School Action Levels and Temporary Occupancy Options for PCBs in Indoor Air of Schools

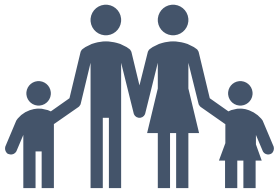
Sarah Owen, PhD

State Toxicologist

PCB Symposium
November 1, 2023

VERMONT
DEPARTMENT OF HEALTH

PCBs can affect our health in many ways



Cancer	Noncancer
• Breast • Liver • Melanoma	• Immune • Reproductive • Nervous • Endocrine

PCBs increase our risk of getting cancer

PCBs cause malignant melanoma, and are associated with non-Hodgkin lymphoma, breast and liver cancer.

- Environmental Protection Agency:
  probable human carcinogens
- International Agency for Research on Carcinogens:
  carcinogenic to humans
- National Toxicology Program:
  reasonably anticipated to be human carcinogens
- National Institute for Occupational Safety and Health:
  potential occupational carcinogens

PCBs have negative effects on the immune system

- Studies have revealed serious effects on the immune system after exposure to PCBs:
  - Significant decrease in the size of the thymus gland, which is critical to immune systems of infants
  - Reductions in the response of the immune system
  - Decreased resistance to Epstein-Barr virus and other infections
- PCBs suppress the immune system, which is thought to be a reason why PCBs also cause cancer.

PCBs have long-lasting effects on the reproductive system

- Studies have shown potentially serious effects on the reproductive system:
  - Reduced birth weight
  - Reduced conception rate
  - Reduced live birth rates
  - Reduced sperm counts
- High exposure to PCBs in certain populations showed:
  - Decreased birth weight
  - Significant decrease in gestational age

PCBs have negative effects on nervous system development

- Proper development of the nervous system is critical for early learning and can impact the health of individuals throughout their lives.
- Studies have shown PCBs affect nervous system development:
  - Significant and persistent deficits in neurological development, including visual recognition, short-term memory and learning
  - Learning deficits and changes in activity after exposure to PCBs

PCBs can impact the level of thyroid hormone

- Thyroid hormone levels are critical for normal growth and development.
- Studies have shown that PCBs:
  - Decrease thyroid hormone levels, which results in developmental deficits, including decreased hearing
  - Are associated with changes in thyroid hormone levels in infants

At BHS, indoor air levels of PCBs were as high as 6,300 ng/m^3

Release of Airborne Polychlorinated Biphenyls from New Bedford Harbor Results in Elevated Concentrations in the Surrounding Air

Andres Martinez,*[,†] Bailey N. Hadnott,[†] Andrew M. Awad,[†] Nicholas J. Herkert,[†] Kathryn Tomsho,[‡] Komal Basra,[‡] Madeleine K. Scammell,[‡] Wendy Heiger-Bernays,[‡] and Keri C. Hornbuckle*[,†]

[†]Department of Civil & Environmental Engineering, IIHR-Hydroscience and Engineering, 4105 Seamans Center for the Engineering Arts and Sciences, The University of Iowa, Iowa City, Iowa 52242, United States

[‡]Department of Environmental Health, Boston University School of Public Health, 715 Albany Street, T4W, Boston, Massachusetts 02118, United States

Supporting Information

ABSTRACT: Qualitatively and quantitatively, we have demonstrated that airborne polychlorinated biphenyl (PCB) concentrations in the air surrounding New Bedford Harbor (NBH) are caused by its water PCB emissions. We measured airborne PCBs at 18 homes and businesses near NBH in 2015, with values ranging from 0.4 to 38 ng m^{-3}, with a very strong Aroclor 1242/1016 signal that is most pronounced closest to the harbor and reproducible over three sampling rounds. Using U.S. Environmental Protection Agency (U.S. EPA) water PCB data from 2015 and local meteorology, we predicted gas-phase fluxes of PCBs from 160 to 1200 μg m^{-2} day^{-1}. Fluxes were used as emissions for AERMOD, a widely applied U.S. EPA atmospheric dispersion model, to predict airborne PCB concentrations. The AERMOD predictions were within a factor of 2 of the field measurements. PCB emission from NBH (110 kg year^{-1}, average 2015) is the largest reported source of airborne PCBs from natural waters in North America, and the source of high ambient air PCB concentrations in locations close to NBH. It is likely that NBH has been an important source of airborne PCBs since it was contaminated with Aroclors more than 60 years ago.

DOI: 10.1021/acs.estlett.7b00047
Environ. Sci. Technol. Lett. 2017, 4, 127−131

At BHS, indoor air levels of PCBs were as high as 6,300 ng/m^3

Release of Airborne Polychlorinated Biphenyls from New Bedford Harbor Results in Elevated Concentrations in the Surrounding Air

Andres Martinez,*[,†] Bailey N. Hadnott,[†] Andrew M. Awad,[†] Nicholas J. Herkert,[†] Kathryn Tomsho,[‡] Komal Basra,[‡] Madeleine K. Scammell,[‡] Wendy Heiger-Bernays,[‡] and Keri C. Hornbuckle*[,†]

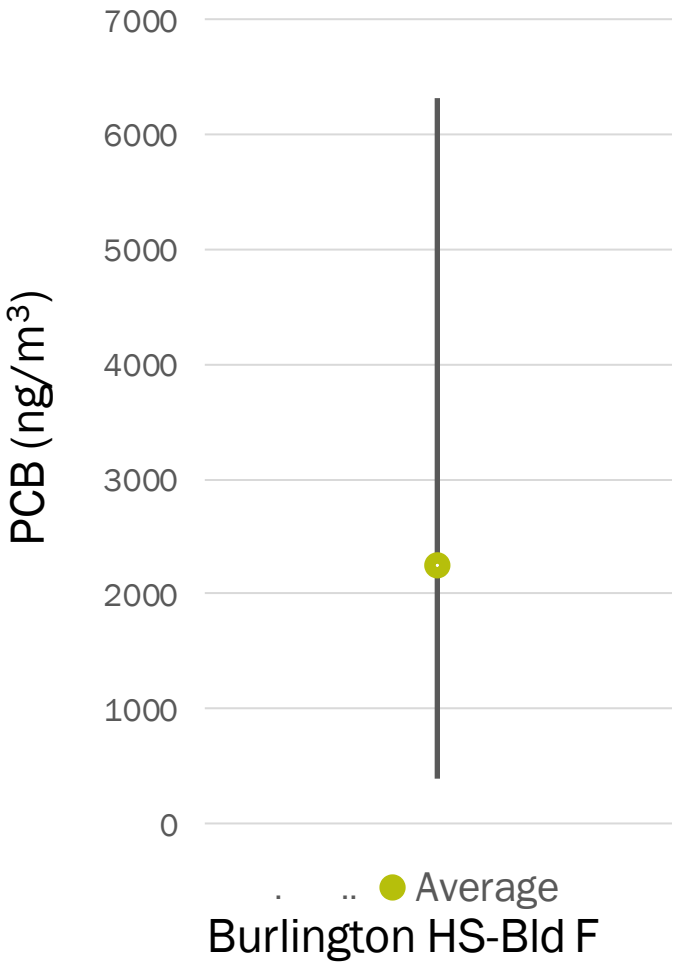
[†]Department of Civil & Environmental Engineering, IIHR-Hydroscience and Engineering, 4105 Seamans Center for the Engineering Arts and Sciences, The University of Iowa, Iowa City, Iowa 52242, United States

[‡]Department of Environmental Health, Boston University School of Public Health, 715 Albany Street, T4W, Boston, Massachusetts 02118, United States

Supporting Information

ABSTRACT: Qualitatively and quantitatively, we have demonstrated that airborne polychlorinated biphenyl (PCB) concentrations in the air surrounding New Bedford Harbor (NBH) are caused by its water PCB emissions. We measured airborne PCBs at 18 homes and businesses near NBH in 2015, with values ranging from 0.4 to 38 ng m^{-3}, with a very strong Aroclor 1242/1016 signal that is most pronounced closest to the harbor and reproducible over three sampling rounds. Using U.S. Environmental Protection Agency (U.S. EPA) water PCB data from 2015 and local meteorology, we predicted gas-phase fluxes of PCBs from 160 to 1200 μg m^{-2} day^{-1}. Fluxes were used as emissions for AERMOD, a widely applied U.S. EPA atmospheric dispersion model, to predict airborne PCB concentrations. The AERMOD predictions were within a factor of 2 of the field measurements. PCB emission from NBH (110 kg year^{-1}, average 2015) is the largest reported source of airborne PCBs from natural waters in North America, and the source of high ambient air PCB concentrations in locations close to NBH. It is likely that NBH has been an important source of airborne PCBs since it was contaminated with Aroclors more than 60 years ago.

DOI: 10.1021/acs.estlett.7b00047
Environ. Sci. Technol. Lett. 2017, 4, 127−131



PCBs in school air is a significant contributor to PCB exposure

High levels of PCBs in school indoor air represent the biggest of exposure for students and staff.

DOI: 10.1021/acs.est.7b01910
Environ. Sci. Technol. 2017, 51, 7853−7860

Vermont levels for PCBs in indoor air are based on EPAs framework and levels

	Vermont	US EPA
	Air level (ng/m^3)	
Screening level: *health based*	15	5
School Action levels: *risk management*	30 – 100 (regulatory)	100 – 600 (not regulatory)
Immediate action levels: *needs immediate attention*	90 – 300	490

Polychlorinated Biphenyls (PCBs) in Schools | Vermont Department of Health (healthvermont.gov)

School Action Levels are risk management levels and are based on noncancer health effects.

	Pre-Kindergarten	Kindergarten to Grade 6	Grade 7 to Adult
School Action Level	30	60	100

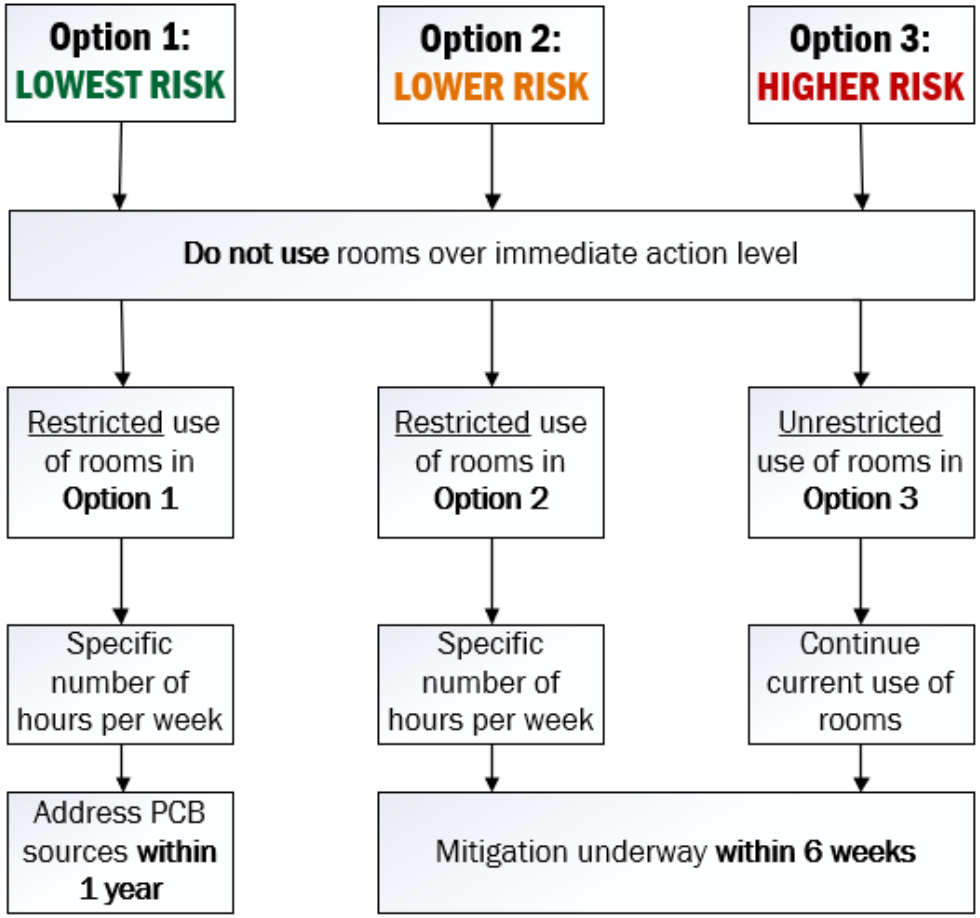
Action levels are risk management levels, and do not replace the screening level (SL).

SALs are calculated using the same exposure assumptions as SL: 235 days a year, 9.75 hours per day.

Calculated based on HI. Highest cancer risk (30 years) 6 in a million

PCBs in Indoor Air of Schools, Development of School Action Levels (healthvermont.gov)

Occupancy options depend on the results within the group and the level of risk the community is willing to accept



PCBs in Indoor Air of Schools, Short-Term Occupancy Options (healthvermont.gov)

Schools will have several options if PCBs are at or above the school action level

Each school will receive an individualized letter detailing results and next steps.

Schools can choose from several occupancy options to reduce exposures to students and staff while working with DEC to address the sources of PCBs.

Schools must stop using rooms three times higher than the immediate action level (IAL) and untested rooms in the same group

We will work with schools to find options that work for them, and support schools to communicate the results and health risks to staff and families.

Room	Group	Result (ng/m^3)	Option 1 30 hours PreK	Option 1 37 hours K-6	Option 1 No limit 7-Adult	Option 2 30 hours PreK	Option 2 37 hours K-6	Option 2 No limit 7-Adult	Option 3 No limit PreK	Option 3 No limit K-6	Option 3 No limit 7-Adult
Room 200	10	Not Tested	Use	Use	Use	Use	Use	Use	Use	Use	Use
Room 201	10	Not detected	Use	Use	Use	Use	Use	Use	Use	Use	Use
Room 203	10	120	Not use	Not use	Not use	Use	Use	Use	Use	Use	Use
Room 206A	10	Not Tested	Use	Use	Use	Use	Use	Use	Use	Use	Use
Room 205	10	Not Tested	Use	Use	Use	Use	Use	Use	Use	Use	Use
Room 102	11	Not Tested	Use	Use	Use	Use	Use	Use	Use	Use	Use
Room 103	11	Not detected	Use	Use	Use	Use	Use	Use	Use	Use	Use
Gym	12	Not detected	Use	Use	Use	Use	Use	Use	Use	Use	Use
Stage	12	Not Tested	Use	Use	Use	Use	Use	Use	Use	Use	Use
Room 103A	13	Not Tested	Not Use	Not Use	Not Use	Use	Use	Use	Use	Use	Use
Room 103B	13	Not Tested	Not Use	Not Use	Not Use	Use	Use	Use	Use	Use	Use
Room 112	13	110	Not use	Not use	Not use	Use	Use	Use	Use	Use	Use
Room 112A	14	Not detected	Use	Use	Use	Use	Use	Use	Use	Use	Use

VERMONT
DEPARTMENT OF HEALTH

Questions?

sarah.c.owen@vermont.gov