPA established the Office of Children's Health Protection. The purpose is to make the protection of children's health a fundamental goal of public health and the environmental protection in the United States, as well as, to help implement EPA's national agenda to protect children's health from environmental threats.

### **School Environmental Health: Policy Recommendations**

Our policies should, but usually do not, take into account children's unique vulnerabilities and exposures. School environmental health policies and activities should be based on medical, scientific, and public health concepts including:

- Children deserve a safe and healthy school environment, including protection from harmful environmental exposures.
- Every child experiences particular windows of vulnerability from conception through adolescence. Exposure at those moments of vulnerability to environmental hazards can lead to permanent and irreversible damage.
- These windows of vulnerability do not exist for adults, so standards based on effects on mature systems will not take into account children's vulnerabilities.
- Children's exposures to environmental toxicants are not the same as adult exposures; exposure estimates based on adult exposures are likely to understate children's exposures.
- Past practices which do not take children's vulnerabilities and exposures into account cannot be assumed to be protective of children's health.
- Parents and other caregivers deserve to know what their children are exposed to in school facilities and the impact of such exposures.
- Research, data collection and other components of public health infrastructure must be in place to identify and to prevent potential environmental problems in school facilities and children and their caregivers should have access to these resources.

### **Issues for Policymakers**

Some small steps to protect children's environmental health in school have been taken. However, little is known about the incidence of health effects which may have a school-related environmental component, the substances to which children are exposed in school, and connections between these exposures and health effects. Few protections from environmental hazards in school exist for children.

### **Healthy and High Performance Schools**

In H.R. 1/P.L. 107-110, the "No Child Left Behind Act of 2001," Congress adopted the Healthy and High Performance Schools program. Under this program:

- The Department of Education is directed to undertake a study of "unhealthy public school buildings" and their health and learning impacts.

- A joint Education-Energy-Environmental Protection Agency grant program was created to award grants to State and local educational agencies to support healthy and high performance school buildings.
- The Department of Education is to biennially report to Congress on this program.

A “healthy, high-performance school building” is described as a school building in which the design, construction, operation, and maintenance:<sup>60</sup>

- use energy-efficient and affordable practices and materials;
- are cost-effective;
- enhance indoor air quality; and
- protect and conserve water.

### **Integrated Pest Management in Schools/School Environment Protection Act**

Many school districts around the nation have implemented integrated pest management (IPM) programs to minimize the use of pesticides and have instituted processes to provide advance notice of pesticide use in schools to parents and employees. IPM integrates both chemical and non-chemical methods to provide the least toxic alternative for pest control. IPM utilizes regular monitoring to determine when treatments are needed.<sup>61</sup> Treatments are not made based on a predetermined schedule, but when monitoring indicates that the pest will cause unacceptable economic or medical damage. Because the health effects of pesticide exposure on children are not well studied, an approach that reduces their exposures to these chemicals is desirable.

“The School Environment Protection Act” has been introduced in Congress to further encourage schools to adopt IPM programs (H.R. 111 in the current Congress and H.R. 3275 and S. 1716 in the 106th Congress). This act requires the safest methods of pest control are used in school buildings and on school grounds to protect children. A compromise version of these provisions has passed the Senate twice, once as part of the “No Child Left Behind Act of 2001” and once as part of “The Agriculture, Conservation, and Rural Enhancement Act of 2002”, otherwise known as the Farm Bill. However, in both bills the provisions were rejected in conference committee.

### **Protection from Hazards**

Schoolchildren deserve to be protected from environmental hazards in their school; however, no standards exist providing such protections. For example, in the states with OSHA coverage, school employees are covered by standards including:

- a written hazard communication standard that lists all products with toxic ingredients, access to material safety data sheets, training for employees on chemical hazards;
  - protective equipment for employees to use;
  - a laboratory standard covering science teachers and technicians;
  - emergency evacuation procedures; and
  - access to any environmental monitoring performed by the employer.
- However, students are not covered by these standards.

### **Research**

Little is known about exposures in the school environment, where millions of American children spend a large portion of their childhood. No research or data collection efforts exist. Schoolchildren and their families deserve access to an agency which can help answer their questions, investigate concerns and provide information on exposures.

As a result of queries from school personnel, the National Institute for Occupational Safety and Health (NIOSH), has visited schools for Health Hazard Evaluation (HHE) investigations, which assess risks and

exposure and health consequences for employees when there are no standards. These investigations can be requested by employers and employees. However, schoolchildren are not under the jurisdiction of NIOSH, so the Institute does not have the authority to undertake investigations based on concerns about student risks, exposures, and health effects.

### **Health Tracking**

A network for identifying, investigating, responding to, and preventing environmental health problems in schools is needed to help protect children's health in school. Data systems that link environmental factors with health conditions need to be developed to obtain data for disease prevention and health promotion. Such a network would help to close the gap in knowledge regarding the prevalence and incidence of environmentally-related conditions and environmental exposures.

**Author:**

**Nsedu Obot Witherspoon**, MPH currently serves as the Assistant Director for the Children's Environmental Health Network (CEHN), a national organization devoted to protecting all children from environmental health hazards through education, policy, and research initiatives. Overseeing the Network's entire education campaign, she works to educate leaders and residents within various communities on the Network's mission while leading outreach and networking opportunities. Nsedu is specifically focused on outreach to disempowered populations and those entities serving underrepresented communities. Nsedu is the Chair of the Environmental Committee for the DC Asthma Coalition and Environmental Policy Coordinator for the American Public Health Association. She is a member of the National Black Environmental Justice Network.

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