Polychlorinated Biphenyls (PCBs) in School Buildings

Information for Schools and Parents

The New Jersey Department of Health (NJDOH) prepared this fact sheet to provide information and general resources for parents, school staff and administrators, and school consultants regarding PCBs in school buildings.

What are PCBs?

PCBs (Polychlorinated Biphenyls) are a group of manmade chemicals that were manufactured and used extensively in electrical equipment such as transformers and capacitors, paints, hydraulic fluids, lubricants, synthetic rubber, plasticizers, floor tile, adhesives, caulk, fluorescent light ballasts, and asphalt among other products. PCBs are either oily liquids or solids that are colorless to light yellow. PCBs are semi-volatile organic chemicals and can vaporize into the air. PCBs have no known smell or taste.

How are people in the general population exposed to PCBs?

PCBs continue to be widespread in our soil, air, water and food because of past use and disposal. PCBs break down very slowly and can remain in the environment for decades.

In the past, a common route of exposure for the general public was indoor environmental exposures from using old fluorescent lighting fixtures and electrical devices and appliances, such as television sets and refrigerators, that were made 30 or more years ago. These items may leak small amounts of PCBs into the air when they get hot during operation and could also be a source of skin exposure. Indoor air and dust may also be a source of PCB exposure from caulk, electrical products, other building materials or products that contain PCBs.

Food is a major source of exposure to PCBs for the general public. PCBs are stored in animal fat, foods such as meat, fish and dairy products, which means that humans may be exposed to PCBs through their diet when eating these food types.

Due to widespread PCB contamination in the environment and past exposures through historical use in consumer products, most people have low levels of PCBs in their bodies. In general PCB levels in people have been decreasing over the past several decades likely due to reductions in sources of exposure.

People can also be exposed to PCBs by handling products that contain them, or by breathing in contaminated air or dust. Workers whose jobs involve manufacturing or handling PCB-containing products are at the highest risk for exposure.

Why are PCBs found in schools?

PCBs were widely used in building materials and electrical products during construction and renovation activities between about 1950 and 1979 until the U.S. Environmental Protection Agency (EPA) banned the manufacturing and certain uses of PCBs in 1979. Many schools may have PCBs in building materials since the period of extensive school construction (about 1950 to 1980) coincides with the time of greatest use of PCBs in building materials.

It is estimated that the number of schools in the country with PCB in building caulk ranges from 12,960 to 25,920 based upon the proportion of buildings found to contain PCB caulk and sealants and number of schools built during that time period (Herrick et al. 2016).

Consumer, Environmental and Occupational Health Service
Environmental and Occupational Health Surveillance Program
www.nj.gov/health/ceohs

NJ Health
New Jersey Department of Health

What are the sources of PCBs in schools?

Primary sources of PCBs that might be currently found in school buildings include caulk or other sealants, window glazing, fluorescent light ballast capacitors, ceiling tile coatings, and possibly other materials such as paints or floor finishes. Secondary sources are materials that become contaminated due to absorption from direct contact with primary PCB sources such as caulk, or through absorption of PCBs in the indoor air that have been emitted by primary sources such as caulk and light ballasts. Materials such as paints, dust, masonry, floor and ceiling tiles, and mastics may become secondary sources after years of exposure to PCBs emitted from primary sources.

Field and laboratory studies have demonstrated that PCBs from both interior and exterior caulking can be the source of elevated PCB air concentrations in these buildings. Building materials and electrical products can generate PCB-containing vapors and dust when they break down or are disturbed.

What indoor air levels of PCBs have been found in schools?

In 2010, the EPA conducted a pilot study to characterize PCB levels in New York City school buildings, identify PCB-containing caulk and other potential PCB sources, and determine the most effective ways to reduce exposures (EPA 2012).

- The study found the median indoor air total PCB concentration based on 64 measurements across six schools was **318 nanogram per cubic meter of air (ng/m^3)**.
- The median indoor air total PCB concentration at each individual school ranged from less than **50** to **807 ng/m^3**.
- The highest indoor air level detected at any school was **2,920 ng/m^3**.

What are the potential health effects from exposure to PCBs?

According to the Agency for Toxic Substances and Disease Registry (ATSDR), the most commonly observed health effects in people exposed to large amounts of PCBs are skin conditions such as acne and rashes. Studies in exposed workers have shown changes in blood and urine that may indicate liver damage. PCB exposures in the general population are not likely to result in skin and liver effects. The U.S. Department of Health and Human Services (DHHS) has concluded that PCBs may reasonably be anticipated to be carcinogens. PCBs have been classified as probably carcinogenic, and carcinogenic to humans by the EPA and International Agency for Research on Cancer (IARC), respectively (ATSDR 2014).

Summary of health effects other than cancer as reported in the ATSDR Toxicological Profile

- In animal studies of PCB exposures, several health effects were observed including anemia, acne-like skin conditions, and liver, stomach, and thyroid gland impacts. Other effects of PCBs in animal studies include changes in the immune system, behavioral alterations, impaired reproduction, liver toxicity in rodents and ocular effects (ATSDR 2014).
- In worker studies, the most commonly observed health effects among workers exposed to high levels of PCBs are dermal/skin conditions such as acne and rashes. Other studies in exposed workers have shown changes in blood and urine that may indicate liver damage. The measurement of PCBs in air in these occupational studies ranged from **3,000 ng/m^3 to 11,000,000 ng/m^3**.
- Studies evaluating the health effects in children from maternal exposures to PCBs through either ingestion (such as fish consumption) or workplace exposures noted health effects such as low birth weight, impacts on cognitive tests, and immune system effects. There were no reports of structural birth defects caused by exposure to PCBs or of health effects of PCBs in older children.

Summary of cancer health effects as reported in the ATSDR Toxicological Profile

- In animal studies, rats that ate food containing high levels of PCBs for two years developed liver cancer.
- Some epidemiological studies of workers exposed to PCBs suggest that occupational exposures to PCBs were associated with cancer at several sites, particularly the liver, biliary tract, intestines, and skin (melanoma). The PCBs measurements in air in these epidemiological studies ranged from **24,000 ng/m^3 to 1,260,000 ng/m^3**.

My child's school tested for PCBs, and they were detected in the indoor air. How do we interpret these indoor air PCB levels in terms of potential health impacts among children and staff?

The health impact of exposure to PCB exposure depends on a number of factors including the following:

- The level of PCBs detected in the air
- The amount of time spent in the school (number of hours per day, days per year, and years)
- The age of the person (younger children are more vulnerable to the impacts of exposures to environmental contaminants in air because their inhalation rates and body weights make them more susceptible). The EPA has developed health protective indoor air values for schools using the PCB Exposure Estimation Tool (PEET).

The excerpt from EPA's table below shows PCB indoor air levels estimated by using the PEET model based on the dose of 20 nanograms per kilogram per day (ng/kg/day) for each age group. This is the level at which adverse health effects would not be expected (also known as a guidance value). These values vary across age groups due to varying exposure scenarios (for example different inhalation breathing rates, body weight).

EPA's PEET model using EPA's age categories

Age: 3 to < 6 years	**Age: 6 to < 12 years Elementary School**	**Age: 12 to < 15 years Middle School**	**Age: 15 to < 19 years High School**	**Age: 19 and older Adult (Staff)**
200 ng/m^3	300 ng/m^3	500 ng/m^3	600 ng/m^3	500 ng/m^3

EPA 2022. Exposure Levels for Evaluating Polychlorinated Biphenyls (PCBs) in Indoor School Air.

What do these guidance values mean for your health?

Guidance values are the level of PCBs in the air that are *unlikely* to produce harmful effects assuming continuous exposure over a person's lifetime. To develop a guidance value, scientists apply protective factors to the actual concentration where health effects were observed.

- Toxicological studies look at cancer effects and health effects other than cancer. Generally, when evaluating the potential for health effects, cancer and noncancer effects are separately evaluated. For some contaminants, lower levels of exposure may result in increased cancer risk, while for other contaminants the lower level of exposure may result in adverse health effects other than cancer.
- For risk assessment calculations, health scientists consider the lowest concentration that would result in adverse health effects (for either cancer or health effects other than cancer)
- The toxicity information on the different exposure routes for PCBs (ingestion, inhalation and skin contact) indicates that the body absorbs PCBs from either of these exposure routes similarly. This provides the basis for EPA selecting a toxicological study based on ingestion exposure to estimate a guidance value for inhalation exposure.
- The EPA guidance values for PCBs, which vary by age, are based on 20 ng/kg/day (the level at which adverse health effects other than cancer would not be expected as reported from animal studies). The 20 ng/kg/day is derived from the lowest level where health effects were observed, which is 5,000 ng/kg/day. This level is known as the LOAEL (Lowest Observed Adverse Effect Level), and is the actual level where health effects (eyelid swelling, fingernail bed malformation and immunological suppression) were observed. Scientists apply protective factors to the LOAEL to account for uncertainties and derive the 20 ng/kg/day as the level where adverse health effects would not be observed (EPA 1989).
- As noted in the table in the section above, the health protective indoor air concentration value for **elementary** aged children is 300 ng/m^3, based on the dose of 20 ng/kg/day. The indoor air concentration which corresponds with the actual level at which *harmful health effects other than cancer* would be observed in this age group is 105,000 ng/m^3.
- For schools with **pre-school aged** children, the indoor air concentration which corresponds with the actual level at which *harmful health effects other than cancer* would be observed is **69,000 ng/m^3**.

How do scientists evaluate cancer risks from chemical exposures?

- In order to evaluate if a chemical can cause an increased cancer risk, a theoretical cancer risk is calculated using findings from toxicological studies. Scientists derive cancer factors from animal or human studies for use in theoretical risk assessments.
- Cancer effects from chemical exposures are evaluated by assessing the theoretical excess cancer risk above the background cancer risk. In New Jersey, approximately 45% of women and 47% of men (about 46% overall) will be diagnosed with cancer in their lifetime (NJSCR 2023). This is referred to as the "background cancer risk."
- The theoretical excess cancer risk estimates an excess cancer risk in terms of the proportion of the population that may be affected by a cancer-causing substance over a lifetime of exposure. In other words, an estimated cancer risk of one in a million would mean that there is a probability of one additional cancer over background levels in a population of one million people. This theoretical cancer risk is not an actual estimate of cancer cases in a community or a prediction that cancer will occur.
- Scientists define an unacceptable cancer risk of one excess cancer case in 10,000 people.

Cancer risk of exposure to PCBs:

- The PCB level in air corresponding to a cancer risk of one excess cancer in 10,000 people is **20,000 ng/m^3.**
- To put this risk in perspective, if 10,000 people are exposed to PCBs in air at **20,000 ng/m^3** for eight hours a day for 20 years, then the theoretical increased cancer risk would mean that 4,701 people may develop cancer instead of the expected 4,700 (background risk) over the course of their lifetime. This one additional cancer in 10,000 people is deemed an unacceptable risk.
- Occupational studies have noted that worker exposure to **24,000 ng/m^3** for three-to-ten years had an increased risk of liver cancer (ATSDR 2000).

Where can building owners, school administrators and their environmental consultants find information on PCBs?

The EPA has a **comprehensive** resource page on PCBs available at: www.epa.gov/pcbs

The links below are from a sub-category *PCBs in Building Materials* that provides the EPA's updated guidance for school administrators and building owners, including information about managing PCBs in building materials to help minimize possible exposures to building occupants.

- Information for school administrators, building owners and managers
- Information for contractors
- Test methods for PCBs in buildings
- EPA research on PCBs in buildings

Specific information for **School Administrators** can be found on this webpage: Information about PCBs in Building Materials for School Administrators, Building Owners and Managers

Highlighted below are some of the resources provided by the EPA for school administrators available at the webpage above:

- Schools administrators and their consultants with concerns about PCBs are encouraged to reach out to their PCB Regional Coordinator; this information is available at: EPA Regional Polychlorinated Biphenyl (PCB) Programs
- School administrators should follow EPA's guidance to implement best management practices to minimize potential exposures. More information can be found at: Practical Actions for Reducing Exposure to PCBs in Schools and Other Buildings
- School administrators, building owners, managers and occupants can better understand the types of building materials that may contain PCBs, the potential for building occupant exposure to PCBs, and how exposure to PCBs can be assessed and reduced at this webpage: Questions and Answers about Polychlorinated Biphenyls (PCBs) in Building Materials

References:

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