Environmental Health and Safety Study in Washington's K–12 Schools

Report to the Washington State Legislature
December 2022

ENVIRONMENTAL & OCCUPATIONAL HEALTH SCIENCES
UNIVERSITY of WASHINGTON | SCHOOL OF PUBLIC HEALTH

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To date, approximately $577 million in settlements and jury judgments have been awarded as a result of the improper management of leaking polychlorinated biphenyls (PCBs) containing light ballasts on one Washington state school campus. Significant media coverage of the events occurred ahead of the 2022 legislative session, prompting some members to question the current state of school health and safety.

In response, the Legislature appropriated funding in the ESSB 5693 operating budget[1] for the Washington State Department of Health to contract with the University of Washington Department of Environmental & Occupational Health Sciences to develop a report regarding school environmental health policies, recommendations, and standards.

Project goals

The objectives of this report were to:

- Summarize the current literature and resources on PCB exposure standards and remediation levels for children and for school-specific facilities (e.g., buildings and grounds).
- Characterize the oversight activities of Washington's Local health jurisdictions regarding environmental health and safety in K–12 schools.
- Conduct a content analysis of K–12 school-specific environmental health and safety policies and regulations in other states with similar public health oversight responsibilities, including summarizing inspections, management, control, and remediation requirements related to PCBs, lead, asbestos, poor ventilation, and mold.
- Compare Washington K–12 school-specific environmental health and safety standards and activities to other states' standards and activities.
- Recommend policy options and next steps.

Methods

This study used a mixed-methods approach to achieve the above research goals, including narrative literature review, semi-structured key informant interviews, directed content analysis, and an online survey collection tool.

Findings

PCB regulations, guidelines, and resources

- PCBs, widely used in building materials manufactured between 1950 and 1979, are regulated at the federal level by the US Environmental Protection Agency's (EPA) Toxic Substances Control Act (TSCA) (40 CFR Subchapter R), with the same rules for schools as for other building use types.

- Use of building materials (e.g., caulking, adhesives, paints, etc.) that contain PCBs at concentrations greater than or equal to 50 parts per million (ppm) is prohibited under TSCA; however, there is no requirement to test materials or their volatilization into air.
- Under TSCA, “totally enclosed uses,” including fluorescent light ballasts manufactured between 1950 and 1979 that commonly contain PCBs, are allowed, provided they are intact.
- A leaking ballast is considered a spill and should be addressed according to TSCA rules for cleanup; however, reporting of spills is only required under TSCA when a spill occurs in water or in vegetable gardens or if it exceeds 1 pound (per the Comprehensive Environmental Response, Compensation, and Liability Act). Light ballasts contain between 1 and 1.5 ounces of PCB liquid.
- The EPA has established guideline exposure levels for PCBs in school indoor air. These levels range between 100 and 600 nanograms per cubic meter, depending on the child’s age, and were developed to be equivalent to the EPA’s oral Reference Dose (RfD) of 20 nanograms per kilogram of body weight per day.
- The US Occupational Safety and Health Administration has also established exposure levels; however, these levels were developed in the 1940s, were intended to prevent only certain health effects, and are much higher than the guideline EPA school levels.
- While the number of fluorescent light ballasts replaced or remaining in schools is unknown, we know that approximately 1,681 Washington school buildings (29.5% of all public school–related buildings) were constructed or modernized prior to 1980 and, presumably, are more likely to include PCB-containing building materials, including light ballasts.
- When samples have been taken, PCBs have been found in pre-1980 buildings, including schools. It is therefore likely that PCBs are present in some Washington schools.

Additional information collected and summarized under this section includes numerous resources available to assist in identifying, sampling for, and remediating PCBs in building materials; clear roles and responsibilities related to PCBs in schools and resources to help school building owners and operators; and a summary of three other states that have supplemented TSCA’s rules with their own state regulations on PCBs in schools.

Local health jurisdiction activity survey

- Of the 22 Local health jurisdictions (LHJs) in Washington that completed our survey (representing approximately 90% of public school children across the state), 32% reported they have an existing, routine school program, 32% reported having a program in development, and 36% reported having no program beyond plan reviews.
- For those with routine or developing programs, 17% reported annual routine inspections, 50% reported inspections every two to three years, and the remaining 33% reported inspections for complaints or as requested.
- Nearly 75% report following up with schools when hazards are found, with the remaining 25% not requiring follow-up for corrective actions.
- Chemical hazards in science labs and lighting issues were the two most frequently cited hazards identified in schools, followed by playground hazards, unsafe conditions, and heating, ventilation, and air conditioning (HVAC) or poor air quality issues.
- Only 25% of LHJs survey schools for chemical hazards such as PCBs, asbestos, lead-based paint, lead pipes, hazardous waste storage, or mercury-containing products. Three LHJs reported responding to reports of leaking or smoking PCB-containing light ballasts.

- The most common *complaints* received by LHJs include indoor air quality issues, food safety, mold and moisture issues, and general safety.
- The Washington State Department of Health's (DOH) School Program is the most cited resource for overall training and technical assistance. A DOH and Washington state Department of Ecology program called "Rehab the Lab," now more than 20 years old and no longer supported, is most frequently used for hazardous chemical-related assistance.
- Approximately half of LHJs with routine programs provide technical support to schools when environmental health and safety issues are discovered and where sampling or testing is required. Most issues are related to noise control, pest control, mold and moisture management, HVAC, and water contamination concerns (most of which are beyond existing WAC 246-366 rules or guidance documents).
- Adequate and flexible funding, updated and concise codes with a clear legislative mandate, training and technical support, and dedicated school environmental health and safety personnel were all cited as top barriers to and facilitators for program implementation.

Content analysis of regulations

- Fifteen state regulations were identified for review, with all implemented or updated since 2002, except for Washington's enforceable WAC 246-366 (implemented in 1991). WAC 246-366A (updated and adopted in 2009) has been under an "implementation suspension" since 2009.
- Over 73% of state regulations require school inspections by a local health official. The frequency of these inspections ranged from twice per year (Kentucky) to once every three to five years, depending on the type of school (New Hampshire). Five state regulations require annual inspections. WAC 246-366 requires "periodic" inspections of each school.
- Of those states requiring inspections, over half stipulate that the health official should establish a specific and reasonable time period for corrective action if a violation is found and consequences for noncompliance. WAC 246-366 does not stipulate a corrective action timeline.
- About half of the regulations explicitly call out chemical management, including addressing asbestos, mercury, and radon. Four specify proper use, storage, and disposal of chemicals. Three require schools to develop a chemical hygiene plan. One requires schools to designate a chemical hygiene officer. Rhode Island is the only state found to address PCBs through their required chemical hygiene plan. WAC 246-366 does not explicitly address chemical management requirements or mention any particular chemical, such as PCBs, lead, asbestos, or mercury.
- All codes reviewed (except WAC 246-366) regulate lead levels in drinking water to some degree, with three requiring testing for lead in drinking water outlets at least every five years.
- Eleven of 15 regulations address ventilation, and six specifically require schools to have functioning ventilation systems. Montana is the only state to require the implementation of new air ventilation, cleaning, and filtration technologies. WAC 246-366 addresses ventilation in relation to odor, noise, and mechanical exhaust.
- Twelve of 15 regulations require specific activities related to the prevention of mold and moisture in school buildings. WAC 246-366 does not address mold.

Recommendations

PCB-related solution strategies

Solution strategy 1: Assume PCBs are present in school buildings of a certain age and implement known efficacious interventions.

- ***Require removal of PCB light ballasts and/or documentation of their removal:*** Removing PCB light ballasts is one of four actions the EPA recommends for schools and is relatively uncomplicated compared to other potential interventions.
- ***Support cleaning and ventilation best management practices:*** Establish and fund required cleaning, ventilation, and filtration practices that are known to be effective in reducing PCB exposure as well as having co-health benefits that positively affect children's health and school performance.
- ***Support schools with expertise, information, and outreach opportunities:*** The state could engage in capacity-building to ensure school operators are aware of their responsibilities related to PCBs and make expertise available to schools investigating or addressing PCBs in their buildings.
- ***Require testing of building materials for PCBs prior to school construction projects:*** Test for and remove PCB-containing building materials before starting school renovation or demolition work on buildings built before 1980.

Solution strategy 2: Characterize and quantify PCB hazards in Washington schools, then implement interventions.

- ***Conduct a study to assess the presence and extent of PCB hazards in schools:*** A study of sufficient power could be used to characterize PCB presence and potential exposures to occupants in Washington schools and guide future interventions.
- ***Require inspection and testing for PCBs in schools***: Create a rule similar to Vermont's, requiring inspection and testing for all school buildings built or renovated within a certain time frame (e.g., prior to 1980).

Local health jurisdiction oversight recommendations

Eliminate implementation suspension proviso in 2023 supplemental state operating budget. Discontinue adopting an "implementation suspension" in the upcoming state operating budget and allow the "new" chapter 246-366A WAC *Environmental Health and Safety Standards for Primary and Secondary Schools,* to enter into force on August 1, 2023.

Update WAC 246-366A using evidence-based science to identify priority hazards, effective control methods, and necessary training and technical assistance opportunities. Update codes using an evidence-based approach to identify and prioritize existing and emerging hazards and associated best control practices to help focus both school district and LHJ limited resources. Further study is needed to elucidate priority hazards in Washington schools and identify appropriate efficacious controls.

Update the *Health and Safety Guide for K–12 Schools in Washington* (2003). Revise the guide to reflect the current evidence base for hazard identification and best practices for controlling hazards. The existing guide is nearly 20 years old and based predominately on content from the 30-year-old WAC 246-366. Our study found this guide remains one of the top resources currently used by LHJs.

Invest in school health and safety at all levels, including the Department of Health School Program, educational service districts, local health jurisdictions, and school districts. Funding and resources for building and maintaining environmental health and safety capacity across the system topped the list of concerns for LHJs seeking to develop programs, as well as those committed to sustaining their services. Federal, state, and local key informants all spoke of the need to fund remediation and control activities at the school level and to eliminate barriers that impede efficient interventions.

Background

K–12 school environmental health and safety in Washington

In the state of Washington, there are 322 school districts comprised of 2,370 public schools and an estimated 550 private schools serving children in kindergarten through grade 12. On average, Washington's 49 legislative districts represent approximately 10 school districts, with a range of one (Leg. District 36) to 54 (Leg. District 14). Within public school districts alone, there are approximately 5,704 buildings associated with school-related business.

Local health officers and their designees are responsible for the oversight of K–12 school health and safety in Washington. The existing regulatory tool used to guide inspections, plan reviews, and technical assistance is chapter 246-366 WAC *Primary and Secondary Schools*,[2] originally passed in 1971 and most recently updated in 1991. The tool is limited in scope and fails to address modern hazards and best practices to control these hazards.

In 2009, the Washington State Board of Health adopted chapter 246-366A WAC *Environmental Health and Safety Standards for Primary and Secondary Schools*[3] to update the regulatory guidance to address hazards of concern not addressed in WAC 246-366. However, prior to implementation, the Washington State Legislature adopted a proviso in the state supplemental operating budget (ESHB 1244) "prohibiting implementation until the legislature acts to formally fund implementation."[4] This budget proviso has been continued in each subsequent supplemental operating budget including the most recent, ESSB 5693, effective through June 2023.[1,5]

Polychlorinated biphenyls (PCBs) primer

Introduction

Polychlorinated biphenyls (PCBs) are a class of synthetic chemicals of 209 possible configurations or congeners. Their chemical stability, low flammability, low heat capacity, and low electrical conductivity made them excellent materials for use as coolants, lubricants, plasticizers, and fire retardants in industrial and commercial products. These include transformers, capacitors, and other electrical equipment; oils used in motors; fluorescent light ballasts; insulation materials; adhesives; caulk; oil-based paint; plastics; and carbonless copy paper, among many other uses.[6–8] The US produced commercial PCB mixtures, known by the trade name Aroclor, between 1957 and 1971. Commercial PCBs were synthesized through batch chlorination of biphenyl with chlorine gas, resulting in the production of complex mixtures of PCBs.[7] Thus, Aroclors are mixtures of congeners of varying chlorine weights by percent.[6,9] PCBs were manufactured in the US from 1929 until 1979, when production was banned by the Toxic Substances Control Act (TSCA) under the US Environmental Protection Agency (EPA) (15 U.S.C. §2601 et seq. 1976) and codified in the Code of Federal Regulations (40 CFR § 761). PCBs' classification as persistent organic pollutants (POPs) with global and ecological consequences as well as increasing findings of toxic health effects on people led to decreased manufacturing of PCBs in the early 1970s and eventual ban under TSCA.[7,10]

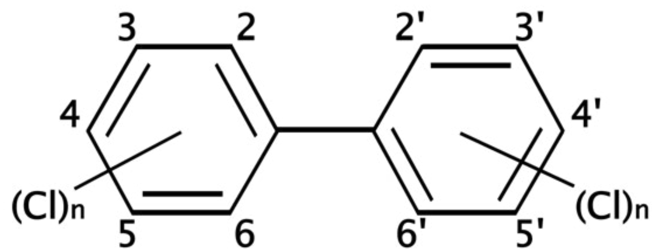
Physical and chemical properties and environmental fate

PCB congeners are biphenyls with chlorine at 209 possible permutations of aromatic ring positions (Figure 1)[11]. Although the 209 congeners have some features in common, their properties vary greatly depending on structural characteristics such as the number of chlorine atoms and the position of the atoms (co-planarity and chirality).[12–15] At room temperature, PCBs are either oily liquids or waxy solids, with differences in volatility depending on the type of congener.[6,16] PCB congeners that are more highly chlorinated are less volatile and are more likely to bioaccumulate, while lower-chlorinated PCBs tend to be more volatile and are more likely to be metabolized, leading to less bioaccumulation.[6,17] Bioaccumulation refers to the accumulation of toxicants in an organism through direct exposure, including through consumption of contaminated food.[18]

PCBs are generally highly resistant to chemical and environmental degradation and tend to accumulate in lipids (fats), thus raising grave concerns regarding biomagnification.[6,12,19] Biomagnification refers to the transfer of toxicants through the food web, with predators accumulating higher concentrations of the chemical than their prey.[18] PCBs are primarily transformed through microbial degradation in environmental media like sediment and metabolism through organisms, resulting in discrepancies between composition of PCB congener mixtures in the environment and original industrial mixtures released into the environment.[12,20,21] Congeners that are highly chlorinated (8-9 chlorines) remain close to the source of contamination.[22] Congeners that are less chlorinated are more volatile and undergo frequent volatilization and deposition cycles, allowing transportation and circulation, even globally. Semi-volatile PCBs are present in air as gas and adsorbed to dust particles.[22–24]

Physiological impacts on organisms

Figure 1: Polychlorinated biphenyl structure[11]



The bioavailability and the rates of absorption, distribution, biotransformation (metabolism), and excretion of PCBs are highly dependent on their molecular structure, specifically the number and positions of chlorines.[13,25] In general, all PCBs are readily absorbed into blood due to their lipophilic properties and distributed to target organs (mainly adipose tissue but also liver, skin, breast milk, and brain).[25,26] Oral absorption of PCBs is highly efficient, with some estimates ranging from 60% to 100%, reaching maximum PCB concentration in blood within 3 to 4 hours after oral administration in rats.[14,27] A minimum of 80% of PCB levels observed in adipose tissue of exposed capacitor workers may have been absorbed via inhalation;[28] a series of nose-only inhalation studies in rats demonstrated that PCBs are absorbed in the lung and distributed systematically in rats,[29,30] with uptake of PCB-11 at 99.8% of inhaled, radio-labeled PCB-11.[31] Dermal absorption rates are both lower and less rapid compared to oral absorption and inhalation, with retention of higher chlorinated (more lipophilic) PCB congeners in fat in the skin.[32,33] It should be noted that while lipophilic PCBs are sequestered in fat-rich tissue, they cannot interact with more sensitive organs. However, they are slowly released into the bloodstream, with significant releases during lipolysis events, increasing the total body burden.[34] In terms of PCB biotransformation, lower chlorinated congeners tend to be more rapidly metabolized compared to higher chlorinated congeners, which are more likely to be retained in adipose tissue.[13] The major routes of excretion of PCBs are fecal and urine, with metabolites primarily excreted through urine. Excretion rates depend on lipophilicity and the extent of metabolism.

Toxicological mechanisms of PCBs are highly dependent on structure.[35,36] Co-planar PCBs have chemical structures and binding activity similar to dioxins. Co-planar PCBs bind to aryl hydrocarbon receptors (AhR) in the cytosol of target cells. This binding causes the ligandreceptor complex to be transported to the nucleus, causing deregulation of normal physiologic function and leading to toxic responses.[37] Many current risk assessments of PCBs use toxicity equivalence factors based on AhR-dependent mechanisms for 12 PCB congeners to assign toxicity weights to each PCB congener by its similarity to 2,3,7,8-tetrachlorodibenzodioxin (TCDD).[38,39]

Health effects

PCBs have been documented to have adverse health effects in both humans and animals in the nervous, immune, reproductive, and endocrine systems.[6,11,16,17,40] Furthermore, PCBs are classified as carcinogenic to humans (Group 1) by the International Agency for Research on Cancer.[41] Additionally, there is increasing evidence that various classes of PCB metabolites can also have toxicities, including carcinogenic, neurologic, and endocrine effects.[9,42,43] Available information about the health effects of PCBs largely comes from studies looking at oral exposures, occupational health studies with relatively high exposures, and animal studies.[6,11,17] Data is extremely limited for the human exposure response relationship for inhaled PCBs, particularly at lower concentrations. As a result, there is very little information on human health effects related to inhaled PCB exposures likely to be encountered by the general public, such as exposures related to time spent in buildings with PCBs.[20,44] A non-exhaustive list of health effects related to PCBs can be seen in Table 1.

Table 1: Summary of human health effects associated with PCBs

- Cancers: malignant melanoma, liver cancer, and others[11,16,17,41]
- Developmental neurotoxicity[16,40]
- Deficits in learning and memory[11,40]
- Immune system suppression[6,17]
    - Increased respiratory infections in children
    - Increased asthma cases
- Endocrine disruption[6,16,17]
    - Earlier puberty in girls
    - Reduced testosterone in men and boys
- Thyroid function suppression[6,16,17]
- Lower birth weight of infants[6,17]
- Cardiovascular disease[6,11,17]
- Hypertension[6,11,17]
- Diabetes[6,11,17]
- Skin irritation[6,16]

The significant variability in structure and properties among PCBs results in different implications for exposure and potential health effects. Historically, there has been more focus on higher chlorinated PCB congeners in relation to health effects as they are more likely to bioaccumulate, stay in the body for longer, and tend to be found in higher concentrations in human serum samples as compared to the lower-chlorinated congeners.[6,17,45] Newer studies, however, have indicated an emerging concern for health effects related to the more volatile lower chlorinated PCB congeners. One study found associations between these types of PCBs and increased risk of cancer in an occupational exposure case study and cardiovascular disease, hypertension, and diabetes in residents living near hazardous waste sites.[11] Others have found toxicological evidence for potential thyroid effects, endocrine disruption, and neurodevelopmental impacts.[46–48] One study in animals found lower-chlorinated PCBs to be more neurotoxic than higher-chlorinated PCBs.[49] These findings indicate that there may be different health implications for inhalation exposures to the more volatile PCBs compared to the types of PCBs found in other exposure sources, such as diet.[11] This may be particularly important for situations where people spend considerable amounts of time in buildings where PCB materials are present and are potentially continuously exposed to airborne PCBs in these spaces.[11,45]

Children are an important population to consider when discussing PCB exposures and health effects. Children are still developing and may be more susceptible to toxic chemicals. In addition to immature metabolism and excretion systems, fat mass tends to decline during childhood, resulting in lower capacity for PCB sequestration in fat-rich tissue. They have more time in their lives for health effects from PCBs to develop, and they are potentially exposed to higher amounts of PCBs relative to adults due to higher rates of breathing and ingestion in proportion to body weight and to increased incidental hand-to-mouth ingestion of PCBs from dusts and surfaces.[50–53] Of particular concern is the association of PCB exposure in children and neurodevelopmental effects.[54]

Sources of and exposure to PCBs

PCB sources

While TSCA halted most new PCB production in 1979, legacy PCBs remain prevalent. For the general population, the most common sources of exposure to legacy PCBs include the food supply and airborne PCBs from buildings with PCB-containing materials.[6,45,51] A more detailed discussion of PCBs in building materials can be seen in Box 1. Other legacy sources include contaminated soil, water, and air near hazardous waste sites. The Agency for Toxic Substances and Disease Registry notes that low concentrations of PCBs have been seen in "almost all" air, soil, sediment, surface water, and animal samples.[6] In addition to legacy exposure sources, PCBs can be found as byproducts in pigmented consumer products such as household paint and can volatilize from these sources or can be inadvertently generated from manufacturing processes.[55–58] These PCB sources are allowable up to 50 ppm in TSCA's excluded manufacturing processes section (40 CFR §761.3). All PCBs found in the environment are due to human activity as there are no known natural sources of PCBs.[6]

PCB exposures

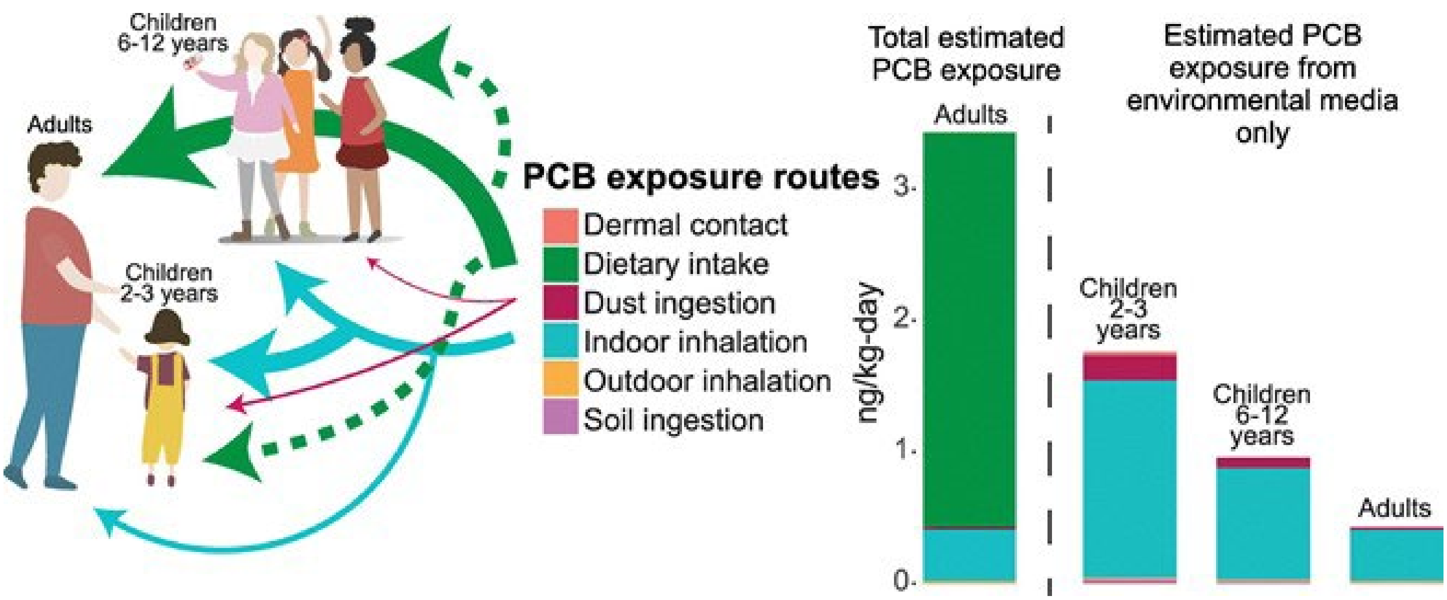
People can be exposed to PCBs through inhalation, oral, and dermal routes of exposure[6] (Figure 2). PCBs can be inhaled as vapors that have volatilized from PCB liquids or materials, or via dust particles to which PCB vapors have adsorbed.[6,59] Ingestion of PCBs occurs via contaminated food such as meat, fish, and poultry; ingestion of contaminated water or breast milk; or hand-to-mouth ingestion of PCB-contaminated dusts and soils.[6,50] Dermal exposure and absorption can occur through skin contact with PCB liquids or PCB-contaminated soil or water.[6]

The contribution of each exposure route to total PCB exposures is not well understood due to the diversity of PCB chemical properties, the concurrence of multiple PCB congeners in mixtures, and limited exposure data.[44] Ingestion of contaminated food has historically been considered the primary exposure route.[6,51] However, recent studies have suggested that inhalation may be a more significant route of PCB exposure than previously believed, particularly for children, though exposures have not been measured, only estimated.

A recent review[51] estimated that dietary intake was the major exposure route for adults, comprising 88% of exposure, followed by indoor air inhalation at 11%, with other routes of exposure being negligible. Due to lack of recent data for dietary PCB exposure for children, this study was only able to make exposure contribution estimates for non-food sources. Inhalation of indoor air was by far the biggest contributor to PCB exposure in children of the environmental media sources. Indoor air inhalation exposure to PCBs was estimated to be nearly four times the rate of adults in 2- to 3-year-olds and two times the rate of adults in 6- to 12-year-olds. This was believed to be due to differences in physiologic and exposure parameters such as body weight in relation to breathing rate and time spent indoors. This study only included data from schools built after 1979 when use of PCB-containing materials was banned, so indoor air inhalation exposures may be underestimated for certain populations.

In another study[44], "inhalation of indoor air was estimated to account for 60.8%, 50.5%, and 34.6% of total exposure, whereas diet accounted for 28.9%, 42.7%, and 62.8% of total exposure for children ages 2 to 3 years, children ages 6 to 12 years, and adults, respectively." This study also points out that absolute and relative indoor air inhalation exposures would be expected to be higher for those spending time in PCB-contaminated buildings. As the Western States Pediatric Environmental Health Specialty Unit concludes, children going to school in buildings with PCB materials may be exposed to more PCBs via inhalation than from their diet.[50]

Figure 2: Estimated contributions of various PCB exposure routes by age (Source: Weitekamp et al. 2021)[51]



PCBs in buildings

As one purpose of this report is to better understand PCB hazards, regulations, and best practices in schools, it is helpful to consider PCB sources and exposures as related to buildings in particular. Between 1950 and 1980, PCBs were widely used in a variety of building materials and in fluorescent light ballasts, which are the part of a fixture that regulates the electrical current.[60,61] Details on PCBs in building materials can be seen in Box 1 and in light ballasts in Box 2. Buildings that were built or renovated in that time frame are likely to have PCBs if they have not had more recent renovation or replacement of PCB-containing materials or equipment.

EPA laboratory research and studies performing air sampling in buildings confirm that PCBs can be emitted from building materials, even decades later.[59,62–64] Studies have also found that intact PCB light ballasts can also emit PCBs.[59] Much like PCB content in building materials, PCB concentrations in indoor air vary widely.[62,65,66] Indoor air PCB concentration will depend on the number, types, and conditions of PCB sources; types and concentrations of PCB congeners in building materials and other sources; type and frequency of cleaning practices; and ventilation and filtration conditions in an indoor area.

Box 1

Building materials

PCBs were widely used in building materials for their flexibility, durability, adherence, and flame-retardant properties.[67] A list of common PCB-containing materials can be seen in Table 2 as well as Figure 3. PCBs have been shown to migrate from building materials into adjoining substrates such as brick or concrete, which are sometimes referred to as secondary sources.[61,67,68] The EPA's "PCBs in Building Materials" fact sheet also states that even after PCB-containing building materials such as caulk have been removed, PCBs can be released from the contaminated substrate into the air or into the PCB-free replacement caulk.[61] One 2016 review[69] summarized data from 25 studies of PCB concentrations in various PCB building materials and secondary sources, with maximum PCB concentrations shown in Table 3. Studies have shown PCB content to vary among materials, finding wide ranges of concentrations even for the same type of material.[62,65,69]

Table 2: Common manufactured products that may contain PCBs found in buildings (from EPA Fact Sheet: PCBs in Building Materials)[61]

- Paint, varnishes, and lacquers
- Non-conducting materials in electrical cables (e.g., plastic and rubber)
- Rubber and felt gaskets
- Coal-tar enamel coatings (e.g., pipe coating) and rust inhibitor coatings
- Insulation materials (e.g., fiberglass, felt, foam, and cork)
- Adhesives and tapes
- Caulk, grout, and joint material (e.g., putty, silicon, and bitumen)
- Pipe hangers
- Plastic applications, including vinyl and PVC
- Galbestos (asbestos-coated metal sheeting)
- Mastics
- Acoustic ceiling and floor tiles
- Asphalt roofing and tar paper
- Synthetic resins and floor varnish
- Sprayed-on fireproofing

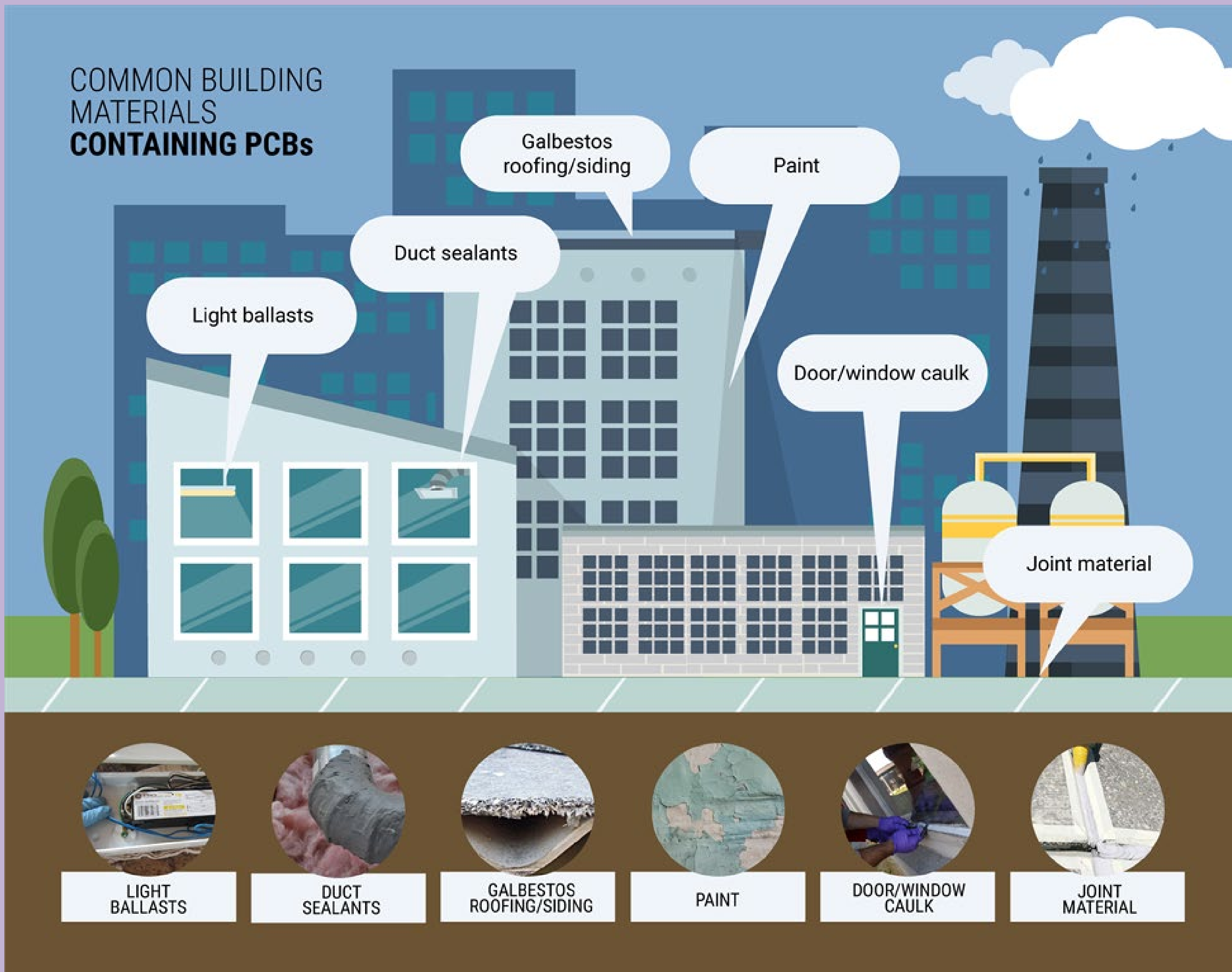
Table 3: Maximum PCB concentrations found in building materials from various studies[a] [69]

Material	Maximum concentration
Primary sources	
Caulking	959–752,000 ppm
Adhesives/mastic	3.9–3,100 ppm
Surface coating	140–255 ppm
Paint	0.7–89,000 ppm
Ceiling tiles	57–51,000 ppm
Light ballast	Up to 100% liquid PCB
Secondary sources	
Insulation materials	0.2–310 ppm
Backer rod	99,000 ppm
Gaskets	4,300 ppm
Polyurethane foam (furniture)	47–50 ppm
Wood	380 ppm
Brick/mortar/cinder block	2.8–1,100 ppm
Concrete	53–17,000 ppm
Non-porous materials	
Metal surfaces	48 µg/100 cm^2
Door frame	102 ppm
Railing	70 ppm

[a]: PCB content varied widely, ranging from non-detectable up to the concentrations seen above.

Box 1 (Continued)

Figure 3: Common building materials containing PCBs (Source: Washington State Department of Ecology)[70]



Box 2

Light ballasts

PCBs were historically used in fluorescent light ballasts because of their insulation and lubricant properties and because they tolerate high levels of heat[71] (Figure 4). PCBs can be found in capacitors (which regulate electrical current and voltage) as a “yellow, oily liquid” or in potting material (which encapsulates and insulates the capacitor) as “a black, tar-like substance.”[71] Capacitors were composed of approximately 50% PCBs prior to the TCSA ban, with some light ballast capacitators containing pure liquid PCBs.[60] The types of fixtures that had PCB-containing capacitators and potting materials were magnetic T12 ballasts with an average lifespan of 10 to 15 years under normal use conditions, or longer if used less frequently, which may be the case in some school settings.[60,72] PCB light ballasts are more likely to leak or rupture if they are used beyond their intended life span.[72] More modern electronic ballasts do not have PCBs, have longer average lifespans, and are more energy efficient.[72]

PCB exposures are most likely to occur if a ballast is leaking, smoking, or has ruptured.[72] Exposure might also occur if there is residue remaining on light fixtures or other materials even after a PCB light ballast has been removed.[62,72] A light ballast leak or rupture is usually an acute exposure event, whereas PCB residues left behind have the potential for chronic exposures if not addressed. PCBs may also be released from intact light ballasts, as confirmed by EPA laboratory studies.[59] One study of New York schools built between 1950 to 1979 measured PCBs in classrooms with 3 to 9 intact PCB light ballasts and found air concentrations ranging between 690 to 1,460 ng/m^3, though PCB-containing building materials may also have contributed to these measurements.[62]

Figure 4: Example of a typical PCB light ballast (Source: EPA)[60]

Methods

This study used a mixed-methods approach, including a narrative literature review, semistructured key informant interviews, directed content analysis, and online survey data collection. Specific methods used for each study objective are outlined below.

PCB literature review

The purpose of the narrative literature review was to serve as a resource for recommendations and best practices pertaining to PCB exposure standards and remediation levels for children and school-specific facilities (e.g., buildings and grounds).

Peer-reviewed journal articles, documents and webpages from government and other institutions, and relevant state and federal regulations were identified using a risk-based framework: Hazard identification, Dose-Response, Exposure, Characterization, and finally Control/Management. Sources used to search relevant materials included the PubMed database and general Google and Google Scholar search engines. Information was then synthesized and reported under two thematic categories:

- PCB primer: Presented in the background section of this report and intended to serve as a general overview of information regarding PCB production and use, chemical and toxicological properties of PCBs, health effects of PCBs, and PCB exposure/hazard characterization.
- PCB regulations, guidelines, and resources: Presented in the findings section of this report and intended as a deeper dive into PCB regulations at the state and federal levels, and practices and resources for characterizing and managing PCB hazards in buildings and schools.

Additionally, a review of state government webpages was conducted to summarize the resources available to the public on PCBs in schools. Searches were conducted using general search engines, as well as the search functions provided on the specific sites. Search topics included general PCB information, PCBs in schools, PCBs in building materials, and PCBs in light ballasts. Government agencies included in the search were the Washington State Department of Health (DOH) and Washington State Department of Ecology (Ecology), EPA's Region 10 PCB Program, each of the 35 Local health jurisdictions, the Office of Superintendent of Public Instruction (OSPI), and each of the Educational Service Districts (ESDs).

Local health jurisdiction activity survey

The purpose of this study's survey was to collect and summarize current school environmental health and safety (EH&S) program activities undertaken by Washington state's Local health jurisdictions (LHJs) and to identify the barriers, facilitating factors, and needs of LHJs for implementing and maintaining successful EH&S programs.

We used a purposive sample approach and invited the school EH&S lead in each of the state's 35 LHJs to complete a web-based survey tool. In cases where no school EH&S lead existed, the jurisdiction's environmental health director was invited to complete the survey.

Contact information was provided by the DOH School Environmental Health & Safety Program Manager. A survey link with an explanation was emailed, along with weekly reminders for one month.

The survey tool was created and distributed via REDCap and featured questions informed by existing state regulations and state and federal guidelines, as well as a previous baseline DOH questionnaire. The following resources provided the basis for activity-based questions:

1. Washington State codes: chapter 246-366 WAC *Primary and Secondary Schools*[2] and Chapter 246-366A WAC *Environmental Health and Safety Standards for Primary and Secondary Schools*[3] (not implemented due to budget proviso).
2. State guidelines: The *Health and Safety Guide for K–12 Schools in Washington* (2003) (*Health & Safety Guide*), DOH and OSPI, developed specifically to guide school health programs per WAC 246-366-140.[73]
3. Local health jurisdiction *School Environmental Health Program Survey,* DOH (2004).[74]
4. Federal guidelines: EPA *Model K–12 School Environmental Health Program*, a comprehensive strategy for preventing and addressing environmental health issues in schools.[75]

Survey questions covered current school inspection activities, resources used by LHJs for developing programs and health recommendations, frequent violations and corrective action taken by LHJs, capacity for LHJs to offer support to schools, needs and barriers of school programs, and specific chemical hazard activities. The survey varied in length based on whether the LHJ self-selected as having a school program. LHJs that selected no school program did not answer questions specific to those having implemented a school program.

Key informant interviews

The purpose of this study's key informant interviews was to provide additional background and resource information with respect to PCB-related regulations, remediation, and preventative program opportunities. Additionally, LHJ key informant interviews were conducted to provide additional depth and clarification regarding barriers and facilitators in school EH&S program implementation.

A semi-structured interview guide was developed in preparation for each interview and was used to guide the discussion. To identify key informants, we used purposive and snowball selection methods (where interviewees recommend additional key informants with expertise). Questions were created to facilitate conversation around PCB regulations and programs at the state and federal levels; other government efforts and initiatives to address PCBs in buildings and schools; PCB hazard control strategies; programs and resources available for schools to address PCBs; barriers for addressing PCB hazards in schools; and the scope of PCB hazards in Washington schools. LHJ key informants were asked about their school EH&S program, historical and present strengths of their program, barriers and facilitators to program implementation, recent emerging hazard management, and key recommendations necessary to ensure success.

Interviews were attended by at least two research team members, and notes were hand-recorded by each member. One team member combined all notes into a master interview document for each interview. Themes were co-identified by two to three team members. A single team member developed a summary of the key themes and summarized by relevant content area.

Content analysis

The purpose of this study's content analysis was to:

1. Identify K–12 school-specific EH&S policies and regulations in other states;
2. Conduct a qualitative content analysis of said policies and regulations;
3. Summarize those regulations, including inspections, management, control, remediation requirements, and content specific to PCBs, lead, asbestos, poor ventilation, and mold;
4. Develop recommendations to inform revisions of Washington's EH&S guidelines and regulations.

A directed approach was used to both quantitatively and qualitatively analyze content. The directed approach, identified by authors Hsieh and Shannon, leverages an existing framework to develop content analysis codes deductively.[76] The *EPA Model K–12 School Environmental Health Program*, published in 2012, was identified as the most suitable framework with which to compare K–12 state school environmental health policies and regulations.[75] The *EPA Model Program* (Box 3) is divided into four sections, two of which informed the development of the content analysis codes: the *Five Key Components of a School Environmental Health Program* and *Additional Opportunities for Promoting Environmental Health in School Facilities*.

Two team members searched each of 50 states for relevant K–12 EH&S regulations. The following search terms were used to identify potential state regulations for review:

- "[name of state] K–12 school environmental health regulations"
- "[name of state] K–12 school environmental health rules"
- "[name of state] K–12 school health and safety regulations"
- "[name of state] K–12 school health and safety rules"
- "[name of state] primary and secondary school health and safety regulations"
- "[name of state] primary and secondary school health and safety rules"

Two online resources were also used to identify potential regulations: 1) the *Environmental Law Institute's Topics in School Environmental Health: Overview of State Laws*, and 2) the *National Association of State Boards of Education's State Policy Database*.

Regulations were included for review based on the following criteria:

- *Inclusion criteria*: Policy must be a comprehensive regulation specific to schools overseen by a health agency or requiring inspection by a health official.
- *Exclusion criteria*: Policy is not a regulation, not specific to schools, and/or not comprehensive (e.g., only addresses one environmental health issue). Policy is not overseen by health agency or does not require inspection by health official.

A REDCap survey was developed using the *EPA Model Program* for reviewers to capture data elements about each state regulation. Activities from the model program were selected for survey inclusion based on feasibility (e.g., "Is this activity feasible for most schools in a state?"); applicability (e.g., "Is this activity applicable to most schools in a state?"); and/or defined frequency. The protocol was designed such that each survey "entry" represented one regulation. To ensure reliability of the data collection protocol, the six team members participating in the review process co-coded the same regulation independently and then convened to adjudicate any discrepancies and refine the data collection survey tool to ensure clarity.

Two team members independently assessed each regulation. Results were combined into a single spreadsheet where they were reviewed by a third team member. Where there were discrepancies, the team members reassessed the regulation in question and made necessary adjustments.

Box 3

EPA Model K-12 School Environmental Health Program

The EPA published the *Model K–12 School Environmental Health Program* (*EPA Model Program*) in 2012 as an appendix to the Voluntary Guidelines for States: Development and Implementation of a School Environmental Health Program.[75] The *EPA Model Program* provides guidance to schools and school districts interested in developing or strengthening school EH&S programs, including key steps for implementing a program and practical actions schools can take to address a wide range of environmental health issues.

The *EPA Model Program* is intended for use by state agencies, Local health jurisdictions, and school districts as a science-based approach and provides a thorough overview of the activities necessary to maintain healthy school environments. The model program describes how its guidance can be used by policymakers: "States are also encouraged to use the model program as a resource for considering new regulations, policies and guidance that might be helpful in promoting healthy school environments".[75]

The *EPA Model Program* groups environmental health issues into five broad categories or key components. Within these categories, the program groups recommendations into a three-tiered structure from basic to more comprehensive so that all schools, even those with minimal resources to address environmental health, may use the document. The five key components are:

1. Practice effective cleaning and maintenance.
2. Prevent mold and moisture.
3. Reduce chemical and environmental contaminant hazards.
4. Ensure good ventilation.
5. Prevent pests and reduce pesticide exposure.[75]

The *EPA Model Program* has limitations. It was published 10 years ago and, as such, it fails to address emerging hazards such as new families of chemicals, innovative curricula, and climate-related hazards. The program also does not address certain existing hazards present on school campuses, namely playground equipment.

Despite its limitations, it remains the most comprehensive and widely applicable framework for school EH&S across the nation. The findings from our LHJ survey allowed us to contextualize the model program with a local lens, developing a more complete image of what school EH&S could look like in Washington.

Results

PCB literature review and key informant interviews

The review of PCB regulations, guidelines, and resources included 17 peer-reviewed journal articles, six of which were review articles; nine reports and guides from various public health–focused organizations, consultants, and a US senator; 20 EPA documents, reports, and guides, and 15 webpages; six Ecology reports, guides, and associated websites; the federal TSCA code pertaining to PCBs; the Washington Administrative Code for the Model Toxics Control Act (MTCA); federal Occupational Safety and Health Administration (OSHA) regulations; and state Division of Occupational Safety and Health (DOSH) regulations. Summary lists of PCB resources can be found in Appendix B.

In total, we conducted nine key informant interviews with 13 individuals or teams from various state and national organizations. The interviewees represented the DOH School Environmental Health and Environmental Toxicology programs; the Ecology Toxics Reductions and Product Replacement Programs; OSPI; the University of Washington Environmental Health and Safety Environmental Programs; the EPA's Region 10 PCB Program; the Snohomish Health District; and the Vermont Departments of Health and Environmental Conservation.

We have synthesized both the literature and key informant interview information into two categories:

- PCB regulations, guidelines, and resources, providing a comprehensive summary of federal and state regulations pertaining to PCBs in school buildings and grounds, as well as numerous guidance documents and federal and state governmental resources available to any school or district with questions about testing, remediation, or preventative control measures.
- Scope of potential PCB hazards in Washington schools, summarizing what is known and unknown about PCBs in the state's schools.

PCB regulations, guidelines, and resources

Federal environmental regulations

PCBs are regulated at the federal level by the EPA's TSCA regulation. TSCA banned PCBs from most uses in 1979, though there are several exemptions and authorized uses. Part 761 of the TSCA regulation outlines rules for the manufacture, import, processing, and distribution of PCBs as well as storage or disposal of waste PCBs and PCB-containing items. This includes proper management of PCBs through prescribed or approved handling, marking, storage, and disposal methods, and clean-up of PCB spills.

From a regulatory perspective, schools are not unique in the TSCA PCBs rule. That is, the regulations around PCBs are the same for schools as they are for other types of buildings. See Table 5 for a summary of EPA requirements and recommendations regarding PCBs and Box 6 for a summary of roles and responsibilities related to PCBs in schools.

The following are key elements of the TSCA rule relevant to schools.

PCBs in building materials

Use of building materials that contain PCBs at concentrationsgreater than or equal to 50 ppm is prohibited under TSCA (40 CFR 761.20(a)). However, there is no requirement to test building materials for PCBs. As such, in older buildings, materials may be in use that predate the ban on PCBs at unknown levels, including levels exceeding 50 ppm. If building materials are tested and found to have concentrations greater than or equal to 50 ppm, they must be removed and properly disposed of (40 CFR 761.50(b)). See Box 7, *Mitigation of PCBs in building materials,* for information on mitigation strategies.

PCBs in fluorescent light ballasts

TSCA allows for "totally enclosed uses" of PCBs, which includes capacitators such as those found in fluorescent light ballasts manufactured between 1950 and 1979 (40 CFR §761.20). This means schools can legally continue using these types of fixtures as long as they are not leaking. If a PCB-containing light ballast leaks or ruptures, that ballast can no longer be used according to TSCA regulation (40 CFR 761.20(a)). In addition, a leaking ballast would be considered a spill and should be addressed according to TSCA rules for cleanup.

Sampling for PCBs

TSCA requirements for PCB sampling are primarily related to disposal, decontamination, and spill cleanup rule elements. PCB concentrations must be established for PCB-containing materials for proper disposal. The rule also requires sampling and outlines maximum concentrations of PCBs in soil, water, and on surfaces after decontamination or spill cleanup (40 CFR 761.130). TSCA does not require sampling for PCBs in air before or after remediation, decontamination, or spill cleanup, and has not established any regulatory limits for airborne PCB exposure.

PCB waste management

TSCA outlines specific storage, transportation, and disposal requirements for PCB-containing items depending on the type of item and PCB concentration. TSCA prescribes certain conditions and time limits for storing PCB-containing materials and requires notification of storage in some situations (40 CFR 761.65). For disposal, TSCA has separate rules for PCB bulk product waste such as caulk and other building materials that contained PCBs originally and some PCB light ballasts (40 CFR 761.62), and for PCB remediation waste such as building materials or soil contaminated by PCB sources (40 CFR 761.61). Rules are more extensive for PCB remediation waste and include requirements for site cleanup and notification and approval from the EPA in many instances. See Box 4, *Environmental contamination from PCBs in school building materials*, for more information about how remediation waste requirements may apply to schools with contaminated soil. There are significant recordkeeping requirements for PCB waste disposal (40 CFR 761.202-219).

PCB spills

Spill response and cleanup requirements are determined by the concentration of PCBs in the materials spilled and the type of space in which the spill occurred. The PCB Spill Cleanup Policy outlines time frames for spill response, reporting requirements, spill area restrictions, cleanup methods and requirements, and recordkeeping rules (40 CFR 761.120135). Reporting of PCB spills under TSCA is only required in certain circumstances, such as spills to water or in vegetable gardens (40 CFR 761.1230(d)), and is only required under the Comprehensive Environmental

Box 4

Environmental contamination from PCBs in school building materials

Soil and surfaces such as concrete and asphalt at the base of buildings can be contaminated with PCBs either through direct migration of PCBs from adjoining building materials, or by being transported from building materials onto the ground by water such as with rain or during cleaning.[61,62,67,69] In an EPA study in New York schools built between 1950 and 1980, PCBs were found above detection limits in the soil in all six schools where measurements were taken.[62] For all the samples, the 75th percentile concentration was 0.98 ppm, with a range up to 211 ppm and wide variability between schools. PCBs were detected at least 8 feet away or more from the building in five of the six schools, with levels higher than 1 ppm at three of these schools.

Soil containing more than 1 ppm of PCBs is considered remediation waste under TSCA, and is thus subject to the cleanup and disposal requirements for remediation waste (40 CFR 761.61). TSCA outlines three options for PCB-contaminated sites, with most situations requiring notification and approval from the EPA before initiating cleanup. The commonly used “self-implementing” option involves site characterization, EPA notification and certification, soil cleanup to 1 ppm for high-occupancy areas such as schools, cleanup verification through sampling of soil and porous and non-porous surfaces, and recordkeeping (40 CFR 761.61(a)).

Oversight of cleanup under Washington’s Model Toxics Control Act (MTCA) may also be required on a case-by-case basis depending on the PCB and PCB concentrations.[67,77] In their building materials guide, Ecology recommends consulting with a regional PCB coordinator for guidance on PCB-contaminated soil and mentions their Voluntary Cleanup Program, in which Ecology staff can provide technical assistance for cleanup questions.

Response, Compensation, and Liability Act for PCB spills of more than 1 pound (40 CFR 761.121(a)(1); 40 CFR 302.4). See Box 5, *TSCA requirements for spill response and cleanup for a leaking PCB light ballast in a school,* for an example of how this policy applies to a leaking, PCB-containing light ballast in a school.

Washington state environmental regulations

TSCA authority is not promulgated to states, so the EPA is the regulatory lead for PCB enforcement in Washington except for the management of waste materials. The EPA has delegated Resource Conservation and Recovery Act (RCRA) responsibilities to Ecology, meaning most PCB waste management is covered under the Dangerous Waste Regulations (Chapter 173-303 WAC) via the Hazardous Waste Management Act and is enforced by Ecology.

Another state regulation that pertains to PCBs is the MTCA. Through MTCA (Chapter 173-340 WAC), Ecology is authorized to regulate contaminated sites and oversee site identification, investigation, and cleanup. PCB releases to the environment must be reported under MTCA. However, this does not apply to releases from PCBs in building materials that are still in use.[67] Key informants also specified that MTCA typically does not apply to spills that occur indoors, and that TSCA/EPA has jurisdiction in these cases. Site cleanup for PCBs requires notification of and approval from the EPA via TSCA and is sometimes also required with Ecology via MTCA. Site cleanup for schools may be necessary if environmental contamination occurs from PCB building materials.

Box 5

TSCA requirements for spill response and cleanup for a leaking PCB light ballast in a school

Assumptions:

- Capacitators in light ballasts are assumed by TSCA to contain high concentrations of PCBs (≥500 ppm) (40 CFR 761.2(a)(4)).
- A school is a non-restricted access area according to TSCA definitions (40 CFR 761.1230(d)).
- Spill is not to water or a vegetable garden and is less than 1 pound.

Within 24 hours of becoming aware of the spill, the responsible party must (40 CFR 761_125(c)(1)):

- Restrict access to the spill within 24 hours.
- Record and document the spill area.
- Initiate spill cleanup.

Cleanup requirements:

- Properly dispose of contaminated furnishings and toys (according to Ecology and TSCA rules).
- Clean up solid surfaces (impervious and non-impervious) using an appropriate solvent outlined in the rule (40 CFR 761.125(c)(4)(ii)). Leaked fluid might be present on the light fixture as well as any surfaces or objects below.
- Post-cleaning sampling must verify that surfaces have been cleaned to a concentration of no more than 10 μg/100 cm^2 (40 CFR 761.130).

Other requirements:

- Recordkeeping (40 CFR 761.125(c)(5)).
- Store, transport, and dispose of leaking light ballast according to TSCA and Ecology Hazardous Waste Management Act rules.
- Note that there is no reporting requirement in this instance (less than 1 pound of PCBs, not to water or vegetable garden), but the EPA recommends consulting with the regional PCB coordinator to ensure proper cleanup and disposal measures were taken.

Federal and state occupational health regulations

In addition to federal and state environmental regulations, occupational safety and health rules for PCBs also apply where employees are exposed (i.e., school staff). The US Occupational Safety and Health Administration (OSHA) and the Washington State Division of Occupational Safety and Health (DOSH) have established Permissible Exposure Limits (PEL) for 42% and 54% chlorine PCBs.[78,79] These levels were adopted in the 1970s and came from the American Conference of Governmental Industrial Hygienists (ACGIH) recommendations developed in 1946.[80] The ACGIH documentation for these two PCB categories states that they were developed to be protective of eye, skin, and respiratory tract irritation, liver toxicity, and chloracne (a skin condition).[81,82] Note that the latest update to these values was in 2001 (when they added a notation that dermal absorption can be a significant contributor to exposure), which is before the International Agency for Research on Cancer changed the classification for PCBs to “carcinogenic to humans” in 2013.[41] OSHA acknowledges that many current PELs are outdated and may not be protective of worker health.[80] The PELs set for PCBs are much higher than levels that would be expected at workplaces that are not actively working with PCBs. PCBs are not routinely sampled for in an occupational health regulatory context. PCBs are not otherwise specified in OSHA or DOSH rules, though they would technically be covered by other, more general rules throughout both federal and state codes for occupational safety and health (i.e., general duty clause, hazard communication).

Non-regulatory EPA resources for PCBs

The EPA has published non-regulatory guidance for addressing PCBs in building materials in general, and in schools specifically. There are several fact sheets, guides, diagrams, and other resources that provide recommendations for a variety of audiences on PCBs in buildings. Many of these offer detailed steps and practical actions for determining whether PCBs are present, and for addressing PCB exposures and managing PCB-containing materials. The following are five major EPA resources that apply to PCBs in schools. Additional EPA resources for PCBs can be found in Table B2 in Appendix B.

Fact Sheet: *"PCBs in Building Materials" (2021)*[61]

This document provides information on identifying PCB products, considerations for sampling and testing for PCBs, guidance for renovations of buildings that will continue to be used, guidance for demolition and PCB waste disposal, as well as discussion of potential outdoor contamination. Of note in this fact sheet is that the EPA does not recommend testing building materials when building owners are not planning renovations or demolition. Instead, they recommend implementing best management practices first.

Fact Sheet: *"Practical Actions for Reducing Exposure to Polychlorinated Biphenyls (PCBs) in Schools and Other Buildings" (2015)*[83]

In this fact sheet, the EPA suggests four recommendations specific to schools built between 1950 and 1979 regardless of whether PCBs are known to be present. These include:

- Removing PCB light ballasts.
- Employing best management practices such as ventilation and cleaning strategies to reduce PCB exposures.
- Removing PCB-containing building materials when doing renovations.
- Considering encapsulating PCBs in building materials that were adjacent to PCB-containing materials that have been removed.

Webpage: *"Exposure Levels for Evaluating Polychlorinated Biphenyls (PCBs) in Indoor School Air" (November 12, 2022)*[84]

The EPA provides guideline exposure levels for PCBs in school indoor air. These levels were developed to be equivalent to the EPA's oral Reference Dose (RfD) of 20 ng/kg/day for Aroclor 1254, and range between 100 and 600 ng/m^3. Different levels were set for different age groups based on weight differences and assumptions about time spent in school buildings. The EPA specifies that these should not be considered "not-to-exceed" levels, but rather used to determine the need for further investigation of PCBs in school buildings. Table 4 shows the EPA exposure levels in comparison to other reference concentrations for airborne PCBs. The table includes new School Action Levels[85] set by the Vermont Department of Health; PELs adopted by OSHA[79] and DOSH[78] that are enforceable at places of work; Threshold Limit Value guidelines from ACGIH[81]; Recommended Exposure Limit guideline values established by the National Institute of Occupational Safety and Health (NIOSH)[86]; and cleanup levels for PCBs defined in Washington's MTCA.[87]

Document: *"PCBs in Building Materials – Question and Answers"* *(2015)*[90]

This document clarifies and adds detail to the information from the above sources through a question-and-answer format. Additionally, there are two visuals that accompany this document that aim to help schools reduce PCB exposures and to manage PCB-containing building materials: *"Actions for Reducing Exposures to PCBs in Indoor School BuildingEnvironments"* [91] and "*An Example for How to Manage Polychlorinated Biphenyl (PCB)-Containing Materials in School Buildings.*"[92]

Table 4. Comparison of reference concentrations for airborne PCBs

Agency	PCB type	Concentration	Description	Date established
EPA	All PCBs	100 – 600 ng/m^3 depending on age	Guideline level for indoor air in schools[a]	2015
Vermont Dept. Of Health	All PCBs	30 – 100 ng/m^3 depending on age	VT regulatory level for indoor air in schools[b]	2021
OSHA/WA DOSH	Chlorodiphenyl (54% chlorine, Aroclor 54)	0.5 mg/m^3 (500,000 ng/m^3)	Regulatory occupational exposure limit[c]	1971
	Chlorodiphenyl (42% chlorine, Aroclor 42)	1.0 mg/m^3 (1,000,000 ng/m^3)	Regulatory occupational exposure limit[c]	1971
ACGIH	Chlorodiphenyl (54% chlorine, Aroclor 54)	0.5 mg/m^3 (500,000 ng/m^3)	Guideline occupational exposure limit[d]	1946
	Chlorodiphenyl (42% chlorine, Aroclor 42)	1.0 mg/m3 (1,000,000 ng/m3)	Guideline occupational exposure limit[e]	1946
NIOSH	Chlorodiphenyl (54% chlorine, Aroclor 54)	0.001 mg/m^3 (1000 ng/m^3)	Guideline occupational exposure limit[f]	1977
	Chlorodiphenyl (42% chlorine, Aroclor 42)	0.001 mg/m^3 (1000 ng/m^3)	Guideline occupational exposure limit[f]	1977
WA MTCA	All PCBs	0.00044 ug/m^3 (0.44 ng/m^3)	Regulatory cleanup standard[g]	1996

[a]: *"health protective values intended for evaluation purposes"*[84]

[b]: *set to prioritize identification and remediation of PCB sources, also serves as cleanup level*[85]

[c]: *adopted from 1968 TLVs, "OSHA recognizes that many of its PELs are outdated and inadequate for ensuring protection of worker health"*[80]

[d]: *set to prevent eye, skin, and respiratory tract irritation, systemic toxicity, and liver injury*[82]

[e]: *set to prevent eye, skin and respiratory tract irritation, liver toxicity, and chloracne*[81]

[f]: *set to reduce the risk of reproductive or tumorigenic effects*[88]

[g]: *From Risk Calculation (CLARC) tables for Method B, based on IRIS carcinogenic potency factor, calculated to ensure exposure doesn't increase an individual's lifetime risk of cancer by more than 1 in 1 million*[89]

Webpage: *Polychlorinated biphenyl (PCB)-contaminated fluorescent light ballasts (FLBs) in school buildings* (August 30, 2022)

This webpage contains guidance for school administrators and maintenance personnel on PCB light ballasts. It has information on the risks associated with PCB light ballasts, detailed steps to identify PCB light ballasts, guidance on whether to replace a PCB light ballast, including cost-savings information and recommended cleanup and decontamination procedures, and proper disposal of PCB light ballasts and waste generated from cleanup and decontamination.

Box 6

Mitigation of PCBs in building materials

As removal of primary PCB sources and contaminated secondary sources in buildings can be costly and time-intensive, there has been interest in alternative strategies for managing PCBs in place. Management techniques for addressing PCB hazards can include ventilation and filtration, encapsulation of PCB sources and physical barriers, and cleaning practices.

Ventilation

One study, conducted in a 1961 elementary school building, found that improving ventilation and filtration reduced average PCB exposures by half, from 533 ng/m^3 to 274 mg/m^3.[64] Another study in New York City schools showed portable air cleaners to be effective in lowering PCB levels in indoor air.[93] Finally, EPA considers ventilation a best management practice for PCBs.[83]

Encapsulation

EPA laboratory studies and modeling on encapsulation methods found that none of the coatings tested were fully impenetrable to PCBs, but that epoxy coatings were most effective.[68] They note that epoxies work best for sources with lower PCB contents (up to 430 ppm). One study, conducted in the 1961 elementary school building, observed a 44% reduction in airborne PCBs after encapsulation of caulking using a tape product followed by new silicone caulking.[64] EPA resources recommend building owners and administrators work closely with regional PCB coordinators to determine whether encapsulation is an appropriate method for their building, and to have a long-term inspection and maintenance plan in place to ensure encapsulation materials are in good condition.[68,83]

Cleaning practices

Cleaning practices recommended by the EPA and others include cleaning surfaces with wet methods or vacuuming with a high-efficiency particulate air (HEPA) filters; avoid using brooms, dusters, or compressed air that can make dust particles become airborne; washing toys; regular and frequent cleaning schedules; use of appropriate protective clothing during cleaning; hand and face washing after cleaning; and proper disposal of cleaning supplies.[45,83]

Other administrative practices

Other recommendations include elements of operations and maintenance plans such as providing in-depth hazard training on PCBs for select maintenance personnel, providing PCB awareness training for other building occupants, and having proactive plans and reporting systems for activities that may disturb PCB-containing material.[45,69]

Box 7

Roles and responsibilities related to PCBs in schools

School building owner/operator

- Provide a healthy, safe environment for school building occupants.
- Remove and properly dispose of leaking PCB light ballasts (required).
- Follow appropriate procedures following a spill such as a PCB light ballast leak (required).
- Recommended to test building materials for PCBs prior to renovation or demolition work and abate or mitigate as appropriate.
- Recommended to implement best management practices for reducing PCB exposures (such as cleaning, ventilation).
- Recommended to coordinate with Region 10 PCB coordinator in the following cases:
  - After a spill to ensure proper cleanup and disposal.
  - After finding PCB-containing building materials ≥50 ppm.
  - To determine whether testing building materials is advised.
  - To determine whether air or surface sampling is advised.
  - To determine whether encapsulation is an appropriate mitigation measure.
  - Any other questions that arise around PCB hazards in schools.

Region 10 PCB coordinator

- Provide guidance for whether/how to conduct air or surface sampling for PCBs.
- Provide guidance for whether to test building materials for PCBs.
- Make recommendations for whether encapsulation is appropriate for PCBs.
- Provide guidance on PCB spill cleanup and disposal of PCB items.

Federal EPA

- Enforce TSCA PCB rule – use, storage, transportation, and disposal of PCB items; PCB spill cleanup.
- Oversee PCB remediation in buildings.
- Occasional oversight of PCB waste management in certain circumstances.

WA Ecology

- Oversee/enforce PCB waste management (Hazardous Waste Management Act).
- Oversee PCB releases to the environment (outdoors) – site identification, investigation, and cleanup (MTCA).

WA Labor & Industries/DOSH

- Oversee/enforce workplace exposures to PCBs.

WA DOH School Environmental Health Program

- Work with Local health jurisdictions, OSPI, public and private schools/districts, and other groups to ensure environmental health and safety in schools.
- Support implementation of the State Board of Health School Rule, Chapter 246-366 WAC.
- May provide PCB support from a general school EH&S perspective.

Local health jurisdictions

- May conduct school health and safety inspections.
- May provide PCB support from a general school EH&S perspective.

Regional PCB Coordinators

A common recommendation in the EPA's resources is to consult with a regional PCB coordinator. In particular, the EPA recommends building owners and operators consult with their region's EPA PCB coordinator to decide whether air sampling or testing of building materials should be done and whether it should be done following implementation of best management practices; to discuss if encapsulation is appropriate; or in cases where air sampling has been conducted and levels are higher than exposure levels for school settings. Washington state is part of EPA's Region 10, which has one PCB coordinator.

Table 5: Summary of select EPA requirements and recommendations for PCBs in buildings

Activity	Required	Recommended	Sometimes recommended	Not recommended
Testing				
Testing building materials before renovation/demolition	No	Yes	No	No
Testing building materials when no renovation/ demolition is planned	No	No	No	Yes
Testing air for PCBs before or after abatement or mitigation	No	No	Yes	No
Testing surfaces for PCBs before or after abatement or mitigation	No	No	Yes	No
Cleanup, removal, and remediation				
Spill cleanup for leaking PCB-containing light ballasts	Yes, in 24 hrs	No	No	No
Removing leaking PCB-containing light ballasts	Yes	No	No	No
Removing non-leaking PCB-containing light ballasts (functioning or non-functioning)	No	Yes	No	No
Removing building materials tested to have PCBs <50 ppm	No	No	Yes	No
Removing building materials tested to have PCBs ≥ 50 ppm	Yes	No	no	No
Other hazard reduction strategies				
Encapsulating building materials with PCBs	No	No	Yes	No
Best management practices for ventilation and cleaning	No	Yes	No	No

Table 5: Summary of select EPA requirements and recommendations for PCBs in buildings (continued)

Activity	Required	Recommended	Sometimes recommended	Not recommended
Reporting and notification				
Reporting of leaking light ballasts	No	Yes	No	No
Reporting building materials ≥ 50 ppm	No	Yes	No	No
Reporting PCB abatement or mitigation activities for building materials	No	Yes	No	No
Reporting storage of PCB waste	Yes, with exceptions	No	No	No

PCB regulations in other states

Very few states have their own regulations pertaining to PCBs in schools. Rhode Island includes PCBs in a list of chemicals that shall not be purchased and are "prohibited from a school" in an Appendix to their regulations for school health programs, though further detail or guidance is not provided.[94] Connecticut requires that PCB presence/absence be determined before the start of school construction projects, along with a PCB Management and Abatement Plan if PCBs are found or assumed to be above 50 ppm in building materials.[95]

The most notable state regulation regarding PCBs in schools is Vermont's new 2021 rule that mandates air testing for PCBs in all schools built or renovated before 1980.[96] The Vermont Department of Health developed School Action Levels for PCBs in indoor air in schools, which the Vermont Department of Environmental Conservation has the authority to enforce. Funding has been provided for contracted consultants to conduct the inspections, building inventories, and indoor air PCB sampling in the 327 affected schools. If PCB levels are above the School Action Levels, schools are required to take action, such as limiting occupancy of areas with high levels or identifying and addressing PCB sources. Details about this program can be found in Appendix A.

Information and guidance on PCBs provided by other state agencies are limited in many states. According to a 2016 report by Senator Edward J. Markey of Massachusetts[97], there are 15 states that do not include any information on PCBs specific to schools on their websites. Only five states provide PCB testing guidance for schools on their websites.

Existing Washington state programs and resources for addressing PCBs in schools

Department of Ecology's polychlorinated biphenyl (PCB) light replacement in schools program

Through their Product Replacement Program, Ecology currently provides reimbursement to eligible K–12 schools to assist with the removal, proper waste management, and replacement of all remaining intact, non-leaking PCB-containing light ballasts. The program was developed to implement one of the recommendations of Ecology and DOH's 2015 Chemical Action Plan for PCBs. A school, tribe, or district must first submit an application including a brief assessment of facilities to identify lights suspected to contain PCBs, a project plan, and a waste management plan. After the application and project plan are approved by the Ecology Product Replacement

Program, the approved work may be performed by a qualified in-house electrician or a qualified contractor. Ecology and DOH personnel are available to provide guidance during replacement and disposal of PCB-contaminated waste. The school must register in the Washington State Payee System and keep records of costs to receive reimbursement of up to $10,000. Once the work is finished and the school has submitted their voucher with required invoices, Ecology will review and process the reimbursement. Applications to the program became available in April 2022, and notification was provided to all public K–12 district superintendents in June 2022. As of July 2022, one school district in Washington had taken advantage of such funds, and several others had inquired about the program. Should funding become limited, applications will be prioritized to offer funds first to schools in economically disadvantaged areas and those with higher environmental health disparities. Efforts to increase awareness and engagement by school districts are underway. Outreach efforts include a joint bulletin with OSPI informing school districts of two funding options now available (see the second below) to address this hazard. Additionally, information about the programs will be disseminated through the Washington Association for Maintenance and Operations Administrators, a membership organization that serves school facilities directors. Funding will remain open through June 2023 and be reevaluated at that time.

OSPI's T-12 Lighting Fixture Removal and Replacement Grant

OSPI has worked closely with Ecology and DOH to launch a PCB light ballast removal, replacement, and disposal program. The grant fund of $1.5 million from the 2022 Supplemental Capital Budget provides schools with reimbursement for removing and disposing of T-12 ballasts manufactured on or before 1979. Public, charter, and state-tribal education compact schools are eligible for funding only if all funding from utility company rebate programs available to Washington schools have been exhausted. To receive grant funding, schools must provide documentation to OSPI showing (1) a certified electrician's report showing the number and location of PCB-containing lighting fixtures and ballasts in their facilities and (2) the age and primary use of each facility where the T-12 lighting fixtures and ballasts are located. The grant funds became available in September 2022 and must be spent before June 30, 2023.

PCB information on Washington state and local government websites

We also conducted a review of government websites to learn what kinds of information are provided at the state and local levels about PCBs in general and/or in schools. We included LHJ websites as well as Educational Service Districts (ESDs) in our search as these are organizations that generally provide health and safety oversight and support for schools.

At the state level, both DOH and Ecology provide a variety of general and school-specific information about PCBs along with links to various EPA resources. Of the 35 LHJs in Washington, we found that only two provided general information about PCBs (Spokane Regional Health District and Public Health—Seattle & King County). In contrast, 32 of the 35 health district webpages had information about other types of environmental hazards such as lead, pesticides, and wildfire smoke. None of the nine ESDs had information about PCBs on their websites, though five had information about other environmental hazards and three referenced environmental health services through their workers' compensation trusts or risk management services. Table B1 in Appendix B shows the government agencies that provided information about PCBs on their websites and includes the kinds of information provided (fact sheets, guides, or publications about PCBs created or referenced by the agency) and what external resources the site references.

Other programs and guidance addressing PCBs in schools and other buildings

Western States Pediatric Environmental Health Specialty Unit (PEHSU) Fact Sheet[98] and Poster[50] (2017)

Western States PEHSU (which receives funding from the EPA) has published a fact sheet and poster about PCBs in schools. They recommend many of the same strategies as the EPA, but also place an emphasis on green cleaning as a best management practice. They point out that green cleaning will also reduce exposure to germs, allergens, some other toxic chemicals on surfaces, and toxic chemicals found in other types of cleaning products or methods.

Washington Department of Ecology PCBs in Building Materials webpage[70] (2022)

Ecology recently published a guide titled "How to Find and Address PCBs in Building Materials."[67] This 59-page document provides extensive guidance for finding and addressing PCBs in exterior building materials. It is primarily intended for use prior to renovation or demolition to prevent PCB contamination of stormwater. The guide details steps for PCB identification, waste management, and abatement, and has background information on PCB regulations in Washington. There is an accompanying guide and worksheet for estimating costs[99] of PCB abatement in building materials. These materials do not provide guidance for addressing PCB exposures or hazards indoors for building occupants.

University of Washington Environmental Health & Safety PCBs webpage[100] (2018)

The University of Washington Environmental Health and Safety department requires a "good faith survey" to be completed before all repair, renovation, or demolition projects to screen for PCBs in building materials such as caulking, glazing, and joining materials. Suspect materials must be sampled for PCBs, and if found, must be managed according to University policy[101] and EPA regulations. A "PCB Caulking Work Plan"[102] was also published by UW EH&S in 2014 that details University policies and serves as a sample work plan for PCB work procedures, removal methods, cleanup and decontamination procedures, waste management requirements, and post-removal sampling approaches.

Potential PCB hazards in Washington schools

There is much we don't know about the presence of PCBs in Washington schools and across the nation. Without a requirement or incentive to sample air or building materials, most schools do not know whether they have PCBs above allowed levels in their buildings or whether there are potential PCB exposures to students, staff, or other building occupants. While there have been some efforts to estimate the number of schools potentially containing PCBs on the national level, we did not encounter similar efforts here in Washington state. To our knowledge, there also has not been any systematic work to inspect or test schools for PCBs to quantify the number of affected schools in Washington or nationally, apart from the new Vermont rule.

PCBs in schools at the national level

School buildings built between 1950 and 1980 are suspected of having PCB-containing building materials like other buildings built in that era. One review study[10] estimated that between 27% and 54% of schools built between 1950 and 1980 have PCB-containing building materials. A 2012 EPA study[62] in five New York schools built between 1950 and 1980 found 17.8% of interior caulk and window glazing samples and 73% of exterior caulk and window glazing samples were greater than or equal to 50 ppm, with samples ranging up to 440,000 ppm. The same study also conducted surveys and inspections of light ballasts and found between 25% and 95% of ballasts likely contained PCBs.

Study data is also limited regarding PCB exposures or concentrations in air and other exposure media. A 2017 study[103] of six Indiana and Iowa schools built between 1918 and 1986 found PCB concentrations ranging up to 194 ng/m^3 in indoor air, compared to up to 3 ng/m^3 in air outdoors. The 2012 EPA study[62] in New York measured PCBs in indoor air in the schools up to 2,920 ng/m^3, with a median of 318 ng/m^3. Another study[64] in a Massachusetts school built in 1961 found concentrations between 350 and 780 ng/m^3 that were from building materials alone, as all PCB light ballasts had been removed. Studies have found significant variability in indoor air concentrations within and between schools, and over time.[62,66] Another study[104] reported that in both rural and urban study locations in Indiana and Iowa, inhalation exposure for PCBs was greater for children than for their mothers due to a five- to ten-fold increase in indoor air PCB concentrations in schools compared to homes.

Other information available about PCB exposures in schools comes from high-profile cases in schools and from the new Vermont rule. At Sky Valley Education Center in Monroe, WA, 81 indoor air samples for PCBs were taken between 2014 and 2016, before remediation activities occurred.[105] Samples ranged between levels not detectable to 630 ng/m^3. Fiftyeight samples (72%) were below the limit of detection, while five samples (6%) exceeded the EPA exposure levels for schools based on occupant age.[105] At Burlington High School in Vermont, the case that prompted the new Vermont rule, PCB levels in indoor air ranged from 160 to 6,000 ng/m^3 in one 1964 building.[106] From the available data related to the Vermont rule, PCBs in indoor air have ranged from not detectable to 210 ng/m^3, with 96 samples (54%) below the limit of detection. Seven samples (9%) have exceeded the School Action Level set by the rule, though none of these is higher than the EPA exposure levels for schools based on occupant age.[107]

PCBs in schools in Washington

In 2015, Ecology published a Chemical Action Plan (CAP) for PCBs,[108] in which they developed recommended actions to identify, learn more about, and address PCBs in a variety of settings.

One recommendation was to identify PCB light ballasts in schools and to encourage their replacement. This led to the development of the "PCB light replacement in schools" effort by Ecology's Product Replacement Program.[109] In conjunction with DOH, Ecology attempted to identify, quantify, and locate PCB light ballasts in schools in the state. They consulted data from OSPI and the Washington State University Energy Program and sent a survey to schools with a monetary incentive for completion in 2021. The existing databases were incomplete, and the survey yielded very few responses, so the extent of the presence of PCB light ballasts is still unknown.

We discussed a variety of possible methods (including using permit data from the Washington State Department of Labor & Industries [L&I]) with our key informants to determine whether it might be possible to develop a list of schools that had not had PCB light ballasts replaced, but it was determined that this would not be feasible without school districts' required cooperation. Multiple key informants suggested most of these light ballasts had already been replaced, many in the 2010s when utility companies had programs for replacement to address energy efficiency. Some key informants also believed some schools and districts had opted to hire their own contractors for replacement, in some cases to avoid publicity or state involvement. Only one school district has applied for funds to address PCB light ballasts through the Product Replacement Program as of mid 2022.

Another recommendation identified in Ecology's CAP for PCBs was to "assess schools and other public buildings for the presence of PCB-containing building materials."[108] From key informant interviews and searches on state websites, it does not appear that this has yet been completed for schools. To describe the potential prevalence of PCBs in schools, we used OSPI public school building data to estimate the number of school buildings more likely to have PCB-containing building materials based on their age and modernization status. Widespread use of PCB-containing building materials started in 1950 and lasted through 1979, when PCBs were banned by the EPA. Thus, we focused on Washington schools built or modernized before 1980 as most likely to have PCB-containing building materials. In Washington, 2,818 (49.4%) of public school–related buildings or structures were built before 1980. Of those, 1,681 buildings (29.5% of all public school–related buildings) have not been replaced or modernized since 1980 and are more likely to include PCB-containing building materials that may pose a risk to humans. Figure 5 illustrates the relative proportion of pre-1980 buildings within each Washington legislative district, whereas Table 6 describes the number of school buildings by county.

Figure 5: School buildings and structures built and/or modernized prior to 1980, by legislative district

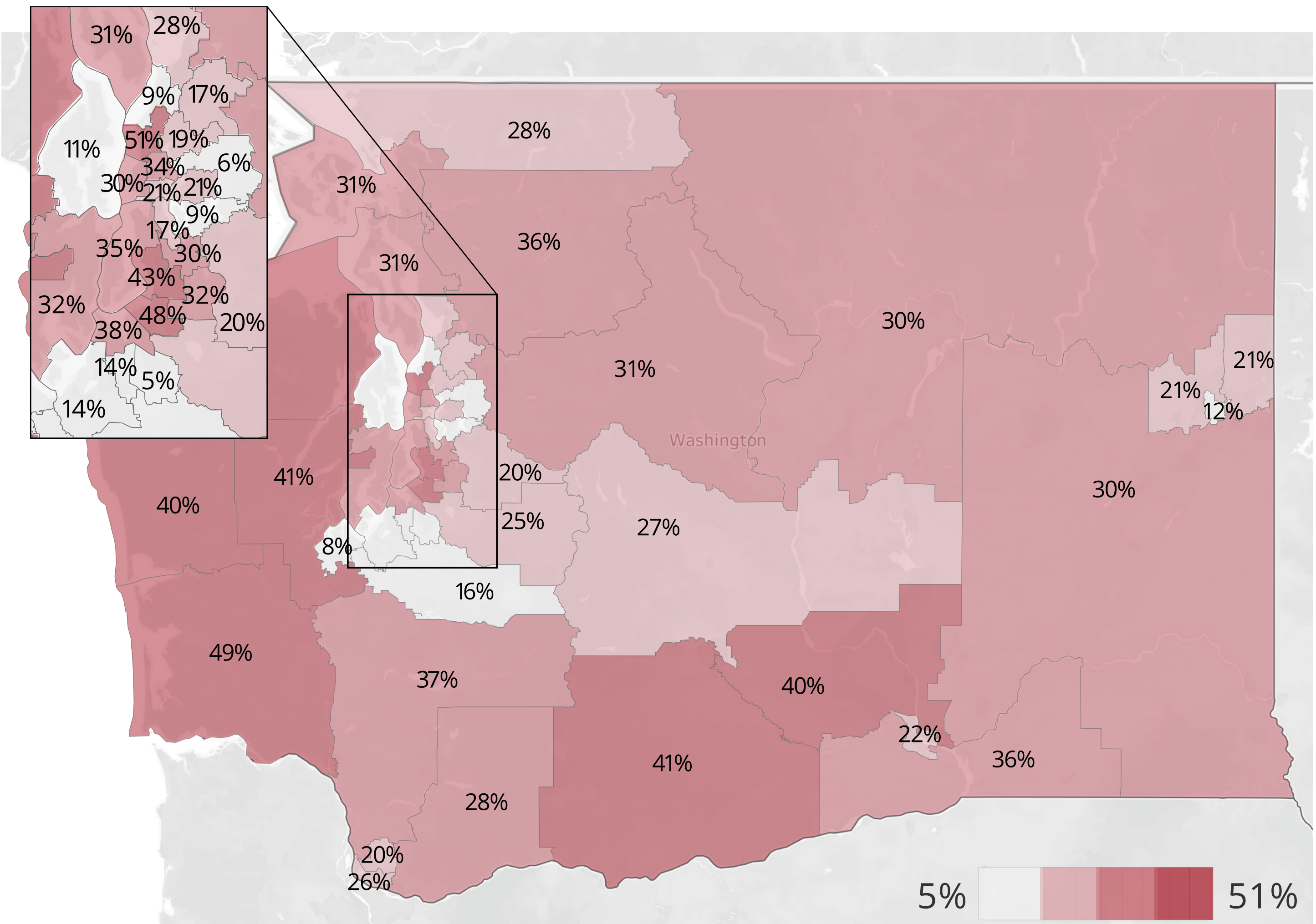


Table 6: School buildings built and/or modernized prior to 1980, by county

County	# of buildings	# of buildings <1980	Percent of <1980 in home county	Percent of <1980 in WA state
Adams	64	17	26.6%	1.0%
Asotin	31	6	19.4%	0.4%
Benton	125	33	26.4%	2.0%
Chelan	63	16	25.4%	1.0%
Clallam	100	46	46.0%	2.7%
Clark	324	81	25.0%	4.8%
Columbia	8	5	62.5%	0.3%
Cowlitz	112	57	50.9%	3.4%
Douglas	48	16	33.3%	1.0%
Ferry	14	6	42.9%	0.4%
Franklin	62	11	17.7%	0.7%
Garfield	2	1	50.0%	0.1%
Grant	123	24	19.5%	1.4%
Grays Harbor	129	58	45.0%	3.5%
Island	68	22	32.4%	1.3%
Jefferson	34	17	50.0%	1.0%
King	1255	380	30.3%	22.6%
Kitsap	142	37	26.1%	2.2%
Kittitas	35	13	37.1%	0.8%
Klickitat	46	18	39.1%	1.1%
Lewis	141	54	38.3%	3.2%
Lincoln	25	18	72.0%	1.1%
Mason	80	38	47.5%	2.3%
Okanogan	41	9	22.0%	0.5%
Pacific	38	15	39.5%	0.9%
Pend Oreille	16	6	37.5%	0.4%
Pierce	681	123	18.1%	7.3%
San Juan	29	9	31.0%	0.5%
Skagit	123	44	35.8%	2.6%
Skamania	17	14	82.4%	0.8%
Snohomish	620	154	24.8%	9.2%
Spokane	251	53	21.1%	3.2%
Stevens	72	26	36.1%	1.5%
Thurston	246	45	18.3%	2.7%
Wahkiakum	11	4	36.4%	0.2%
Walla Walla	60	25	41.7%	1.5%
Whatcom	158	47	29.7%	2.8%
Whitman	43	23	53.5%	1.4%
Yakima	267	110	41.2%	6.5%
Grand Total	5704	1681	---	100.0%

PCBs have been found in Washington state buildings that are of similar ages to the schools listed above. One 2011 study[110] sampled and quantified PCBs in building materials in older buildings in Seattle. The "Lower Duwamish Waterway Survey of Potential PCB-Containing Building Material Sources" examined a 5.5-mile stretch of the Lower Duwamish Waterway (LDW) located in Seattle, south of Elliott Bay. The goal of this survey was to better understand and identify sources of sediment pollution, specifically PCBs, to prevent further pollution in the LDW, where high PCB concentrations in paints and caulk have been detected. Composite paint and building caulk samples were taken from 31 properties built between 1950 and 1977, primarily industrial and commercial buildings, in the Diagonal Avenue South stormwater drainage basin. Ecology reported PCB concentrations of 0.85 to 61 mg/kg in 39% of the building paint composite samples, and PCB concentrations of 3.0 to 920 mg/kg in 47% of the building caulk composite samples. Another Ecology effort[111] estimated that there are between 1.7 and 6.2 million PCB light ballasts and 87 metric tons of PCBs in caulk in Washington state buildings.

Based on the age of Washington's school buildings, the discovery of PCBs in schools where sampling has been conducted in Washington[105] and in other states,[97,106,107] as well as in buildings of similar ages in Washington,[110,111] it is likely that PCBs are present in some Washington schools. However, it would require inspecting and sampling for PCBs in building materials (including light ballasts), indoor air, and/or surfaces to determine whether they exist in a specific school and whether building occupants are potentially exposed.

Local health jurisdiction activity survey

We administered a survey to LHJ school EH&S leads to summarize current LHJ school activities and identify program implementation and maintenance barriers, facilitating factors, and needs. *Routine programs* are defined as established EH&S inspection-based programs, while *developing programs* include programs actively being built.

Current school inspection program activities

> *"Schools are a community resource and include health centers, libraries, play fields, community art rooms and gardens, etc. They are not just for instruction. A past survey of one of our partner districts showed their schools were used more hours per year by community members than by students. School health and safety protects our entire community." – Routine program*

A total of 22 LHJs completed an online REDCap survey. The 63% response rate represents approximately 90% of public-school children across the state. Figure 6 illustrates the geographical distribution of LHJ survey responses. It is important to note that several of the non-responding LHJs have routine and developing programs, and that the survey's timing likely competed for very limited staff time in these rural counties. Additionally, four key informant interviews were conducted with routine programs to further elucidate barriers and facilitators to successful program implementation.

Our first survey question split our survey findings into LHJs with some semblance of a school EH&S program and those without:

> *Does your LHJ currently have a K–12 school EH&S inspection program that focuses on health and safety issues in schools (besides food safety)?*

Thirteen of the 22 LHJs answered "Yes" or "Other" and were given the full survey, which included questions about program activities, administration, and implementation barriers and facilitators. Nine LHJs that selected "No" were not asked questions about activities about administering a school program but were asked questions about perceived barriers and facilitators to program implementation, as well as resources used.

Figure 6: LHJ survey responses

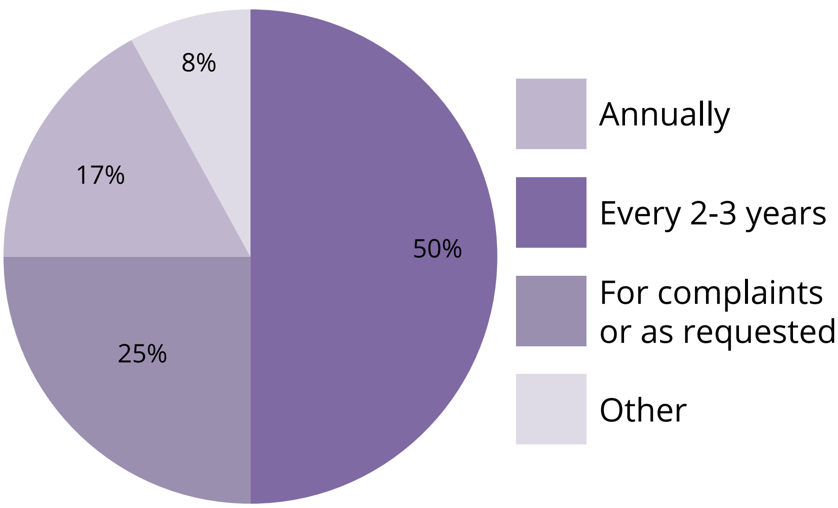
This question allowed an open-ended comment box 3onnected to "Other" for LHJs to further describe the degree to which a program delivered EH&S activities. Seven (32%) of the 22 LHJs have a routine school program; seven (32%) have a program in development; and eight (36%) have no program or only complete building plan reviews for new construction or remodels. Unfortunately, two respondents misclassified their response to this question, selecting "No program" even though they are actively developing a program and were not given the full survey to complete. An additional program that only provides plan review services answered "Other" but didn't complete the program activity-related questions. Therefore, many of the findings throughout this section are based on the 12 developing or routine programs that answered "Yes" or "Other" to having a program (percentages from these 12 are henceforth labeled with ‡).

Inspection frequency

LHJs were asked how frequently they visit schools for EH&S inspections. Only two (17%)‡ of the 12 conducted annual routine school inspections (Figure 7). Half‡ performed inspections every two to three years, including one LHJ that allows schools to self-inspect in between LHJ inspector visits. The remaining one-third‡ only inspected for complaints or as requested, or they marked "Other." As required by chapter 246-215 WAC all LHJs inspect school food service facilities twice per year. We found no reported difference between school type (public, private, etc.) or school age group (elementary, middle, and high school) frequency. The seven LHJs with full inspection programs all complete school inspections every one to three years. All LHJs surveyed conducted routine food service inspections in schools, typically twice per year. These were usually conducted separately from full EH&S inspections.

> *"[Our] program includes an innovative self-inspection model, developed with the advisory committee in 1999. It consists of risk-based inspections conducted by the health district, followed by re-inspections and comprehensive self-inspections conducted by school representatives. [We] assists schools in identifying and prioritizing inspection items. Accountability is ensured through written agreements, annual training and spot checks. This collaborative approach incorporates the expertise of all school partners and has resulted in strong partnerships, earlier identification/correction of health and safety concerns (more cost-effective for schools), and safer learning environments for students and the community."*
> ***– Routine program***

Figure 7: School inspection frequency



Hazard identification

The survey asked about the most frequently cited hazards identified by LHJ inspectors. Chemical hazards in science labs and lighting issues were the two most frequently cited, followed by playground hazards, unsafe conditions, and heating, ventilation, and air conditioning (HVAC) or poor air quality issues (Table 7). It is an important note that "playground hazards" were not included on the survey as an option but were identified in an open-ended response box connected with "Other," and were still a top hazard. Other hazards listed included chemical and physical hazards in vocational classrooms, cleanliness, chemical hazards in the classroom, and plumbing/sewage issues.

> *"Overall poor chemical management (for labs, arts, shop, and facilities) are perennial problems for most schools."* ***– Routine program***

> *"HVAC: lack of exhaust ventilation for 3D printers or CNC machines installed after initial school construction"* ***– Routine program***

The most common complaints received by LHJs include indoor air quality issues, food safety, mold and moisture issues, and general safety. The LHJ serves as a liaison between the complainant and the school district to resolve health complaints, but their response is limited by legislation and resources.

Table 7: Frequently cited hazards

Hazards cited	Total (%)‡	Routine program	Developing program
Chemical hazards in Science Labs	9 (75%)	7	2
Lighting	7 (58%)	6	1
Playground hazards*	5 (42%)	3	2
Unsafe conditions, including Maintenance conditions	5 (42%)	4	1
HVAC issues or poor air quality	5 (42%)	4	1
Chemical hazards in Vocational classrooms	4 (33%)	4	0
Physical hazards in Vocational classrooms	4 (33%)	4	0
Cleanliness	4 (33%)	4	0
Unapproved chemicals in classrooms**	3 (25%)	3	0
Plumbing/sewage issues	3 (25%)	2	1
Unsecured chemicals in classrooms**	2 (17%)	2	0
Tipping hazard*	2 (17%)	2	0
Noise	2 (17%)	2	0
Food safety	2 (17%)	0	2
Fall hazards*	1 (8%)	0	1
Electric hazards*	1 (8%)	1	0
Pests	1 (8%)	1	0
Earthquake issues***	1 (8%)	1	0
Fire hazard***	1 (8%)	1	0

**Other physical hazards written in*
***Other chemical hazards written in*
****Other hazards written in*

Corrective action

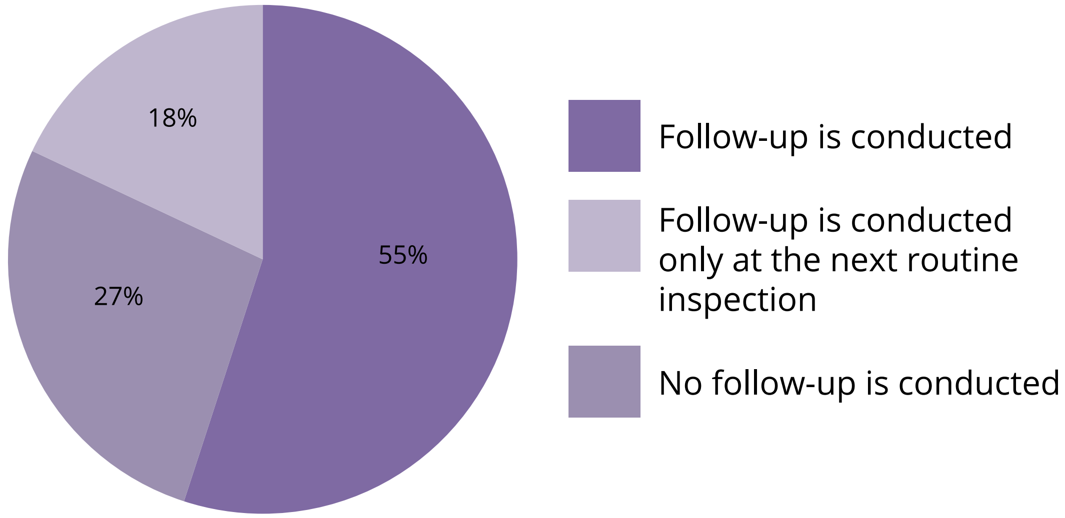
When hazards are discovered in schools, nearly three-quarters‡ of LHJs with programs follow up with schools, either immediately or at the next routine inspection, depending on severity (Figure 8). Note that one developing program did not respond and is not included in this percentage. About one-quarter do not follow up with schools at all.

Follow-up policies vary between LHJs and include requesting schools to provide their own corrective actions and time frame, documenting school responses to cited hazards, and reevaluating the hazards at the next inspection. If schools fail to address corrective actions after follow-up, over half of LHJs that follow up said there are no ramifications for schools. Only one jurisdiction described potential escalation. Note that LHJs can prevent a school from opening in the plan review phase, but in routine EH&S inspections, there are few ramifications for schools that fail to meet environmental health standards. When asked if LHJs require schools to notify the school community in the event of an imminent health hazard, one-fourth‡ selected yes, but all added caveats that notification is not required, only recommended, except for pesticide use. When asked what reasons schools give for not correcting issues after an inspection, the top two responses were lack of funding and that it was not required in regulations.

*"Draft inspection reports are sent to schools/districts (per the K–12 Guide) via spreadsheet format. They respond with correction comments. Final reports are then issued with their comments included. We inspect with an escort, so if there are hazards that need immediate attention, the school/district can initiate corrective action while we are there." – **Routine program***

"Lack of a clear, concise code and inability to easily enforce regulations force us to dedicate a large amount of our available time coming up with solutions for school districts when they do not willingly make changes in response to inspections. While this aspect would not be removed with a new code/enforcement tool, our time commitment would be greatly reduced."
– Developing program

Figure 8: Corrective action follow-up



Trained workforce

All twelve LHJs with a program reported that their inspectors had received training from DOH's School Program, with three-quarters‡ receiving training annually or more frequently, including via a weekly/biweekly Zoom meeting run by DOH. Inspectors also engaged in a variety of other trainings provided by EPA, the US Centers for Disease Control and Prevention, the US Food and Drug Administration, L&I, the National Association of County and City Health Officials, Washington State and National Environmental Health Associations, and the Washington Association of Maintenance and Operation Administrators. The most frequently mentioned training need described was for playgrounds—specifically, the Certified Playground Safety Inspector (CPSI) training (Box 8).

Lastly, a little over one-third of LHJs surveyed publish an environmental health newsletter or keep schools regularly updated on environmental health issues. Topics covered include COVID-19 and other communicable disease prevention, food safety, and ventilation.

Chemical hazards in schools

Only one-quarter of the 22 LHJs reported surveying schools for chemical hazards, including PCBs, asbestos, lead-based paint, lead pipes, hazardous waste storage, or mercury-containing products. When asked about PCBs specifically, only one jurisdiction had any estimation of the number of PCB-containing light ballasts in current use within their jurisdiction's schools but did not maintain a list. Additionally, three LHJs reported responding to reports of leaking or smoking

PCB-containing light ballasts. For the few LHJs that had surveyed schools for other chemical hazards, nearly all described the surveys as part of a larger hazardous waste program, including "Rehab the Lab," Ecology's Pollution Prevention Partnership, and their local county hazardous waste management program (Box 9).

When asked about whether LHJs had knowledge of and shared current hazardous waste management funding programs, including OSPI's Lead in Water Remediation Grant and Ecology's Fluorescent Light Ballast Replacement Grant, there was a wide gap between LHJs familiar with available programs and LHJs sharing that information with schools. Over half said their inspectors were familiar with the Lead in Water grant, but only two (10%) shared information with schools. Similarly, about 40% reported familiarity with Ecology's light ballast replacement grant, but only three (14%) reported having passed along the information.

Box 8

What does it take to become a Certified Playground Safety Inspector?

To become a CPSI, you must successfully pass the National Recreation & Park Association's CPSI exam. New candidates are highly encouraged to take the supplemental course, which consists of about 15 hours of training on topics including playground hazards, risk management, comprehensive safety programs, and entrapment, protrusion, and entanglement methods. The course is offered online, virtually, and in-person, while the exam is offered as a remote or in-person proctored exam at one of 200+ testing centers in the US. The course and exam fee for a Washington Recreation & Park Association (WRPA) member is $590, or $650 for a non-member. The CPSI certification is valid for three years, after which a re-certification test is $199 for WRPA members and $250 for non-members. Candidates must pay for their own hotel and transportation costs.[112,113]

Box 9

Department of Ecology's "Rehab the Lab" program

"Rehab the Lab" was a program funded by Ecology and implemented at the county level to assist in the removal of hazardous waste from schools. It was the most recent statewide effort to survey and remove school chemical hazards, such as lead, mercury, and otherwise outdated and unwanted chemicals. The program ran from 1998 to 2002, successfully disposing of 38.2 tons of hazardous chemicals from school buildings.

Ecology is in the initial stages of creating a new school lab cleanout program that will assist individual schools in identifying waste chemicals that are either expired or toxic for proper collection and disposal. While the criteria for this new grant program are not fully developed, it is projected to launch mid- to late 2023. Participating schools will be encouraged to adopt a green chemistry curriculum or switch to safer alternatives to be eligible. The application process will work similarly to Ecology's current PCB Light Replacement in Schools program, and it will initially be offered to under-resourced and tribal schools, and to Pollution Prevention Assistance partners.

Capacity and equipment for technical support

Among the 12 LHJs with a routine or developing program, half provided technical support to schools when EH&S issues were discovered that required sampling or testing. Technical support was most frequently provided for issues related to noise control, pest control, mold and moisture management, HVAC/ventilation, and water contamination concerns. Other technical areas where support was provided included concerns around air contaminants, contaminated building supplies, electrical issues, playground safety, food safety, and building plan reviews. LHJs unable to offer technical support can usually still provide guidance and referrals to schools.

> *"Staff FTE and time limitations restrict the depth of campus safety inspection effort conducted. More importantly, the level of training and PPE provided to inspectors limits their activity. I do not expect my inspectors to be plumbers, electricians, building inspectors, and especially, hazardous waste specialists. Our best effort lies in validating a school's active managerial control of risks. For example, does a school have a chemical management plan, do they follow it, and do they have a current chemical inventory, vs looking bottle-by-bottle in each cabinet."*
> ***– Routine program***

While technical support for schools is limited, many LHJs have tools locally available for sampling or testing. All‡ reported having access to a light meter and sound meter, while most‡ also reported having access to an infrared thermometer, moisture meter, and carbon dioxide monitor. Approximately half‡ reported having access to an air flow meter, electrical tester, smoke pen for evaluating air flow, pH meter, chemical testing kit, and/or playground safety tools. Very few LHJs reported having access to chemical-protective gloves, hygrometers for humidity, carbon monoxide sensors, particle counters, light meters, total dissolved solids meters, wipe sampling supplies, voltage detectors, or respirators. No LHJs described having access to a dew point meter, wet bulb temperature monitor, radon monitor, combustible gas detector, oxidation-reduction potential meter for water, microwave tester, electrical gloves, or thermal infrared camera. Survey questions on sampling and testing tools for inspections were drawn from EPA's *Indoor Air Quality Tools for Schools*[114] and departmental exposure science expertise. Table 8 summarizes the difference between the types of reported *information* and *technical support* delivered to schools for the specified EH&S hazards and control topics. For each topic, most responses were from LHJs with routine or developing programs, but all 22 LHJs surveyed were given the opportunity to respond.

Table 8: Information and support provided by LHJs to schools

Topic	Information	Technical support
Asbestos	3 (14%)	2 (9%)
COVID-19 ventilation	12 (55%)	4 (18%)
Green cleaning	7 (32%)	2 (9%)
Lead (paint)	5 (23%)	3 (14%)
Lead (pipes)	6 (27%)	2 (9%)
Mercury	4 (18%)	3 (14%)
Mold	7 (32%)	3 (14%)
PCBs	3 (14%)	2 (9%)
Radon	2 (9%)	1 (5%)
Wildfire smoke	12 (55%)	3 (14%)

Legal authority and guidance resources

All LHJs with current or developing programs reported relying on the same three regulations, guidance documents, and state departmental resources to implement their school EH&S programs:

- Chapter 246-366 WAC *Primary and Secondary Schools*[2] (last updated in 1991).
- Individual consultation with DOH School Program.
- The DOH's *Health & Safety Guide*[105] (last updated in 2003).

Aside from local codes, other resources used include:

- Chapter 246-366A WAC (implementation suspended since 2009)[3,5].
- EPA's *Indoor Air Quality Tools for Schools*[104].
- EPA *Model K–12 School Environmental Health Program*[61].
- *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*[106] by the National Research Council of the National Academies.
- The *U.S. Consumer Product Safety Commission Playground Standards*[107].

When seeking guidance on air quality recommendations, most LHJs use:

- DOH's *School Indoor Air Quality Best Management Practices Manual* (2003)[108].
- DOH School Program's *Responding to Indoor Air Quality Concerns in our Schools*
- (2005)[109].
- EPA's *Indoor Air Quality Tools for Schools*[104].

Other mentioned resources include the American Society of Heating, Refrigerating and AirConditioning Engineers (ASHRAE) recommendations[110] and local guidance.

When asked what resources are most frequently used to support hazardous chemical–related recommendations, roughly half of LHJs cited:

- DOH School Program and Ecology-supported "Rehab the Lab" programs. Note that while "Rehab the Lab" occurred throughout the 1990s and early 2000s, it is still one of the most important resources for chemical hazard–related information and recommendations.

Other mentioned guidance includes:

- Ecology's *Laboratory Guide for Managing Dangerous Waste* (2015)[111] and Hazardous Waste and Toxics Reduction Program[116].
- EPA's *Toolkit for Safe Chemical Management in Schools*[112].
- Local county solid/dangerous waste program recommendations and specialists.
- Chapter 296-62 WAC: *General Occupational Health Standards*[113].
- Pollution Prevention Assistance grant (Ecology)[114].
- Chapter 296-800 WAC: *Safety & Health Core Rules*[115].

Finally, when asked about pest control, integrated pest management (IPM), and pesticide use, LHJs reported using:

- DOH's School Program guidance (41%).
- EPA's *Model Pesticide Safety & IPM Guidance Policy for School Districts*[117] (27%).
- Washington State University (WSU) *School IPM* website[118].
- IPM Institute of North America: *IPM Standards for Schools*[119] or *IPM STAR Certification*[120].
- Washington State Department of Agriculture.

Unlike the previous resource questions, nearly 32% of LHJs were unsure of what guidance resources were available to consult for pest control.

Barriers, facilitators, and needs for LHJ school EH&S program implementation

All LHJs, regardless of existing program status, were asked to rank their top three program implementation–related barriers, facilitators, and support needs from a select list of factors. Programs were also given an opportunity to choose "Other" and write in a barrier, facilitator, or need not listed. Each category was then weighted using the following formula to calculate a summary score that was used to rank the factors:

Score = (Factor #1)(3) + (Factor #2)*(2) + (Factor #3)*(1)*

Barriers

The top three cited barriers to program implementation—reported by at least 50% of surveyed LHJs—were lack of funding, staffing, and training, followed by the lack of a clear, concise code (Table 9). Funding and staffing were reported as greater barriers by LHJs with full inspection programs than LHJs with programs in development. Each of our key informant interviews with LHJs revealed that Foundational Public Health Services (FPHS) funds have been instrumental for LHJs developing a new program or building capacity for an existing program. The following quotes from survey comments illustrate common differences in funding and capacity constraints between LHJs with established, routine programs and those without:

> *"There is a constraint on FPHS funding that does not allow us to use it to replace existing fees. While we can use it to supplement existing fees, it puts us in a difficult position as LHJs with new programs can use the funding in lieu of fees, e.g., our schools pay for services, their schools don't."* ***– Routine program***

> *"I am contemplating a school program, but even with Foundational Health funding, it is difficult because of the historic underfunding in core programs."* ***– Program that conducts plan review only***

> *"We currently do not have a full school inspection program. If we were required to start one, I would need our Board of Health support and adequate funding to add FTE and inspection equipment in order to do the work. Additionally, since we don't have in-house experience, we would need training provided by DOH or coordinated regionally with LHJs that have programs currently."* ***- Program that conducts plan review only***

The top reported barriers for LHJs with programs in development were lack of training and clear codes. The following quotes from survey comments reflect sentiments from other programs in the process of developing their school EH&S programs.

> *"In addition, standardized and widely available training is a huge barrier—training is mostly self-led and, without a standardized program, can take up to a year to fully train a new inspector. With a high turnover rate in public health, this often leaves us with a revolving door of new/partially trained staff, which benefits neither the LHJ nor the school. A 'new inspector training' model similar to that of the DOH Food Safety Group would be extremely helpful. Standardized state forms and inspection field marking guides would significantly help training efforts as well."* – ***Developing program***

> *"Lack of defined codes and enforcement tools mean each interaction/inspection results in sometimes a month of follow-up and negotiation on corrections. Having defined tools for enforcement would not only minimize the need for these lengthy follow-ups but would also help significantly with standardizing our training and decision-making in the field."* ***– Developing program***

Additional barriers, in order of score, include competing priorities, time constraints, enforcement inability, resistance from school districts, COVID-19, outdated guidance, politics, and a limited understanding of requirements versus recommendations.

When asked what their perception was of the top barriers for schools in their jurisdiction with respect to meeting EH&S requirements and recommendations, LHJs reported budget constraints or lack of funding as the top barrier. This was followed by lack of staff and clear, concise regulations (Table 10).

> *"All of our school partners desire to have safe, healthy learning environments and all have budgetary concerns."* – ***Routine program***

Other perceived barriers for schools were lack of support from district officials, time constraints, lack of training, limited understanding of health impacts, and COVID-19.

Table 9: Top barriers for EH&S program implementation

LHJ barriers	Total (%)	Routine program	Developing program	No program	Score
Budget constraints or lack of funding	11 (50%)	3	3	5	**26**
Staffing constraints or lack of personnel	14 (64%)	4	2	8	**24**
Lack of training	11 (50%)	2	3	6	**20**
Lack of a clear, concise code	9 (41%)	2	4	3	**14**

Table 10: Top perceived barriers for school compliance

Perceived barriers	Total (%)	Routine program	Developing program	No program	Score
Budget constraints or lack of funding	18 (82%)	5	6	7	**45**
Staffing constraints or lack of personnel	15 (68%)	6	5	4	**27**
Lack of clear, concise regulations	9 (41%)	2	4	3	**13**

Facilitators

As shown in Table 11, the top factor LHJs reported as important to facilitate school EH&S program implementation was adequate funding, reported by 68% of surveyed LHJs, followed by clear, concise codes, frequent DOH training, and dedicated school EH&S personnel, aligning with the barriers reported by LHJs. LHJs with full inspection programs considered funding and clear codes to be more important facilitating factors than LHJs with programs in development.

> *"Long-term funding support through FPHS or other mechanism would be most helpful."*
> ***– Routine program***

> *"We had two staff trained 5+ years ago, but our program never materialized due to funding, and these two staff have left our agency. We have new staff with no training."* – ***No program***

Other facilitators include enforcement support, political support, county administrative support, low-cost or free training from the DOH School Program, community support, and program evaluation. Additional "Other" write-in facilitators included updated guidance, statewide consistency, ESD support, State Board of Health support, and a clear understanding of requirements versus recommendations.

> *"[Our ESD] has an industrial hygienist; that expertise and partnership allows [our] school program to focus on areas such as playground safety and student-related complaints. The industrial hygienist provides services such as sound level surveys, Asbestos Hazard Emergency Response Act inspections, employee complaint response, etc. The expertise and partnership are beneficial to schools and public health."* – ***Routine program***

> *"Successful school programs are based on trusting, collaborative relationships with school partners, including maintenance/facilities, administrators, nurses, principals, teachers, ESDs, designers, etc., not on enforcement. LHJs are one piece of a very complex puzzle, which includes many agencies, funding streams, etc."* ***– Routine program***

Table 11: Top facilitating factors for EH&S program implementation

Facilitating factors	Total (%)	Routine program	Developing program	No program	Score
Adequate funding	15 (68%)	5	4	6	**40**
Clear, concise codes	13 (59%)	6	3	4	**24**
Frequent training from DOH School Program	12 (55%)	4	6	2	**20**
Personnel specifically dedicated to school EH&S	11 (50%)	3	5	3	**20**

An important facilitator identified through an additional key informant conversation centers on the need to develop a risk-based model for school EH&S inspections, based on evidence from previous inspection encounters and/or a cross-sectional study of hazards identified in schools across the state. Many LHJs with routine programs have a thorough understanding of common hazards within schools in their jurisdiction, but new programs do not have the historical inspection experience to know what hazards to expect. A risk-based approach could provide the foundation for a baseline inspection form highlighting the most prevalent hazards, efficacious control measures, and technical assistance resources. Additionally, utilizing illness reporting systems established during COVID-19 response to identify situations where the school building and grounds could be contributing to student illnesses could further focus LHJs and school districts on priority areas. See Box 10 for one LHJ's example of identifying priority hazards through illness and injury data reporting systems.

Needs

Sixty-eight percent of surveyed LHJs reported clear, concise codes as a top support need from state agencies, followed by funding, technical support, low-cost training and certification, and more frequent training opportunities (Table 12). Support needs were ranked similarly by routine programs and programs in development.

Box 10

A case study on one LHJ's attempt to better understand health and safety impacts in their school environments

An LHJ has identified the benefits and barriers to data collection in schools by using the REDCap data collection tool to periodically survey schools on their incidence of COVID-19, other communicable disease trends, and injury trends. This LHJ began collecting data from schools through use of the REDCap tool to collect individual case information directly from school nurses and district personnel. As the guidance shifted from individual case collection to aggregate weekly data, the REDCap survey was redesigned to collect both COVID-19 data and general health room data that could be useful for the School Environmental Health & Safety Program. After consulting with school nurses, human resources, and safety and risk management staff at several local school districts, a new survey was created that had two required components (total weekly number of student COVID-19 cases and staff COVID-19 cases) and one optional component: health room data.

The new health room data component asked individual school nurses to report:

- Number of students who visited the health room with respiratory symptoms (excluding COVID-19 positive cases).
- Number of students who visited the health room with gastrointestinal symptoms (excluding COVID-19 positive cases).
- Number of students who visited the health room with playground-related injuries.
- Number of students who visited the health room with athletics/physical education–related injuries.
- Number of students who visited the health room with other injuries (please describe).

The vision was that collecting this data would allow epidemiologists and environmental health staff to predict trends in communicable disease and injury to assist the public health programs to best meet the needs of the community and highlight high-priority areas where an abnormal number of illnesses or injuries were occurring. In addition, the data epidemiology team at the LHJ created a PowerBI dashboard based on the survey data that could be used to visualize trends and share with schools so they could take preventative measures.

A barrier to the survey and data collection is that there is no requirement for schools to report many of these data points. The survey was optional, and approximately two out of the nine districts in this area routinely complete the information. However, even with a limited number of schools reporting, the LHJ has been able to identify trends that have led to improvement in school facilities and procedures.

Additional support needs include plan review technical assistance and training, educational materials for schools, funding for training and equipment, liaison with OSPI and school districts, enforcement support, public relations support, EH&S newsletters, and access to tools and equipment. Under "Other," LHJs wrote in long-term funding support, updated guidance, ESD industrial hygienist staff, and new program set-up guidance.

> *"In addition, there is a large gap with plan review training—more resources and opportunities in this area would yield a good return, as many of the issues we find on complaints/in the field could have been easily prevented during the plan review process if caught."* ***- Developing program***

Box 10 continued

The first week of data collection, a concerning anomaly presented itself. An elementary school nurse from one small-sized school district reported 54 playground injuries in a single week. The LHJ's team reached out to the school nurse directly to find out more about the types of injuries occurring. During the conversation, the school nurse amended the report to 29 injuries but reported that at least nine of these reported injuries were head injuries. Other injury types ranged from simple scrapes and bruises to collisions, impacts, and falls. Falls, impacts, and head injuries are among the leading types of injuries and leading causes of fatalities on playgrounds in the United States. As such, the LHJ followed up with the district to continue collecting and monitoring injury data. The LHJ is currently working with the district's safety and risk management team to help identify the causes of injuries and develop a plan for reducing their frequency. Improved data systems in school health rooms may encourage cleaner and more consistent data collection and improve participation in public health surveys, ultimately resulting in a safer school environment for children.

Table 12: EH&S program support needs from state agencies

Needs	Total (%)	Routine program	Developing program	No program	Score
Clear, concise codes	15 (68%)	5	5	5	**26**
Funding for school EH&S program	10 (45%)	3	3	4	**16**
Technical support	12 (55%)	3	3	6	**14**
Low-cost or free training & certification	16 (73%)	5	5	6	**13**
More frequent training opportunities	10 (45%)	5	3	2	**13**

The top two reported support needs from Washington State legislators were funding and updated, enforceable regulations, both cited by over three-quarters of surveyed LHJs, followed by a clear legislative mandate (Table 13). The need for a clear mandate was ranked higher by LHJs developing their programs than by those with routine programs.

Table 13: EH&S program support needs from legislators

Needs	Total (%)	Routine program	Developing program	No program	Score
Funding for school EH&S program resources & staff	17 (77%)	5	5	7	**36**
Updated & enforceable regulations	17 (77%)	6	5	6	**36**
Clear legislative mandate	15 (68%)	3	6	6	**25**

Limitations

Our survey faced some limitations. Of 35 LHJs, we received submissions from 22, for a response rate of 63%. We recognize the time it took to complete our survey and the seasonal time in which it was delivered may have been a significant burden to LHJs. The opinions and perspectives of 13 LHJs are not included in this report, including a few LHJs with long-standing, routine programs. These LHJs represent just over 10% of public school children in the state, and all thirteen are classified as rural counties by the Washington State Office of Financial Management.[115]

Twenty-four surveys were submitted, but one LHJ submitted two surveys from different school EH&S personnel, and one LHJ submitted both an incomplete and complete survey. We used the survey from the higher-ranking personnel and the survey that was complete. As described above, there was some inconsistency in response to the question: *Does your LHJ currently have a K–12 school EH&S inspection program that focuses on health and safety issues in schools (besides food safety)?* We attempted to correct for it by making most calculations about survey programs out of the 12 LHJs with a routine or developing program that answered "Yes" to the above question. This omitted the one LHJ that responded "Yes" but only reviews construction plans and the two LHJs with developing programs that responded "No" and were, therefore, not given the opportunity to answer the full survey tool.

While we sent the survey to environmental health directors at each LHJ, some surveys were completed by someone in a different position. There are likely differences in perspective between environmental health staff in an administrative role compared to those in a technical role.

Lastly, our survey was largely based on EPA's *Model K–12 School Environmental Health Program,* which does not incorporate all areas of EH&S that our Washington state LHJs prioritize, such as playground safety.

> *"This survey [based on the EPA Model Program] has been challenging as it is limited in focus and does not include important priority areas such as playground safety, operational issues (e.g., testing eye washes, providing equipment user instructions) or innovative curriculum issues (e.g., necessary ventilation for adding 3D printers). Many of the areas not included in the survey are as (or more) frequently addressed than those in the EPA model program."* ***– Routine program***

Content analysis of regulations

Regulations pertaining to K–12 school environmental health vary significantly by state. Washington is one of a handful of states to have a comprehensive regulation specific to schools, overseen by a health agency. Other states, such as California, have numerous regulations pertaining to K–12 school environmental health. However, they are patchwork strategies, with oversight spread across multiple state agencies.

Twenty-seven states were identified as having one or more relevant policies. Based on our inclusion criteria,13 state regulations were identified for review in addition to our own state's two relevant regulations: Chapters 246-366 and 246-366A of the Washington Administrative Codes (WAC 246-366 and WAC 246-366A). Table 14 presents these regulations, including the oversight agency, date of implementation, and most recent update, if applicable. Twelve of 14 states have regulations overseen by the state's health agency, and two states, New Hampshire and Oregon, have regulations overseen by those states' Department of Education. New

Hampshire's regulation requires inspection by a local health official as a part of the school approval process, conducted every few years. While Oregon's Healthy and Safe Schools Plan does not require inspections, it was included due to its proximity to Washington, its relatively recent implementation (2017), and its novel requirement that schools develop their own Healthy and Safe Schools Plan (Box 11). All enforceable regulations reviewed were implemented or have been updated since 2002, except for Washington's implementable school code. Montana's regulation was updated most recently, in 2020. Notably, Washington's Environmental Health and *Safety Standards for Primary and Secondary Schools* (WAC 246-366A) is prohibited from being implemented until "the legislature acts to formally fund implementation."[5] West Virginia's General Sanitation Rule, which applies to other institutions as well as schools, was suspended as of 2020.[116] All regulations reviewed, except for Arizona's and Oregon's, cover public as well as private and religious schools. However, New Hampshire inspects public and private schools at different intervals, and Pennsylvania private schools are only inspected if requested by the state's Department of Environmental Resources.

Inspection and remediation requirements

Eleven of the 15 regulations reviewed require school inspections by a local health official; however, the frequency of inspections and remediation requirements vary widely across regulations (Table 15). Of the regulations that require school inspections, Washington's enforceable regulation, WAC 246-366, and Pennsylvania's School Sanitation Program are the only two regulations to not specify inspection frequency; WAC 246-366 requires "periodic" inspections[119], and Pennsylvania requires inspections "as often as necessary to maintain satisfactory compliance with applicable rules, regulations and standards..."[120] Of the 11 states that require school inspections, the frequency of inspections ranges from twice per year (Kentucky) to once every three to five years, depending on the type of school (New Hampshire; three years for private schools, five years for public schools). Five regulations require annual inspections, including WAC 246-366A, which is not enforceable.

Box 11

Oregon Healthy and Safe Schools Plan

In 2017, the Oregon State Legislature passed SB 1062, which requires school districts, ESDs, and public charter schools to adopt a Healthy and Safe Schools (HASS) Plan to address environmental conditions in all buildings where students and staff are present on a regular basis.[117] The plan must address all elements under ORS 332.331 (Healthy and Safe Schools Plan)[118] and may include additional elements relevant to that community. Parties were required to submit an initial HASS Plan to the Department of Education in 2019, and plan updates must be submitted annually if new buildings are acquired, constructed, or leased, or if the plan is modified by the district. The Oregon Department of Education published a model HASS Plan in 2019. Required plan elements include, but are not limited to, the following: identification of an individual responsible for maintaining and implementing the HASS Plan; a plan to test for elevated levels of radon, a plan to test for and reduce exposure to lead in drinking water, a plan to implement integrated pest management practices, and a plan to communicate test results to the school community.

Regulations are roughly split (7 of 15) on whether they require follow-up inspection and/or specify a timeline if corrective action is necessary. Six regulations require the health official to establish a specific and reasonable time period for corrective action if a violation is found. Colorado's regulation[121] allows the Department of Public Health and the environment to issue a compliance advisory if violations are identified, requiring schools to submit a Plan of Action to the department. Nevada requires all deficiencies indicated in an inspection report to be corrected within 30 days of the inspection, unless otherwise indicated on the report.[122]

Eight of 15 regulations contain consequences for noncompliance, including unannounced inspections (North Carolina), public notification of unresolved critical violations (Colorado), and possible school closure (multiple regulations). Rhode Island is the only state to require that schools receive an annual approval to operate.

> *Rhode Island – R16-21-SCHO 22.1*[123] *…it shall be the responsibility of each local fire chief, local building inspector, the Director of the state Department of Health, and the Director of the state Labor and Training Department to determine and notify each local school superintendent or non-public school official by August 1 of each year as to whether the…school buildings conform to appropriate state and federals laws and regulations within their respective jurisdiction.*

Common among all regulations is the responsibility of schools or school boards for corrective action.

Regulation elements by activity category

Appendix C presents a complete checklist of regulation elements, and Table 16 presents a summary of regulation elements organized by health issue. The following results are organized by the categories identified as the *Five Key Components of a School Environmental Health Program* and *Additional Opportunities for Promoting Environmental Health in School Facilities* detailed in the EPA *Model K–12 School Environmental Health Program*.[75] Note: The research team reviewers agreed to code all activities relevant *only* to new construction and/or renovations in the section of the survey specific to new construction and renovation. As such, a regulation that has robust requirements for the ventilation of *new* buildings, but requires no updates to existing structures, would have those regulation elements captured only under "new construction and renovation," not "HVAC."

Table 14: State K–12 School Environmental Health & Safety Regulations Reviewed

State	Name of Regulation	Code	Oversight Agency	Type of Policy	Date Implemented	Most Recent Update	Notes
WA	Primary and Secondary Schools	Washington Administrative Code 246-366	Department of Health	Regulation	1971	1991	
WA	Environmental Health and Safety Standards for Primary and Secondary Schools	Washington Administrative Code 246-366A	Department of Health	Regulation	Passed 2009; not enforceable	NA	Implementation subject to WA state legislature providing funding to public schools in accordance with section 222 of the 2009-11 biennial operating budget, chapter 564, laws of 2009, and may be subject to future legislative requirements.
AZ	NA	Arizona Adminstrative Code Title 9, Article 7	Health Department	Regulation	2006	NA	Regulation does not cover private or religious schools.
CO	Rules and Regulations Governing Schools in the State of Colorado	6 Code of Colorado Regulations 1010-6	Department of Public Health and the Environment	Regulation	2015	2018	
IN	Sanitary Schoolhouse Rule	410 Indiana Administrative Code 6-51	Board of Health	Regulation	1985	2007	
KY	School Sanitation	902 Kentucky Administrative Regulations 45:150	Department of Public Health	Regulation	1984	2021	
MT	Montana School Health Rules	Administrative Rules of Montana 37.111.8	Department of Public Health and Human Services	Regulation	1986	2020	
NV	NA	Nevada Administrative Code 444.568 - 444.5682	Board of Health	Regulation	2002	NA	

Table 14: State K–12 School Environmental Health & Safety Regulations Reviewed (Continued)

State	Name of Regulation	Code	Oversight Agency	Type of Policy	Date Implemented	Most Recent Update	Notes
NC	Rules Governing the Sanitation of Public, Private and Religious Schools	15A North Carolina Administrative Code 18A .2400	Department of Health and Human Services	Regulation	1986	2002	
NH	Minimum Standards for Public School Approval	New Hampshire Administrative Rule Ed 306.07	Department of Education	Regulation	1982	2014	The School Health Inspection Manual, developed by the Department of Health and Human Services for use by local health officers, was reviewed.
OR	Healthy and Safe School Plan	Oregon Administrative Rule 581-022-2223	Department of Education	Regulation	2017	NA	Regulation does not cover private or religious schools. In addition to OAR 581-022-2223, Oregon Revised Code 332.331 and the Model Healthy and Safe Schools Plan, were also reviewed.
PA	School Sanitation Program	Pennsylvania Code 28.17.51; School Sanitation Program	Department of Health	Regulation	1979	2004	
RI	Rules and Regulations for School Health Programs	R16-21_SCHO; Part IV Healthful School Environment	Department of Health	Regulation	1964	2009	
UT	Design, Construction, Operation, Sanitation, and Safety of Schools	Utah Administrative Code R392-200	Department of Health	Regulation	1998	2018	
WV	General Sanitation Rule	West Virginia Code of State Rules §64-18	Bureau for Public Health	Regulation	2013; suspended as of 2020	NA	Regulation not specific to schools; applies to other institutions including recreational facilities, campgrounds, and motels.

Table 15: Inspection Activities as Required by State K–12 School Environmental Health & Safety Regulations

State	Frequency of regular inspections	Party responsible for inspections	Party responsible for corrective action	Follow up required	Follow up timeline specified	Enforcement mechanisms	Notes
WA [246-366]	"Periodic"	Department of Health	Schools				
WA [246-366A]	1x per year	Department of Health	Schools				Not enforceable
AZ	1x per year	Health Department	School's governing board				
CO	Min. 1x per year for schools with labs; 1x every 3 years for schools without	Department of Public Health and the Environment	Schools	Yes	As soon as possible or by date specified by the Department	Compliance advisory from Department; Plan of Action developed by school officials; enforcement action may include, but is not limited to, public notification of unresolved critical violations; prior to enforcement action, Department may schedule meeting with school offficals to determine Plan of Action to bring school into compliance	
IN	Inspections not required	NA	NA				
KY	2x per year	Cabinet for Health and Family Services	Schools	Yes	Specific and reasonable period of time for the corrective action of each violation found, determined by member of the Cabinet	Failure to comply with any notice issued during inspection shall result in further action being taken; Cabinet shall report suspected noncompliance with applicable requirements of other state agencies to those agencies	
MT	1x per year	Department of Public Health and Human Services	Schools	Yes	Time schedule for compliance set by representative of Department or local health authority conducting inspection		

Table 15: Inspection Activities as Required by State K–12 School Environmental Health & Safety Regulations (continued)

State	Frequency of regular inspections	Party responsible for inspections	Party responsible for corrective action	Follow up required	Follow up timeline specified	Enforcement mechanisms	Notes
NV	Min. 1x per year	Board of Health	Schools	Yes	Within 30 days after the inspection unless otherwise indicated on inspection report	Health authority may notify the following parties of noncompliance: Department of Education; board of trustees of school district where school (public or charter school) is located; Superintendent of Public Instruction (if private school)	
NC	1x per year	Department of Health and Human Services	Schools	Yes	Only for schools that request resinspection to improve classification; unannounced resinspection occurs within 30 days after date of request	Schools classified based on score received during inspection and given a grade, scores of 70 or less are classified as unnaproved; schools can request reinspection to imrove their classification	
NH	1x every 3-5 years, depending on type of school	Department of Health and Human Services	Local school board	Yes	By date determined by local health officer	Department notifies local board of health if school is deemed to be a "menace," if after reasonable time period complaint has not been attended to, Department can order changes to the school building or condemn the school building	Private schools require inspection every 3 years, public and charter schools every 5 years
OR	Inspections not required	NA	NA				
PA	"As often as necessary to maintain satisfactory compliance with applicable rules, regulations, and standards..."	Department of Health	Schools			For public schools which are found to be noncompliant, a copy of the inspection report shall be sent to the Department of Environmental Resources (DER); for public schools that continue in noncompliance, after proper notice, DER will coordinate with Department of Education for abatement	Private schools only inspected if requested by Department of Environmental Resources
RI	Inspections not required	NA	Schools			School officials subject to sanction set forth in RIGL section 16-21-3.1 if school is noncompliant	

Table 16: Summary of State K–12 School Environmental Health and Safety Regulation Elements (continued)

State	Frequency of regular inspections	Party responsible for inspections	Party responsible for corrective action	Follow up required	Follow up timeline specified	Enforcement mechanisms	Notes
UT	Inspections not required	NA	Governing body of the school				
WV	1x every 2 years	Bureau for Public Health	Schools	Yes	Inspecting health officer determines timeline	Health officer may issue written order to operator requiring action to be taken; operator may request hearing; health officer may suspend or revoke permit to operate	Suspended as of 2020

Table 16: Summary of State K–12 School Environmental Health & Safety Regulation Elements

0-20%	21-40%	41-60%	61-80%	81-100%

Regulation Elements	WA 246-366	WA 246-366A*	AZ	CO	IN	KY	MT	NV	NC	NH	OR	PA	RI	UT	WV**
Five Key Components of a School Environmental Health Program															
1. Practice Effective Cleaning and Maintenance															
1a. Inspections; maintenance practices	2/6	3/6	1/6	3/6	1/6	3/6	3/6	2/6	2/6	2/6	0/6	2/6	1/6	1/6	2/6
1b. Cleaning practices	1/9	4/9	2/9	3/9	2/9	1/9	5/9	2/9	2/9	1/9	0/9	1/9	2/9	2/9	4/9
2. Prevent Mold and Moisture	2/10	6/10	0/10	1/10	3/10	1/10	2/10	1/10	1/10	1/10	0/10	1/10	0/10	1/10	4/10
3. Reduce Chemical and Environmental Hazards															
3a. Chemical and chemical-containing products	3/19	6/19	0/19	7/19	1/19	1/19	8/19	2/19	1/19	1/19	0/19	1/19	9/19	3/19	3/19
3b. Mercury	0/4	1/4	0/4	1/4	0/4	0/4	0/4	0/4	0/4	0/4	0/4	0/4	1/4	0/4	0/4
3c. PCBs	0/4	0/4	0/4	0/4	0/4	0/4	0/4	0/4	0/4	0/4	0/4	0/4	1/4	0/4	0/4
3d. Lead	0/2	0/2	0/2	1/2	0/2	0/2	0/2	0/2	0/2	1/2	1/2	0/2	1/2	0/2	0/2
3e. Asbestos	0/1	0/1	0/1	1/1	0/1	0/1	0/1	0/1	0/1	1/1	1/1	0/1	1/1	0/1	0/1
3f. Radon	0/4	0/4	0/4	1/4	0/4	0/4	0/4	0/4	0/4	1/4	2/4	0/4	3/4	0/4	0/4

Table 15: Inspection Activities as Required by State K–12 School Environmental Health & Safety Regulations (continued)

Regulation Elements	WA 246-366	WA 246-366A*	AZ	CO	IN	KY	MT	NV	NC	NH	OR	PA	RI	UT	WV**
3g. Drinking water; lead	3/14	7/14	2/14	4/14	3/14	3/14	11/14	4/14	5/14	5/14	4/14	1/14	3/14	2/14	5/14
3h. Outdoor air pollution	0/9	0/9	0/9	0/9	0/9	0/9	2/9	0/9	0/9	0/9	0/9	2/9	1/9	1/9	2/9
3i. Secondhand smoke	0/3	0/3	0/3	0/3	0/3	0/3	1/3	0/3	0/3	1/3	0/3	0/3	2/3	0/3	1/3
4. Ensure Good Ventilation	1/15	3/15	1/15	4/15	3/15	0/15	4/15	1/15	4/15	0/15	2/15	2/15	0/15	5/15	7/15
5. Prevent Pests and Reduce Pesticide Exposure	1/17	1/17	1/17	2/17	0/17	2/17	4/17	3/17	2/17	1/17	2/17	2/17	4/17	5/17	6/17
Additional opportunities for promoting environmental health in school facilities															
New Construction and Renovation															
School siting	1/2	1/2	0/2	0/2	1/2	0/2	1/2	0/2	0/2	0/2	0/2	2/2	0/2	1/2	1/2
Construction process; materials; IAQ; precipitation controls; design for pest reduction	1/12	3/12	0/12	1/12	0/12	1/12	2/12	1/12	0/12	0/12	1/12	1/12	1/12	1/12	4/12
Energy and water efficiency	0/4	0/4	0/4	0/4	1/4	0/4	0/4	0/4	0/4	0/4	0/4	0/4	0/4	0/4	0/4
Other opportunities															
Classroom Comfort	3/4	3/4	0/4	3/4	2/4	2/4	2/4	2/4	1/4	1/4	0/4	2/4	2/4	3/4	3/4
Energy and Water Efficiency	0/17	0/17	0/17	0/17	1/17	0/17	0/17	0/17	0/17	0/17	0/17	0/17	0/17	0/17	0/17
Waste Management	0/7	0/7	1/7	3/7	1/7	1/7	2/7	1/7	1/7	1/7	0/7	2/7	1/7	1/7	1/7

**Regulation not enforceable **Regulation suspended as of 2020*

For complete list of regulation elements, see Appendix C: State K–12 School Environmental Health and Safety Regulation Elements

Five Key Components of a School Environmental Health Program

Practice effective cleaning and maintenance

Fourteen of 15 regulations require schools to be kept clean; however, required cleaning activities vary widely among regulations. Notably, Oregon's regulation does not include any cleaning requirements, and Washington's enforceable regulation, WAC 246-366, specifies only that school officials shall "keep school facilities clean and in good condition."[124] Montana's regulation has the most robust cleaning requirements, requiring schools to conduct routine cleaning, use equipment properly to perform cleaning tasks, and store cleaning products in a manner that makes them inaccessible to students. Additionally, deodorizers and odor-masking agents are not permitted, and green cleaning products are to be used to replace older, conventional products when they require restocking. Rhode Island's is the only regulation to require up-to-date inventories of all cleaning products used. No state regulation requires vacuuming with HEPA filters.

Prevent mold and moisture

Twelve of 15 regulations require activities related to the prevention of mold and moisture in school buildings. Washington's WAC 246-366A, which is not enforceable, has the most robust requirements, including routine inspection of school buildings for moisture problems and water damage, acting quickly to address leaks, and drying affected areas within 24 to 48 hours. WAC 246-366A requires schools to use recognized remediation procedures, such as those documented in the EPA's *Mold Remediation in Schools and Commercial Buildings Guide*, published in 2001.[125]

Reduce chemical and environmental hazards

Four of 15 regulations, and just two enforceable regulations (Montana and Rhode Island), require proper use, storage, and disposal of chemicals. Three states (Colorado, Montana, and Rhode Island) require schools to develop a chemical hygiene plan. No regulation requires schools to develop a hazard communication plan, as is recommended by the *EPA Model Program*, though Montana's regulation requires schools to designate a chemical hygiene officer and to store safety data sheets in rooms where chemicals are stored and in a separate secure location (common components of a hazard communication plan). Rhode Island is the only state to require a chemical purchasing policy, and Colorado and Montana are the only states to require unused hazardous materials to be removed from the school with the assistance or guidance of a qualified professional.

Chemical hazards found in equipment and building materials, and those that are naturally occurring, are regulated to a similar or lesser extent than chemical and chemical-containing products. Oregon is the notable exception with no regulation of chemical and chemical containing products, but robust requirements for the regulation of asbestos and radon. Colorado, New Hampshire, and Rhode Island also have requirements pertaining to asbestos and require testing for radon. Three regulations (Colorado, Rhode Island, and WAC 246-366A – not enforceable) regulate the use of mercury in laboratories, though none require mercury inventories or the replacement of unneeded mercury-containing products with mercury-free alternatives, as recommended by the *EPA Model Program.* Of the regulations we reviewed, Rhode Island is the only state to regulate PCBs, though the requirements are non-specific. The regulation requires schools to develop a chemical hygiene plan, which "shall include a prohibition on the use of the chemicals listed in Appendix A."[94] PCBs are listed among nearly a thousand other chemicals in their "Appendix A." The regulation prohibits such chemicals from being purchased by schools and are "prohibited from a school."[126].

New Hampshire is the only state to require the inspection and inventory of lead-based paint. However, all state regulations reviewed regulate lead levels in drinking water to some degree, except for WAC 246-366. Three regulations (Montana, New Hampshire, and WAC 246-366A – not enforceable) require testing for lead in drinking water taps at minimum every five years, which is the frequency of testing recommended by the *EPA Model Program*. The Washington State Legislature passed E2SHB 1139 in 2021, which requires lead testing and remediation in schools, to fill the gaps in WAC 246-266. Montana is the only state to require lead concentrations at all drinking water taps to be below 15 ppb, in line with current EPA action levels.[127] Four regulations (Montana, Oregon, West Virginia – regulation suspended, and WAC 246-366A – not enforceable) require schools to develop a plan for providing drinking water if contaminants are discovered, and three of those states require a lead reduction plan. Colorado, North Carolina, and New Hampshire are the only three states to require routine maintenance of drinking water infrastructure. Overall, Montana has the most robust requirements in this area.

Few states regulate outdoor air pollution via their school environmental health regulations. Only five states address this issue: Montana, Pennsylvania, Rhode Island, Utah, and West Virginia (regulation suspended). Rhode Island requires school bus schedules to be designed to minimize idling. Utah and West Virginia require intake vents to be located away from vehicular traffic. Montana is the only state to require schools to have a procedure for responding to air quality index advisories.

Ensure good ventilation

Similar to other activity categories, ventilation requirements vary widely among regulations. Eleven of 15 regulations address ventilation (Kentucky, New Hampshire, and Rhode Island do not), and six of 15 regulations specifically require schools to have functioning ventilation systems. Montana, Utah, and West Virginia require regular system cleaning, and Arizona requires schools to have HVAC maintenance plans. Montana and Utah are the only states to require regular HVAC system inspections. Four states (Colorado, Indiana, North Carolina, and West Virginia – suspended) require school building outdoor ventilation to meet or exceed ASHRAE standards and/or local codes, and Utah and West Virginia require building air intakes to be located away from high vehicular traffic areas, plumbing and exhaust stacks, and chimneys for the school's heating system. Montana is the only state to require the implementation of new air ventilation, cleaning, and filtration technologies in their school code; the regulation requires the use of air filters with a MERV rating between 8-13, unless non-MERV-rated filters are used. Further, the regulation recommends that schools with ventilation systems using MERV-rated filters change to MERV-13 filters during periods of poor outdoor air quality.[128]

Prevent pests and reduce pesticide exposure

Fourteen of 15 regulations address pest prevention and/or the reduction of pesticide exposure; however, three regulations (Arizona, WAC 246-366, and WAC 246-366A – not enforceable) require no specific activities. Montana, Oregon, and Utah require schools to develop and implement Integrated Pest Management (IPM) programs, which include protocols to reduce pest levels while minimizing risk to people and the environment. Despite not requiring IPM programs, three states (Colorado, Utah, and West Virginia – regulation suspended) require the use of pesticides that present the least risk of exposure, if pesticide use is necessary, and four states (Nevada, North Carolina, Utah, and West Virginia – regulation suspended) require pesticides to be stored in a secure location. Montana and West Virginia (regulation suspended) require pest prevention activities in areas beyond school buildings, including playgrounds, athletic fields, and parking lots. The Rhode Island regulation permits parents or guardians of students and school staff to register for prior notice of all pesticide applications at their school and requires school authorities to provide school community members with a written statement on pesticide application policies.[129]

Additional opportunities for promoting environmental health in school facilities

Classroom comfort

Thirteen of 15 regulations address classroom comfort. Twelve of 15 regulations specify minimum lighting requirements, with some regulations differentiating minimum lumens by room use. Five of 15 regulations address acoustics, including both Washington regulations. Eleven of 15 regulations address temperature control, either relating to HVAC systems, water temperature, or both. Pennsylvania requires staff to be trained in HVAC use but does not regulate the temperature in school buildings.

Energy and water efficiency

Indiana is the only state to address energy or water efficiency in its school environmental health regulation. Indiana's Sanitary Schoolhouse Rule requires "heating facilities be constructed, operated, and maintained for the efficient consumption and utilization of energy."[130]

Waste management

Of the regulations we reviewed, all, save for Washington's and Oregon's, addressed waste management in some capacity. Of the regulations that do address the issue, most specify that waste bins shall be made of a durable and easily cleanable material, have tight-fitting lids, be accessible, and be emptied at least once per day. Colorado and Montana are the only two states to require schools to provide recycling bins, and Colorado is the only state to require that schools provide compost bins as well.

Construction and renovation

Seven of 15 regulations oversee school siting activities. Montana, Pennsylvania, and Utah require environmental factors to be considered during the siting process. Eleven of 15 regulations regulate construction and/or renovation plans and procedures. WAC 246-366A (not enforceable) and Montana's regulation are the only two codes that explicitly require indoor air quality to be addressed during the design phase. Oregon is the only state to require contractors to follow EPA's Lead Renovation, Repair, and Painting Rules. The rules require renovations, repairs, and painting projects that may disturb lead-based paint to be conducted by EPA-certified contractors.[131] Montana and West Virginia (regulation suspended) require schools to incorporate precipitation controls in the design process, implementing features such as sloped roofs and landscaping to carry water away from buildings. West Virginia (regulation suspended) is the only state to require schools to incorporate pest prevention in the design phase of new buildings and renovations.

Limitations

States vary significantly in their regulation of K–12 school EH&S. Some states, like Washington, regulate school environments primarily through a comprehensive school-specific code overseen by the state's health agency. Other states take a piecemeal approach, granting different agencies authority to regulate various hazards. Because we looked specifically at codes comparable to Washington's, we may have missed regulations that thoroughly regulate a particular issue or offer innovative enforcement mechanisms. Further research in this area may be beneficial, especially related to emerging hazards.

Discussion

PCB regulations, guidelines, and resources

Washington schools compared to other states and best practices

Washington schools are regulated for PCBs under the federal TSCA rule, which does not have specific rules for school buildings. As is the case with almost all other states, Washington does not have any additional state rules for PCBs in buildings or for schools. Therefore, the way PCBs are addressed in Washington schools, from a regulatory perspective, is largely similar to how they are being addressed elsewhere in the country. Similarly, Washington does not provide its own guidance for addressing PCBs in schools, and instead refers to EPA's PCB resources. This leads to the question of whether the TSCA regulation and EPA guidance is sufficient to effectively address PCBs in schools and protect the health of school building occupants. The following is a discussion of the limitations of current rules and guidance, as well as barriers to compliance with these rules and guidelines and other challenges of addressing PCBs in schools.

Knowledge of and resources for identifying and addressing PCB hazards

In discussions of awareness and knowledge around PCBs in Washington schools, some key informants said they had heard PCBs referred to as "an East Coast problem," meaning there may be Washington school building owners or operators who do not think PCB hazards exist in their schools. Key informants also mentioned that if there was awareness of PCB hazards, it was typically around PCB light ballasts and not PCBs in building materials, which some of our informants believed are the more prevalent hazard.

Another area of insufficient knowledge cited by key informants is around PCB regulations. In particular, the regulatory authority for PCBs can be confusing, and awareness of TSCA requirements for spill cleanup, abatement and mitigation, and disposal may be lacking among school owners, operators, and staff who may be most likely to discover potential PCB hazards. And while some agency websites include PCB information as described above, very few provide specific actions to take regarding PCBs in schools other than the EPA.

Lastly, even if there is awareness of the potential for PCB hazards in schools, there may be competing priorities and scarce resources such as time, expertise, and funds for inspecting for PCBs, characterizing the hazard, and if identified, properly addressing the hazard. One key informant pointed out that there is no certification or specified training required by TSCA to address PCB hazards properly as there are for other environmental hazards such as lead and asbestos. There are also very few government-based PCB specialists to offer support to LHJs and schools in Washington.

Authorized use of PCB-containing light ballasts

Many key informants said the continued authorized use of PCB-containing light ballasts is concerning, particularly as these fixtures are well beyond their intended lifespan and may be malfunctioning and releasing PCBs into the air without obvious signs to those using them. EPA guidance recommends removing all PCB-containing light ballasts in schools; however, as described above, we do not know whether or how many schools still have PCB-containing light ballasts in their buildings. Our interviews highlighted some barriers that schools may encounter if they do still have PCB-containing light ballasts. Key informants mentioned that some schools may be unaware of the hazards of PCB light ballasts or believe that they are no longer a problem as many PCB light ballasts had been replaced through energy efficiency efforts, when, in fact, some remain in use in infrequently occupied areas. Another barrier mentioned was the lack of time or in-house resources for schools to inspect their light ballasts and then follow up on any discoveries.

While there are two funding sources available for Washington schools to remove and replace PCB lights, very few schools had used these programs by the end of 2022. Possible reasons for this described by key informants were that for the Ecology program, schools must inspect and come up with a plan to apply for funds, which may be time-consuming, or they may not have in-house expertise or available approved contractors to do the work. It was also mentioned that state contract laws made development of an effective replacement grant program difficult.

No testing requirements for potential exposures or in building materials

Another challenging element of the TSCA regulation is the lack of requirement to test for potential PCB exposures or PCBs in building materials. Without this requirement, key informants believed schools were unlikely to do so. An analysis of EPA PCB cases in schools in a 10-year span found that only one of 286 cases involved a proactive attempt to identify and address PCBs.[97] In the remainder of the cases, PCBs were discovered when testing had been done prior to renovation or demolition work to assess waste management needs, or in cases where school occupants had illnesses or symptoms that prompted an investigation.

One reason for not proactively testing is that if PCBs are found in building materials above 50 ppm, school building owners are required to remove, remediate, and dispose of those materials. As many of our key informants explained, this can be time-consuming and costly, and thus a significant barrier for schools to perform testing. Furthermore, we did not learn about any publicly available resources for schools to test for PCBs in our review, so schools are likely responsible for finding and paying contractors and labs for any testing performed. Some of our key informants mentioned that another reason schools may not want to test is the fear of negative publicity or litigation if PCBs are found, as has happened in several local and national cases.

No testing requirement following abatement or mitigation work

There is also no testing requirement for sampling for PCBs in the air following a PCB abatement or mitigation project, meaning it does not have to be verified that the actions taken were effective in reducing PCB levels and exposures. Senator Markey’s report also highlights two cases where PCB concentrations in the air continued to be above guideline levels despite significant PCB abatement work following EPA guidance.[97] In these instances, one school in Massachusetts was demolished, and the other in Connecticut is no longer in use.

Lack of sampling protocols

In various guidance documents, the EPA mentions that testing air or surfaces for PCBs can help characterize exposures and can be a step to verify whether interventions to reduce PCB exposures have been effective. While there are established EPA methods for taking and analyzing air and surface samples, there are no recommendations for general sampling strategies such as when, where, how long, and in what situations sampling for potential exposures may be useful. In our conversation with the current and former PCB coordinators for EPA Region 10, we learned that they are currently developing these types of sampling protocols specifically for schools and that this document will be available in early 2023.

Limited reporting requirements

There are very few instances that apply to schools where reporting related to PCBs is required. As illustrated in Box 5, leaking light ballasts do not have to be reported as the "spill" is most likely less than the threshold for reporting under the Comprehensive Environmental Response, Compensation and Liability Act, and the spill is not to water or vegetable gardens or animal grazing land. There is also no requirement to report to or coordinate with the EPA before, during, or after spill cleanup efforts or PCB abatement and mitigation work. EPA guidance does recommend consulting with regional EPA PCB programs in these instances. Key informants mentioned in some cases, schools may be hesitant to contact government agencies for help for fear of citations or negative publicity and subsequent litigation.

Local health jurisdictions and regulatory oversight

LHJ school programs ensure that children, teachers, school staff, and other community members are kept healthy and safe within school buildings. Of the 22 LHJs surveyed, only seven currently provide routine school program services, and nearly all felt their capacity and influence was limited by outdated codes and inadequate funding. A similar number of LHJs have programs in the development stages, and nearly all voiced the same concerns for their programs moving forward. Many without programs worry that they would not have the staff or funding to create a program if the Legislature requires regular inspections.

Outdated codes and guidance documents

> *"Since there is a proviso on WAC 246-366A, [our department] only uses it to facilitate or provide context to discussions, e.g., what was intended to be in the next iteration of the regulations, how certain terms were defined, etc."* – ***Routine program***

> *"We are working with a 50+-year-old rule, and the Legislature refuses to fund and implement the new rule that is already over 10 years old."* ***– Developing program***

Overwhelmingly, in both the survey results and key informant interviews, participants enumerated the many ways in which outdated codes and guidance documents affect their ability to ensure a safe school environment. Washington's enforceable code for K–12 school EH&S, chapter 246-366 WAC *Primary and Secondary Schools* (WAC 246-366), originally passed in 1971 and was most recently updated in 1991. It is limited in scope relative to comparable state codes and federal guidance. Of the 13 enforceable state K–12 EH&S regulations reviewed for this report, all were implemented after or have been updated since 2002. When evaluating standards compared to the *EPA Model Program,* Washington's enforceable code has numerous gaps and only provides for basic EH&S standards in school facilities.

In 2004, in response to complaints about mold, water quality, and indoor air quality in schools across Washington, the Washington State Board of Health began work to develop, with wide stakeholder involvement, the *Environmental Health and Safety Standards for Primary and Secondary Schools* (WAC 246-366A). The Board adopted these updated rules in 2009; however, due to budgetary concerns around K–12 funding, the Legislature adopted a proviso in the state supplemental operating budget (ESHB 1244) "prohibiting implementation until the Legislature acts to formally fund implementation." The state's supplemental operating budget, each year, continues to prohibit implementation of the rules, including (ESSB 5693) effective through June 2023.[5] LHJs can use these codes only to facilitate discussions with schools, but they cannot be enforced. WAC 246-366A is now over a decade old and has fallen behind current federal and state standards and guidance for various environmental health issues.

> *Updated K–12 Guide, WAC 246-366-140, references the K–12 Guide (a DOH/OSPI document), so that is a higher priority for updating than the WAC. The L&I references are in particular need of an update. -* ***Routine program***

The primary guidance document used to interpret applicable codes and control measures for identified hazards is the *Health and Safety Guide for K–12 Schools in Washington* (*Health & Safety Guide*). This guide was jointly developed and published in 2003 by DOH and OSPI and was required by WAC 246-366-140 to be created for use by LHJs "during routine school inspections in identifying violations of good safety practices. The guide should also include recommendations for safe facilities and safety practices."[132] The 2003 *Health & Safety Guide* remains the most comprehensive school EH&S resource for LHJs and schools in

Washington. While an updated version of this guide was in preparation to accompany WAC 246-366A, it remains unpublished until this rule is implemented. It is currently undergoing technical corrections.

Inconsistency in school EH&S program implementation

> *"Since very few LHJs have a comprehensive program, those of us who do are sometimes looked upon as putting additional requirements on our schools. In addition, we are tasked with providing consultations and training to other LHJs, which takes staff time and funding." –* ***Routine program***

The stratified state of school program scope and capacity across Washington creates inequitable environmental public health service delivery. Students in jurisdictions without a school program presumably are not receiving the same level of health and safety oversight as those jurisdictions with a fully developed and implemented EH&S program. Schools left to manage their own EH&S may differ in effective implementation based on the school district's knowledge and resources. In jurisdictions with an LHJ oversight program, schools may feel that undue burdens are placed upon them for health and safety management when compared to jurisdictions without. Additionally, our survey found that LHJs with full inspection-based programs were more likely to rely on WAC 246-366A for additional guidance than the developing programs. The influence that updated EH&S guidance documents have on LHJ technical assistance and support to school districts is likely to further disparities in program implementation across the state.

In this report, we identified inconsistencies in the school inspection process across Washington. While school program presence or absence is the primary contributor to differences in inspection comprehensiveness, even programs that perform routine inspections differ in frequency, breadth, and depth. Both annual and alternative inspection frequency models were identified and advocated for by their respective LHJs. Alternative school inspection models include those such as Spokane Regional Health District's three-year rotation, giving schools the opportunity to self-inspect between LHJ inspections. States with recently updated regulations, such as Colorado (2018) and New Hampshire (2014), came to a similar conclusion. Colorado requires local health officials to inspect schools with labs annually, but all other schools are inspected by the local health department every three years.[133] New Hampshire requires inspections by a local health official as a part of its school approval process, which is required every three years for private schools and every five years for public schools.[134] A collaborative model can result in schools building their own risk management teams that, reportedly, reduce the financial burden on schools, improve school ability to identify hazards outside of LHJ inspections, and relieve staff and time burdens on LHJs.

In both our interviews and survey results, we observed significant variation in the type of inspection checklist used across programs in the state, including the use of no checklist at all. This is due in part to the minimum standards for school EH&S set by WAC 246-366 and the lack of an explicit requirement to use a survey tool. Meanwhile, the *Health & Safety Guide* serves as a surrogate checklist for LHJs that choose to use it, though inspectors are not required to use the guide during inspections. Setting clear, comprehensive expectations for both the health agency and the school via a universal inspection checklist has been accomplished in other states, like New Hampshire. The New Hampshire Department of Education has published a standardized form to be used to complete all school inspections, creating continuity and clear expectations for schools and inspecting officials. The instructions for inspecting officials, published by the Department of Health and Human Services, also include the materials inspectors are to have on hand to complete the inspection.[135]

Inadequate regulatory capacity to address existing and emerging hazards

Washington is not currently positioned to adequately address existing or emerging hazards, require known efficacious control methods, or apply new knowledge affecting technical assistance, in part because of the prohibition on implementation of WAC 246-366A and the lack of statewide program implementation. The top five cited existing hazards during school inspections, according to LHJs surveyed, were chemical hazards in the lab, lighting, playground hazards, unsafe conditions including hazardous maintenance conditions, and HVAC issues or poor air quality. Lighting is the only one of these that is thoroughly covered in WAC 246-366. The other top hazards are only briefly mentioned in the code or not covered at all, like playground safety. Additionally, hazards important to the scope of this report, such as lead, PCBs, asbestos, radon, and mercury-containing products, are not directly referenced in the currently enforceable code.

When a hazard is identified during an inspection, surveyed LHJs frequently described challenges with school corrective action for issues beyond the current standards set by WAC 246-366. LHJs report attempting to persuade or encourage schools to remediate known hazards in the absence of being able to cite a specific code. Lack of clear, updated regulatory guidance results in extended back-and-forth discussion between LHJs and schools. Survey responses and interviews also revealed LHJ interest in guidance that includes a clear time frame for resolution, such as those for pool or food inspections, that are based on current best control practices.

WAC 246-366A takes steps toward addressing some of these shortcomings, including chemical hazards related to laboratories and cleaning activities, playground safety, drinking water hazards such as lead and copper (although action levels are outdated), and indoor air quality concerns, including mold and moisture. However, the updated Washington code regulates existing structures differently from new construction and renovations. The code is more comprehensive for new and renovated buildings, addressing various health issues such as ventilation and playground safety in greater depth. Regulations for existing structures are more limited in scope. As such, students in existing buildings may not benefit from the updated code. Other shortcomings of both WAC 246-366 and WAC 246-366A include a lack of descriptive control methods to prevent and mitigate health issues in school buildings. Additionally, neither of these codes prepares schools for emerging hazards, such as wildfire smoke, emerging diseases, and new technologies.

The lack of updated and implementable codes has led to a piecemeal legislative approach in addressing important health and safety concerns for the state's schools. One example of this approach has been the passage of Engrossed Second Substitute House Bill (E2SHB) 1139, an act to address testing and remediation requirements for lead in school drinking water outlets.[136] Many of the requirements in E2SHB 1139 are included in WAC 246-366A, albeit the existing lead action levels are out of date.

Conversely, Montana, Colorado, New Hampshire, Oregon, and Rhode Island all have codes that stand out for their approach to addressing present and emerging environmental health hazards. For example, Montana's regulation addresses wildfire smoke in their ventilation and filtration standards. These states also stand out for the mechanisms by which they oversee school EH&S and have implemented innovative tools designed to support capacity-building among schools and school districts and to ensure continuity across school EH&S program delivery, thereby increasing their capacity to respond to emerging concerns. Additionally, while many of the state codes reviewed require routine inspections, Colorado, Kentucky, and New Hampshire stand out by providing additional guidance for "post inspection," including a timeline for follow-up if corrective action is deemed necessary and detailed consequences for noncompliance. Each of these regulations require violations identified during inspection to be corrected within a reasonable time frame, as determined by the local health official or the health department.

If violations are not corrected within the stated time frame, each code specifies additional enforcement steps that may be taken.

Equitable funding

Budgetary constraints ranked as the top barrier for LHJs implementing a school program and for schools carrying out recommendations. Funding was also by far the number one facilitating factor for a successful school program and one of the top needs from legislators. Each of our interviews with LHJs revealed that Foundational Public Health Services funds have been instrumental for LHJs developing a new program or building capacity for an existing program. However, the interviewees also explained that this money is strictly earmarked for certain usages and cannot be used to replace existing fees for inspections, which creates inequities in program implementation across the state.

Funding and staffing issues also heavily affect schools. According to our interviews, LHJs report schools struggle to improve health and safety for students and staff without the appropriate resources to correct identified hazards.

Recommendations

PCB regulations, guidelines, and resources

In considering potential solutions and next steps for PCB hazards in schools, feasibility should be a key factor in decision-making. We recognize that implementing solutions may be challenging due to existing regulations, lack of funding and expertise, and the need for cooperation with school districts and other stakeholders.

Many of our recommendations can be grouped into two different solution strategy categories. The first strategy assumes PCBs are present in schools of a certain age and moves directly into implementing known efficacious interventions to address PCB hazards. The other strategy is to first characterize and quantify PCB hazards in Washington schools, then take actions specific to those findings.

Solution strategy 1: Assume PCB presence and implement known efficacious interventions.

Require removal of PCB light ballasts

Removing PCB light ballasts is one of four actions the EPA recommends for schools and is relatively uncomplicated compared to other potential interventions. As described earlier, there are already resources for addressing PCBs in light ballasts in the form of practical guidance from the EPA as well as two state-level programs that offer funding for replacement. To facilitate efforts related to such a requirement, the state could remove contract barriers; fund trained contractors to identify, remove, and properly dispose of materials; fund trained school-designated personnel to identify, remove, and properly dispose of materials; and/or create a more streamlined disposal process, such as offering pick-up of PCB light ballasts.

Support cleaning and ventilation best management practices

Another approach would be to establish, and fund, required cleaning, ventilation, and filtration practices that are known to be effective in reducing PCB exposure. These procedures also have the co-benefit of being effective at reducing other potential chemical and microbial exposures and improving indoor air quality generally. As seen in Box 12, improved indoor air quality has been associated with improvements in health and academic performance. Resources might include funding and expertise for evaluating, updating, and maintaining ventilation and filtration systems and support for green cleaning supplies, equipment, and increased custodial personnel necessary for conducting cleaning activities described in EPA recommendations.

Support schools with expertise, information, and outreach opportunities

As described above, there may be a lack of awareness and information about PCB hazards in schools. The state could engage in capacity-building in these areas to ensure school owners and operators are aware of their responsibilities related to PCBs, and to have expertise available to schools wanting or needing to investigate or address PCBs in their buildings. This could include outreach efforts to school owners and operators to inform them of PCB hazards and regulatory requirements; developing more specific guidance and clarification around regulatory requirements in Washington; providing more guidance and training to LHJ school inspectors on PCB hazards; and funding more indoor air quality, industrial hygiene, or environmental health specialists at the state, regional, or local levels to consult with schools about PCB issues.

Require testing of building materials for PCBs prior to school construction projects

A requirement to test and remove PCB-containing building materials before starting school renovation or demolition work is another EPA recommendation and is also an approach taken by Connecticut and the University of Washington. With this approach, schools may need technical support as well as funding to conduct the testing. Consideration would also need to be made for increased costs related to proper removal and disposal of PCB materials, safe PCB work practices, and potential PCB contamination of soil or other environmental media around building exteriors. Other elements found in the Asbestos Hazard Emergency Response Act could also be considered, such as hazard management plans and recordkeeping.

Solution strategy 2: Characterize and quantify PCB hazards in schools, then implement interventions.

Conduct a study to assess the presence and extent of PCB hazards in schools

One strategy would be to carry out a study of sufficient power to suitably characterize PCB presence in Washington schools to guide future interventions. Study aims could be to: estimate the presence of PCB light ballasts in schools; estimate the number of schools with building materials containing PCBs ≥50 ppm; characterize materials containing PCBs (identification of materials, measuring PCB concentrations); characterize potential PCB exposures to occupants of school buildings; and/or other aims to identify the presence and extent of PCB hazards or exposures.

Require inspection and testing for PCBs in schools

Another strategy would be to create a rule similar to Vermont's, where inspection and testing would be required for all school buildings built or renovated in a certain time frame (e.g., prior to 1980). Planning for a regulation like this would need to consider funding, expertise, and personnel needs for completing the inspections and testing and should also consider potential expenses for abatement and mitigation work if PCBs are found in indoor air or building materials.

Box 12

Impact of school indoor air quality on children's health and performance

Poor indoor air quality (IAQ) can be caused by lack of proper ventilation and filtration of indoor spaces, leading to the accumulation of air pollutants, mold, chemicals, and fumes that can be harmful to occupants. Temperature and humidity are also important factors that, when not regulated properly, can allow for mold growth. Carbon dioxide concentrations are a good indicator for IAQ as it is used to measure ventilation as a percentage of outside air in a building.[137]

Why is it important?

According to the EPA, indoor air pollution is one of the top five environmental risks to public health,[138] as children and adults spend up to 90% of their time indoors.[139] Without adequate IAQ in schools, students and teachers are subject to multiple health risks that range from "sick building syndrome" to a higher frequency of asthma attacks, especially for children whose developing bodies may be more susceptible.[138] Asthma is the leading cause of absenteeism in schools due to chronic illness, and about 1 in 13 school-age children suffer from it.[138] The presence of mold, dust mites, and pests—common school allergens— can trigger or worsen asthma symptoms.[138] Other individuals with respiratory diseases, suppressed immune systems, or even those who wear contact lenses are also more susceptible to indoor air pollutants,[138] taking time, energy, and focus away from learning.

In the literature

Much of the literature surrounding IAQ in schools has shown significant correlations between good IAQ and student performance. In a literature review of cross-sectional and intervention studies on ventilation rates in schools and student performance, eight out of 11 studies found "statistically significant improvements in at least some measures of performance with increased ventilation rates or lower carbon dioxide concentrations."[140] Some studies looked at performance measures such as speed and accuracy in addition, multiplication, proofreading, and logical thinking, while others analyzed attendance rates and even nasal patency—an indicator of nasal openness—as their response measure.[140] The overwhelming majority of the results correlated their measure of performance with carbon dioxide concentrations. The strongest study included in the review followed 162 classrooms over two years and reported a "1.6% decrease in absence for each 1 liter/second/person increase in ventilation rate."[140]

High carbon dioxide concentrations have been attributed to causing symptoms such as headaches, tiredness, and difficulties in concentrating.[141] Multiple other studies in the US and UK have found direct correlations between classroom ventilation rates and student academic performance through increased standardized test scores. These studies also found a reduction in cognitive performance in classrooms with higher levels of carbon dioxide and particulate matter.[142]

Solutions

In a school setting following the COVID-19 pandemic, students, families, and teachers are more aware of and concerned with IAQ. It is important that they have the knowledge and tools to feel empowered to protect their health from not only infectious diseases but from common air pollutants as well. Improving a school's IAQ can be as simple as opening windows or doors if the weather permits or using fans to circulate air in and out of classrooms.[139] IAQ sensors can be used by teachers to assess the state of their classrooms throughout the day .[143] Simply installing or improving air filters for PM (particulate matter) 2.5 can prevent harmful air pollutants from entering classrooms and has been shown to reduce incidences of asthma.[142] A study performed by Brown University in California's San Fernando Valley confirmed an increase in student performance only one year after local authorities ordered the installation of air filters in schools.[142]

Local health jurisdiction and regulatory oversight

Washington can address equity within school EH&S implementation while positioning itself to be ready for emerging hazards or EH&S concerns. The following policy solutions focus on using evidence-based science to guide an update of codes and guidance documents, as well as on building EH&S capacity across the system. We again recognize that there may be challenges related to funding, availability of expertise, and the cooperation of school districts and other stakeholders.

Eliminate the implementation suspension proviso in the upcoming supplemental state operating budget

One substantial solution the Legislature could choose is to discontinue adopting an "implementation suspension" in the upcoming state operating budget. Allowing the current proviso to lapse would result in the "new" chapter 246-366A WAC *Environmental Health and Safety Standards for Primary and Secondary Schools,* to enter into effect on August 1, 2023.[5] The implementation of WAC 246-366A would expand school health and safety to include a wider range of hazards and current control measures, including concerns identified by the Legislature (the genesis of this report). The importance of this recommendation was communicated to us in every LHJ and PCB-related interview, as well as throughout the survey. It is important to note that none of the Legislature's stated hazards of concern (including PCBs, lead, asbestos, or mold) are addressed in the existing WAC 246-366 but are in WAC 246-366A.

Update chapter 246-366A WAC using evidence-based science to identify priority hazards, effective control methods, and needed training and technical assistance opportunities

The "new" chapter 246-366A WAC was adopted 13 years ago and is out of date for a number of existing (e.g., lead) and emerging (e.g., 3-D printers, wildfire smoke, etc.) hazards. Updating these codes using an evidence-based approach to identify and prioritize common existing and emerging hazards and associated best control practices will help to focus both school district and LHJ limited resources on what really impacts health and safety in schools. Further study is needed to elucidate priority hazards in Washington schools and identify appropriate efficacious controls. One solution would be to conduct a retrospective study, examining past inspection data from LHJs and follow-up corrective actions taken by school districts. Another approach would be to conduct a cross-sectional study using a validated survey tool in participating schools to quantify consistently identified hazards, along with control strategies used by school districts. A final approach would be to use illness and injury data collected by schools to identify impacts from hazards found in school buildings and grounds (e.g., playgrounds). It is important to note, however, that continued flexibility for program implementation will be important to those LHJs with existing collaborative relationships with schools.

Update the *Health and Safety Guide for K–12 Schools in Washington* (2003)

This study identified the *Health & Safety Guide* as one of the top resources used by LHJs to guide hazard identification and best practices for controlling those hazards. This guidance document is nearly 20 years old and is based predominately on the content contained within WAC 246-366. If WAC 246-366A is allowed to become effective in 2023, this guide will need substantial revision and is required by WAC 246-366A-015. Additionally, this guidance document, regulated under WAC 246-366A–015(a), will need to be updated every four years. Regardless of WAC status, the Legislature could choose to initiate and fund an update to the existing guidance document. While the guide itself would not be enforceable, it could better outline current best control practices for priority hazards and provide recommendations for school health and safety, setting clear and consistent expectations for school health and safety across the state. It is important to note that this guide, although 20 years old, is still the top resource used by LHJs for program implementation and for guidance related to indoor air quality, hazardous chemical guidance, and pest control. Updating the *Health & Safety Guide* was consistently identified as one of the top facilitators to EH&S program implementation.

Invest in school health and safety at all levels: DOH School Program technical expertise, ESDs, LHJs, and school districts

While the scope of this study did not include a cost-benefit analysis of impact from various legislative solutions, it did document the overwhelming sentiment of funding needs across the system. Funding and resources for capacity topped the list of concerns for LHJs seeking to develop programs, as well as those committed to sustaining their services. Federal, state, and local key informants all spoke of the need to fund remediation and control activities in both private and public schools and to eliminate contract barriers that impede efficient interventions.

It is reasonable to assume that any proposed improvements in EH&S program implementation (defined broadly) as well as addressing PCBs in schools will require resources currently undirected toward the EH&S system. It is also reasonable to assume unfunded mandates will not produce the expected results. A logical next step would be to convene a stakeholder group to advise on equitable funding needs, allocations, and solutions, given that all who are involved with the K–12 EH&S system have likely contemplated ways to reduce barriers, streamline service delivery, and leverage existing collaborations.

Conclusion

This report identified that Washington is not currently positioned to address existing or emerging environmental health hazards in our schools. PCB-containing building materials are a concern facing school EH&S, but other hazards exist and should not be ignored. The suspension on implementation of WAC 246-366A, funding constraints, and a consistent program implemented statewide, are among the current barriers to addressing the school EH&S problem. This is a problem with known solutions that have been successfully used in other states and that could readily be adopted in Washington. Additionally, many recommendations in this report offer co-benefits that positively affect children's health and school performance, such as cleaning and ventilation best management practices. While individual solutions exist, we recommend a risk-based approach focusing on evidence-based science to address school EH&S. By using a comprehensive approach, Washington can ensure equity within school EH&S implementation while positioning itself to be ready for the next emerging hazard or EH&S concern for school building occupants.

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Appendices

Appendix A: Vermont's PCBs school regulation

Background

Prompted by the discovery of elevated PCB levels in Burlington High School, Vermont established a rule in 2021 requiring all public and independent schools built or renovated before 1980 to have indoor air tested for PCBs.[96] The Vermont Department of Health developed School Action Levels for PCBs in indoor air in schools, which the Vermont Department of Environmental Conservation (DEC) has the authority to enforce. DEC has contracted with consultants to conduct the sampling and created a schedule that will have all affected schools sampled by 2025. One news article about the rule stated priorities for testing included schools with younger children and schools built between 1950 and 1979, when PCBs were most commonly used.[144]

Sampling and follow-up actions

Consultants conduct a pre-sampling inspection and compile an inventory of materials potentially containing PCBs. A sampling plan is then developed and approved by DEC, and sampling is conducted in the schools. Sampling results are submitted to DEC and are subsequently shared with the Vermont Department of Health (DOH) and the EPA. Schools receive a joint letter from the DOH and DEC with results and any next steps, which may include implementing best management practices, identifying and addressing PCB exposure sources, and relocating building occupants to prevent or minimize exposure. Areas with results exceeding the Immediate Action Levels can no longer be used. If results exceed the School Action Levels, DOH recommends several occupancy scenarios to use while schools work with the state to address exposures.

Development of School Action Levels

The Vermont Department of Health published a document detailing the development of School Action Levels.[85] A Screening Value for PCBs had been previously established in 2013 and is defined as "the chemical concentration below which no additional actions are recommended." This value is meant to be protective of both cancer and non-cancer effects for school building occupants of all ages and sets the cancer risk to 1 excess cancer per 1 million people exposed.

This value was initially considered for use as the School Action Level, but there were concerns with the screening value being too close to background values for PCBs in indoor air (defined as 22.5 ng/m3)[145], which they believed would make it difficult to identify and address PCB sources. Thus, the School Action Levels, which are higher than the PCB Screening Value and based on the age of occupants, were created to prioritize the need for action. The School Action Levels accept a higher cancer risk -- 6 extra cases per 1 million people exposed (assuming a 30-year exposure duration and exposures of 9.75 hours per day and 235 days per year). Immediate Action Levels were defined as three times higher than the School Action Levels, though the development process of these levels was not described in the document or elsewhere.

Table A1: Vermont indoor air threshold levels for schools (ng/m^3)

	All ages		
Screening Level	15		
	Pre-Kindergarten	Kindergarten to Grade 6	Grade 7 to Adult
School Action Level	30	60	100
Immediate Action Level	90	180	300

Funding

An initial $4.5 million was allocated to conduct the indoor air sampling in the 327 schools built or renovated before 1980. Despite giving DEC authority to require schools to take action if PCBs are found above the School Action Levels, the legislation did not specifically provide funding for schools to address PCB hazards. After initial sampling, potential costs could include additional consulting needs to identify and test materials for PCBs and work to abate or mitigate the PCB hazards found, or for sampling after any abatement or mitigation work to verify effectiveness. There is an additional $32 million in the state's education fund set aside for schools to address PCBs, but decisions have not been made as to how it will be allocated.[146] Some $2.5 million of that fund can be used for "significant health threats" due to PCBs, but so far, the Vermont Emergency Board has not released any of those funds to schools.

Perspectives of program staff

We interviewed three staff members working on this program from DEC and DOH for their perspective on the rule, program development, and implementation. They explained that the political disposition of state government and budget resources in Vermont made for straightforward rule development and considerable cooperation from schools. They also cited the importance of collaboration with schools and facilities staff to facilitate efficient and effective sampling work and to promote cooperation and trust. In particular, they stated working closely with custodial staff was critical to ensuring thorough inspections and PCB inventories as they often have some of the best knowledge of school operations and layouts.

Now that the program has been developed and sampling has begun in schools, they've found that there is a significant amount of work to support schools and building occupants in understanding results and potential implications. Program staff were concerned that schools with results above School Action Levels may feel underprepared to address the hazard and make risk-based decisions and may want more technical advice and definitive guidance. Program staff expressed that additional technical staff would be beneficial to address these needs. Another consideration is that because PCBs hadn't been regulated in buildings or indoor environments in this way, there was limited existing PCB expertise within state agencies and among potential consultants to conduct the sampling.

The staff emphasized that starting a brand-new regulatory program is a significant undertaking, and that some issues have arisen that were not anticipated during rule development. They suggested a pilot program may clarify needs for staffing and expertise, as well as enforcement implications and burdens on schools (i.e., potentially extensive state or federal remediation requirements following certain findings).

Findings as of November 2022

Sampling results are publicly available via the program webpage. As of November 2022, results were available for seven schools. As seen in Table A2, only two schools with available results have samples above the School Action Levels. In one school, one area had a concentration higher than the Immediate Action Level, meaning the space could no longer be used (a stage in a gym, at 210 ng/m^3), and three additional areas had results above the School Action Level (a gym at 110 ng/m^3, a locker room at 77 ng/m^3 and an art room at 120 ng/m^3). The other school had three samples above the School Action Level (three kindergarten rooms ranging from 95- 120 ng/m^3).

Table A2: Vermont Schools PCBs sampling results (ng/m3)

School	Samples above IAL	Samples higher than SAL, less than IAL	Samples higher than background values, lower than SAL	Samples higher than detection limit, but lower than background	Samples lower than detection limit	Total samples
School A	1	3	8	6	21	39
School B	0	3	0	1	20	24
School C	0	0	3	20	2	25
School D	0	0	0	20	2	22
School E	0	0	0	11	13	24
School F	0	0	0	7	19	26
School G	0	0	0	0	19	19

**Field blanks, outdoor samples, and samples marked as duplicates were not included in counts*
***Results available as of 11/20/2022*

Appendix B: PCB Resource Lists

Table B1: Summary of publicly available PCB information on Washington state webpages

WEBPAGE	CONTENT	DOCUMENTS	LINKS TO EXTERNAL RESOURCES
WA Department of Health			
PCBs homepage	General info Health effects, Sources/exposure Exposure reduction, Environmental fate		EPA PCBs homepage EPA Fact Sheet: Practical actions for reducing exposure to polychlorinated biphenyls in schools and other buildings PEHSU PCBs webpage
Ecology			
PCBs homepage	General info Health effects Sources/exposure Ecology work addressing PCBs	PCB Chemical Action Plan	
PCBs in building materials page	PCBs in building materials – background, regulations Ecology efforts to reduce PCBs in building materials	Guide “How to find and address PCBs in building materials” Guide “How to estimate abatement project costs” Polychlorinated Biphenyl Dangerous Waste Guide Focus On: PCBs in building materials	EPA Fact Sheet: PCBs in building materials

Table B1: Summary of publicly available PCB information on Washington state webpages (Continued)

WEBPAGE	CONTENT	DOCUMENTS	LINKS TO EXTERNAL RESOURCES
PCB light replacement in schools program page	Background on PCB light ballasts, identification Hazards/health effects Exposure reduction strategies Information/ application for product replacement program What to do with a leaking PCB light ballast	Fluorescent Light Ballast Replacement Application	PEHSU PCBs webpage EPA PCBs homepage EPA Fact Sheet: PCBs in building materials EPA Fact Sheet: PCBs in Fluorescent Light Ballasts DOH PCBs homepage
PCBs in Schools blog post	Ecology efforts to address PCBs in schools PCBs in building materials info, link to report >50ppm PCBs in light ballasts info, link to product replacement program		EPA Fact Sheet: PCBs in building materials
EPA Region 10			
PCBs Program page	PCB Cleanup sites PCBs in building materials PCB waste management PCB Coordinator Contact information		Ecology Guide “How to find and address PCBs in building materials”
OSPI			
T-12 Lighting Grant page	No PCB info		

Table B1: Summary of publicly available PCB information on Washington state webpages (Continued)

WEBPAGE	CONTENT	DOCUMENTS	LINKS TO EXTERNAL RESOURCES
Seattle & King County Public Health			
PCBs homepage	General info health effects, Sources/exposure		
Spokane Regional Health District			
Protecting Spokane's Water – PCBs	PCB sources		

Table B2: Summary of resources available on the EPA Polychlorinated Biphenyls (PCBs) website

Type	Title	Date of publication	Pages	Contains information specific to schools?
General PCB information				
Webpage	Polychlorinated biphenyls (PCBs)	2022		No
Webpage	Learn about polychlorinated biphenyls	2022		No
Webpage	Policy and guidance for polychlorinated biphenyl (PCBs)	2022		No
Document	PCB question and answer manual	2014	134	No
Webpage	EPA regional polychlorinated biphenyl (PCB) programs	2022		Yes
PCB-containing fluorescent light ballasts				
Webpage	Polychlorinated biphenyl (PCB)-containing fluorescent light ballasts (FLBs) in school buildings	2022		Yes
Document	Fact sheet: PCBs in fluorescent light ballasts	2020	5	No
Document	Chart: TSCA storage disposal requirements for fluorescent light ballasts	2015	1	No
PCBs in building materials and indoor air				
Webpage	Polychlorinated biphenyls (PCBs) in building materials	2022		
Document	Fact Sheet: PCBs in building materials	2021	7	No
Document	Fact Sheet: Practical actions for reducing exposure to polychlorinated biphenyls in schools and other buildings	2015	4	Yes
Document	PCBs in building materials - questions and answers	2015	18	Yes

Table B2: Summary of resources available on the EPA Polychlorinated Biphenyls (PCBs) website (Continued)

Type	Title	Date of publication	Pages	Contains information specific to schools?
Webpage	Exposure levels for evaluating polychlorinated biphenyls (PCBs) in indoor school air	2022		Yes
Document	Science in Action: Polychlorinated biphenyls (PCBs) research overview	Unknown	2	Yes
Document	Science in Action: Laboratory study of polychlorinated biphenyl (PCB) contamination in buildings: Emissions from selected primary and secondary sources	Unknown	2	No
Research Report	Laboratory study of polychlorinated biphenyl (PCB) contamination and mitigation in buildings: Part 1. Emissions from selected primary sources	2011	127	Yes
Research Report	Laboratory study of polychlorinated biphenyl (PCB) contamination and mitigation in buildings: Part 2. Transport from primary sources to building materials and settled dust	2012	166	Yes
PCB mitigation and abatement for building materials				
Webpage	Steps to safe renovation and repair activities	2022		Yes
Webpage	How to test for PCBs and characterize suspect materials	2022		Yes
Webpage	Steps to safe PCB abatement activities	2022		No
Webpage	Summary of tools and methods for caulk removal	2022		No
Document	Science in Action: Laboratory study of polychlorinated biphenyl (PCB) contamination in buildings: Evaluation of the encapsulation method	Unknown	2	No
Research Report	Laboratory study of polychlorinated biphenyl (PCB) contamination and mitigation in buildings: Part 3. Evaluation of the encapsulation method	2012	108	Yes

Table B2: Summary of resources available on the EPA Polychlorinated Biphenyls (PCBs) website (Continued)

Type	Title	Date of publication	Pages	Contains information specific to schools?
Research Report	Laboratory study of polychlorinated biphenyl (PCB) contamination and mitigation in buildings: Part 4 Evaluation of the activate metal treatment system (AMTS) for on-site destruction of PCBs	2012	82	Yes
Research Report	Literature review of remediation methods for PCBs in buildings	2012	68	Yes
Site cleanup and remediation waste				
Webpage	Managing remediation waste from polychlorinated biphenyls (PCBs)	2022		No
Document	Facility Approval Streamlining Toolbox	2017	56	No
Document	Standard operating procedure for sampling porous surfaces for PCBs	2011	15	No
Document	PCBs sampling guidance for Subparts M, O, P, and R	Unknown	28	No
Document	Verification of PCB spill cleanup by sampling and analysis	1985	74	No
Document	Field manual for grid sampling of PCB spill site to verify cleanup	1986	55	No
Document	Wipe sampling and double wash/rinse cleanup	1987	31	No

a: For documents, date listed is date of publication. For webpages, the date is when last updated

Table B3: Summary of non-EPA PCBs resources

Type	Title	Date of publication	Pages	Contains information specific to schools?
Washington State Department of Ecology				
Webpage	Polychlorinated biphenyls (PCBs)	Unknown		Yes
Document	PCB Chemical action plan	2015	223	Yes
Webpage	PCB light replacement in schools	2022		Yes
Webpage	PCBs in building materials	2022		No
Document	How to find and address PCBs in building materials	2022	59	No
Document	How to estimate abatement project costs for PCBs in building materials	2022	14	No
Document	Focus on: PCBs in building materials	2021	3	No
Document	Polychlorinated biphenyl dangerous waste guide	2021	14	No
Research Report	Polychlorinated biphenyls (PCBs) in general consumer products	2014	64	No
Western States Pediatric Environmental Health Specialties Unit				
Webpage	PCBs	Unknown		Yes
Document	Fact Sheet: Polychlrinated biphenyls (PCBs) in schools: How children are exposed, health risks, and tips to reduce exposure	2017	2	Yes
Document	Poster: Managing PCBs in schools	2017	1	Yes
University of Washington Environmental Health & Safety				
Webpage	Polychlorinated biphenyls (PCBs)	Unknown		No
Document	Polychlorinated biphenyls (PCBs) management	2018	5	No
Document	PCB caulking work plan: University of Washington's Seattle campus	2014	12	
The Office of Senator Edward J. Markey (D-Mass)				
Research Report	The ABCs of PCBs: A toxic threat to America's schools	2018	46	Yes

a: For documents, date listed is date of publication. For webpages, the date is when last updated

Appendix C: State K–12 school environmental health and safety regulation elements

Table C-1: State K–12 school environmental health and safety regulation elements

Regulation Elements		WA 246-366	WA 246-366A[1]	AZ	CO	IN	KY	MT	NV	NC	NH	OR	PA	RI	UT	WV[2]
Practice Effective Cleaning and Maintenance																
Inspections; maintenance practices																
Tier 1	Regular inspections required	X[a]	X	X	X		X	X	X	X	X		X[a]			X
	Annual inspection of school facilities by building professional							X		X						
	Roof inspected 2x per year															
Tier 2	Accurate records maintained of building inspections		X		X		X	X	X							
Tier 3	Teacher/ staff training												X			
Additional regulations		X	X		X	X	X				X			X	X	X
Cleaning practices																
	Routine cleaning			X	X	X		X								X
	Proper equipment used to perform cleaning tasks		X					X								X
	Cleaning products are inaccessible to students		X		X			X	X	X					X	X
	Up to date inventory of all cleaning products used													X		
	Vacuum with HEPA filters															
Tier 1	Walk-off mats placed at building entrances															

	Regulation Elements	WA 246-366	WA 246-366A[1]	AZ	CO	IN	KY	MT	NV	NC	NH	OR	PA	RI	UT	WV[2]
Tier 2	Purchasing plans prioritize cleaning products that have one or more of the following traits: low or no VOC emissions, neutral PH, no known carcinogens, are biodegradable		X					X								
Tier 3	Teacher/ staff training												X			
Additional regulations		X	X	X	X	X	X	X	X	X	X			X	X	X
Prevent Mold and Moisture																
Mold and moisture																
Tier 1	Routine inpsections to ensure building is free of moisture problems, water damage, and visible mold on all exterior surfaces		X								X					
	Fix leaking plumbing and leaks in the school building ASAP		X													
	Dry wet areas within 24-48 hours		X													
	Moisture-generating appliances (e.g. dryers) are vented to the outside							X								X
	Downspouts drain to the storm sewer or visibly sloped grade away from building															
Tier 2	Established mold prevention/ remediation plan		X													
	Ventilation systems circulate indoor air properly	X	X		X	X				X						X
	Humidity levels are kept between 30-60%															
	Vents installed to the outside in all areas of school building that use large quantities of water (e.g. kitchens, bathrooms, locker rooms, and pool facilities)					X										X

Regulation Elements		WA 246-366	WA 246-366A[1]	AZ	CO	IN	KY	MT	NV	NC	NH	OR	PA	RI	UT	WV[2]
Additional/ other regulations		X	X			X	X	X	X				X		X	X
Reduce Chemical and Environmental Hazards																
Chemical and chemical-containing products																
	Annual chemical inventory of the school				X											
	Chemicals not on the school district's approved chemical list marked for removal		X													
	Screenings and inspections of chemical-containing equipment (e.g. PCB light ballasts, mercury-containing items) to ensure equipment is properly managed; chemical equipment inventory lists															
	Chemicals are stored properly: clearly labled, in undamaged containers, and stored according to chemically compatible families	X	X		X		X	X	X					X	X	X
	Chemicals are used properly; according to SDS or label instructions		X		X			X						X		X
	Chemicals are disposed of properly		X		X			X						X		X
	Regulation requires development of chemical hygiene plan				X			X						X		
	Chemical hygiene plan contains: chemical spill control policy; staff training requirements for chemical management; contact information for local authorities responsible for managing chemical spills							X						X		
Tier 1	Regulation requires development of hazard communication plan															

	Regulation Elements	WA 246-366	WA 246-366A[1]	AZ	CO	IN	KY	MT	NV	NC	NH	OR	PA	RI	UT	WV[2]
Tier 1 cont.	Hazard communication plan contains: contact information for person resonsible for implementing plan; procedures for acquiring, maintaining, and providing access to SDSs; updated chemical inventory; provisions for employee training; and chemical labeling requirements							X[b]								
Tier 2	Regulation requires development of chemical management plan															
	Regulation requires development of chemical purchasing policy													X		
	Chemical purchasing policy ensures all chemical-containing products are reviewed and purchased by one individual or team															
	Chemical purchasing policy ensures no more than 5 year supply is purchased															
	Teachers and staff receive chemical management training as mandated under OSHA's laboratory safety standards													X		
	Students understand proper chemical management		X											X	X	
	Unused, unneeded, degraded, and unknown chemicals are removed from the school with the help of qualified professional				X			X								
Tier 3	Green chemistry curricula															
Additional/ other regulations		X	X		X	X		X	X	X	X		X	X	X	

Regulation Elements		WA 246-366	WA 246-366A[1]	AZ	CO	IN	KY	MT	NV	NC	NH	OR	PA	RI	UT	WV[2]
Mercury																
Tier 1	Mercury inventory list (in which all elemental mercury, mercury compounds, mercury solutions, and mercury-containing devices are cataloged)															
Tier 2	Excess, outdated, and unneeded mercury-containing products are removed and/ or replaced with alternatives containing no mercury															
	Mercury is recycled or disposed of in accordance with federal, state, and local regulations															
Additional/other regulations			X		X									X		
PCBs																
Tier 1	Inspection of the school’s fluorescent light ballasts for leaking PCBs															
	Immediate removal and disposal of leaking PCB-containing light ballasts															
	Disposal of any PCB-contaminated materials at EPA-approved facility															
Additional/ other regulations														X		
Lead																
Tier 1	Inspection and inventory of lead-based paint (including: interior painted areas, exterior painted areas, play areas, playground equipment, and painted toys and furniture)										X					
Additional/ other regulations					X							X		X		
Asbestos																
Any regulations pertaining to asbestos					X						X	X		X		

Regulation Elements		WA 246-366	WA 246-366A[1]	AZ	CO	IN	KY	MT	NV	NC	NH	OR	PA	RI	UT	WV[2]
Radon																
Tier 1	Test frequently occupied rooms at or below ground level for radon; levels should be lower than EPA's action level of 4 pCi/L											X		X		
Tier 2	If mitigation is required, retest routinely to ensure mitigation is effective													X		
Tier 3	Re-testing after all major renovations; HVAC modifications or upgrades may affect radon intrusion															
Additional/ other regulations					X						X	X		X		
Drinking water; lead																
	If public water system, comply with all primary drinking water regulations and applicable underground injection control requirements	X	X	X	X	X	X	X	X	X				X	X	X
	If public water system, ensure only lead-free pipes are used in installation or for repairs								X							
	If school water system, system in compliance with drinking water regulations	X	X		X	X	X	X	X	X	X			X		X
	Up to date plumbing survey							X								
	Lead test results for drinking water taps conducted within past 5 years		X					X			X					
Tier 1	Lead concentrations at all drinking water taps should be below 15 ppb for a 250-milliliter sample (for PWS), for school water system lead concentrations at 10% of drinking water taps must be below EPA action level of 15 ppb							X								

Regulation Elements		WA 246-366	WA 246-366A[1]	AZ	CO	IN	KY	MT	NV	NC	NH	OR	PA	RI	UT	WV[2]
	Test drinking water for contaminants (timing will differ depending on number of people served and where school get its water)		X		X			X		X		X				
	Plan in place for providing drinking water if contaminants are discovered		X					X				X				X
	Lead reduction plan (includes lead testing on regular basis; flushing program; replacement of pipes etc. if known to be source of lead and; disabling taps)		X					X				X				
	Routine maintenance of drinking water infrastructure (includes, if applicable, source water assessments and identification of any surrounding activities or sources that might have an adverse effect on water quality, inspection of water pipes for leaks and corrosion)				X					X	X					X
	Replace drinking fountains identified on EPA's list of known lead-containing models															
Tier 2	Schools with own wastewater management systems inspect and pump systems regularly							X			X					
Tier 3	Record measures specific to school							X								
Additional/ other regulations		X	X	X		X	X	X	X	X	X	X	X	X	X	X

Regulation Elements		WA 246-366	WA 246-366A[1]	AZ	CO	IN	KY	MT	NV	NC	NH	OR	PA	RI	UT	WV[2]
Outdoor air pollution																
	Vehicle and bus idling: school bus schedules designed to minimize bus idling													X		
	Intake vents are located away from vehicular traffic areas and chimneys for school heating systems; if intake vents cannot be moved, traffic is directed away from vent locations														X	X
Tier 1	Procedure for responding to air quality index advisories							X								
Tier 2	Anti-idling policy applied to school buses, passenger vehicles, delivery trucks															
	Retrofit school bus fleet with improved emission control technologies or replace older schools buses with newer, more fuel-efficient buses															
	School Flag Program to help school and surrounding community know daily air quality conditions															
	Teacher/ staff training												X			
Tier 3	Student curricula												X			
Additional/ other regulations								X								X
Secondhand smoke																
Tier 1	Campus smoke-free policy							X			X			X		
Tier 2	Student smoking education program covers social and physiological consequences of tobacco															
Additional/ other regulations														X		X

	Regulation Elements	WA 246-366	WA 246-366A[1]	AZ	CO	IN	KY	MT	NV	NC	NH	OR	PA	RI	UT	WV[2]
Ensure Good Ventilation																
HVAC																
Tier 1	Building has functioning ventilation system		X		X	X				X					X	X
	HVAC system settings fit schedule of building use		X													
	Regular HVAC inspections, including regular schedule for inspecting and changing filters							X							X	
	Regular cleaning of air supply diffusers, return registers, and outside air intakes									X						X
	Ducts and interior of air-handling units or unit ventilators are clean									X					X	X
Tier 2	All rooms are ventilated; outdoor ventilation meets or exceeds ASHRAE standards and/ or local code				X	X				X						X
	Install high effeciency filters							X								
	HVAC maintenance plan			X												X
	Air intakes are located away from high vehicular traffic areas, plumbing and exhaust stacks, and chimneys for the school's heating system														X	X
	Carbon monoxide detectors installed near combustion sources (e.g. boilers, stoves, hot water heaters, and vocational education shops)				X							X				

	Regulation Elements	WA 246-366	WA 246-366A[1]	AZ	CO	IN	KY	MT	NV	NC	NH	OR	PA	RI	UT	WV[2]
	ASHRAE IAQ Procedure (performance-based design approach in which building and ventilation system are designed to maintain contaminant contentrations at specified levels)															
	New air ventilation, cleaning, and filtration technologies (e.g. MERV-13 filters)							X								
	Specific measurements recorded to indicate and track HVAC system performance							X								
Tier 3	Student curricula												X			
Additional/ other regulations		X	X		X	X			X			X	X		X	X
Prevent Pests and Reduce Pesticide Exposure																
Pest prevention and pesticide use																
	Inspection and mitigation: entryways						X									X
	Inspection and mitigation: classrooms and offices															
	Inspection and mitigation: food preparation and serving areas								X							X
	Inspection and mitigation: rooms with extensive plumbing															
	Inspection and mitigation: maintenance areas							X								
	IPM program							X				X			X	
Tier 1	IPM program: policy statement													X[c]	X	

Regulation Elements		WA 246-366	WA 246-366A[1]	AZ	CO	IN	KY	MT	NV	NC	NH	OR	PA	RI	UT	WV[2]
	IPM program: roles/ training												X			
	IPM program: regular site inspections															
	IPM program: records													X[c]		
	Pesticide use: pesticides that present least risk of exposure are used (experimental, phased out, or conditional-use pesticides not permitted)				X										X	X
	Caulk and crevice pesticide application, bait stations, or targeted spraying prioritized															
	All pesticides stored in secure area								X	X					X	X
Tier 2	Pesticides are not sprayed during school hours													X		
	Expanded IPM addresses outdoor areas such as playgrounds, athletic fields, parking lots, etc.							X								X
Tier 3	Student curricula												X			
Additional/ other regulations		X	X	X	X		X	X	X	X	X	X		X	X	X
New Construction and Renovation																
School siting																
Community needs and environmental factors are considered; resources such as EPA's Voluntary School Siting Guidelines, EPA's Smart Growth and Schools website, or other resources are utilized in the decision making process								X					X		X	
Additional/ other regulations		X	X			X							X			X
Construction process; materials; IAQ; precipitation controls; design for pest reduction																

Regulation Elements	WA 246-366	WA 246-366A[1]	AZ	CO	IN	KY	MT	NV	NC	NH	OR	PA	RI	UT	WV[2]
IAQ addressed during design phase; EPA's IAQ Design Tools for Schools website, or other resources utilized		X					X								
Entry mat system addressed specifically during design process															
Materials selected to optimize for IAQ (e.g. contain low-toxicity, water-based formulations, release no or low VOC emissions, emit little or no odor, contain no heavy metals, are formaldehyde free, easy to clean and maintain, and are not susceptible to moisture damage that can foster mold growth)		X													X
IAQ management plan required to protect workers during construction process and prevent residual problems with IAQ in the completed building															
Materials installation: order of installation optimized for IAQ (e.g. allow potential off-gassing materials to dry before finishing materials are installed)															
Occupant safety: construction and renovation activities are scheduled while school is not in session or building occupants are relocated to prevent exposure to harmful chemicals															
Contractors required to follow EPA's Lead Renovation, Repair, and Painting (RRP) Rules (including using renovators certified by the EPA trained to follow lead-safe work practices)											X				
Contractors required to demonstrate they have received all necessary trainings and certifications															
Contractors utilize procedures to protect workers during construction process, such as isolating and ventilating work areas															

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Precipitation controls installed to keep school building dry (e.g. sloped roofs, landscaping creates ground slopes to carry water away from building, prevent air intakes from collecting precipitation)							X								X
Design features incorporated to reduce the likelihood of pest problems															X
Additional/ other regulations	X	X		X		X		X				X	X	X	X
Energy and water efficiency															
Energy efficiency energy efficiency goals established; energy addressed at all levels of construction project; best practices for energy design as part of overall design, construction, and operations process to translate design intent into buildings that perform and earn ENERGY STAR															
Water efficiency incorporation of water-effecient products into building design and renovation plan															
LEED, CHPS, other certification															
Additional/ other regulations					X										
Additional opportunities for promoting environmental health in school facilities															
Classroom Comfort															
Lighting	X	X		X	X	X	X	X	X			X	X	X	X
Acoustics	X	X		X										X	X
Temperature control	X	X		X	X	X		X		X[d]		X[e]	X[d]	X	X
Additional/ other regulations							X[f]								
Energy and Water Efficiency															
Regular leak audits															
Landscaping uses plants with low-water needs															
Irrigation occurs at cooler times of day															

Regulation Elements	WA 246-366	WA 246-366A[1]	AZ	CO	IN	KY	MT	NV	NC	NH	OR	PA	RI	UT	WV[2]
Operate all building systems (e.g. chillers, cooling towers, boilers, plumbing fixtures, and cafeteria equipment) as effeciently as possible															
Install water-saving devices when possible															
Install water bottle filling stations															
Low-carbon IT policy															
Appliance servicing schedule															
Removal of all pre-1979 fluorescent lighting															
Replace older equipment with energy-saving devices															
Procurement policy favors ENERGY STAR qualified products and/ or WaterSense labeled products															
EPA ENERGY STAR partner; minimum energy-performance score; and/ or management plan															
Portfolio Manager or other measures used to track energy and water effeciency															
Invest in solar panels, green roofs, or rain barrels															
Teacher/ staff training on best practices for energy and water saving															
Student curricula related to energy and water saving															
Additional/ other regulations					X										
Waste Management															
Recycling bins offered				X			X								
Minimize food waste															
Composting				X											
Purchasing policy prioritizes school supplies and equipment made with reycled materials															
Teacher/ staff training												X			

Regulation Elements	WA 246-366	WA 246-366A[1]	AZ	CO	IN	KY	MT	NV	NC	NH	OR	PA	RI	UT	WV[2]
Student curricula												X			
Additional/ other regulations			X	X	X	X	X	X	X	X			X	X	X

[1]Regulation not enforceable
[2]Regulation suspended as of 2020
[a]Frequency not specified
[b]Regulation does not require hazard communication plan specifically, but requires the elements of a hazard communication plan listed here.
[c]Regulation does not require IPM plan specifically, but requires pesticide use policy statement and record keeping.
[d]Only pertains to water temperature.
[e]Only pertains to staff training related to HVAC systems.
[f]This section of the regulation has been repealed.

Learn More

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