REMOVAL OF PCBs

Removing PCB-containing materials is the most effective way to reduce exposure to PCBs but the costs are high. These materials have to be treated as hazardous waste. When renovating a school that could contain PCBs, the contractor must test the materials for PCBs, or just treat them as hazardous waste.

WHAT IF MY SCHOOL IS PLANNING A RENOVATION?

It is best to contact your regional PCB Coordinator at the EPA for guidance prior to beginning a renovation or removal project. During building renovations of windows, doors, ventilation systems, and roofs, the EPA recommends testing the building caulk and other building materials for PCBs and removing them. During planned renovations, contractors may sometimes decide to bypass testing building materials and assume there are PCB contaminated building materials if the school was built or renovated between 1950 and 1980. The contractor can then follow the necessary EPA guidance for PCB containing building materials removal. **It is important for contractors to take extra precautions when removing PCB-containing building materials to minimize PCB transfer to both dust and soil.** Disposal of renovation debris must follow EPA regulations for RCRA hazardous waste disposal. Prior to renovations, review the EPA factsheet, *Practical Actions for Reducing Exposure to PCBs in Schools and Other Buildings* (see Resources).

RESOURCES

ATSDR, Public Health Statement: PCBs, available online at http://www.atsdr.cdc.gov/ToxProfiles/tp17-c1-b.pdf

EPA PCBs Home Page www.epa.gov/pcbs
Contains Information on:

- EPA guidelines for disposal of PCB construction waste
- fluorescent ballasts removal
- evaluation of PCBs in Indoor School Air
- caulk

EPA Regional PCB Coordinators https://www.epa.gov/pcbs/epa-regional-polychlorinated-biphenyl-pcb-programs

EPA Fact Sheet, *Practical Actions for Reducing Exposure to PCBs in Schools and Other Buildings* https://www.epa.gov/sites/production/files/2016-03/documents/practical_actions_for_reducing_exposure_to_pcbs_in_schools_and_other_buildings.pdf

EPA Indoor Air Quality Tools for Schools Action Kit: https://www.epa.gov/iaq-schools/indoor-air-quality-tools-schools-action-kit

Green Cleaning, Sanitizing and Disinfecting: A Toolkit for Early Care and Education https://wspehsu.ucsf.edu/for-clinical-professionals/training/pediatric-environmental-health-interactive-curriculum/resources/environmental-health-in-early-care-and-education-project/

EPA's Safer Choice Program (third party certified cleaning products) www.epa.gov/saferchoice

Green Seal (third party certified cleaning, and other, products) www.greenseal.org/

Microfiber for Child Care Centers http://www.informedgreensolutions.org/?q=publications/microfiber-child-care

National Center for Healthy Homes, HEPA Vacuums and HEPA Exhaust Control http://www.nchh.org/Program/EPACertifiedLeadRenovatorTrainingRRP/HEPA.aspx

For more information, see wspehsu.ucsf.edu/pcbsinschools

REFERENCES

1. Herrick, R.F., J.H. Stewart, and J.G. Allen, *Review of PCBs in US schools: a brief history, an estimate of the number of impacted schools, and an approach for evaluating indoor air samples.* Environ Sci Pollut Res Int, 2016. **23**(3): p. 1975-85.
2. Brown, K.W., et al., *PCB remediation in schools: a review.* Environ Sci Pollut Res Int, 2016. **23**(3): p. 1986-97.
3. Ludewig, G. and L.W. Robertson, *A primary objective of the 2008 workshop was to bring these scientists together in one location to facilitate interactions and the exchange of information.* Preface. Environ Int, 2010. **36**(8): p. 813.
4. Marek, R.F., et al., *Airborne PCBs and OH-PCBs Inside and Outside Urban and Rural U.S. Schools.* Environ Sci Technol, 2017. **51**(14): p. 7853-7860.
5. Robertson, L.W. and G. Ludewig, *Polychlorinated Biphenyl (PCB) carcinogenicity with special emphasis on airborne PCBs.* Gefahrst Reinhalt Luft, 2011. **71**(1-2): p. 25-32.
6. Lehmann, G.M., et al., *Evaluating health risks from inhaled polychlorinated biphenyls: research needs for addressing uncertainty.* Environ Health Perspect, 2015. **123**(2): p. 109-13.
7. Carpenter, D.O., *Exposure to and health effects of volatile PCBs.* Rev Environ Health, 2015. **30**(2): p. 81-92.
8. Hunt, G., J. Stegeman, and L. Robertson, *PCBs: exposures, effects, remediation, and regulation with special emphasis on PCBs in schools.* Environ Sci Pollut Res Int, 2016. **23**(3): p. 1971-4.
9. Trajtman, A.N., K. Manickam, and M.J. Alfa, *Microfiber cloths reduce the transfer of Clostridium difficile spores to environmental surfaces compared with cotton cloths.* Am J Infect Control, 2015. **43**(7): p. 686-9.

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The Western States Pediatric Environmental Health Specialty Unit
A network of experts in reproductive and children's environmental health

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POLYCHLORINATED BIPHENYLS (PCBs) IN SCHOOLS:

How children are exposed, health risks, and tips to reduce exposure

WHAT ARE POLYCHLORINATED BIPHENYLS (PCBs)?

- PCBs are a group of chemicals that are useful in manufacturing and construction. Between 1950 and 1980, many building materials like
  - caulk,
  - fluorescent light fixtures,
  - paint,
  - adhesives and
  - acoustic ceiling tiles with PCB-containing fire-retardant coatings

  were made using PCBs.
- Some studies have also shown that several new coloring agents (azo and phthalocyanine pigments) in paints emit PCBs as a byproduct. However, this level of emission is below regulatory standards.

- It is estimated that between ¼ and ½ of the 48,000 schools built or renovated between 1950 and 1979 may have used these materials containing PCBs[1].
- PCBs were banned in 1979, but many schools built between 1950 and 1980 still contain PCBs.

WHY ARE PCBs A PROBLEM?

Unfortunately, PCBs can also affect human health and the environment. They also take a very long time to break down in the environment and they can be stored in our bodies for a long time.

Caulk and other PCB-containing materials used in buildings between 1950 and 1979 may contain as much as 40% PCBs and can release PCBs into dust and the surrounding air. PCBs from these materials may also contaminate adjacent materials such as masonry or wood. PCBs can also get into dust and soil, especially as materials age[2]. For children who attend school in buildings with PCB-containing materials, inhalation of air containing PCBs may expose them to more PCBs than through foods and skin contact[3-8]

PCBs build up in the body over many years. We are all exposed to very small amounts of PCBs. When girls are exposed to PCBs, they can be stored in their bodies and then expose their fetuses when they become pregnant as adults.

We are still learning about all the ways that PCBs may affect our health. Some of the health effects that may be related to PCB exposure include:

- **neurodevelopment problems in children**
- **cancer**
- **problems in the immune and endocrine systems**

Young children are at higher risk for exposure and health problems from PCBs compared with adults because:

- they eat more and breathe more air per pound of body weight than adults.
- they touch surfaces and then put their hands in their mouths, leading to ingestion of toxic chemicals from dust and surfaces.
- their organs are immature and developing rapidly.
- they have more years in their lives in which to develop health problems related to PCBs exposure.

Pregnant teachers and staff are a concern because:

- Exposures to even low levels of toxic chemicals during pregnancy may affect the developing brain.

HOW DO WE KNOW IF OUR SCHOOL CONTAINS PCBs?

If your school was built between 1950 and 1980 the EPA recommends that schools use best management practices (BMPs) in the building (see below) before they test for the presence of PCBs. BMPs can reduce the presence of germs, allergens and other toxic chemicals that collect in dust as well as PCBs. After implementing BMPs, if there is still concern about PCBs, your school should consult the Regional EPA PCB Coordinator about testing the air rather than caulk or other building materials. If the air levels are above the EPA's suggested levels, your school should follow up with your regional EPA PCBs Coordinator (see Resources).

HOW CAN CHILDREN AND STAFF BE EXPOSED TO PCBs IN SCHOOLS?

When PCB-containing building materials age, they may release:

- PCBs into dust on surfaces, into the air, and into soil outside.
- PCBs may also migrate into adjoining materials. For example, caulk can migrate into the surrounding masonry or bricks. These materials can then also release PCBs into the environment.

Children can be exposed by:

- inhaling PCBs in the air into their lungs.
- touching contaminated surfaces and absorbing PCBs through their skin,

- putting their hands in their mouths and ingesting PCBs that may be in dust.

Young children may be at increased risk of exposure to PCBs because they put their hands in their mouths often.

WHAT CAN WE DO ABOUT PCBs IN SCHOOLS?

All schools built between 1950 and 1980 are advised by the EPA to use "best management practices" (BMPs) and to remove PCB light ballasts. While removal of the materials that contain PCBs is the safest, it is often not possible because of the costs.

IMPLEMENTING BMPs: START A GREEN CLEANING PROGRAM!

A Green Cleaning Program will help reduce the risk of exposure to PCBs. It will also reduce the risk of exposure to germs, allergens and some other toxic chemicals commonly found on building surfaces and in dust.

- **Choose cleaning products certified by an independent third-party agency as safer**. This will also reduce exposure to toxic chemicals often found in many cleaning products. (See Resources, below, for third party certifiers.)

- **Clean the inside of buildings frequently to remove dust residue using damp microfiber cloths and mops.** Removing PCB particles from surfaces and in dust reduces exposure through skin contact as well as through ingestion (eating) of dust on hands while eating food or mouthing toys.
- **Microfiber is much better at holding on to particles** than cotton[9]. It also picks up germs and allergens better.[9] A good microfiber mop and an all-purpose cleaner have also been shown to pick up as many germs as a cotton mop and a disinfectant.
- **Wash all microfiber separately** in hot water without fabric softener (cotton fibers and fabric softener will gum up the microfibers and reduce its effectiveness). This will help maintain its ability to absorb dust and water.

- **Do not sweep with dry brooms or use dry cloths** for dusting– they will just stir particles into the air where they can be inhaled.

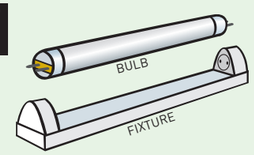
- **Wash hands with soap and water often,** particularly before eating and drinking. Dust on hands gets into the body when children are eating if they haven't washed their hands.
- **Wash toys frequently with soap and water.**

- **Use a vacuum with a HEPA filter** to reduce dust containing PCBs, allergens and other toxic chemicals often found in dust.
  - The EPA defines a HEPA vacuum as "a vacuum cleaner which has been designed with a high-efficiency particulate air (HEPA) filter as the last filtration stage. A HEPA filter is a filter that is capable of capturing particles of 0.3 microns with 99.97% efficiency. The vacuum cleaner must be designed so that all the air drawn into the machine is expelled through the HEPA filter with none of the air leaking past it." (40 CFR 745.83) Unfortunately, there is no approved method to test HEPA vacuums to determine whether they meet EPA's requirement that no air leaks around the HEPA filter.
  - Slow, steady vacuuming keeps dust from flying up into the air and allows the vacuum the chance to effectively remove and contain particles and dust.
  - Make sure the vacuum is equipped with a beater bar when vacuuming carpets and rugs.
- **Implement an Indoor Air Quality improvement program.** The EPA's Indoor Air Quality Tools for Schools Action Kit is a great place to start (See Resources).

  - **Delivery of outdoor air** into the school and removing air containing PCBs through ventilation reduces exposure to PCBs from inhalation.

  - **Ensure ventilation systems are operating as designed** to maintain adequate fresh air flows. Change filters per manufacturer recommendation. Use MERV 8 or better filters for effective particle filtration.
  - **In some schools, lowering PCB levels in air through ventilation may be too costly.** Replacing windows/caulk in these cases will provide energy savings and save money.
  - In cases where PCB air levels are very high, ventilation and BMPs can lower levels, but not always below the recommended levels, especially for young children. In these cases, replacing caulk/windows is the only way to reduce PCBs in air to safe levels.

REMOVE OLD FLUORESCENT LIGHT FIXTURES



In addition to starting a green cleaning program, it is recommended that schools **remove fluorescent light fixtures** that may contain PCBs:

- Fluorescent light fixtures manufactured before July 1, 1979 may contain PCBs. Fixtures that do not have any risk of containing PCBs should have a label saying "No PCBs." If the ballasts do not have this label, they are at risk of containing PCBs.
- Many light fixtures containing PCBs that are still in use are beyond the life expectancy of their ballasts, increasing the risk of leaks, ruptures and even fires. This will result in release of PCBs. Replacement of fluorescent fixtures with LED fixtures will result in future energy cost savings. This will offset the cost of replacement over time, as well as making the building safer. Fixtures should be removed by a contractor, or by maintenance staff personnel who are familiar with PCB removal procedures. The EPA has guidance for replacing these fixtures (see Resources).