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Polychlorinated Biphenyls (PCBs) Research Overview

In 1976, Congress banned the manufacture and use of PCBs because of concern about their health and environmental effects and they were phased out except for certain limited uses in 1979. PCBS have been used in various commercial products including caulking, electronics, fluorescent light ballasts and other building materials from the 1950s to the late 1970s. Buildings built or renovated during that time may contain PCBs in caulking and other materials.

PCBs are regulated by the Toxic Substance Control Act (TSCA) Title 40, Part 761 (enacted in 1976). Unless specifically authorized, current regulations require the removal of materials using PCBs if their content are over 50 parts per million (ppm). However, there is no federal requirement for testing of materials so the amount of PCBs in materials and PCB emissions are often unknown.

Solutions through Research

In response to concerns raised by the public about PCBs in schools, EPA announced in the fall of 2009 a series of steps that building owners and school administrators should take to reduce exposure to PCBs that may be found in caulk and other materials in buildings constructed during this timeframe. EPA scientists also began researching PCB sources, evaluating potential routes and pathways of exposure, and studying mitigation and remediation methods in 2009. EPA released the results of this research in five studies and a literature review. In November 2012, EPA used the results of this research to update its guidance to building owners and school administrators about how to reduce exposures to PCBs that may be found in schools. A summary of the EPA PCB research is summarized below.

Above: Picture of ruptured fluorescent light

Study 1 confirmed that emissions from old caulk causes elevated PCBs in the surrounding air. Old fluorescent light ballasts were also tested for PCB emissions. The emission rates for fluorescent light ballasts containing PCBs were small at room temperature for non-leaking light ballasts but increased significantly at temperatures similar to those reached during operation. Fluorescent lighting fixtures that still contain their original PCB-containing light ballasts have exceeded their designed lifespan, and the chance for rupture and emitting PCBs is significant.

Study 2 concluded that some building materials (e.g., paint and masonry walls) and indoor dust can absorb PCB emissions and become potential secondary sources for PCBs. Once the primary PCB-emitting source is removed, the secondary sources are likely to begin emitting PCBs on their own. Although the rate of emissions is typically lower than emissions from the primary sources, these secondary sources can have large surface areas. These secondary sources may make mitigation more complex. A remediation plan must consider the potential effects of secondary sources.

Study 3 described an emission containment method called “encapsulation,” where PCB sources are coated with a coating material that separates the source from its surrounding environment to reduce PCB emissions. EPA scientists found encapsulation to be a solution to the PCB emissions issue, but it is

*Laboratory Study of Polychlorinated Biphenyl PCB Contamination and Mitigation in Buildings: Part 1. Emissions from Selected Primary Sources, EPA/600/R-11/156, October 2011.

**Laboratory Study of Polychlorinated Biphenyl (PCB) Contamination and Mitigation in Buildings: Part 2 Transport from Primary Sources to Building Materials and Settled Dust, EPA/600/R-11/156A, January 2012.

only effective at reducing air concentrations to desirable levels when PCB content in the source is low. Selecting high-performance coating materials is key to effective encapsulation. Multiple layers of coatings enhance the performance of the encapsulation. Ten commercially available coatings are ranked in the report for effectiveness. Encapsulating sources that contain high levels of PCBs may still be beneficial but may not be sufficient to reduce the air concentration to the desirable level. Thus, encapsulating old caulk can only be used as a temporary measure before the caulk is removed.

Study 4 evaluated another method to reduce exposure to PCBs called Active Metal Treatment System (AMTS), developed by NASA and its collaborators. AMTS eliminates PCBs by dechlorination and can remove PCBs from paint, up to several thousand parts per million, using a form of chemical scrubbing. Results from the study show that the current AMTS can remove PCBs from paint effectively but the method tested is less effective in removing PCBs from thicker sources such as caulk and concrete because of its limited penetration ability. The AMTS method that was tested in this study is not designed to remove PCBs from these other sources. However, NASA recently developed an improved method that could be tested to see if it works to remove PCBs from these other sources.

Study 5 generated limited data for characterizing real-world PCB sources and environmental levels in six schools that were built or renovated from the 1950s to the 1970s. EPA exposure scientists collected air, dust, soil, and surface wipe samples from one old school building scheduled for demolition. From this same school, scientists also collected samples from building materials like caulk, tile and paint. In addition, scientists used environmental and building material PCB measurement data provided by EPA Region 2 that was gathered from five schools by the New York City School Construction Authority. The measurement data collected from these five schools included measurements from the schools before mitigation methods were implemented and after mitigation methods were implemented. A model was used to predict exposures that a typical student might experience based on the PCB measurement data. The measurements collected from the five New York City schools following PCB mitigation actions were inputted into the model and it predicted that less than 1% of the students would have exposures exceeding the reference dose following mitigation. Not surprisingly, the identified sources of PCBs were caulk and light ballasts containing PCBs—similar to the sources identified by the EPA laboratory study (see above).

"The *Literature Review of Remediation Methods for PCBs in Buildings*" compiled and categorized the various studies and reports about methods to remediate PCB contamination in buildings.

For more information on PCBs in school research:
www.epa.gov/pcbsincaulk/caulkresearch.htm

For more information on EPA guidance for PCBs in schools: http://www.epa.gov/pcbsincaulk/

For more information on PCBs in light ballasts:
http://www.epa.gov/epawaste/hazard/tsd/pcbs/pubs/ballasts.htm

For more information on the New York City Schools and EPA PCB efforts:
http://www.nycsca.org/Community/Programs/EPA-NYC-PCB/Pages/default.aspx

***Laboratory Study of Polychlorinated Biphenyl (PCB) Contamination and Mitigation in Buildings: Part 3. Evaluation of the Encapsulation Method, EPA/600-12/156B, April 2012.

****Laboratory Study of Polychlorinated Biphenyl (PCB) Contamination and Mitigation in Buildings: Part 4. Evaluation of the Activated Metal Treatment System (AMTS) for On-site Destruction of PCBs, EPA/600/R-11/156C, December 2012.

***** Polychlorinated Biphenyls (PCB) in School Buildings: Sources, Environmental Levels and Exposures, January 2013.

******EH&E. Literature Review of Remediation Methods for PCBs in Buildings, EPA/600/R-12/034, January 2012.