Contaminants in Schools and Child Care Facilities

The indoor and outdoor environmental quality of schools and child care facilities plays an important role in affecting children's health and academic performance. Depending on the type of facility and its particular characteristics (i.e., age, usage, and maintenance), children may be exposed to contaminants from a variety of indoor and outdoor sources. Potential indoor exposure sources include building materials and furnishings (such as paint, treated wood, furniture, carpet, and fabrics), products used for building maintenance (such as cleaning products and pesticides), and products used for hobbies, science projects, and arts and crafts projects or within the learning environment (such as paint, markers, and correction fluid). Potential outdoor exposure sources include air pollution from nearby traffic and industry. In addition to these specific exposures, children may also experience unsatisfactory environmental conditions such as inadequate lighting, ventilation, indoor air quality, or noise control.[1] These exposures potentially impact the comfort and health of students, which may adversely affect their academic performance and increase their risk of both short- and long-term health problems.[2-4]

These potential exposures are of particular concern because children generally spend most of their active, awake time at schools and child care facilities. Children are especially sensitive to contamination, for several reasons. First, children are biologically more vulnerable than adults since their bodies are still growing and developing.[5-7] Second, children's intake of air and food is proportionally greater than that of adults. For example, relative to body weight, a child may breathe up to twice as much air as adults do; this increases their sensitivity to indoor air pollutants.[8] In particular for younger children, the inhalation and ingestion of contaminated dust is a major route of exposure due to their frequent and extensive contact with floors, carpets, and other surfaces where dust gathers, such as windowsills, as well as their high rate of hand-to-mouth activity.[8] Lastly, children have many years of future life in which to develop disease associated with exposure.[7]

School and child care environments share many characteristics influencing children's exposure to indoor environmental contaminants, such as the sources and types of potential environmental contaminants. Both environments also tend to house a large number of occupants in a small confined space, so that without proper ventilation a large number of children can be at risk for potential exposure to indoor contaminants.[9] However, there are also a number of important differences between the two. Children in child care facilities are generally much younger than those in schools, sometimes as young as a few weeks old. The behaviors of very young children (e.g., crawling, hand-to-mouth activity) increase their exposure to contaminants in dust, on surfaces, or in toys and other objects.[6,10] Younger children may also spend more time in child care facilities, some as many as 10 hours per day, 5 days a week.[11,12] Also, compared with schools, child care facilities can be located in a much wider variety of settings, including office buildings, individual homes, and religious buildings. As a result, the indoor and outdoor environments can differ widely between child care facilities and may not be directly under the control of those running the child care itself. Furthermore, child care facilities are more often operated independently, while schools are frequently part of a school district with centralized facilities management. This has important implications for strategies to address environmental issues in these facilities.

Building upkeep characteristics are extremely important, because the design, construction, and current condition of school and child care center facilities can contribute to children's exposure to environmental contaminants.[13-17] Age, level of deterioration, and ventilation efficiency are key characteristics that determine a building's indoor environmental quality. Many substances are released into the indoor environment as a result of deterioration of the building from old age, poor maintenance, or through improperly managed removal and renovation processes.[15,18]

Children may be exposed to a variety of contaminants in school and child care settings, such as lead, asbestos, polychlorinated biphenyls (PCBs), pesticides, brominated flame retardants, phthalates, and perfluorinated chemicals. Exposure to indoor contaminants can occur through multiple routes, such as dermal (through the skin), inhalation, and direct and indirect ingestion. These types of indoor environmental contaminants have been associated with a variety of adverse health outcomes, as well as outcomes related to educational performance for which impaired health is a suspected cause.[19,20] These adverse health effects may be short-term (headache, dizziness, nausea, allergy attacks, or respiratory problems) or longer-term and more serious (asthma, neurodevelopmental effects, or cancer).[21] Children exposed to indoor air pollution also miss more days of school due to illness.[14,22] A child's overall academic performance can suffer as a result of such an illness or absence.[23] For example, exposure to indoor air pollutants has been associated with decreased concentration and poor testing outcomes.[24-26]

There is evidence that many schools and child care facilities in the United States have significant and serious problems with indoor environmental contaminants,[27] and certain groups of children are especially susceptible to such exposures.[28] Children with allergies, asthma, and other respiratory problems are especially susceptible to the effects of indoor air pollution. Asthma attacks and allergies are often triggered by indoor allergens (pollen, dust, cockroaches), as well as by mold.[29]

Lead

Lead is a pervasive and serious environmental health threat for children in the United States.[30,31] The most common sources of lead exposure in schools and child care environments are lead-based paint, lead dust, and lead-contaminated soil in outdoor play areas.[32] This is a particular concern for young children, due to their frequent and extensive contact with floors, carpets, window areas, and other surfaces where dust gathers, as well as their frequent hand-to-mouth activity.[33] A nationally representative sample of licensed child care facilities in 2001 estimated that approximately 14% of these facilities in the United States have significant lead-based paint hazards. Most of these are facilities in older buildings: 26% of facilities located in a building built before 1960 were found to have lead-based paint hazards, compared with 4% in newer buildings. [11]

Additional sources of lead may include lead in drinking water, lead-contaminated products (such as toys, books, and jewelry), and outdoor air from nearby industry.[33-35] The ingestion and inhalation of lead-contaminated dust are the primary pathways of childhood exposure to lead.[36] The National Toxicology Program has concluded that childhood lead exposure is associated with reduced cognitive function, reduced academic achievement, and increased attention-related behavioral problems.[30] Studies have reported associations of childhood exposure to lead with behavioral problems such as attention-deficit/hyperactivity disorder,[37-44] increased likelihood of school absenteeism and of dropping out of high school,[45] increased risks of juvenile delinquency and antisocial behaviors,[46-49] higher total arrest rates, and arrest rates for violent crimes in early adulthood.[50,51]

Polychlorinated Biphenyls (PCBs)

PCBs are a family of industrial chemicals used primarily as cooling or insulating fluids for electrical equipment or as additives to paints, plastics, and rubber products.[20] While the manufacture of PCBs was banned in 1979, PCBs continue to be present in products and materials produced before the ban. Many schools in the United States have lighting systems containing PCBs. When contained in the lighting systems, PCBs pose very little health risk or environmental hazard.[52] However, lighting systems degrade as they age, increasing the risk of PCB leaks or even fires, which pose health and environmental hazards. In December 2010, EPA issued guidance recommending that schools take steps to reduce potential exposures to PCBs from these types of older lighting fixtures.[53] PCBs are also found in caulk and paint used in building structures before 1980,[54,55] which may mobilize into the surroundings from removal efforts, natural weathering, or deterioration over time, and contribute significantly to PCB levels in indoor air and dust in schools.[56,57] Although there is some inconsistency in the epidemiological literature, several reviews of the literature have concluded that the overall evidence supports a concern for adverse effects of PCBs on children's neurological development.[58-62]

Asbestos

Asbestos is a naturally occurring mineral fiber that has been used in building materials as an insulator and fire retardant.[63] The production and use of building materials containing asbestos is currently limited by law in the United States,[64] but many older schools and other buildings may have asbestos-containing materials that were previously allowed in construction. The Asbestos Hazard Emergency Response Act provides rules for the management of asbestos in schools.[65] Under this law, some asbestos-containing products are removed when found, but most often it is recommended that they are "managed-in-place"—i.e., maintaining and managing the contaminated material to reduce potential exposure. Properly managed asbestos that has not been disturbed poses little health risk to students. However, if asbestos-containing materials are disturbed or begin to deteriorate, they can release hazardous fibers into the air and water. Long-term exposure to these fibers can lead to lung cancer, asbestosis (lung scarring), or mesothelioma (cancer of the lung cavity lining).[66,67] These diseases require a long time to develop following exposure, putting children at greater risk of disease development later in life.

Other Indoor Contaminants

Cleaning products and maintenance activities in schools and child care facilities are significant sources of exposure to chemical contaminants. Many conventional cleaning supplies contain harmful chemicals that have been associated with various health effects, including asthma and cancer.[68] Additionally, maintenance activities, from routine cleaning to renovation, can cause dust and particulate matter to become airborne, leading to increased opportunity for inhalation and ingestion of contaminated particles.[69]

Children also may be exposed to a variety of other hazardous chemicals in these environments, such as glues, paints, and other art supplies; mercury from older thermometers; a range of chemicals in chemistry labs; lead acid in batteries and other automotive and trade shop supplies; formaldehyde in pressed wood furniture, flooring, carpets, curtains, and cleaning products; volatile organic compounds (VOCs) in paints, aerosol sprays and fresheners, cleaning supplies, and building materials and furnishings; and the wide variety of toxic chemicals found in environmental tobacco smoke.[70] These and other chemicals commonly found in indoor air have been associated with a range of short-term effects, such as eye, lung, and skin irritation; headaches; nausea; fatigue; and a range of long-term health effects, from chronic lung irritation to cancer, depending on the specific chemical.

In addition to these direct sources of potential exposure, inefficient or malfunctioning heating, ventilation, and air conditioning (HVAC) systems may increase the risks of adverse health effects or even become an additional source for indoor contaminant exposures. First, failing to provide sufficient circulation and filtration of the indoor air mixed with fresh outdoor air can lead to an accumulation of existing air pollutants to dangerous levels.[9,71] This includes increased levels of the chemical contaminants already discussed, as well as other environmental contaminants such as particulate matter and allergens such as cockroach allergen, rodent dander, or pollen.[72] Second, failing to adequately control moisture and temperature levels can trigger the growth of dust mites and mold, which thrive in damp, warm environments.[19,72] Exposure to these are known to cause asthma or trigger asthma attacks.[73,74] Inefficient HVAC capabilities are of particular concern in temporary classroom structures, such as trailers and portable classrooms, which have been associated with poor indoor air quality due to a combination of inadequate ventilation along with use of toxic building materials. A state-wide survey of permanent and portable classrooms in California found that, on average, portable classrooms had worse indoor air quality than permanent ones did, including less efficient or improperly functioning HVAC systems; higher levels of indoor air formaldehyde, particulate matter, polycyclic aromatic hydrocarbons (PAHs), and humidity; and temperatures above and below thermal comfort standards during warm and cool seasons, respectively.[75]

School Siting

School siting (selecting a site, or location, for a new school) is a complex process that often requires assessment of several considerations, such as whether to renovate an old school or to build a new one, cost of land and location preparation, and the availability of infrastructure including roads and utilities. EPA has recently developed voluntary guidelines for school siting as a way to support states, tribes, communities, local officials, and the public in understanding and appropriately considering environmental and public health factors when making school siting decisions. These siting guidelines address issues such as the special vulnerabilities of children to hazardous substances or pollution exposures, modes of transportation available to students and staff, the efficient use of energy, and the potential use of the school as an emergency shelter.[17]

School locations may have underlying causes of potential exposure, such as site contamination, neighborhood emission sources, or indoor air quality problems.[17] Radon, a naturally occurring gas, can seep into buildings from soil. A nationwide survey of radon levels in schools estimates that nearly one in five schools has at least one schoolroom with a short-term radon level above the level at which EPA recommends that schools take action.[76] Additionally, children attending schools near highways or industrial sources may be exposed to various air pollutants such as ozone, particulate matter, carbon monoxide, VOCs, and lead. These potential exposures may pose either short-term or long-term health risks to children who utilize school facilities.[17]

Pesticides in Schools and Child Care Facilities

Pesticides are used in the indoor and outdoor environment to prevent, destroy, repel, or otherwise control pests such as rodents, insects, unwanted plants, and microbials (such as bacteria). They can be sold in many different forms, such as sprays, powders, crystals, or balls, and thus their application inside or outside of schools and child care facilities may lead to several potential routes of exposure for children. For example, application of pesticides in the indoor environment has been shown to contaminate untreated surfaces, including kitchen counters and toys,[77-83] indoor air,[77-79,83-87] and dust.[84,88-92]

Once applied, pesticide residues may take anywhere from a few hours to several months or years to completely break down (degrade). Pesticide residues in the indoor environment are less exposed to factors, such as sunlight, that enable their degradation, and therefore are more persistent than those pesticide residues in the outdoor environment.[82,93,94] This persistence means that pesticide exposures can remain a potential concern for a long period of time, even if the area is no longer being treated. For example, an assessment of pesticide residues in dust of inner city homes found a high prevalence of the pesticide chlorpyrifos two to three years after its indoor use was banned.[90] DDT also continues to be measured in indoor dust several decades after its use was banned in the United States.[91,92,95,96] Furthermore, the persistence of pesticides in the environment after application creates not only an opportunity for children to be exposed directly to the residues, but also the potential for residue migration, leading to contamination of untreated areas.[82,97] As a result, exposures may occur long after application and through a variety of routes such as inhalation and indirect ingestion of dust.[77]

Outdoor pesticide applications on school property, as well as on nearby agricultural fields, lawns, or house perimeters, may contaminate nearby schools and child care facilities.[77] Several studies demonstrate increased levels of pesticides in indoor air[82,98] and dust[95,98] following pesticide applications in an adjacent outdoor area. This often occurs when outdoor air contaminated with pesticide residues mixes with the indoor air (through natural drifting into the building or being brought in through HVAC systems), or residue particles are tracked in on the shoes and clothing of people entering the building.[80,82,95,98,79]

Few studies have evaluated pesticide exposures in the school environment. Some states have conducted studies of pesticide occurrence in their schools. A comprehensive survey of public K–12 classrooms was conducted by the state of California between October 2001 and February 2002.[99] The California study found residues of both available and restricted-use pesticides in all floor dust samples, and concluded that pesticides enter classrooms either during application or by being tracked in on clothing or shoes from outdoors. Pesticides detected in more than 80% of the samples include *cis*- and *trans*-permethrin, chlorpyrifos, and piperonyl butoxide. The First National Environmental Health Survey of Child Care Centers evaluated potential pesticide exposures in child care facilities, and reported that 75% of licensed child care facilities had at least one pesticide application in the past year.[97] The study detected numerous organophosphate and pyrethroid pesticides in indoor floor wipe samples. Chlorpyrifos, diazinon, and permethrin were detected in more than 67% of the tested centers.[97]

Several studies have reported associations between exposure to pesticides in early life and adverse health effects such as cancer and neurodevelopmental disorders. Childhood leukemia in particular has been associated with childhood exposures to pesticides.[100-104] Permethrin and resmethrin, which both belong to the commonly used class of pesticides known as pyrethroids, were recently classified by EPA as "likely to be carcinogenic to humans."[104] Childhood exposures to organophosphate pesticides have been associated with various adverse neurodevelopmental effects.[105-107] Exposure to herbicides and/or other pesticides in the first year of life has been associated with higher risk of asthma.[108]

The short- and long-term health effects of exposure to pesticides in the school environment are largely unknown, due to a lack of data. Between 1993 and 1996, there were 2,300 pesticide-related exposures reported to poison control centers that involved individuals at schools, resulting in 329 people seen in health care facilities, 15 hospitalized, and 4 treated in intensive care units.[109] Data on the long-term effects of pesticide exposure in schools are not available.[109]

Currently, there is no federal law on pesticide use in the school environment. However, at least 35 states have adopted laws on pesticide use in schools.[110] The state laws are generally focused on the adoption of certain types of practices that eliminate or minimize the use of hazardous pesticides: adoption of Integrated Pest Management (IPM) programs, prohibiting when and where pesticides can be applied, requiring signs before and after indoor and outdoor pesticide application, requiring prior written notification to parents and staff for pesticide use, and establishing restricted buffer zones to address chemicals drifting into school yards and buildings. Strategies such as restrictions on the use of pesticides and adoption of IPM have been shown to be effective at reducing human exposure.[87,111,112]

There is no national system for compiling data on the amount of pesticides used in schools.[109] Some states require reporting on pesticide use in schools. The state of Louisiana requires schools to submit a written record of “restricted use” pesticides used annually.[113] In the state of New York, commercial applicators are required by a 1996 law to report the amount of each specific pesticide used and the location where it was applied. Also, six states—Arizona, California, Connecticut, Massachusetts, New Hampshire, and New Mexico—require commercial applicators to report the amount of specific pesticides used.[109]

Measures in This Section

Data on school or child care environmental exposures are not systematically collected. Over the years, there have been few national and state-specific surveys or assessments to acquire information on environmental hazards in educational facilities. The following two measures provide data on the use or presence of pesticides and other chemicals of concern indoors in schools and child care facilities. Measures S2 and S3 present data on detectable levels of pesticides and other contaminants in a regional and national sample of child care centers. Measure S4 presents data on the amount of pesticides applied in schools in California.

Measure S2: Percentage of environmental and personal media samples with detectable pesticides in child care facilities, 2001

Measure S3: Percentage of environmental and personal media samples with detectable industrial chemicals in child care facilities, 2001

About the Measures: Measures S2 and S3 present information about the types of contaminants that were detected in child care facilities. The data come from two different studies. One study collected information from selected child care facilities in Ohio and North Carolina, while the other study collected information from child care facilities throughout the United States. The measures show how frequently different contaminants were detected in various media samples (e.g., indoor air, dust) taken at the testing locations.

CTEPP Study and the First National Environmental Health Survey of Child Care Centers

Measures S2 and S3 present data on the relative potential exposures of children to a variety of pesticides and other contaminants found in child care centers. The measures are based on data from two different federal studies: the Children's Total Exposure to Persistent Pesticides and Other Persistent Organic Pollutants (CTEPP) Study and the First National Environmental Health Survey of Child Care Centers. Data shown in these measures were obtained directly from these sources:

> Tulve, N.S., P.A. Jones, M.G. Nishioka, R.C. Fortmann, C.W. Croghan, J.Y. Zhou, A. Fraser, C. Cave, and W. Friedman. 2006. Pesticide Measurements from the First National Environmental Health Survey of Child Care Centers Using a Multi-Residue GC/MS Analysis Method. *Environmental Science and Technology* 40(20) 6269-6274.
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> Morgan, M.K., L.S. Sheldon, C.W. Croghan, J.C. Chuang, R.A. Lordo, N.K. Wilson, C. Lyu, M. Brinkman, N. Morse, Y.L. Chou, C. Hamilton, J.K. Finegold, K. Hand, and S.M. Gordon. 2004. A Pilot Study of Children's Total Exposure to Persistent Pesticides and Other Persistent Organic Pollutants (CTEPP), Appendix I and Appendix J. Research Triangle Park, NC: U.S. Environmental Protection Agency. http://www.epa.gov/heasd/ctepp/.

The CTEPP study investigated the potential exposures of 257 preschool children, ages 1.5 to 5 years, and their primary adult child care providers to more than 50 anthropogenic chemicals, including pesticides, PAHs, PCBs, phthalates, and phenols. This regional study was conducted by EPA at 29 child care centers in North Carolina and Ohio in 2000–2001. Environmental (indoor and outdoor air, carpet house dust, and soil) and personal (hand wipe, solid and liquid food, drinking water, and urine) samples were collected for each child in the study at home and at the child care center over a 48-hour period.[114]

The First National Environmental Health Survey of Child Care Centers was conducted by the U.S. Department of Housing and Urban Development, the Consumer Product Safety Commission, and EPA in 2001. Indoor and outdoor environmental media samples (surface wipes and soil samples) from a nationally representative sample of 168 child care centers were tested for lead, allergens, and pesticides. No personal samples were collected.

Data Presented in the Measures

Measure S2 presents the percentage of environmental and personal media samples (indoor air, hand wipe, dust, and floor wipe samples) taken from selected regional and national child care facilities with detectable pesticides. Measure S3 presents the percentage of environmental and personal media samples (indoor air, hand wipe, and dust samples) taken from selected regional child care facilities with detectable industrial chemicals. The “Regional Data” in the first graph and all data in the second graph are derived from the CTEPP study, and reflect the percentage of media samples with detectable pesticides and chemical residues. The chemicals were each measured in 42–43 indoor air and dust samples collected from child care centers in Ohio and North Carolina, and the chemicals were measured in hand wipe samples collected from 60–61 children attending those child care centers. The “National Data” in the first graph are derived from The First National Environmental Health Survey of Child Care Centers, and reflect the percentage of 168 floor wipe samples with detectable chemical residues. The level that is detectable is determined by the capabilities of the sampling and testing equipment used in a study; therefore, it cannot be completely ruled out that contaminants are present at lower levels in samples classified as being below the detection limit. Both measures are based on whether the contaminant is detected or not detected, and thus provide an indication of potential for exposure, but they do not provide data on concentrations of the chemicals or levels of exposure.

The “indoor air” category reflects children’s potential exposure to airborne chemicals through inhalation. The “hand wipes” category is based on sampling for the presence of chemicals on children’s hands. Due to children’s high levels of hand-to-mouth activity, hand wipe data indicate potential exposure via ingestion.[8] The “dust” category captures contaminants that accumulate in dust on various indoor surfaces, and reflects potential inhalation exposure to contaminants if dust is resuspended in the air, as well as indirect ingestion if dust contaminates items that children put in their mouths, such as food, toys, and their hands.

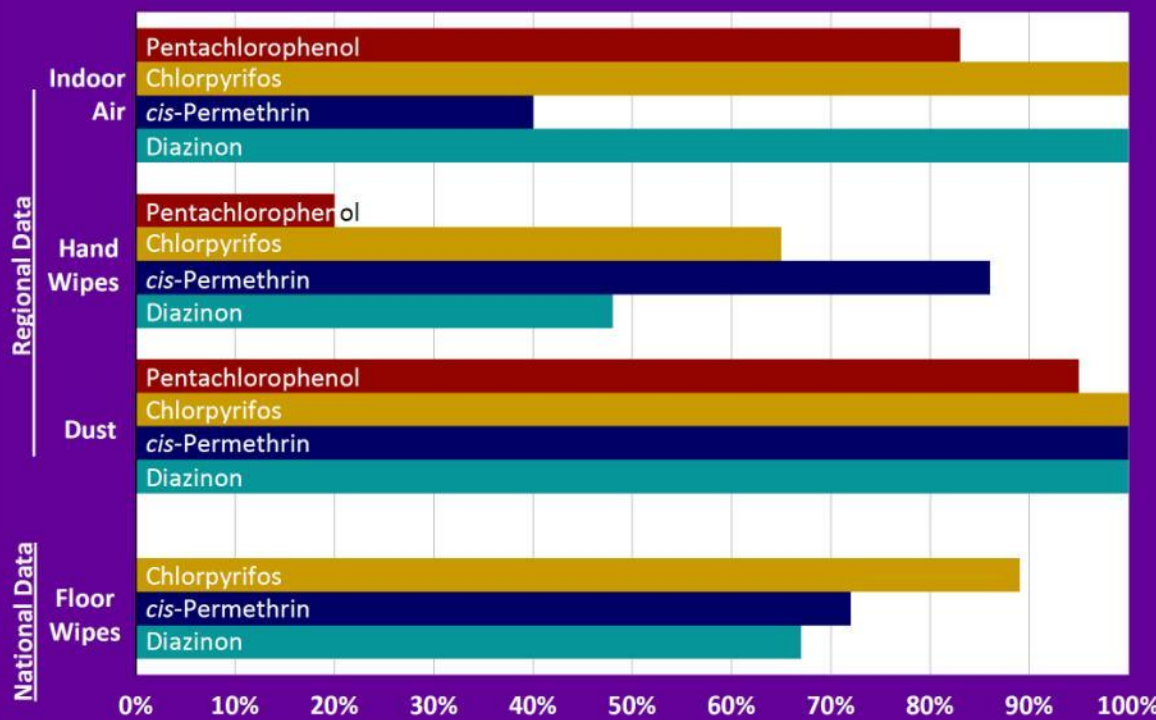
The specific pesticides shown in Measure S2 are pentachlorophenol, an organochlorine pesticide that has been used in the past in some paints, and in industrial and agricultural practices, but which is now limited to use in wood railroad ties and utility poles; chlorpyrifos, an organophosphate insecticide used previously indoors against cockroaches, fleas, and termites, and currently used on farms to control pests on animals and crops and in warehouses, factories, and food processing plants; *cis*-permethrin, a synthetic pyrethroid used to kill and repel domestic insects; and diazinon, an organophosphate pesticide with current agricultural uses and previous residential uses.

The industrial chemicals shown in Measure S3 are PCB-52, polycyclic aromatic hydrocarbons (PAHs, represented in the measure with data for the PAH benzo[b]fluoranthene), dibutyl phthalate, and bisphenol A. While the manufacture of PCBs was banned in 1979, PCBs continue to be present in electrical equipment and some building materials, such as caulk, produced before the ban. Several PCBs were measured in the CTEPP study; data for PCB-52 are displayed in the graph because it is one of the PCBs most frequently detected in the study, and thus gives an indication of potential for exposure to PCBs in general. Benzo[b]fluoranthene is one of several PAHs measured in the CTEPP study. Mixtures of PAHs are produced when carbon-based fuels are burned. Data for benzo[b]fluoranthene are displayed in the graph because it is one of the PAHs most frequently detected in the study, and thus gives an indication of potential for exposure to PAHs in general. Dibutyl phthalate is a chemical commonly used in adhesives, plastics, and personal care products. Bisphenol A is a high-volume industrial chemical used in the production of epoxy resins and polycarbonate plastics. Polycarbonate plastics may be encountered in many products, notably food and drink containers, while epoxy resins are frequently used as inner liners of metallic food and drink containers to prevent corrosion.

Many of these pesticides and industrial chemicals are no longer available or have highly restricted uses. Manufacture of PCBs and PCB-containing equipment and materials was banned in 1979, though equipment and materials manufactured with PCBs prior to the ban remain in use. Pentachlorophenol has not been used other than as a wood preservative since 1987. Indoor application of chlorpyrifos, and any use at schools, was restricted beginning in 2001. All indoor uses of diazinon were banned in 2001.

Measure S2

Percentage of environmental and personal media samples with detectable pesticides in child care facilities, 2001



Data: Children's Total Exposure to Pesticides and Other Persistent Organic Pollutants Study (Regional Data); First National Environmental Health Survey of Child Care Centers (National Data)

Note: Pentachlorophenol was not examined in the national study

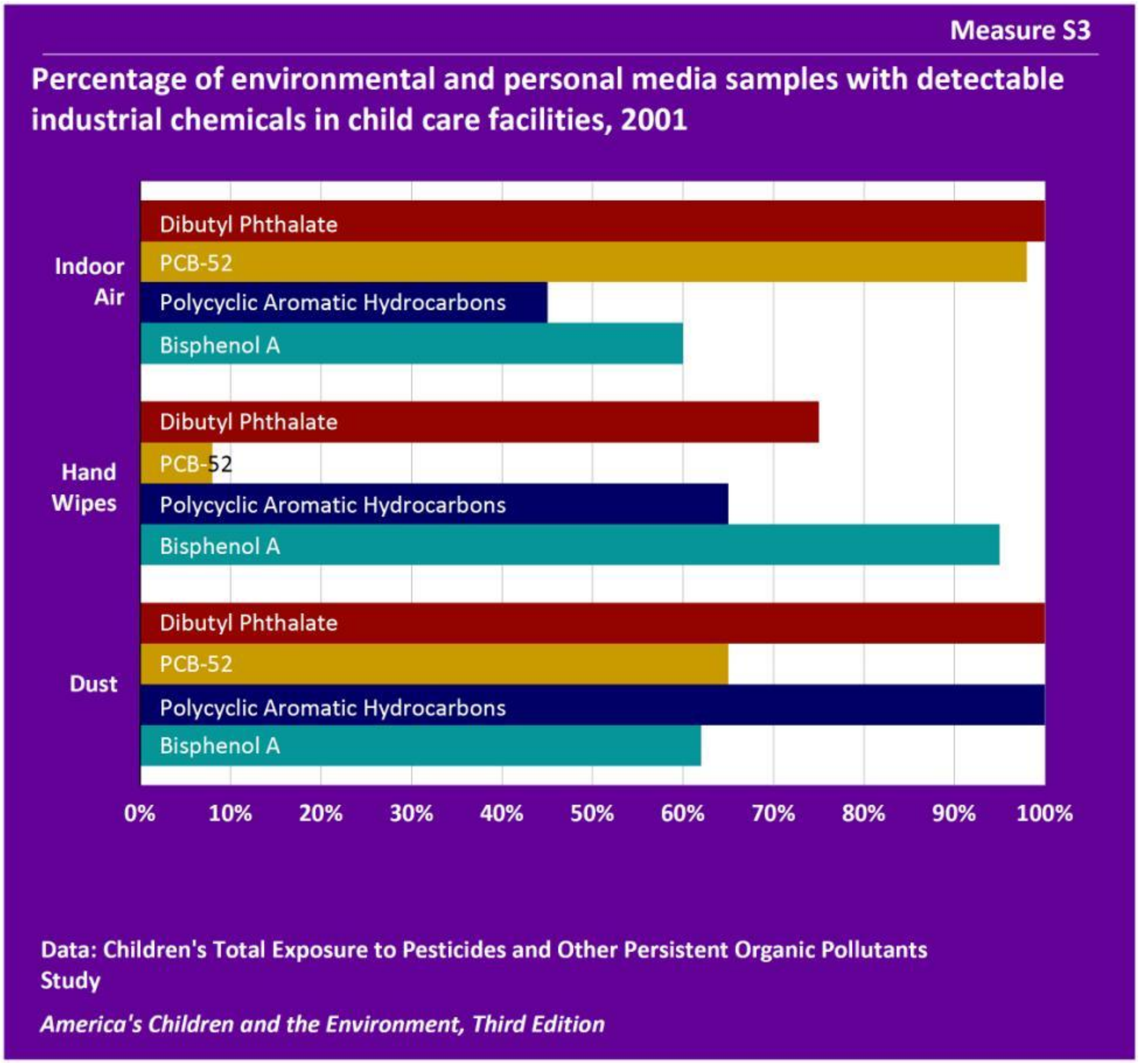
America's Children and the Environment, Third Edition

Data characterization

- National data for this measure were obtained from a federal government study of a nationally representative sample of 168 child care centers. Pesticides were measured in environmental samples collected from the child care centers.
- Regional data for this measure were obtained from an EPA study of 29 child care centers in Ohio and North Carolina. Pesticides were measured in environmental samples collected from the child care centers and from the hands of children in the centers.

- Chlorpyrifos, *cis*-permethrin, and diazinon were detected in all of the dust samples collected at Ohio and North Carolina child care centers included in the CTEPP study in 2000-2001. Chlorpyrifos and diazinon were also detected in all of the indoor air samples collected at these child care centers.

- Pesticide residues were detected least often in the hand wipe samples collected at the selected Ohio and North Carolina child care centers, but chlorpyrifos and *cis*-permethrin were detected in more than half of the hand wipe samples.
- The national level floor wipe sampling found chlorpyrifos most frequently, in 89% of samples. *Cis*-permethrin and diazinon were also detected frequently, in 72% and 67% of floor wipe samples, respectively. (Pentachlorophenol was not examined in the national study.)



Data characterization

- Data for this measure were obtained from an EPA study of 29 child care centers in Ohio and North Carolina.
- Chemicals were measured in environmental samples collected from the child care centers and from the hands of children in the centers.

- Of the chemicals shown in this measure, dibutyl phthalate was the most frequently detected in indoor air and dust samples collected at Ohio and North Carolina child care centers included in the CTEPP study in 2000–2001.
- Dibutyl phthalate and PAHs (represented by benzo[b]fluoranthene) were detected in 100% of the dust samples. PCB-52 and bisphenol A were detected in 65% and 62% or dust samples, respectively.

- Dibutyl phthalate, PAHs, and bisphenol A were detected in more than 60% of hand wipe samples, while PCB-52 was detected in less than 10% of these samples.
- Dibutyl phthalate was detected in all of the indoor air samples and PCB-52 was detected in almost all (98%) of the samples. PAHs were detected in slightly less than half of the indoor air samples, while bisphenol A was detected in slightly more than half of the indoor air samples.

Measure S4: Pesticides used inside California schools by commercial applicators, 2002–2007

About the Measure: Measure S4 presents information about pesticides used inside California schools. The data for this measure come from the California Department of Pesticide Regulation, which collects data on all commercial pesticide application in California schools. The measure shows how the application amounts of different pesticide categories have changed over the years.

California Schools Pesticide Use Reporting Database

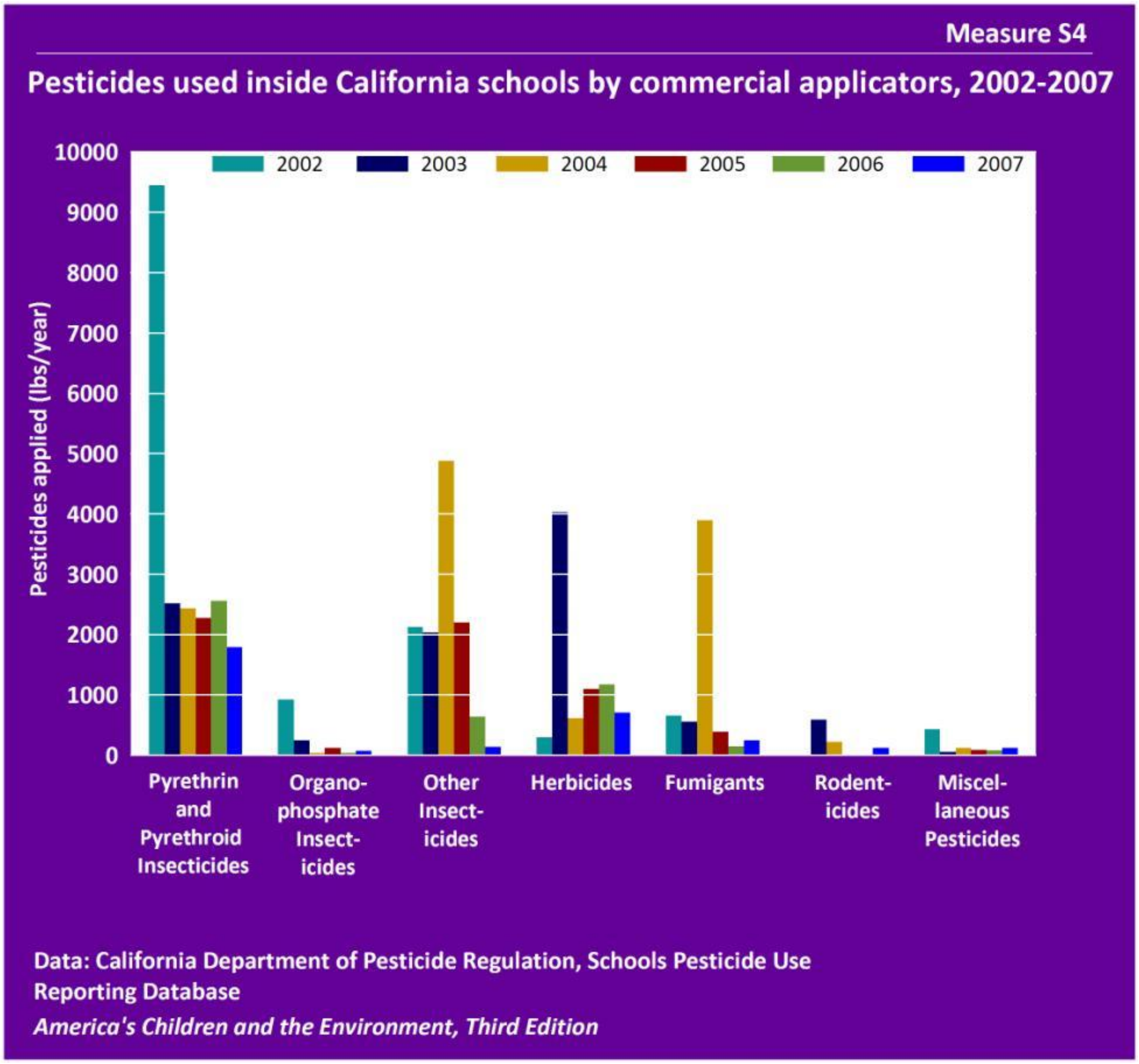
The California Department of Pesticide Regulation collects data on all commercial pesticide application in California schools. In the year 2000, California passed the Healthy Schools Act of 2000, which required all public child care facilities and school sites to report pesticide use on school sites by pest control businesses.[115] Schools are required to report pesticide use at least once per year, and all schools are required to maintain records of their reports on-site for four years. The California Healthy Schools Act requires reporting for application of pesticides to the buildings or structures (including attics and crawl spaces), playgrounds, athletic fields, school vehicles, or any other area of school property, indoors and outdoors, visited or used by pupils.[115] The law does not apply to products used as self-contained baits or traps; gels or pastes used as crack-and-crevice treatments; pesticides exempted from regulation by EPA; or antimicrobial pesticides, including sanitizers and disinfectants. All other pesticides must be reported.

Data Presented in the Measure

Measure S4 displays the annual amount (pounds per year) of pesticides used inside California schools and child care facilities by commercial applicators. The measure presents data for the indoor applications of pesticides for all years for which data are available: 2002–2007. Although the measure presents data for schools and child care facilities, nearly all of the data reported are from schools.

The measure presents the amount of pesticides applied in California schools and child care facilities, in pounds per year, with pesticides grouped into seven categories: pyrethrin and pyrethroid insecticides, organophosphate insecticides, other insecticides, herbicides, fumigants, rodenticides, and miscellaneous pesticides. Most use of the “other insecticides” category inside of California schools is accounted for by imidacloprid, which is marketed for indoor termite and cockroach control. Most of the “miscellaneous pesticides” category use inside of schools is accounted for by a borate compound used as a fungicide and insecticide.

Routinely collected pesticide use data can provide helpful information about the types of pesticides used and the extent of such use, including changes over time. However, these data do not indicate the extent of pesticide exposure experienced by children in California schools.



Data characterization

- Data for this measure are obtained from a reporting database maintained by the California Department of Pesticide Regulation.
- Reporting is required for all pesticide applications by pest control companies at all school and childcare facilities in California.
- Pesticide reports are submitted to the database at least annually and report all pesticide application on any area of school or childcare facility property visited or used by pupils.

- Pyrethrin and pyrethroid insecticides accounted for the greatest volume of pesticide use in California schools overall from 2002 to 2007, although there was greater use of herbicides in 2003, and of the “other” insecticides category and fumigants in 2004.
- The application of pyrethrin and pyrethroid insecticides, and organophosphate insecticides inside California schools has decreased since 2002.

Supplementary Topics

Contaminants in Schools and Child Care Facilities

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Contaminants in Schools and Child Care Facilities

Table S2: Percentage of environmental and personal media samples with detectable pesticides in child care facilities, 2001

	Pentachlorophenol	Chlorpyrifos	*cis*-Permethrin	Diazinon
Indoor Air (Regional Data)	83.2	100.0	40.3	100.0
Hand Wipes (Regional Data)	20.0	65.0	86.5	48.3
Dust (Regional Data)	95.2	100.0	100.0	100.0
Floor Wipes (National Data)	NA	89.0	72.0	67.0

DATA: Children's Total Exposure to Pesticides and Other Persistent Organic Pollutants Study (Regional Data); First National Environmental Health Survey of Child Care Centers (National Data)

NOTE: Data are from both national and regional sources, and are identified accordingly. Regional data are from samples collected in North Carolina and Ohio only.

Table S3: Percentage of environmental and personal media samples with detectable industrial chemicals in child care facilities, 2001

	Dibutyl Phthalate	PCB-52	Polycyclic Aromatic Hydrocarbons	Bisphenol A
Indoor Air	100.0	97.6	45.3	59.7
Hand Wipes	75.0	8.3	65.0	95.2
Dust	100.0	65.1	45.3	62.3

DATA: Children's Total Exposure to Pesticides and Other Persistent Organic Pollutants Study

NOTE: Regional data, from samples collected in North Carolina and Ohio only.

Table S4: Pesticides used inside California schools by commercial applicators, 2002-2007

	Pounds of Pesticide Applied					
	2002	**2003**	**2004**	**2005**	**2006**	**2007**
Pyrethrin and Pyrethroid Insecticides	9,452	2,515	2,430	2,274	2,556	1,794
Organophosphate Insecticides	919	244	39	119	36	70
Other Insecticides	2,125	2,037	4,883	2,205	641	142
Herbicides	295	4,031	613	1,099	1,174	701
Fumigants	651	556	3,890	392	149	249
Rodenticides	1	589	219	0.4	0.7	120
Miscellaneous Pesticides	434	52	121	88	76	124

DATA: California Department of Pesticide Regulation, Schools Pesticide Use Reporting Database