State of Vermont PCBs Testing Program in Vermont Schools an Overview

This overview is meant to cover the timeframe from the passage of the legislative mandate to conduct indoor air testing in Vermont schools (July 2021) through to January 2024.

High level elements of the PCB program are provided below and expanded upon within the document.

- To date, no schools that are a part of this program have closed due to elevated concentrations of PCBs in indoor air quality. DEC and Health have worked with schools to balance keeping students in school while maintaining a healthy learning environment.
- 165 schools (51% of schools in the program) have taken the first step in the testing program, approval of a pre-sampling inventory
- 118 schools (36% of schools in the program) have an approved indoor air testing plan
- 61 out of 98 schools (62% of schools) have PCB results below the SAL
- 37 schools indoor air results above the Vermont School Action Level (SAL) (38% of schools)
- 14 schools have indoor air results above the Immediate Action Level (IAL) (14% of schools)
- 17 of the 37 schools have building materials sampling underway or has been completed (46% of schools above the SAL)
- The timeframe to conduct source investigation and mitigation activities has ranged from 3 - 13 months
- Three schools have had some form of PCB removal or cleanup occur
- 3,187 individual indoor air results have been collected; detectable PCB indoor air levels range from 1.4 - 2,600ng/m^3.
- Across 13 schools 369 carbon filtration units have been deployed. Use of carbon filtration has been effective:
    - The average percent reduction of indoor air concentrations is 66%.
    - 93% of spaces have shown decreases in concentrations of PCBs in indoor air
    - 48% of spaces have had indoor air concentrations reduced to below the SAL
    - 7% of spaces retested with units running have not had a decrease in concentrations

Background

Polychlorinated biphenyls (PCBs) are human-made chemicals that were commonly used in building materials and electrical equipment built or manufactured before 1980. Monsanto was the sole manufacturer of PCBs in the United States. The U.S. Environmental Protection Agency (EPA) banned manufacturing and certain uses of PCBs in 1979.

PCBs can cause serious health problems. The potential for health effects from PCBs, as with other chemicals, depends on how much, how often, and how long someone is exposed to them. Numerous studies in both humans and animals have shown that exposure to PCBs can affect the nervous, immune, reproductive and endocrine (hormone) systems. PCBs are also classified as human carcinogens. This means that exposure to PCBs can cause cancer in humans. Additionally, the different health effects of PCBs may be interconnected. This means that if one system of the body is affected by PCBs, it may have significant effects on other systems of the body, which can lead to many serious health problems.

High levels of PCBs in the indoor air of schools represent the biggest exposure for students and staff. PCB levels in the indoor air of schools should be kept as low as possible.

Schools renovated or built before 1980 have a high likelihood of PCBs being present in their building materials. Caulk, paint, glues, mastics, spray on fireproofing, window glazing, fluorescent lighting ballasts, transformers and capacitors are examples of products that may contain PCBs.

In 2021, Act 74 required all public and approved and recognized independent schools built or renovated before 1980 to test their indoor air for PCBs. The original Act passed in 2021 required that all testing be completed by July 1, 2024. This date was extended to 2025 and now to 2027. There are 324 schools in Vermont that were built or renovated before 1980. The Vermont Department of Environmental Conservation (DEC) has the authority to require schools to address releases of PCBs to indoor air and reduce concentrations to health protective levels established by the Vermont Department of Health. Under Act 178, Section 3, $13.5M was set aside for funding the investigation, testing, assessment, remediation and removal of PCBs in schools statewide. $16M was set aside for Burlington High School.

The Department of Health (Health), Department of Environmental Conservation (DEC) and Agency of Education (AOE) worked collaboratively to develop a PCB sampling program for Vermont Schools. School sampling began in June 2022. Guidance for schools and environmental consultants has been developed, distributed and publicly posted 10 days after the school has received the results from the initial indoor air sampling event. All sampling results are publicly available online. To date, 118 of 324 schools have approved work scopes for indoor air sampling.

Current sampling efforts have identified 36 schools where PCBs in indoor air have been detected above health protective levels and assessment and mitigation activities are required.

There is no question that PCBs are toxic chemicals. There is no question that it is time-consuming and costly to remove PCBs from schools. The science on these chemicals is clear; PCBs pose long-lasting health risks to students and staff and the work under this sampling program helps to ensure that PCBs can be reduced and removed in Vermont schools.

School Action Levels

Health developed school action levels in 2021 to prioritize the need for action. The State recognizes that action levels need to protect against health effects of PCBs, both noncancer and cancer, while considering their widespread presence in our environment and the challenges of removing them. The school action levels protect students and staff from unacceptable health risks including increased cancer risk, and toxicity to the immune, reproductive, endocrine and nervous systems.

School action levels (SAL) are based on the amount PCBs found in the indoor air at a school. The State of Vermont has established three different action levels for schools, depending on the age of the students. Younger children tend to have more exposure to PCBs from their diet, so the levels for younger children are more stringent than those for older children and staff. The three school action levels are:

- 30 nanograms per cubic meter (ng/m3) for Pre-K

• 60 ng/m3 for kindergarten to 6th grade

• 100 ng/m3 for 7th grade to adult

The immediate action levels (IAL) are three times higher than the school action levels. Since these levels pose a greater exposure risk, no room at or above these levels will be able to be used. The three immediate action levels are:

• 90 nanograms per cubic meter (ng/m3) for Pre-K

• 180 ng/m3 for kindergarten to 6th grade

• 300 ng/m3 for 7th grade to adult

What we have accomplished

Between June 2021 and January 2024, the following has been completed:

- Approval of pre-sampling inventories of 165 schools (51% of known schools)
- Approval of Indoor air testing of 118 schools (36% of known schools)
- 98 schools currently have publicly available data (30% of public schools to be tested)
- 61 out of 98 schools (62% of schools with publicly available data) have PCB results below the SAL
- 37 schools have indoor air results above the Vermont School Action Level (SAL) (38% of schools with publicly available data)
- 14 schools have indoor air results above the Immediate Action Level (IAL) (14% of schools with publicly available data)
- 17 of the 37 schools have building materials sampling underway or has been completed (46% of schools above the SAL with publicly available data)

One of the largest impediments to timeframes has been waiting for lab results. Lab results have been taking up to 7 weeks for receipt of data.

Number of schools with Bulk Materials Sampling

17 of 37 schools have started building materials sampling as part of the next steps in the testing program. This is the next step that occurs when schools have indoor air exceedances of the SAL.

Number of schools with Cleanup Documents

Cleanup documents can be very detailed and take some time to prepare. There are two documents that DEC requires. An Evaluation of Corrective Action Alternatives (ECAA). This document is meant to evaluate all of the potential cleanup alternatives, their cost, timeframe, effectiveness and community support. The selected alternative from the ECAA is then prepared in the Corrective Action Plan (CAP). This document is detailed with both the scope of the corrective action, the cost and serves as Notification to EPA.

Two schools have submitted an ECAA as part of the remediation process: Cabot and Twin Valley Elementary.

Two schools have approved CAPs. Oak Grove for replacement windows and Twin Valley Elementary for removal of PCB building materials. An Interim Measures Mitigation Plan for

North Country Union High School to apply a coating over building materials that have high concentrations of PCBs in them.

Timeframes

The timeframe to conduct source investigation and mitigation activities has ranged from 3 - 13 months.

Timeframes for schools working through the ECAA and CAP process have ranged from 9 – 15 months. Implementation timeframes for the approved CAPs or mitigation plans has been days to weeks. The exception being Oak Grove where the window replacement was delayed until summer break.

Memorandum of Understanding with EPA

ANR is working with EPA's Region 1 in developing a Memorandum of Understanding (MOU) to define roles and responsibilities of state and federal regulations related to cleanup of PCBs in Vermont schools. The memorandum is currently under legal review at EPA. When signed by both parties the MOU will streamline state and federal roles related to the cleanup of PCBs in schools.

Indoor Air Results

3,187 individual indoor air results have been collected between June 2021 and January 2024. Detectable PCB indoor air levels range from 1.4 - 2,600ng/m^3.

Continuing to Occupy Schools

To date, no schools have closed due to elevated concentrations of PCBs in indoor air quality. DEC and Health have worked with schools to balance keeping students in school while maintaining a healthy learning environment.

Health has developed several temporary occupancy options to help schools balance in person learning and limit student and staff exposure to PCBs. These options allow the school to maintain use of current spaces under the IAL with a requirement to start work to address the source(s) of PCBs within 6 weeks. The tables below indicate various occupancy options schools have selected. Most schools have selected temporary occupancy options 2 or 3.

Occupancy Option	Number of Schools	Percent of Schools
Ancillary	10	27%
Option 1	12	33%
Option 2	9	24%
Option 3	6	16%
Total > SAL	37	100%

- **Option 1:** Use all tested rooms less than the school action level. Use untested rooms in a group with no rooms at or above the immediate action level and equal to or less than 50% of rooms at or above the school action level.
- **Options 2**: Use all tested rooms less than the immediate action level and use untested rooms in a group with no rooms at or above the immediate action level.
- **Option 3**:

- Use all tested rooms less than the immediate action level and use untested rooms in a group with no rooms at or above the immediate action level. OR
- Use all tested rooms less than the immediate action level, and all untested rooms for a specific number of hours per week.

Impact to Learning School Operations	Number of Schools	Percent of Schools
Reduced time per week only	2	5%
Some primary spaces not used	11	30%
Reduced time and primary spaces not used	5	14%
No impact	19	51%
Total	37	100%

Where possible schools have reduced or eliminated student or staff time in primary spaces above the SAL by using alternative spaces.

Some schools have been able to change grade levels in affected spaces. The switching of spaces for students and staff has allowed school to continue while limiting exposure. For example, schools with libraries above the SAL have brought materials to classrooms, rather than using the space. Although these are not ideal outcomes, it has allowed consultants to have the time needed to focus on sampling and designing effective mitigation or remedial options to reopen the spaces where indoor air concentrations couldn't be reduced by other mitigation tools to below the IAL or SAL.

In addition, schools have utilized tents, trailers and outdoor spaces to reduce time spent in spaces above the SAL. Reimbursement for installation and setup has been covered by the funding available from the Agency of Education. Some examples of alternative spaces are below:

- Use of other spaces
  - Twin Valley Elementary School is using gym space at a facility in town
- Tents
  - At the beginning of the 2023-24 School Year Bellows Falls Union High School (BFUHS) used tents for classes
- Trailers
  - Brighton Elementary is using trailer for PreK
  - BFUHS is leasing a modular office for use

Air Filter Effectiveness

Activated carbon air filters have been used in primary spaces where detections of PCBs were above the SAL or IAL. When sized appropriately for the spaces carbon air filters have effectively reduced PCBs levels to below the SAL.

Across 13 schools 369 carbon filtration units have been deployed with an approximate cost of $425,995.40, which includes units and all filters. Based on manufacturer information, DEC has targeted 8 months for filter replacements.

The effectiveness of carbon air filter units depends on the space and at what setting the air filter unit is set to. Larger spaces such as gyms and ancillary spaces such as hallways and

bathrooms are not currently spaces where filter units are deployed or effective at reducing PCB concentrations. Testing PCBs levels after air filters have been deploy indicate:

- The average percent reduction of indoor air concentrations is 66%.
- 93% of spaces have shown decreases in concentrations of PCBs in indoor air
- 48% of spaces have had indoor air concentrations reduced to below the SAL
- 7% of spaces retested with units running have not had a decrease in concentrations

Some of the downsides of the filtration units include noise the fan makes when operating at maximum speed. Adjustments have been made at some schools to decrease the noise while maintaining the need to reduce PCBs. Filtration units have proven inefficient in larger areas such as gyms in reducing concentrations in indoor air. Increased electrical usage and potential trip hazards are other downsides of the units. In these large spaces we have reverted to increasing HVAC operations or temporarily not using these spaces.

Discussion of Current Results

Out of 3,187 results detectable PCB indoor air levels range from 1.4 – 2,600 ng/m^3, the maximum level was detected in a primary classroom. The sources of PCBs in this classroom appear to be from multiple sources, but primarily expansion joint materials and window caulk. PCB source sampling data has shown that some of the sources of PCBs in building materials currently consist of light ballasts, adhesives, caulking, paints, compressors, fireproofing, roof materials, window glazing and expansion jointing. Concentrations of PCBs in building materials has informed cleanup activities to reduce concentrations of PCBs in indoor air.

DEC has received technical assistance from the University of Iowa's Superfund Research Program. Under the direction of Dr. Keri Hornbuckle, 19 schools in Vermont have been sampled for emissions of PCBs from building materials and indoor air. The University of Iowa has conducted air sampling and emission sampling.

Air sampling is a measure of PCBs in a space over a period of time (6 weeks). The sampler is lowered from the ceiling and allowed to absorb PCBs that are in the air of the room. These samples are labeled as PAS samples below. Emission testing is the direct measure of the PCBs volatizing from a specific building material.

Emissions have been collected from a range of materials such as painted and bare walls, flooring, expansion joint caulks, and different adhesives. These samples are labeled as PES samples below. Results of emission indicate a wide range of results depending on the material.

The highest emission results to date have been from a concrete masonry unit (CMU) near an expansion joint caulking with a result of 480,000 ng/m^3 day. University of Iowa's data has been helpful in planning next steps in investigations, mitigations and remediation. The figure below summarizes samples collected by Dr Hornbuckle's team.

Total Deployed Sample Count	(total count includes school that do not have results yet)
Total	465

PUF-PES	PUF-PAS	Field Blank
230	174	61

School Count	
Total	19
Completed	12

Emissions Range	
min	30 ng/m2/d
max	480000 ng/m2/d

Air Concentration Range	
min	2 ng/m3
max	5700 ng/m3

The testing program's next steps are to evaluate the relationship between volatilization from building material and impact to indoor PCB air levels. This will help us better understand material impacts to indoor air, materials to target for removal and possible projected costs of PCB remediation.

What's Remaining

As noted above, 51% of schools have started the PCB testing program. Additionally, the first quarterly monitoring, building material sampling, ECAA and CAP phases are currently occurring where PCBs are above the SAL. It is expected that the costs of corrective action will be dependent on the corrective action approach chosen. All costs to date have been paid by the State of Vermont.

School Name	Action	Timeframe (Months)	Costs	Cost To Date
Cabot School	Working on ECAA	15	$915,013 (proposed demolition only)	$ 88,153.00
Oak Grove	Window replacement CAP	11	$326,796	$ 382,445.90
Twin Valley Elementary	Implementing interim CAP	9	$2,096,687.00	$ 2,324,955.44
North Country Union High School	Source investigation and Mitigation	8	$489,000.00	$ 681,604.74
Range of materials and indoor air sampling	Materials and indoor air sampling		$16,000 (low)	$82,000 (high)
Range of quarterly Indoor Air (IA) monitoring	Quarterly IA monitoring		$26,000 (low)	$72,000 (high)
Range of ECAA development	ECAA development		$13,000 (low)	$19,000 (high)
Range of CAP Development	CAP development		$35,300 (only one completed)	

For schools with an exceedance of school action levels, the following table presents cost ranges for building material sampling, quarterly indoor air monitoring and ECAA and CAP development to date.

Materials and indoor air sampling	$16,500 (low)	$82,400 (high)
Quarterly IA monitoring	$26,200 (low)	$71,800 (high)
ECAA development	$13,100 (low)	$18,800 (high)
CAP development	$35,300 (only one completed)	

Current DEC and Agency of Education costs

	Remaining
DEC ($4.5M) Environmental Contingency Fund (ECF)	*$1,074,000*
Proposed transfer from Solid Waste Management Fund (FY24 BAA)	*$3,500,000*
DEC Total	**$4,574,000**
AOE Statewide 13.5M (Ed Fund)	**$9,162,000**
AOE BHS $16M (Ed Fund)	**$16,000,000**

Schools and results

The table below lists minimum and maximum Total Reportable PCBs for schools with publicly available data. ND = non detect. Schools with all NDs have a blank in Max Total Reportable PCBs.

School(s) Name	DEC site number	Min Total Reportable PCBs	Max Total Reportable PCBs	unit
Academy School	20225091	ND	27	ng/m3
Alburgh Community Education Center	20225102	ND	21	ng/m3
Barton Graded School	20225104	ND	4.9	ng/m3
Bellows Falls UHS #27	20225206	ND	880	ng/m3
Bellows Free Academy Middle/Hs (Fairfax)	20225114	ND	17	ng/m3
Berkshire Elementary School	20225118	ND	210	ng/m3
Bethel Elementary and White River Middle Schools	20225106	ND	27	ng/m3
Blue Mountain Us #21	20225132	ND	7.4	ng/m3
Bradford Elementary School	20225204	ND		ng/m3
Bridport Central School	20225145	ND	8.9	ng/m3
Brighton Elementary School	20225174	ND	200	ng/m3
Brookfield Elementary School	20225205	ND		ng/m3
Brownington Central School	20225127	ND	22	ng/m3
Cabot School	20225101	ND	230	ng/m3
Cavendish Town Elementary	20225105	ND		ng/m3
Champlain Elementary School	20225147	ND	48	ng/m3
Charleston Elem School	20225208	ND	67	ng/m3
Charlotte Central School	20225112	ND	110	ng/m3
Chester Andover Us #29	20225170	ND	26	ng/m3
Clarendon Elementary School	20235291	ND	160	ng/m3
Concord School	20225153	ND	57	ng/m3
CP Smith School	20225129	ND	9.1	ng/m3

School(s) Name	DEC site number	Min Total Reportable PCBs	Max Total Reportable PCBs	unit
Currier Memorial Us #23	20225094	ND		ng/m3
Danville School	20225122	ND	110	ng/m3
Derby Elementary School	20225142	ND	31	ng/m3
Dover Elementary School	20225194	ND	52	ng/m3
Dummerston Schools	20225143	ND	130	ng/m3
Early Essential Education/Burlington Preschool Program	20225095	ND	2.8	ng/m3
Elm Hill School	20235190	ND		ng/m3
Enosburg Falls Elementary School	20225117	ND	28	ng/m3
Fairfield Center School	20225154	ND	36	ng/m3
Fisher School	20235359	ND	2.9	ng/m3
Fletcher Elementary School	20225152	ND		ng/m3
Georgia Elem/middle School	20235303	ND	21	ng/m3
Green Mountain UHS #35	20225171	ND	600	ng/m3
Green Street School	20225100	ND		ng/m3
Hartford Mem Middle School	20235301	ND	9.5	ng/m3
Highgate Elementary School	20225155	ND		ng/m3
J F Kennedy Elem School and Winooski Middle School and Winooski High School	20225092	ND	7	ng/m3
J J Flynn School	20225128	ND	7.5	ng/m3
Jamaica Village School	20225140	ND	10	ng/m3
Leland And Gray UHS #34	20225198	ND	250	ng/m3
Ludlow Elementary School	20225123	ND	9.1	ng/m3
Lunenburg/Gilman Schools	20225200	ND	56	ng/m3
Main Street Middle School	20225193	ND	6.9	ng/m3
Marlboro Elementary School	20225141	ND	150	ng/m3
Middlebury Union High School	20225211	ND	96	ng/m3
Millers Run School Us #37	20225201	ND		ng/m3
Montessori of Central Vermont	20225146	ND	3	ng/m3
Monument Elementary	20225156	ND	36	ng/m3

School(s) Name	DEC site number	Min Total Reportable PCBs	Max Total Reportable PCBs	unit
Mt Holly School	20194905	ND		ng/m3
Newport City Elem Schools	20225099	ND	34	ng/m3
Newport Town School	20225173	ND		ng/m3
North Country UHS #22b	20225157	ND	2600	ng/m3
Northeast Primary School	20225175	ND		ng/m3
Oak Grove School	20225090	ND	120	ng/m3
Pacem School	20235294	ND	160	ng/m3
Patricia A. Hannaford Career Center	20225115	ND	180	ng/m3
Peacham Elementary School	20225169	ND		ng/m3
Poultney Elementary School	20225136	4.7	160	ng/m3
Poultney High School	20225176	ND	110	ng/m3
Pownal Elementary	20225192	ND	29	ng/m3
Proctor Elementary School	20225178	ND	73	ng/m3
Proctor Jr/Sr High School	20225137	ND	14	ng/m3
Putney Central School	20225144	ND	6.2	ng/m3
Richford Elementary School	20225097	ND	10	ng/m3
Rick Marcotte Central School	20225126	ND	8.2	ng/m3
Riverside Middle School	20235360	ND	38	ng/m3
Rutland Town Elem School	20225177	ND	170	ng/m3
Saint Paul's School	20235223	ND	61	ng/m3
Shaftsbury Elementary	20235215	ND	27	ng/m3
Sheldon Elementary School	20225119	ND	67	ng/m3
Soar Learning Center	20225103	ND	110	ng/m3
South Royalton Elementary and White River Valley High School	20225133	ND	14	ng/m3
St Albans City School	20225098	ND	83	ng/m3
St Johnsbury School	20235251	ND	12	ng/m3
Sustainability Academy At Lawrence Barnes	20225096	ND		ng/m3
Swanton Schools	20225203	ND		ng/m3
The Arlington School	20235226	ND	7.9	ng/m3

School(s) Name	DEC site number	Min Total Reportable PCBs	Max Total Reportable PCBs	unit
Troy Elementary School	20225209	ND		ng/m3
Twin Valley Elementary School	20225121	ND	830	ng/m3
Twin Valley Middle High School	20225093	ND	77	ng/m3
Twinfield Us #33	20225131	ND	310	ng/m3
U-32 Middle High School	20235225	ND	210	ng/m3
Union Elementary School	20104036	ND	5.6	ng/m3
Union Street School	20225183	ND	17	ng/m3
Vergennes Union Elementary School #44	20235212	ND	5.3	ng/m3
Vergennes Union High School #5	20235252	ND	6.2	ng/m3
Vernon Elementary School	20225125	ND	57	ng/m3
Wallingford Village School	20225210	ND	120	ng/m3
Warren Elementary School	20184808	ND	70	ng/m3
Waterford Elementary School	20225124	ND	22	ng/m3
West Rutland School	20225135	ND	13	ng/m3
Westminster Schools	20225120	ND		ng/m3