Report to the Massachusetts Secretary of Education on Opportunities to Further Green Massachusetts Schools

For the safety of children and staff and the improved performance of educational facilities

May 18, 2020

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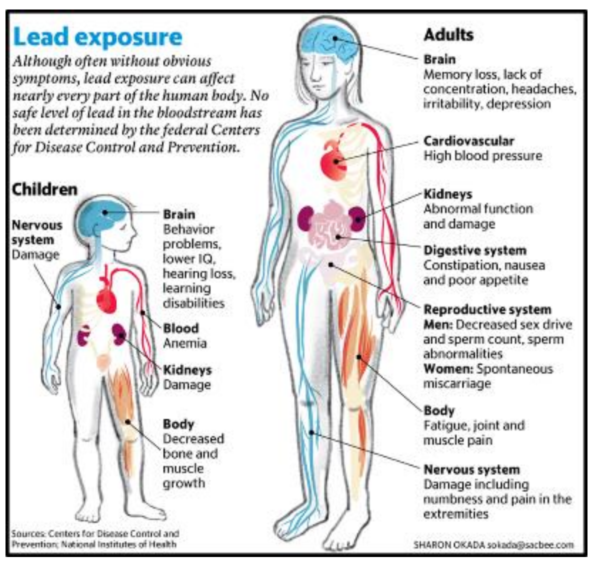
Dear Secretary of Education Peyser,

We, students of the class “Research for Environmental Agencies and Organizations”[1] thank you in advance for your time and attention to these matters. The class allows us to choose the projects we wish to pursue, and we each chose subjects that represent the opportunity to prevent harm to children. We were gratified to learn that you would be interested in what we have found. Although our studies have shown us that there are low-cost options that can be implemented, we understand that change of any kind can be challenging. Yet we hope that in some way our work can contribute to the effort to reduce unnecessary risks.

The following report reviews a set of problems found in many K-12 public school districts in Massachusetts. Secondary schools must comply with over twenty regulations that relate to environmental health of students and staff, as well as face many unregulated issues that require best practices to reduce risk. The issues highlighted in this report are a subset of the multitude of environmental health issues faced by schools. As noted below, some issues are related to the age and condition of the buildings, while others are an outcome of academic activities and facility operations that can affect both new and older school buildings. Some older buildings still carry the legacy of previous use of toxic building materials, such as PCBs, lead and asbestos (this report covers only lead), and are continuing sources of potential harm. Operations that involve the use of potentially harmful chemicals and pesticides are also of concern. Inadequate ventilation can compound these issues by concentrating contaminants in the indoor air.

The first issue addressed in the report is the persistent problem of lead in water, which has received much attention lately, but remains a serious concern despite the recent infusion of funds. We discuss reasons for continuing the progress that has begun.

This is followed by a review of the issue of lead in soil, which has not received as much attention, but is also a significant route of exposure, particularly for school children in preschools and elementary schools that can be reduced. The CDC states that there is no safe level of lead exposure in children, and that exposure can cause well-documented long-term adverse effects such as damage to the brain and nervous system. This can result in lower IQ, and cause learning and behavior problems and underperformance in school.



[1] Lead in Water is by Avital Chissick, Lead in Soil is by Jessica Fuchs, Chemicals Management is by Kai Medina, Urban Gardens in Public Schools in Food Deserts is by Hermon Minda, and Integrated Pest Management is by Bridget De La Torre.

Of great importance to health and educational performance is the feasible reduction in the use of and careful management of chemicals that cannot be reduced or eliminated in school facilities and academic activities. We focus on the need for training to improve the understanding and skills of facility staff (including teachers) in achieving these goals. Accidents of acute and fatal injuries have occurred, through improper mixing of chemicals such as cleaners, antimicrobials and floor care products, mismanagement of lab chemicals used in instruction, etc. We also note that pesticide use can be reduced by attention to the physical integrity and operations of school buildings, which enhances their durability. Pursuing such short term and permanent solutions also reduces the need for recurring expenditures on pest control.

We think that schools can greatly benefit by providing good nutrition and education in raising food by establishing programs for urban gardens, focusing on areas where children do not typically have access to fresh food. By creating such projects in areas considered "food deserts," schools can aid in the healthy development of children, and provide a priceless education in biology, natural processes, and self-support.

We are proud that the Commonwealth, your agency and Massachusetts school districts have taken the actions that have made the state a national leader in many respects concerning pesticides. The Children's and Families Protection Act of 2000, 333 CMR 14.00, and the state contract for Integrated Pest Management, minimize the use of pesticides in schools. We think that both of these set a foundation that provides some protection for children and others, but that much more can be done.

Of great interest to us is the Massachusetts Healthy Schools Checklist (HSC) and related resources created by the Massachusetts Healthy Schools Council during its tenure.[2] The HSC was used as a basis to assist schools in identifying relevant environmental health requirements and best practices to limit unnecessary occupant exposures to harmful substances.

The U.S. EPA grant funds supported Massachusetts to pilot, revise and use the HSC as a basis to create both a checklist that can be used to benchmark compliance with requirements and best management practices and a yearlong training for facility managers in 2008. This training program worked with all state agencies involved in the HSC and won an EPA Environmental Merit Award. While the state of Massachusetts still provides information on its website developed by this initiative, the revised materials need to be updated again and reposted, and the training needs to be updated and made available once again.

2008 EPA Region 1
Environmental Merit Award Ceremony

Due to the extensive amount and types of environmental health issues facing schools and their limited resources (staff and

[2] https://www.mass.gov/service-details/the-massachusetts-school-checklist-indoor-air-quality

financial), schools need a system to identify and prioritize what issues to address. The use of the HSC and related training will help schools identify and prioritize issues to be addressed, and to guide the development of environmental management plans to address them.

Please note that the following issues require a combination of strategies to address. Some issues involve capital investments (e.g.: new HVAC systems, replacing lead service lines, fixing leaky roofs), while other operations-based initiatives do not (e.g.: procurement criteria for safer products and services; recommendations on how a facility is maintained in order to prevent exposure to contaminants such as pests, flaking lead based paint; implementing preventative maintenance measures such as changing filters; training on best management practices).

A key recommendation is the need to allocate resources for training, technical assistance, and guidance that will help schools to reach all the goals discussed herein. Another is to begin the higher-cost capital investments by prioritizing them for school districts that need them most, such as those with older building stock, and located in areas with high asthma and other health impacts.

We couple our recommendations to take action to reduce the potential for harm from toxics, with the establishment of food programs, again targeted in areas known as food deserts, because improving children's nutritional intake is a factor in reducing their susceptibility to toxic exposure. Support, enhancement and expansion of these initiatives can reduce unnecessary exposures to children and staff. Doing so will result in fewer disruptions of service, healthier populations, better academic and employee performance, reduced absenteeism, and safer and more durable facilities.

We were not able to estimate the full value of implementing the suggestions in this report, but we believe that the need to support the operation and management of school buildings to ensure student academic performance cannot be overstated.

The contents of this report are as follows:

<u>Lead in Massachusetts Schools' Drinking Water</u>

Background Information

In Massachusetts, most drinking water sources from reservoirs and groundwater are lead free. When lead is present in water, it is typically due to the water flowing through lead pipes or plumbing in buildings with lead parts or solder. Municipal Lead Service Lines (LSL), which connect schools and other buildings to the water main, may have lead in them. Inside a school, there may also be lead pipes, pipes connected with lead solder, or brass faucets or fittings containing lead (premise plumbing).[3]

Recognizing that elevated levels of lead in drinking water have historically been the result of LSLs and premise plumbing, the federal government enacted the 1986 Safe Drinking Water Act Amendments, limiting the allowable concentration of lead in plumbing materials, including the banning of lead containing solder. In 2011, the federal Reduction of Lead in Drinking Water Act further decreased the allowable levels of lead in plumbing materials to 0.25% of the water-exposed material.[4]

In 1991, the U.S. EPA promulgated the Lead and Copper Rule (LCR) to decrease the health risk of lead in drinking water obtained from premise plumbing. LCR sets Action Levels (ALs) for drinking water at 0.015 mg/L for lead. The LCR requires public water suppliers (PWS) to test water and to ensure that 90% of the results are below the ALs. If 90% of the results exceed the ALs, the PWS must take certain actions, including implementing corrosion control treatment to prevent the leaching of metals and public education regarding mitigation.[5]

In 1988, the U.S. Congress passed the Lead Contamination Control Act (LCCA), which directs U.S. EPA and its state designees (MassDEP) to assist **school systems** to identify and reduce or eliminate lead contamination in their facilities' drinking water. Unlike LCR, the LCCA is an **assistance-based, non-regulatory program**.

In 2016, Massachusetts launched a cooperative program to help public schools voluntarily test for lead in drinking water and reduce lead levels to 0.015 mg/L and below. Then in May, 2019, MassDEP notified schools of the release of a revised version of EPA's "3Ts for Reducing Lead in Drinking Water in Schools and Child Care Facilities" manual (Training, Testing, and Taking Action). MassDEP recommended that schools use the revised (October 2018) 3Ts guidance to implement the voluntary lead in drinking water testing programs under the LCCA.

Of note in the revisions, EPA states that "there is no known safe level of lead for children". EPA removed its longstanding LCCA trigger level for lead and did not set a new

[3] Massachusetts Department of Public Health - Fact Sheet, Lead in Drinking Water for Schools and Childcare Facilities
[4] MassDEP - Massachusetts Assistance Program for Lead in School Drinking Water Final Report - May 2017
[5] MassDEP - Massachusetts Assistance Program for Lead in School Drinking Water Final Report - May 2017

trigger level. Instead, EPA recommended that schools prioritize permanent remediation efforts to achieve lead levels consistently at or **below 1 ppb**. As a result of these initiatives by EPA and MassDEP, many schools had tested and remediated their plumbing systems and fixtures to the initial 2016 AL of 15ppb. The 2019 recommended next phase of resampling and implementing measures to bring lead levels down further to 1 PPB or non-detect threshold is now the generally recognized goal.

Many school districts do not currently have the resources to undertake this effort, which is only voluntary. This creates a situation in which some children are protected and some are not. Any preexisting lead-based plumbing and fixtures remaining in place under some circumstances can continue to expose students and staff to lead in their drinking water.

Lead exposure leads to many health effects for people at all ages, including headache, irritability, aggressive behavior, difficulty sleeping, abdominal pain, constipation, reduced appetite and anemia. Lead exposure leads to additional complications in fetus development and in young children. Lead exposure, and poisoning, can have irreversible brain damage when exposed to a certain level[6]. This can lead to the loss of developmental skills, hearing loss, kidney damage, reduced IQ, behavior, attention problems and slowed body growth.[7]

Children's exposure to lead in drinking water at school is only a small part of their overall potential exposure. Paint in residences is considered the most serious source of exposure, and while renovation to "child-occupied" facilities, including schools with children under six, must be performed to control the dispersion of lead dusts, the regulation does not apply to schools with older children. But it is important to address all sources of lead as it accumulates within the body. In addition, risks will vary depending on the individual, the circumstances, and the amount of water consumed.[8]

Addressing the Problem

Testing schools' water is the first step towards ensuring that students, faculty and staff are consuming safe drinking water. Many schools are not testing (Figure 1, 2) due to the cost of testing, lack of knowledge regarding the issue or lack of funding for mitigation. Experts have raised with us the possibility that some schools may be resistant to testing because finding a problem could generate pressure from parents to devote scarce resources to addressing it, complicating the budgetary process.

[6] https://www.epa.gov/lead/learn-about-lead
[7] https://www.cdc.gov/nceh/lead/prevention/health-effects.htm
[8] Massachusetts Department of Public Health - Fact Sheet, Lead in Drinking Water for Schools and Childcare Facilities

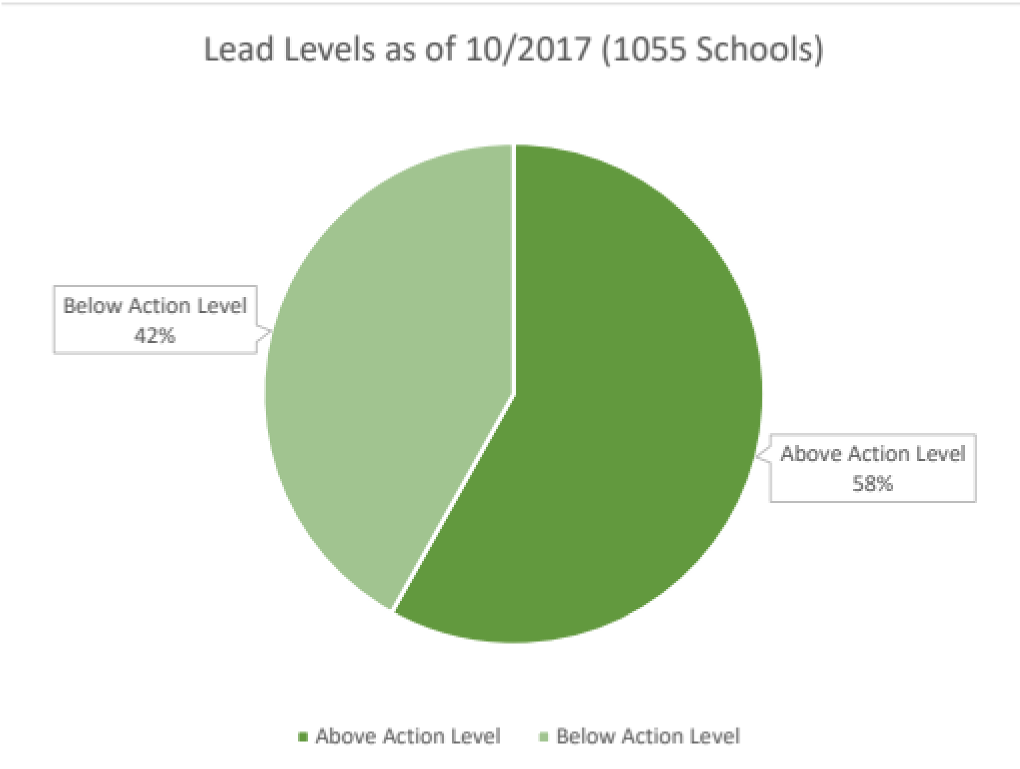


Figure 1. Schools in Massachusetts with lead levels above and below the Action Level of **1 ppb**, out of 1,055 schools tested. Source: Summary Results of Recent Lead and Copper Drinking Water Testing at Mass. Schools.[9] Schools with results above the Action Level were those that showed at least one test result with lead levels above 1 part per billion (ppb).[10]

[9] https://www.mass.gov/doc/summary-results-of-recent-lead-and-copper-drinking-water-testing-at-massachusetts-schools/download
[10] https://www.mass.gov/service-details/lead-and-copper-in-school-drinking-water-sampling-results

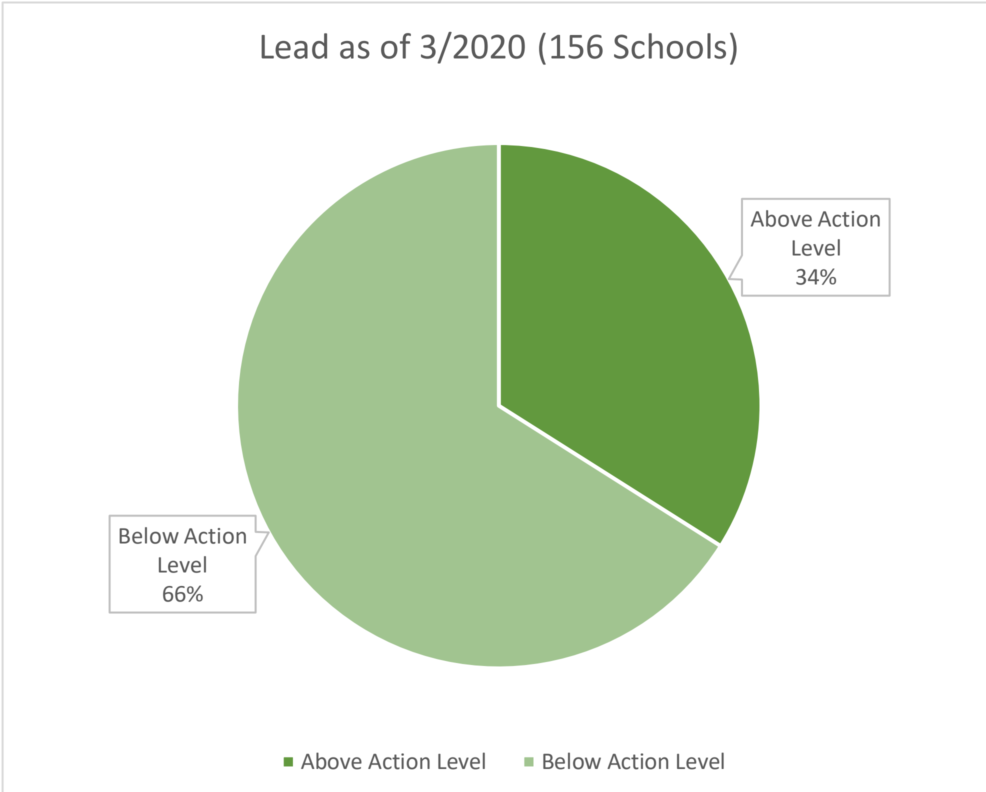


Figure 2. Schools in Massachusetts with lead levels above and below action level, out of 156 schools retested after 10/2017. Current as of March 2020. Data taken from The Energy & Environmental Affairs Data Portal.[11]

In order to effectively replace an LSL, it must be replaced in its entirety. If a line is partially replaced, it will continue to expose the consumer to lead, sometimes at even higher rates than before as the fixture was disturbed which lead to more corrosion[12]. This includes the public and the school side. To do this, both the city and the school must budget for this replacement. Unfortunately, many times this does not happen. This leads to none of the pipe being replaced, or some of it being replaced.

Service line replacements typically run between $3k-$7k.[13] According to EPA estimations, a 10-year full LSL replacement leads to major economic benefits. Their estimation predicts *a return of $22,000 per lead service line replacement, $205B in cardiovascular disease benefits, IQ benefits and a total of $207B in societal benefits nationwide*.[14]

Another aspect of the problem is retesting after the initial test, to check on the accuracy of the original test and to see if treatment, if applied, has worked. Of the schools above the

[11] https://eeaonline.eea.state.ma.us/portal#!/search/leadandcopper
[12] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4770854/
[13] https://www.epa.gov/sites/production/files/2019-10/documents/strategies_to_achieve_full_lead_service_line_replacement_10_09_19.pdf
[14] http://blogs.edf.org/health/2020/02/20/lslr-reduced-cardiovascular-disease-deaths/?utm_source=expert&utm_campaign=edf-health_lead_upd_hlth&utm_medium=email&utm_id=1582218645

Action Level when originally tested in 2017, (schools that showed at least one test result with lead levels above 1 ppb), 39 schools (7%) have since retested and all results were below the Action Level, and 35 schools (6%) have since retested and had results above the Action Level. But 506 schools (87%) have not been retested.

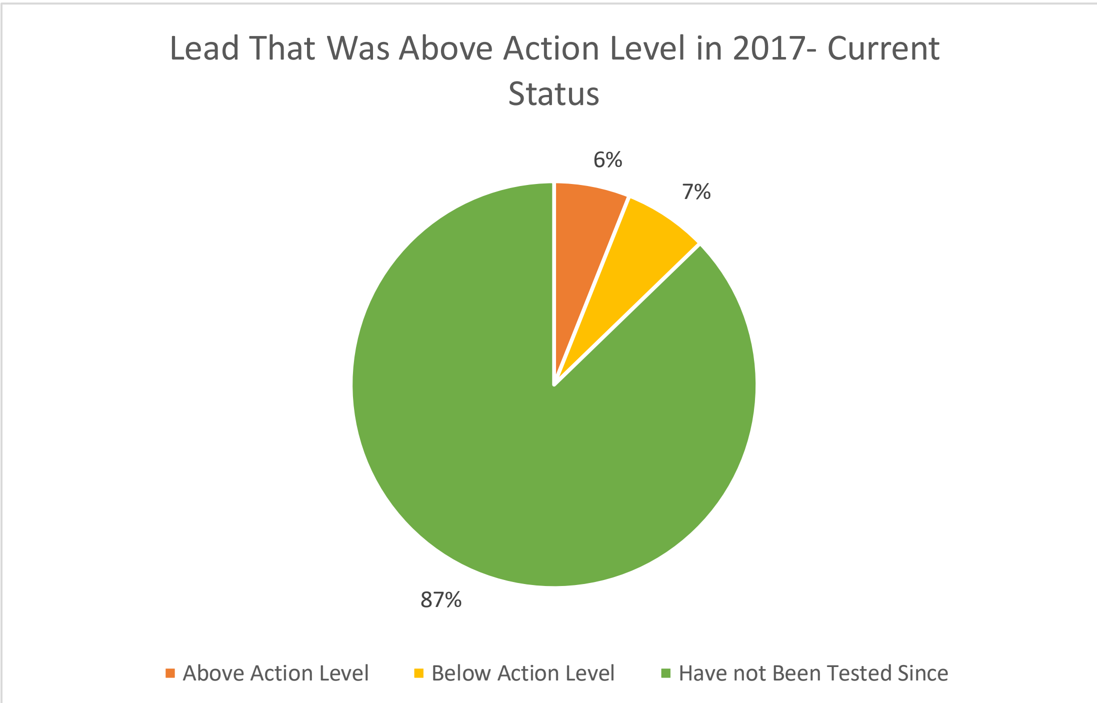


Figure 3. Schools in Massachusetts that had lead above Action Levels in 10/2017. Current as of March 2020. Data taken from The Energy & Environmental Affairs Data Portal.[15]

[15] https://eeaonline.eea.state.ma.us/portal#!/search/leadandcopper

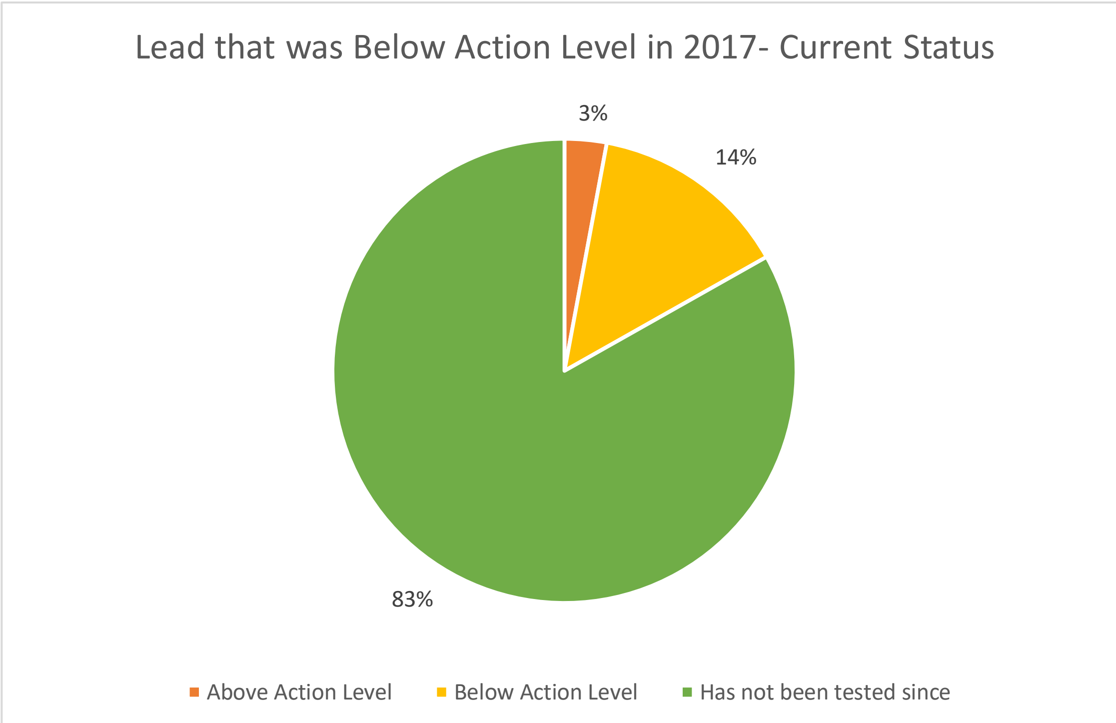


Figure 4. Schools in Massachusetts that had lead Below Action Levels in 10/2017. Current as of March 2020. Data taken from The Energy & Environmental Affairs Data Portal[16].

Few schools below the Action Level in 2017 showed subsequent lead test results with lead levels above 1 ppb. Eighty-three percent of schools that had lead levels below the Action Level (341 schools) have not had subsequent testing. 57 schools, (14%) have since tested and were below the Action Level. But indicating the importance of retesting, even for schools that originally tested safe, is the fact that twelve schools (3%) have since tested and were above the Action Level.

There are 5,446 schools in Massachusetts[17]. The testing data represents less than twenty percent of this total. Six percent had lead, and the 3% that thought they did not have a lead problem in their water, actually do. Extrapolating from the results above suggests that there may be at least 490 schools in Massachusetts (6% + 3% = 9%) that have lead in their drinking water, potentially affecting a rough estimate of 245,000 students and 19,000 teachers.[18]

Downloading the sampling results provides information about whether remediation was performed. The majority of entries is no remediation action reported, but some schools have disconnected plumbing or fixtures, posted notices not to use the water, or performed daily flushing. The problem is threefold: lack of testing, lack of replacing and repairing and lack of retesting to confirm the desired outcome. Solving this problem will lead to many health benefits.

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[16] https://eeaonline.eea.state.ma.us/portal#!/search/leadandcopper
[17] https://www.greatschools.org/massachusetts/
[18] https://ballotpedia.org/Public_education_in_Massachusetts

The Solution

The overall goal should be to completely remove and replace all lead service lines in all schools. In the meantime, steps can be taken to ensure that students, teachers and faculty are not consuming lead through their drinking water. In order to help with this, daily flushing can help. (See p. 13 below for EPA's recommendations on best management practices in flushing).

Until and unless water service lines made of or containing lead (such as lead solder or brass with high lead content) are replaced, temporary solutions are necessary. Along with flushing, these include universal testing and inspection, preventing use of or installing filters on selected fixtures and fountains known to be sources of lead based on test results, and programs for filter maintenance and replacement, to avoid filter failures. The costs of temporary solutions will mount up over time, making the choice of a permanent solution more attractive, when the long view is taken. If the upfront investment can be made, replacement of lead pipes and fixtures is a better course of action.

In order to accomplish the overall goal, communities and cities can utilize existing resources, such as:

1. *The Massachusetts Water Resources Authority (MWRA) fund*. In 2016 the MWRA approved a $100M fund dedicated to the complete removal of lead service lines. This is an interest-free loan which the cities can pay back over the course of 10 years. Eligible MWRA communities: Arlington, Ashland, Bedford, Belmont, Boston, Braintree, Brookline, Burlington, Cambridge, Canton, Chelsea, Chicopee, Clinton, Dedham, Everett, Framingham, Hingham, Holbrook, Lancaster, Leominster, Lexington, Lynn, Lynnfield, Malden, Marblehead, Marlborough, Medford, Melrose, Milton, Nahant, Natick, Needham, Newton, Northborough, Norwood, Peabody, Quincy, Randolph, Reading, Revere, Saugus, Somerville, Southborough, South Hadley, Stoneham, Stoughton, Swampscott, Wakefield, Walpole, Waltham, Watertown, Wellesley, Weston, Westwood, Weymouth, Wilbraham, Wilmington, Winchester, Winthrop, Woburn, Worcester.
   http://www.mwra.com/comsupport/llp/llpprogram.html

Loans approved FY17-FY20:

Town/City	Amount (M$)
Quincy	1.5
Newton	4
Winchester	1
Marlborough	2
Needham	1
Winthrop	0.771850
Revere	0.195
Everett	2
Chelsea	0.4
Somerville	0.9
Total	**13.76685**

2. *The Massachusetts State Revolving Loan Fund*. This is a loan under the Assistance Program for Lead in School Drinking Water dedicated towards improving the drinking water infrastructure. https://www.mass.gov/state-revolving-fund-srf-loan-program
3. *The Massachusetts Clean Water Trust (MCWT)* announced a fund of $2M dedicated towards assisting public schools across the state test for lead in their drinking water. Additionally, they have recently dedicated $5M towards testing drinking water in schools and installing filters in necessary water fountains with help from MassDEP. https://www.mass.gov/service-details/lead-and-copper-in-school-drinking-water-sampling-results https://www.mass.gov/news/massachusetts-officials-announce-programs-to-address-lead-in-drinking-water-at-schools-and
4. *The Boston Water and Sewer Commission*, *Lead Service Line Removal Program*. The BWSC pays the first $2,000 of the cost to the replacement of the lead service line on the private side. If necessary, the rest of the amount the homeowner pays back, interest free, over the next 4 years in their monthly water bill. https://www.bwsc.org/environment-education/lead-your-water/lead-replacement-incentive-program
5. *Non-profit community engagement assistance*. Non-profits such as Clean Water Action reach out to communities to work together in creating more accurate and public inventories, public outreach events and formal committees to lead the lead service line replacement. An example of a successful assistance program can be seen in Chelsea, MA. They applied for and received a loan from the MWRA. Following this they had a campaign to educate the citizens in the town about the lead problem and to conduct a more thorough inventory.

6. *The Massachusetts Public Interest Research Group* has a grant program which schools can apply for in order to receive funding to replace a fixture or install a filter at a drinking water faucet in the school. https://masspirg.org/news/map/new-program-launched-protect-children-lead-drinking-water-schools

EPA's Recommended Flushing Procedure for Schools

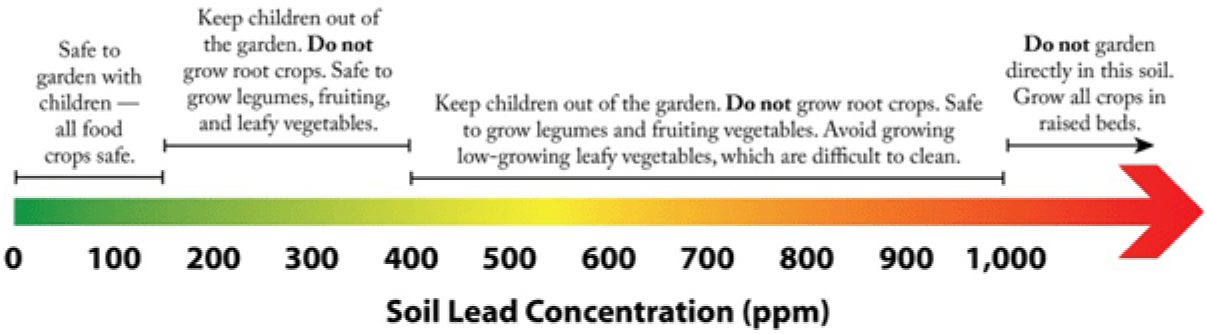
Remember that each drinking water outlet should be flushed individually; flushing a toilet will not flush your water fountains. All flushing should be recorded in a log submitted daily to the office, or person, in charge of this program. • Locate the faucet furthest away from the service line on each wing and floor of the building, open the faucets wide, and let the water run for 10 minutes. For best results, calculate the volume of the plumbing and the flow rate at the tap and adjust the flushing time accordingly. This 10-minute time frame is considered adequate for most buildings. • Open valves at all drinking water fountains without refrigeration units and let the water run for roughly 30 seconds to one minute, or until cold. • Let the water run on all refrigerated water fountains for 15 minutes. Because of the long time period required, routinely flushing refrigerated fountains may not be feasible. It may therefore be necessary, and more economical, to replace these outlets with lead-free, NSF-approved devices. • Open all kitchen faucets (and other faucets where water will be used for drinking and/or cooking) and let the water run for 30 seconds to one minute, or until cold.

https://www.epa.gov/sites/production/files/2018-09/documents/flushing_best_practices_factsheet_508.pdf

Lead in Massachusetts Schools' Soil

Lead Exposure in Soil at Schools

One direct route of exposure to lead that is less known is through soil. Soil naturally contains lead, and a normal amount of lead in soil will range from 15-40 parts lead per million parts of soil. In addition, pollution, improper lead paint abatement, and construction are all ways that lead contamination may increase in soil to unsafe levels. Lead paint on exterior of buildings and windows that has deteriorated can accumulate in soil around buildings. Though our world now restricts the use of lead in paint and gasoline, the metal can persist in soil for many years, so soil lead contamination remains a problem today (UMass Extension, n.d.).



Gardening on Lead-Contaminated Soils, Kansas State University,
https://webapp.agron.ksu.edu/agr_social/eu_article.throck?article_id=378

Though lead poisoning through contaminated soil is a pathway that is less common than water, air, and paint dust, lead contaminated soil poses a problem particularly for children in areas where soil may be openly exposed, such as in a playground or the exterior of a school building. Exterior lead-contaminated dust may also be tracked into and accumulate on and around entryways. Due to child behavior of hand-to-mouth contact while playing outside, as well as higher absorption rates of toxins compared to that of adults, high exposure to lead in soil in schoolyards is dangerous for children (Almansour et al, 2019). Children who use playgrounds that are closer to major roadways are at greater risk because those playgrounds are more likely to contain contaminated soil (Almansour et al, 2019) from leaded gasoline.

Over the last two and a half decades, research has shown that this is a greater problem than we may have realized, which has caused governments to take steps to mitigate the issue. There are a few ways to test soil for lead levels—including through agricultural labs and with an XRF (see appendix).

Various strategies have been developed by the U.S. Environmental Protection Agency (EPA), and researchers from Louisiana, New York, and Massachusetts, to reduce exposures to children.

Federal Guidelines & Interventions

The federally accepted level of lead in soil is 400 parts per million (ppm) in bare soil in children's play areas or 1200 ppm average for bare soil in the rest of the yard (the Massachusetts level is lower, as noted below). As part of EMPACT (Environmental Monitoring for Public Access and Community Tracking), a program created to educate people about environmental issues that may be affecting their communities, the EPA created the Lead-Safe Yard Project in Boston and Dorchester. The Lead-Safe Yard Project tested for lead in residential soil, implemented low-cost interventions to reduce potential exposure to lead, and created a template for informing communities and agencies across the country on how to address this issue (EPA, 2001). (See *Action Taken in Massachusetts* below).

Most of the strategies from EMPACT are specific to residential yards, though they can be applied to playgrounds as well. Specifically, EPA recommends constructing raised sand boxes that are lined with perforated plastic, landscaping fabric, or other material that would protect the sand from the contaminated soil below it (EPA, 2001). Raised boxes can be built in any part of a playground as a way to protect an area from soil, and could be filled with sand, mulch, woodchips, or by putting down rubber matting. Planting evergreen shrubs can keep children away from areas with particularly high levels of lead (EPA, 2001). (See *Appendix* to this chapter for information about costs of these different renovations).

An additional strategy is to add gardens to playgrounds. This would serve as a beautifying strategy as well as a potential educational opportunity in teaching children about growing plants. Plants would similarly need to be put in raised garden boxes and the importation of soil or the addition of clean compost would minimize or eliminate lead levels. Similarly, phytoremediation, also known as phytoextraction, the process of using living plants to remove contaminants, will also allow gardens to extract lead from soil (EPA, 2001). The roots of the plant uptake the lead from the soil and transport it to other parts of the plant without absorbing lead. Sunflower and Indian mustard plants have been found to absorb especially high levels of lead. Phytoremediation has been used in battery sites, in Dorchester, and even in Chernobyl, and is a well-received method for those who are hoping to *remove* lead from the land, rather than just cover it (EPA, 2001). Phytoremediation has also been proven effective when growing grass, specifically vetiver grass. A study comparing two different types of vetiver grass found that roots of these two species of grass accumulated lead from soil more so than the shoots or leaves (Chantachon et al, 2003). It was found that roots of this grass could accumulate up to 2842 mg/kg of lead from soil over the course of 12 weeks; it is worth noting however, that this strategy works best in areas where there is less lead in the soil. If there is more than 11 mg/L of lead, the grass will die after 12 weeks (Chantachon et al, 2003). For playgrounds with levels of soil that are high enough to be a risk to children, but not excessively high, growing grass over the soil is a proven effective strategy.

Soil Interventions Outside of Massachusetts

Howard Mielke of the Tulane School of Medicine's Pharmacology Department and creator of the Lead Lab implemented an intervention in New Orleans, Louisiana to reduce children's exposure to lead in soil in childcare center and community center playgrounds. Initially, the study measured soil samples at childcare centers in and just outside of New Orleans and found significant differences in levels of soil contamination based on geographical differences. Inner city centers had much higher levels of contaminated soil than centers in the outer-city childcare centers (Mielke et al, 2010). In this study, the intervention strategy was soil emplacement by covering the soil with a water-pervious geotextile material to signal that this soil should not be dug into; it was then covered with lead-safe soil. Upon implementing this intervention, median soil Pb in childcare centers went from an average of 558 mg/kg to 4.1 mg/kg (Mielke et al, 2010). This was proven to be an effective intervention that can be replicated in other urban areas. An additional finding to take from this intervention was that high-traffic centers of the city will have highest levels of lead, meaning that playgrounds located in the center of urban areas of Massachusetts should be of focus. Additionally, lead-safe soil emplacement is another potential safe intervention that is worth consideration.

In New York, Sara Perl Egendorf (Adjunct Professor in Urban Studies at Queens College and the Graduate Center, City University of NY), and her research team explored ways to mitigate lead exposure in soil in urban community gardens. In this study, raised beds were constructed out of pine lumber and filled with different materials to determine which is the safest in which to grow fruits and vegetables. Materials included garden soil, landscape fabric, as well as compost and sediments of varying amounts. Egendorf took advantage of a Clean Soil Bank created by the Mayor's Office of Environmental Remediation, which diverted sediment excavated from building sites to local development projects, instead of paying to ship it to landfills. It was found that these sediments, mixed with organic matter and topsoil, were safe to grow crops with undetectable levels of lead or low enough levels to safely consume, according to European Commission standards (Egendorf, 2018). Research has found that the safest crops to grow in gardens with leaded soil are tomatoes and other fruiting vegetables, while root vegetables such as carrots and sweet potatoes will contain the most lead if grown in leaded soil. Leafy vegetables such as lettuce contain the next-highest levels of lead (Doyle, 2014). Egendorf's study validated the fact that adding more compost to a garden will lower the levels of lead that appear in crops (Egendorf, 2018).

Egendorf notes in her paper that "low-income people of color are disproportionately located in areas of high soil Pb contamination in NYC"; in Boston, the same was true for the "lead belt" encompassing lower-income communities such as Dorchester. This information is useful in identifying priority schools to test and potentially renovate first. The urban, low-income schools are at a higher risk of exposing their students to greater levels of lead in their soil.

Egendorf's intervention in New York City can be taken into consideration if Massachusetts combines an initiative to reduce lead in soil with the initiative discussed below to add gardening instruction and food production to urban schools. Using clean soil from deep excavations could produce clean soils to mix with compost and sufficiently cover contaminated soil and enable the cultivation of food to serve as an educational tool for children. Such a combined initiative for safe playgrounds and school community gardens would substantially enrich education and health.

Action Taken in Massachusetts

The regulatory safety threshold for lead in soil in Massachusetts is 200 ppm total lead, while the limit on lead in soil that will be used for gardening is 100 ppm (UMass Extension, n.d.). There have been numerous successful soil interventions done in Massachusetts, particularly in Boston, Cambridge, and Dorchester. The researchers in charge of these interventions were leaders in the field and have informed EPA recommendations for the rest of the country. While many of these MA interventions were focused on renovating residential yards, they contain strategies that may be valuable in informing decisions for improving playgrounds.

The Lead-Safe Yards Project was implemented in Dorchester, part of the "lead belt" of Boston in the 1990s and early 2000s. The project focused on outreach and education, collecting soil analyses of lead levels at baseline, and implementing low-cost ways to reduce exposure to lead in soil. The main methods used in this project to reduce such exposure involved installing wood framed boxes, moving gardens and children play areas from parts of the yard with high levels of lead to areas with lower levels, as well as laying down stone paths, planting grass, and placing landscape cloth or other groundcover, such as mulch and woodchips (Prevention Institute, n.d.). In some cases, porches or decks with lead paint chipping off into the soil were barricaded and the soil under the porch or deck was covered with mulch or gravel (EPA, 2001).

Research has shown that soil reduction of 2,060 ppm was associated with a decline in blood lead levels ranging from 2.25 to 2.70 μg/dl (Prevention Institute, n.d.). Thus, this project was considered a success by EPA and is an example to all, especially cities, on how to reduce children exposure to lead in soil. However, a study done in 2008 found that, upon testing raised gardening beds in residential yards in Dorchester four years after installing the beds, lead levels increased from 150μg/g to 336μg/g (Clark et al, 2008). If raised gardening beds are to be installed in playgrounds, it is advisable that maintenance would be required, as well as testing, every few years to maintain low lead levels. Further research is necessary to determine whether such maintenance would be required on a public playground, given that this occurred in residential yards.

A similar study done by the Boston Public Health Commission, EPA, and U.S. Department of Housing and Urban Development was the Boston lead-safe yards evaluation. Using ground coverings and ground barriers decreased soil lead levels from 2021 ppm to 206 ppm (Litt et al, 2002).

A more playground-specific intervention was the Boston Schoolyard Initiative (BSI). This was a public-private partnership that began in 1995 with the goal to improve schoolyards in every neighborhood of Boston. Neglected lots were revitalized to create educational and recreational spaces outside for children, as well as form community partnerships with local organization (BSI, 2013). At the time of this project's creation, there were 128 schoolyards, of which 88 were renovated through BSI between 1995 and 2013. Renovations of the surfaces included installing "asphalt, poured-in-place rubber, rubber tiles, pea gravel, compacted crushed stone, and fibar, or woodchips" (BSI, 2013). Turf was chosen for higher trafficked areas, while sand and dirt were provided for digging areas. Raised beds for community gardening were included in design guidelines as well.

While BSI required both government and private funding from community organizations and philanthropists, it was a sustainable, long-lasting model that improved playgrounds for thousands of students in Boston, including older schools in inner-city neighborhoods (Lopez et al, 2008). This project has the potential to be replicated in other parts of Massachusetts and would provide much safer playgrounds for students across the state. The yearly capital investment from the city of Boston was $1.2 million, and from the Funders Collaborative $600,000, to serve more than 25,000 children (Khadaroo, 2008).

It is worth noting that a recent study in Boston showed that there are still playgrounds throughout Boston that contain lead-contaminated soil. Additionally, rubber surfacing, which is made of recycled waste tires and is used for its shock resistance, was found to also contain higher, even unsafe levels of lead relative to the 400 μg/g federal standard, and even the stricter California guideline of 80 μg/g (Almansour et al, 2019). This study found that the safest materials for low lead levels in playgrounds include sand and mulch, the latter of which is as effective, if not more so, in preventing injury than rubber (Almansour et al, 2019).

Appendix

Testing

One way to test soil for lead levels is by sending samples to a lab. University of Massachusetts Amherst has a UMass Extension Soil and Plant Nutrient Testing Laboratory that offers Routine Soil Analyses and Total Sorbed Metals Tests to measure the levels of lead and other metals in a soil sample. The routine analysis identifies where lead levels are elevated, while the total sorbed metals test will provide reports of the level of lead that are "environmentally available" (UMass Extension, n.d.). The Total Sorbed Metals Test is ideal to measure soil in potentially contaminated playgrounds. Each test costs $55.00 (UMass Extension, n.d.).

An additional way to test, which has been verified by the EPA and used by researchers, is field-portable XRF technology. This is a machine that provides results immediately regarding lead contamination levels onsite (EPA, 2001). This may be a more reasonable investment than purchasing laboratory tests, if many playgrounds across the state are to be sampled for lead contamination. This technology is expensive, with the model used by the EPA—Niton Model 702—costing $26,500.00. However, there is a portable XRF that tests exclusively for lead that costs $17,000.00 (EPA, 2001). Research has suggested that XRF technology can be used successfully to measure broken rubber or heterogenous surfaces, though it is not ideal (Almansour et al, 2019).

<u>Costs</u>

The Lead-Safe Yard project in Boston outlined estimated costs for different renovations. In order to install 20' x 24' area of woodchips, in which filter fabric, 2" of topsoil, and then 6" of woodchips cover the lawn for $905.00, before labor costs (EPA, 2001). The average playground is estimated to be about double the size of this area, so the cost of this type of renovation for a school playground would be about $1,810.00 before labor costs. The cost of adding 30, 12" x 12" steppingstones and additional plantings to surround a yard costs $125.00 (EPA, 2001). These materials may be beneficial in keeping children away from areas of a playground that have the highest levels of lead.

We estimate that the playgrounds of all 1,479 Massachusetts public schools and 471 private schools (Massachusetts Elementary Schools, n.d.) could be made safer with investments ranging from less than half a million to less than four and a half million dollars, (not counting labor). In order to renovate all public schools in Massachusetts, installing raised beds and placing filter fabric, topsoil, woodchips, steppingstones, and plantings would cost $2,861,865.00 before labor costs. Purchasing a portable XRF that tests for lead would bring this total up to $2,878,865.00.

The Boston Public Health Commission intervention of installing wood-framed dripline boxes, planting grass and shrubs, and installing stone walkways cost an average of $3,000 per yard, including labor costs. These yards were larger because they were shared by two or three residences and are the approximate same size as a schoolyard. For all 1,479 public schools, this would cost $4,437,000.00 total.

For playgrounds where lead levels are low enough that growing grass over the contaminated soil would be a sufficient strategy, it would cost about $270.00 per playground that is 2,000 square feet. This would cost a total of $399,300.00 before labor costs. However, this will only be a useful intervention in playgrounds with lower levels of lead, and it will take a longer period of time to fully grow grass over contaminated soil than to install other types of ground coverings.

The Lead-Safe Yard Project was able to collect free materials from local sources such as parks departments, recycling centers, tree services, sponsors, and local nurseries (EPA, 2001). Working with community partners to obtain materials in this way may cut down costs, though these materials must be tested for lead levels before being installed into playgrounds. Taking clean soils from construction site excavation could save on transportation and disposal fees and present an opportunity for free material.

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Green Cleaning and Toxics Use Reduction for Improving Indoor Air and Safety in Schools

A system-wide initiative to develop environmental management plans and to train teachers and staff in general principles and standard operating procedures on Green Cleaning, Indoor Air Quality, Chemical Management, and Integrated Pest Management (see next chapter) is an efficient means of reducing exposures and increasing safety, as well as reducing costs, liabilities and incidents that cause public concern. A lack of management systems with policies, standard operating procedures and training in these topics contributes to disparities in safety, compliance and performance, a higher incidence of health problems for staff and students, and a lack of trust in the community, impeding educational progress.

Using available resources developed from the Massachusetts Healthy Schools Checklist and piloted in New, Springfield and Worcester public school districts,[19] schools can reduce unnecessary toxic exposures. By forming committees to carry out this mission, benchmark compliance status and best practices, develop and implement programs, evaluate and learn from incidents, and track progress, a school can implement green cleaning systems, reduce the use of toxic and hazardous materials, and improve safety and indoor air.

One example of how a school can implement these toxics use reduction (TUR) strategies at the front end of their operations is establishing purchasing criteria and an annual procurement review process to reduce the **quantity** and **toxicity** of products purchased for academic, operational and maintenance purposes. If a department desires to purchase products that do not meet the criteria, they need to identify the product's hazards, document that there is no viable safer alternative, and that they have the training, personal protection, storage and emergency response systems to safely use and dispose of the product within one or two years.

One school district, the Worcester Public Schools, has implemented TUR purchasing strategies throughout all departments, including; science, custodial, food service, building maintenance, transportation, grounds maintenance, etc. They have established purchasing criteria and a purchasing program to reduce toxics in all departments. Public school districts that have implemented green cleaning programs include Holyoke, Springfield, Worcester, and Newton.

When hazards have not been eliminated schools can establish a Hazardous Materials Management and Safety Program which provides regulatory guidance, work practices, assigns roles and responsibilities, specifies recordkeeping, identifies training, etc. A few examples of protocols related to hazardous materials management:

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[19] See, for example: https://www.turi.org/Our_Work/Community/Topic_Areas/Schools/Worcester_Public_Schools_Toxic_Use_Reduction_Strategies_for_Pathogen_and_Asthma_Reduction_in_Schools

Storage should have an assigned responsible party; be organized in compatible categories to prevent reactions between substances stored; maintain safe housekeeping practices; be inspected on a scheduled basis, and responsibly removed when use is no longer anticipated.

Hazardous waste should be separated out into an established "Accumulation Area", containers of waste relabeled, and waste disposed by a licensed vendor.

Training on how to develop and implement toxics use reduction strategies should be provided, as well as the necessary chemical expertise to assist schools that do not have it. Investing the time and effort to elevate the importance of avoiding incidents of chemical spills, exposure, and the routine expenses of hazardous materials management will save costs and reputational injury in the long run, as well as protecting the health of students and staff.

An effort to reduce chemical use should be coupled with efforts to improve indoor air quality, as any chemicals that evaporate or release particulates in the building will be more of a hazard if the ventilation system does not effectively remove them. Creating green cleaning programs and providing related training for all schools will help protect all children and school occupants.

Green cleaning, defined as using cleaning products that preserve environmental quality and human health, has been proven to be viable as a replacement to commonly used hazardous cleaning supplies. Financially, studies have shown with few exceptions that environmental cleaning counterparts hold equivalent, if not, cheaper prices.[20] The largest obstacle in pilot studies to adopting green cleaning was not financial, but instead resistance from staff. [21] Health risks of nongreen cleaning include chemical pollutants released into the air[22] and work-related illnesses. [23] [24] There are many instances of a lack of chemical control with non-green cleaning products, as well as incidents where combinations of chemicals used by janitorial staff have led

[20] Espinoza, Tyler, Chris Geiger, and Iryna Everson. "The real costs of institutional "Green" cleaning." *Journal of Hospital Infection* (2011): 1-15.
[21] Solely the case for one school district; wider studies have not been implemented. Xu, Nina. "Lean, Mean, Green Cleaning Machine: One School District's Quest for Sustainability." (2012): 1-18.
[22] Nazaroff, W. W., C. J. Weschler. 2004. Cleaning products and air fresheners: exposure to primary and secondary air pollutants. Atmospheric Environment 38:2841-2865.
[23] Acosta-Leon, A. L., B. P. Grote, S. Salem, and N. Daraiseh. 2006. Risk factors associated with adverse health and safety outcomes in the US Hispanic workforce. Theoretical Issues in Ergonomics Science 7:299-310.
[24] Ashkin, Stephen. "Making Green Cleaning Easy for Local School Boards." State Education Standard 12.1 (2012): 37-41.

to the generation of toxic vapors. For example, a recent incident involved a mixture of acid and bleach that caused a fatality.[25][26]

Green cleaning programs are of the easiest TUR programs to implement. Most vendors of green cleaning supplies provide free training and technical assistance to develop and implement a green housekeeping program. The Commonwealth's purchasing office, the Operational Services Division (OSD) of Administration and Finance, Environmental Preferable Products Program (EPP), has pioneered green cleaning initiatives, provided training and created[27] the Statewide Contract (SWC) FAC85, "issued to offer a broad selection of environmentally preferable cleaning products, intended to replace commonly used harsh chemical cleaners". These resources are available at the same terms negotiated by OSD for state agencies, to all subdivisions of the state, including municipal departments and public schools. The contract requires vendors to provide free technical assistance and training. The state has already established purchasing standards and vetted the safety of the products and the competency of the vendors.

There is an abundance of free resources tailored for schools available from nonprofits and some states. The Toxics Use Reduction Institute at the University of Massachusetts in Lowell provides a handbook on "Cleaning for Healthier Schools and Infection Control".[28] The Agency for Toxic Substances and Disease Registry and the Interstate Chemical Threats Working Group produced a guide to reducing chemical accidents in schools.[29] The state of New York has made available a program toolkit on green cleaning (https://greencleaning.ny.gov/Entry.asp). The Healthy Schools Campaign's *Green Clean Schools*, intended to motivate parent involvement, has now partnered with Green Seal, a third party certifying company, to produce Healthy, Green Schools & Colleges (https://healthyschoolscampaign.org/programs/healthy-green-schools-colleges/) and Informed Green Solutions (https://www.informedgreensolutions.org/). Beyond Benign (located in Wilmington, MA) "develops and disseminates green chemistry and sustainable science educational resources that empower educators, students and the community at large to practice sustainability through chemistry"[30], including curricula for elementary, middle and high schools.

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[25] https://tinyurl.com/s39u3xl

[26] https://www.nbcnews.com/news/us-news/deadly-accidental-mix-acid-bleach-blamed-buffalo-wild-wings-manager-n1078866

[27] https://www.mass.gov/guides/epp-program-environmentally-preferable-products-and-services-on-statewide-contracts#-green-cleaning-products,-programs,-equipment-and-supplies-

[28] https://www.turi.org/Our_Work/Community/Topic_Areas/Schools/Cleaning_for_Healthier_Schools_and_Infection_Control_Workgroup_Statewide

[29] https://www.atsdr.cdc.gov/ntsip/docs/Reducing_Chemicals_in_Schools.pdf

[30] https://www.beyondbenign.org/

A Guidance Manual for K-12 Schools completed in 2006 for EPA notes issues in Science Labs, Fine Arts, Nursing, Shop, Swimming, Computer, and many other departments. Facility operations involve environmental issues with boilers, Heating, Ventilation and Air Conditioning (HVAC) systems, plumbing, solid and hazardous waste, construction and maintenance activities, cafeteria operations, etc. The Guide contains easily implementable Best Management Practices,[31] which don't all require large investments (often a reason for putting off attention to these matters). The King County, Washington school district has implemented programs to reduce chemical wastes and exposures, including a "Rehab the Lab" program that has made science instruction safer and saved money in waste management costs.[32] Worcester Public Schools has implemented a program similar to Rehab the Lab.

Recommendation

Improved indoor air quality in schools lowers health risks and raises academic performance. Lowering the amount of harmful chemicals in the indoor air and increasing fresh-air exchange in a school can improve student and teacher performance, increase test scores, and reduce airborne transmission of infection. It has been shown the cognitive performance is improved with better indoor air quality.[33] In one study, students in classrooms with higher outdoor air ventilation rates scored 14 to 15 percent higher on standardized test scores than children in classrooms with lower outdoor air ventilation rates.[34] Although the transition to TUR and green cleaning does involve implementation of new protocols and processes and purchases of new supplies and equipment, it is a worthwhile investment as these efforts prevent impacts on student, occupant and staff health, provide more efficient work practices, reduce alarming incidents of harm, and improve relationships with the community.

Indoor air can be improved through adequate ventilation, especially with adequate filtration that addresses particulate matter. But another key component is addressing sources of the contaminants (e.g. chemical vapors, fumes and particulates) that come from the use of equipment and products, and building materials themselves. For example, coatings and composite wood products can emit volatile chemicals. School districts should implement programs to examine ingredients and train staff in toxics use reduction and indoor air quality *as an integrated effort*. Regular reviews should be conducted by top administration. This is key because leadership will invest the effort with seriousness, and some improvements will include capital investments. For example, as discussed below, reducing pesticide use is one category of hazardous chemicals presenting the risk of exposures. Structural repairs may eliminate the infestation and thus the need for pesticides. The root cause of a pest infestation may be rotting

[31] https://files.eric.ed.gov/fulltext/ED496022.pdf
[32] https://www.hazwastehelp.org/educators/index.aspx
[33] https://green.harvard.edu/tools-resources/research-highlight/impact-green-buildings-cognitive-function
[34] https://www.epa.gov/sites/production/files/2014-08/documents/student_performance_slideshow.pdf

wood or a leaky roof. Administrative leaders can make the connection to programs dedicated to repair, rather than to simply apply traps or pesticides as a temporary solution. Another example is the location of air intake vents that draw from continuous sources of emissions, such as exhaust vents or vehicular traffic. Trained staff may note this as an issue, but administrative leaders can take the necessary action to effect the necessary changes, which may have to involve ductwork to relocate the intake vents.

The operating costs of the latter may be low, but a capital investment in improving the structural integrity of the building will provide savings over the long-term. Training, technical assistance and management review can bring these resources and issues together to make clear how they can lower costs, limit liabilities, and protect children and staff.

Below is a (non-exhaustive) list of additional relevant resources.

Resources

The United State Environmental Protection Agency

EPA's Tools for Schools[35] is a ready-made instrument for implementation and training and can cost little or nothing to implement. Tested in hundreds of schools nationwide, it provides a Framework with Key Drivers, essential elements of effective and enduring IAQ management programs, applying a cycle of continuous assessment, planning, action and evaluation. Training school facilities in organizing and communicating a program, assessing the indoor environment, addressing structural, institutional and behavioral issues, and evaluating results has proven to be a low-cost and effective method of addressing indoor air problems. Coupled with EPA information on chemical control programs provides resources for training that can help existing as well as new facilities. For example, in addition to such obvious issues as PCBs in caulk and asbestos furnace insulation, schools have laboratory and maintenance chemicals that ought to be inventoried. Old chemicals must be carefully managed for disposal or recycling, and purchases of dangerous, unnecessary chemicals can be avoided. EPA advises: "Compare the chemical inventory to the school district's approved chemicals list, if available. Chemicals not on the school district's list should be marked for removal."[36] EPA's Sensible Steps to Healthier School Environments focuses on cost-effective, affordable measures to address asbestos, asthma Triggers, carbon monoxide, lead, mercury, mold, PCBs, pesticides, radon.[37]

[35] https://www.epa.gov/iaq-schools
[36] https://www.epa.gov/schools/appendix-model-program-state-school-environmental-health-guidelines#component3
[37] https://www.epa.gov/sites/production/files/2017-06/documents/sensible_steps_final_may2017_web.pdf

Tools for Schools has been implemented to varying degrees in school districts throughout Massachusetts. The challenge has been to maintain the school teams and the district wide initiatives as administrations change. This involves ongoing training and technical assistance.

Massachusetts Department of Environmental Protection

MassDEP has a guide on how to conduct a school chemical management program,[38] buses and vehicle idling, with its diesel reduction guidance recommends Best Management Practices,[39] and its "Green Team", which supplies information resources and recognition on recycling, has 341 participating schools[40], and waste reduction. It also has some links on its website to other Massachusetts's agency programs and U.S. EPA, such outdoor air near schools, asbestos[41] (Massachusetts Department of Labor Standards), asthma (EPA and Massachusetts Department of Public Health), green cleaning, lead, mercury, mold (EPA and Massachusetts Department of Public Health), PCBs (EPA), pesticides and pest management (Massachusetts Department of Agricultural Resources), radon (Massachusetts Department of Public Health).[42]

LEED for Schools

LEED is a certification system of the US Green Building Council that outlines and rewards green building strategies. A facility is awarded certification rankings that may be displayed at a green building through completion of various environmentally friendly tasks. These certifications can additionally aid in obtaining tangible eco-friendly building awards.[43] While these certifications do include fees, they may be outweighed by the savings created through energy efficiency means, as well as publicity from this well-known system.[44] The following are areas in which LEED recognizes action:

- Water and waste reduction.
- Environmental, social, and health impacts of building materials. This includes maintenance but is more focused towards the initial planning of a building so it is least impactful of the environment.
- Indoor Air Quality to improve health, reduce owner liability and costs, and enhance productivity.

38 https://www.mass.gov/doc/massachusetts-school-chemical-management-program
39 https://www.mass.gov/doc/massdep-best-management-practices-reducing-diesel-pollution-at-schools/download
40 https://thegreenteam.org/
41 https://www.mass.gov/service-details/asbestos-resources-for-schools
42 https://www.mass.gov/cleaner-greener-healthier-schools
43 "USGBC Awards." U.S. Green Building Council, www.usgbc.org/resources/usgbc-awards.
44 "A Closer Look At The Average LEED Certification Costs." TerraCast Products, 28 June 2016, www.terracastproducts.com/closer-look-average-leed-certification-costs/.

- Having in place a "high performance green cleaning program".[45]

If a school system is not able to afford the costs of LEED certification, it may claim "LEED equivalency" by performing the prescribed activities, although no official rewards are given, and it should be prepared to substantiate the claim.[46]

Massachusetts School Buildings Alliance Green Schools Projects (MSBA)

The MSBA Green Schools Projects goal is to create and provide funding for sustainable green programs in Massachusetts schools. According to the February, 2017 Update on Sustainable Building Design Guidelines and Policy Recommendations, 128 Massachusetts School Building Authority ("MSBA") Core Program projects have registered with either the Collaborative for High Performance Schools or the United States Green Building Council, which include indoor air quality with energy efficiency and other green objectives. While the program provides funding for new or substantial renovation, other resources may be necessary to address the need for training, improved maintenance and the minor repairs.

NE-CHPS

The Northeast Collaborative for High-Performing Schools, part of North East Energy Partnerships (NEEP), provides extensive guidance and verification for new school projects and renovations, "sets a high standard for energy-efficient and healthy learning environments while also streamlining the process for design teams and school districts." The components include:

- Reducing carbon emissions though anti-idling measures, lighting updates, environmentally preferable refrigerants, electric vehicle charging, and other general efficiency measures
- School health measures via IPM (Integrated Pest Management), chemical control, green cleaning, and Indoor Air Quality (Extensive. Includes pollutants, air systems, moisture management, and renovation for "Low-Emitting Materials Paints and Coatings and Flooring Systems")
- General waste reduction and recycling
- Training for facility staff and occupants
- Building to optimize acoustics and minimizing window glare for a better learning environment[47]

[45] https://www.usgbc.org/credits/eq31?view=language
[46] Spilger, Alex, and Brad Gates. "LEED Certification vs. Equivalency: Which Is Best for Your Project?" BCCI Builders, bcciconst.com/wp-content/uploads/2015/09/CoreNet_The_Leader_LEED_vs._Equivalency.pdf.
[47] https://neep.org/northeast-collaborative-high-performance-schools-criteria-ne-chps-version-32

Tip: *Ask if health and environmental criteria are part of the purchasing policy. Maybe no one ever asked before!*

The Healthy Schools Network (HSN)

HSN has created a toolkit for schools to reduce unnecessary chemical use and exposures, which advises parents, staff and system and facility directors on how to proceed.[48] Directors, for example, are urged to:

- Evaluate your highest volume/most toxic general cleaning products
- Ask your preferred vendor to demonstrate green-rated substitutes
- Schedule custodial staff training
- Pilot in one or more schools and track success
- If the first choice does not perform well, pilot another green-rated product

Parents are advised to "Check with your Facility Director or look in your school board policy manual for the district's purchasing policy and the designated purchasing official. Make sure that health and environmental criteria are part of the school board purchasing policy and actual specifications." (Green Cleaning for Healthy Schools Toolkit).

[48] http://www.healthyschools.org/Cleaning-For-Healthy-Schools/

<u>Creating Urban Gardens in Public Schools in Food Deserts</u>

Introduction

Approximately 2.8 million individuals who reside in low-income areas in Massachusetts are unable to access grocery stores (Freyer). Grocery stores are scarce and located far from low-income residential areas. Access to grocery stores requires individuals to own vehicles, and a majority of residents in these areas are unable to afford them. They are compelled to shop for food from convenience stores that only offer processed food or eat in fast food joints. The result is poor nutrition, which has increased the number of people suffering from obesity and diabetes. Nutrition plays an essential role in the development of the brain and cognitive abilities in children, which ultimately affects their academic performance.

School meals should comprise of healthy diets, which has a positive impact on the mental health of children and their ability to learn. Building urban gardens in public schools in Massachusetts as a source of vegetables and fruits is a cost-effective way of ensuring students eat healthy diets. Learners are enlightened on the importance of proper nutrition; this enables them to develop a healthy eating culture from a young age. Urban gardens in food deserts increase the accessibility to fresh fruits and vegetables to public schools and reduce the cost of purchasing them.

Location of Food Deserts in Massachusetts

At least seven hundred thousand children and five hundred and twenty-three thousand seniors living in Massachusetts are unable to access grocery stores, as they come from low-income families. Low-income residential areas are most affected with regards to inaccessibility to grocery stores as their low purchasing power discourages grocery stores from opening in those areas. Some of the most affected cities are Lawrence, Chelsea, Lowell, Springfield, Chicopee, Everett, Revere, Lynn, Brockton, and Taunton (Massachusetts Public Health Association). A majority of grocery stores in rural areas cannot be easily accessed by residents, as they are too far, and residents are unable to afford cars.

Food Options in Public Schools

Nutritional programs in schools located in Massachusetts are meant to ensure students receive proper nutritional diets. The programs available are Special Milk, Summer Food Service, School Breakfast, Child and Adult Care Food, and National School Lunch program. At least ninety-five thousand public and private schools offer the National School Lunch program. The meals are either offered at no cost or subsidized cost to over two million children daily. The meals are required to meet the American Dietary Guidelines. Learning institutions that participate in the program receive cash subsidies by the United States Department of Agriculture. Students below 130% poverty levels qualify for free meals, and those between 130%-185% can access food at a subsidized cost. The food offered to students through the programs includes meat, grain products, frozen, canned or fresh fruits and vegetables, etc. (Massachusetts Department of

Elementary and Secondary Education). Some school menus include processed foods such as corn dogs, which are unhealthy. A limited amount of resources for food programs makes it a challenge to provide healthier food options, which are a bit expensive.

Nutrition and Education

Nutrition plays an important role in brain development and academic performance in children. Poor nutrition is a result of poor diet or inability to afford healthy food. The brain is one of the most active organs in the body, and it needs nutrients to function properly (Selhub). Poor nutrition leads to a deficiency of minerals such as iron, which is vital for brain development. Lack of iron in the body can lead to a drop in the IQ of children and the development of anemia. Most parents nowadays are busy with work, making it challenging for them to ensure their kids eat a healthy balanced diet, which negatively affects their academic performance. Breakfast is an essential meal for school-going children as it ensures they can concentrate during class sessions and engage in tedious brain activity. Adoption of breakfast programs by schools is an approach that ensures children eat their breakfast before starting their day at school (Hoxworth).

A study by (O'Neil, Quirk and Jacka) revealed that there is a relationship between diet and mental health in teenagers and children. Children and young adults who consumed healthy food performed better in school better compared to those who ate unhealthy diets. In food deserts, the inability to access grocery stores as a result of their scarcity has increased the consumption of processed and fast foods. These diets have high amounts of fat, sugar, and sodium, and their regular consumption is a risk factor in the contraction of heart diseases, obesity, and other chronic ailments. Unhealthy diets in food desserts have increased the number of obese and diabetic children. Children with health issues have poor academic performance, as they are sickly hence unable to attend school as frequently as required. Serving healthy diets in schools should be prioritized to ensure that the nutritional needs of children are met, which has a positive impact on their school performance.

Urban Gardens in Schools

Almost all public schools in Massachusetts participate in school food programs that aim at ensuring students receive proper nutrition. Building urban food gardens by public schools located in food deserts increases children's access to fresh grocery and fruits. Participating in such a project will enable schools to have readily available fresh fruits and vegetables, which will be incorporated in school meals rather than serving processed food. The amount of money used by schools to buy and transport groceries from stores to learning institutions would be reduced. Purchasing groceries in food deserts is expensive, as grocery stores are far from schools. The perishable nature of groceries requires their regular purchase in small quantities, which makes it even more expensive for schools. The project would enable schools to educate students on sustainable agriculture and healthy eating habits, which have an impact on their future eating culture.

Demonstrated Projects in Massachusetts

Some schools in Massachusetts have successfully implemented such projects. Various schools have participated in the Edible Schoolyard Project. A food garden was created in 2015 at Bennett-Hemenway Elementary School in Natick to educate upper elementary students on the sources of food and plant cycles. Over three years, the garden has grown in size and serves five hundred people (The Edible School Yard Project). The food garden built-in 2014 by Y.O.U. Educational Day Academy in Worcester enabled middle and high school students, who also participated in the same project, plant a variety of vegetables and herbs in school. Their garden is a success, and there are plans to expand it and construct a greenhouse. Milford High school also participated in a similar project by constructing a greenhouse. The participants were high school students, and one aim of the project was to aid students in identifying their future career paths and advocated for the preservation of the environment.

Target Audience

Public schools located in food deserts in Massachusetts should be the target audience for an urban garden project. Inaccessibility of fresh fruits and vegetables has a negative impact on the meals offered to students. Meals offered by schools, especially lunches, in some cases are the only decent meal for children from low-income families, hence the need to ensure they are highly nutritious. Building urban gardens will increase the availability of fresh vegetables and fruits at a reduced price for the schools, which ensures that children are given healthier menus.

Cost and Resources

The cost of building urban food gardens varies depending on the garden size and the type of fruits and vegetables grown. Resources will be used to build a healthy garden. The gardens have to be constructed, and a variety of seedbeds made depending on the size of the seeds used to plant various fruits and vegetables. The cost includes purchasing agricultural tools, soil, fertilizers, construction material, and seeds. Staff who take part in the project have to be trained by agricultural experts on how to maintain the garden so that the produce is properly cultivated. Alternatively, agricultural experts can be hired to train staff and students on how to cultivate vegetables. Local gardeners and parents with gardening knowledge may be able to contribute expertise in estimating projected costs.

Funding

With cost projections, schools interested in participating in the urban food garden project can apply for state and educational grants. The Massachusetts Department of Agricultural Resources offers funding programs for agriculture-based projects that increase the accessibility of food. The schools can apply for funding from the Massachusetts Food Trust Program and Massachusetts Food Ventures Program to enable them to build urban food gardens (Commonwealth of Massachusetts). Application for federal and non-federal grant programs provided by the United

States Department of Education, such as Team Nutrition Training Grants for School Meal Recipe Development, will financially aid the urban garden project in public schools (Grants.Gov).

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Optimizing Integrated Pest Management in MA Schools

The Commonwealth of Massachusetts has been a leader in action to reduce the use of toxic substances, including pesticides. The Children Protection Act of 2000, and the regulations at 333 CMR 14.00, promote the implementation of Integrated Pest Management (IPM) techniques and require procedures to minimize the risk of unreasonable adverse effects on human health and the environment regarding the use of pesticides within a school, daycare center or school-age child care program facility in Massachusetts. It mandates that parents, staff, and children of any school or daycare facility receive notification whenever pesticide applications are being made on the property. The state's Executive Order No. 403 (2003) mandates that all facilities managed or owned by the Commonwealth implement IPM programs.

The Massachusetts Department of Agricultural Resources (MDAR), has developed a School IPM Program to which schools and daycares submit their Integrated Pest Management (IPM) Plans, which are made public. These indoor and outdoor IPM plans are intended to incorporate the principles of integrated pest management: to use preventive solutions and safer practices such as physical barriers that prevent pest entry in facilities, bait and trap, and surveillance of pest infestations, instead of presuming the continued presence of pests and employing routine applications of dangerous chemicals. When pesticides are used, an IPM approach employs the least-risk method of application, avoiding methods that involve exposures to people and wildlife, or which persist in the environment. Schools can purchase the service of pest control companies who are licensed by the state.

According to MDAR's website for information on the School IPM Program, 98% of schools in Massachusetts's have an IPM plan. However, having a plan and hiring companies that claim to comply with IPM requirements is not sufficient to ensure that children and staff are protected from unnecessary exposure to pesticides. Children especially are at risk from exposures to chemicals that can affect their development and health, physical and mental. To ensure these programs and plans guarantee the safety of children's health, school staff require training in what a high-quality IPM service should provide, and what role each staff member can play.

In 2015 version 3.0 of *SCHOOL IPM 2020: A Strategic Plan for Integrated Pest Management in Schools in the United States* was released, a collaborative effort involving the IPM Institute of North America, the US Department of Agriculture, USDA Regional IPM Centers, US EPA, Land-Grant universities, school district personnel, and representatives from private industry, non-governmental organizations and consultants. The report found:

> Pest management practices in our nation's schools are in need of improvement. More than 63 published surveys and reports from public agencies, advocacy groups and others since 1994 (Appendix G) have documented deficiencies including unmanaged pest infestations and inappropriate and off label use of pesticides in and around schools. The

American Academy of Pediatrics (2012) warns that, "High-dose pesticide exposure may result in immediate, devastating, even lethal consequences".

Notably, the report states that "Improvement is feasible and affordable. Pest complaints and pesticide use in schools and other public buildings have been reduced by up to 93% through Integrated Pest Management (IPM), with no long-term increase in costs in multiple well-documented studies (Gouge et al. 2006; Greene and Breisch 2002, Williams et al. 2005).[49]

Because many pest problems are related to facility quality, such as carpenter ants that live in rotting wood, or rodent infestations that occur because of gaps in the building envelope, pest management efforts need to be integrated into other programs, such as maintenance and plans for renovation. Other school operations affecting pest issues include recycling and waste management, food service storage and cleaning, breakfast in the classroom, etc. Thus, teachers, custodians and kitchen staff must be trained to prevent the conditions that attract and harbor pests, and to report pest problems in their departments. Facility managers need to ensure pest companies are not just "bait junkies" treating the symptoms, but are also addressing the root causes of the problems.

When pest contractors arrive, staff need to be knowledgeable enough to judge whether the school is actually receiving IPM services. Pest control companies will save time and money by doing the minimum, and IPM contemplates time spent in observation, as well as employing methods to completely eliminate the problem, instead of having a job to come back to again and again. To be effective, the integrated pest management effort must be well understood, and many people need to be involved.

The state's contract for IPM (FAC 92)[50] sets minimum criteria for contractors providing IPM services. However, many requirements are nonspecific to school situations due to the fact that the contract is written for state agency use. In 2005, OSD sought to address this issue by writing a guide for schools, *Massachusetts Statewide Contracts, For Healthier Schools: How to Use Massachusetts Contracts for Pollution Prevention in Schools*, which included a section on how to use the state control for pest control. This guide provided guidance to schools to access the wealth of expertise used to vet the state contracts which school districts do not have. In addition to helping schools understand how to use state contracts, OSD also worked with pest control vendors on the state contract to orient their services for schools. This guide needs to be updated and reposted to continue to assist school district use of state contracts as these contracts are revised and renewed every few years.

Training would help school facilities understand how to get the high-quality service they deserve. When the law passed in 2000, there was some minimal training on the law's

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49 https://ipminstitute.org/wp-content/uploads/2016/05/School-IPM-2020-Pest-Management-Strategic-Plan-V3.0.pdf, p. 6.
50 https://www.mass.gov/doc/fac92/download

requirements and a limited few trainings on how to implement an IPM program. The state contract specifies some training requirements for vendors to provide contract users:

> …within 30 days of conducting the initial inspection, the Contractor must submit an IPM Plan. The plan must include details on: the training of the staff, contractors and occupants, frequency of technician visits, and the activities they will perform with a description of the pest monitoring program. After each service visit, the technician must submit a final service report with the facility manager, detailing the following information: pesticides used and location, results of monitoring, description of any temporary conditions that may be contributing to pest problems and any other actions that were taken. Contractors are responsible for providing an annual training session to facility staff, contractors and facility occupants free of charge. The contractor must provide additional training sessions for a mutually agreed upon cost if agreed necessary.

The contract is not specific about what the training will include. Training content needs to cover the following: requirements of the Massachusetts Families Protection Act, conditions that attract and harbor pests, how to prevent pest infestations, how to document and reports pests, etc. The contract itself doesn't specify that the contractor will identify points of entry, attractants, or that every effort will be made to avoid the use of pesticides unless necessary, and if used, how the pesticides will present the least risk to occupants. It doesn't require the contractor to train in observation of pests by staff and recording and reporting incidents of pest activity. Training is necessary to ensure that facilities receive the intended service.

Training content should be customized to address issues in each relevant department (e.g. training for kitchen staff is different than for classroom teachers). The contract is provided on a monthly fee basis, but it is best to expect an IPM contractor to devise a service that does not indefinitely recur. Most important, notification of pest applications is not enough. Those notified need to know enough to ensure that lower-risk options are being used.

Facility managers need to be trained on the distinction between true IPM and convention pest control. Besides ensuring that contractors are using the least-risk mitigation methods, and strategies that eliminate the pest problem, facility managers also need to address structural repairs for long term solutions when warranted. Ideally, the state system will integrate the solution called for with programs for renovations, repairs and maintenance. While simply treating the superficial symptoms of pest infestations on school grounds and within buildings may be a convenient business plan for pest contractors, fixing the underlying cause (such as a leaky roof or improper management and disposal of food) will lower costs and the need for pest control. The structural repairs and maintenance can be integrated with efforts to reduce energy consumption (e.g. door sweeps reduce energy loss and prevent pest access), and improve building durability. Grounds personnel (including municipal departments that maintain school athletic fields) need to be trained on IPM and organic lawncare strategies, as well as incorporating IPM requirements into any service contracts for field management.

Professional information on IPM and training programs for IPM that would benefit school administrators and staff is predominately available online. For example, the Northeastern IPM Center, which is comprised of representatives from land-grant IPM programs, government, private industry, and nonprofits from 11 northeastern states, has created an IPM Best Practices Guide.[51] In addition, they funded a recent 2020 update of a school-related website https://www.northeastipm.org/schools/ with *Site Specific Best Management Practices for School IPM* by the School IPM Working Group and the NYS IPM Program of Cornell University. It is designed for use by all school departments and has links to free training and resources. Educational events and resources are also provided periodically by the Massachusetts Facilities Administrators' Association.

Upon training, school staff may be able to diagnose the appropriate pest control methods with regards to IPM and decrease the reliance on using conventional pest control contractors to make sure that the root of the pest problems is addressed. Once facility managers can adequately address pest problems themselves, they are in a much more informed position to reach out and secure funding for the impacted facilities that will need structural renovations or other long-term strategies. For grounds IPM, these strategies can involve minimizing chemical-based treatment of fields by using organic lawncare instead of herbicides and pesticides to decrease chemical exposure in children.

Organizing a Budget for School IPM

Facility managers and school business officers can work together to recognize and allocate capital expenses as structural repairs which include fixing roofs, upkeep of basement drainage, window and door replacements, etc. Some expenses to implement the IPM plan can be contained in the operational budget. Some operational funding for school training programs focused on educating school staff, teachers, and students can be secured through local town funding, but the capacity for this is quite varied, so the state role to ensure that all children are protected is key.

Schools are able to benefit from financial guidance provided by an expense analysis calculated by the School IPM Cost Calculator that can be accessed online for free, developed by the Southwest Technical Resource Center for School IPM[52], a budget planning tool for maintenance professionals to resourcefully develop and manage IPM programs.

IPM Certifications

Certifying that schools are receiving advanced IPM services and adopting successful IPM strategies can be ensured through compliance with certification programs such as GreenShield, EcoWise, GreenPro, and IPM STAR that the state can sponsor or incentivize adoption through award recognitions. These certifications would allow schools to go a step further than just the

[51] https://www.northeastipm.org/schools/
[52] http://www.ipmcalculator.com/

state required submission of IPM plans, for they are awarded to facilities that demonstrate a commitment to the least risk non-chemical pest control practices.

For a school or daycare facility to receive an IPM STAR certification, an application must be submitted and on-site evaluation must be performed. Based on the results of the evaluation, the facility will be awarded an IPM STAR Certificate, effective for three years and renewable after another three. These certifications are also available for IPM professionals working in schools, such as contractors. Schools that hire these professionals will have extra assurance that they receive IPM services. The integration of IPM with other goals for greening schools can be part of LEED certification (see Chemical Control section above), and courses on implementing IPM in buildings including LEED projects are made available by the U.S. Green Building Council (USGBC), which notes:

> The building envelope has been proven to control energy loss and moisture. But why not upgrade the envelope to exclude pests by using IPM (Integrated Pest Management)? Excluding insects and pests over the life of the structure addresses the LEED objective of reducing chemical exposure and air contaminants. Pesticides are considered to be "chemicals of concern" and LEED has begun to call for implementation of Integrated Pest Management (IPM) programs. IPM specifically mentions the design of non-chemical pest preventive measures into the structure.[53]

Prioritizing IPM for Most At-Risk Schools

To ensure that the most at-risk schools throughout the state are receiving adequate IPM services, priority should be given to the schools most in need of necessary funding for IPM integration. The need of IPM in schools should be assessed as well as the effectiveness of current IPM plans to guarantee that schools are doing their best to protecting public health. Schools with budgets that do not provide sufficient funding for pest management may also have an inadequate amount of staff, deteriorating property infrastructure, and poor facility maintenance.

Dangers of Pesticide Exposures

It may be understood that the health dangers imposed by pesticides gives rise to a responsibility to take action to prevent unnecessary exposure, but it may be necessary to emphasize this is especially true for school age children. Greater health effects due to pesticide exposure are experienced by children as they spend large amounts of time in schools and can be physically closer to and interact with areas where pesticides have been applied. Children are still growing and developing organ systems, behavioral habits, metabolism and anatomy. They breathe more in proportion to their body weight compared with adults, which means a proportionately larger amount of a chemical is received.

[53] https://www.usgbc.org/education/sessions/adding-sustainable-insect-barriers-building-envelope-10516640

Commonly used pesticides in schools have been identified as neurotoxins, possible or known carcinogens, developmental and reproductive toxins by authorities such as the U.S. EPA (US EPA 2006) and exposure has been linked to chronic respiratory symptoms and diseases in children (Salameh et al. 2003). The vulnerability and risks associated with pesticide exposure in children have been shown to increase in school settings. Onsite evaluations of more than 29 school systems in more than 14 states has revealed that about half of the school systems were in violation of legal requirements for pest management policies, such as having outdated or unregistered pesticides, including DDT (Green et al. 2007). All schools should carefully review pesticide labels for risks to children and ensure that staff and/or contractors switch to products that effectively minimize exposure toxicity. Many common spray-applied liquids and volatile formulations can drift onto and accumulate on contact surfaces.

The IPM Institute estimates that of the nearly 14,000 school districts in the U.S. that there are more than 5,000 districts where pesticides have been applied without proper training, licenses, or certifications (Hurley et al. 2013).

Massachusetts, however, places strict limitations on the use of dangerous pesticides in schools. State regulation (333 CMR 14) requires that no pesticides be applied unless they are used in accordance with facility Integrated Pest Management Plans. No pesticides classified as known, likely or probable human carcinogens by EPA or DEP may be used, and no pesticides can contain inert ingredients categorized as "List 1" or any equivalent categorization by EPA may be used. But for these requirements to be effective, people must understand and implement them. School IPM plans must be meaningfully executed. An understanding of which pesticides are permitted and which are not must be a factor in approving pest contractor actions. This requires training to ensure these provisions deliver the intended results.

In Massachusetts, state legislators and local advocates are supporting Bill H.791, "An Act Relative to Improving Pesticide Protections For Massachusetts Schoolchildren" to minimize the amount of toxic pesticides currently approved by the state to be used near and in schools and child care centers. The bill would only allow the use of certified organic pesticides or those considered "minimum risk" by the EPA. The support for this bill, which has been received favorably by the House's committee, reflects that concerns persist pertaining to applications of chemicals known to be toxic or carcinogenic to human health. Some of the toxic chemicals mentioned in the bill are still commonly used, such as glyphosate. The International Agency for Research on Cancer (IARC) of the World Health Organization (WHO) identifies glyphosate as probably carcinogenic. TruGreen, a national chemical landscaping company, is being sued for using glyphosate while claiming that they do not use any chemicals defined as probable human carcinogens by the IARC and EPA. This lawsuit is an indication of the need for up-to-date training and an informed staff at all schools.

Integration of successful IPM programs within schools

Adoption of IPM in schools can be extremely successful in reducing pesticide exposure. A research study performed over a ten-year period in seven states showed IPM programs resulted in a 78% reduction in pest complaints to school administrations and a reduction of pesticide applications of about 71% (Gouge, D.H., M. L. Lame, and J. L. Snyder. 2006). We found no study specific to Massachusetts, but some examples: the town of Milton has integrated effective IPM strategies into their public-school system through municipality-wide consolidated facilities management. Director of Milton's Consolidated Facilities Department William Ritchie has supported and developed IPM integration into facility management by training facilities and custodial staff on the goals of IPM and the necessary coordination across departments for IPM to function effectively and efficiently as well as scheduling timely facility and structural IPM assessments.[54] The city of Newton, MA has received IPM Star certification.[55] Lexington had early adoption of IPM and a study of IPM in Boston's housing program "recommended integrated pest management as the single intervention with the most potential to be implemented broadly and have the biggest impact with the most efficient use of resources".[56]

In New York City, the Board of Education ended the use of all aerosols in classrooms as well as any indoor dust products, "pelleted" rodenticides, outdoor rodenticide bait sets, and some harmful chemicals such as pyrethroids and pyrethrin treatments anywhere within the 1,200 schools in the city represented by the Board. The schools are now using less toxic pest management methods such as monitoring programs and preventative structural sealing (IPM Standards for Schools 2004). Santa Barbara County in California and Monroe County in Indiana have also been implementing IPM strategies in their public schools. In Santa Barbara County costs were reduced by 30% from the integration of IPM methods. Monroe County's pilot IPM program had reduced pesticide applications in three elementary schools by 90% (IPM Standards for Schools 2004).

To assist schools in their IPM programs, the EPA's *Tools for Schools* program is useful and accessible (see above section on Green Cleaning and Chemical Control). This program, which focuses on ensuring healthy indoor air quality for schools, recognizes that eliminating the threat of airborne pesticide compounds is an essential effort. Tools for schools provides action kits, training webinars, publications, video resources, guides and checklists. To reduce pest induced asthma triggers in schools, the Massachusetts Department of Public Health has put together an asthma toolkit which refers to IPM concepts as best practices to minimize and reduce exposure to toxic chemicals such as pesticides. The asthma toolkit also lays out sample IPM

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[54] The latest indoor IPM plan (https://massnrc.org/data/ipm/Milton_High_School_in_1_2019_5604.htm) shows how facility staff are involved: "Reports from facility personnel (pest reporting forms) would prompt the IPM coordinator to contact the facility's Pest Management Professional who would then conduct a facility audit."

[55] https://www.beyondpesticides.org/assets/media/documents/schools/publications/schoolmonitor/vol%204%20no%203.pdf

[56] https://www.bostonhousing.org/en/Departments/Planning-and-Real-Estate-Development/Healthy-Homes.aspx#PestStudy

policies and provides educational materials for schools to stay in accordance with state IPM laws and regulations.

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Appendix A: A Method to Measure the Environmental Impacts of Pesticides

The Environmental Impact Quotient (EIQ) is a formula created to provide growers with data regarding the environmental and health impacts of their pesticide options so they can make better informed decisions regarding their pesticide selection.

The original paper introducing and describing the EIQ was written by members of the NYS Integrated Pest Management Program (NYSIPM) in 1992.

An EIQ calculator was also developed to aid users in computing Field Use EIQ values, and facilitate comparison of pest management options and systems.

NYSIPM periodically calculates EIQ values for new pesticide active ingredients, and reviews old EIQ values. Brian Eshenaur leads these efforts, and can be contacted at bce1@cornell.edu.

MA Environmental and IPM Consulting Services can be found here: https://www.davey.com/environmental-consulting-services/

Appendix B: Cornell's IPM Inspection and Monitoring Forms for School Buildings

This appendix, which can be found here:
https://ecommons.cornell.edu/bitstream/handle/1813/52291/school-municipal-app-FS-NYSIPM.pdf?sequence=3&isAllowed=y

is a collection of forms that can be used to enhance and organize your IPM program. Record keeping is an essential part of any IPM program. Few pest management professionals or building managers would be able to remember the details of an in-depth inspection for pests and conditions supporting pests, especially on a larger campus of buildings. Furthermore, recording pest numbers and locations provides a record for future comparison to determine whether the pest management program is working; whether pest sightings have decreased over time.

• The first form is the Building Exterior Pest Control Inspection Form. Inspection of the building exterior is important for identifying pest activity, access points, water damage and landscape features that contribute to pest problems.

• The Pest Sighting and Follow-Up Log should be made available to all building occupants as well as the pest professional as a form of indirect communication. Building occupants will feel as if their complaints are being addressed if the pest manager also uses the Log to organize a response to pest complaints.

• The Building Maintenance Log is another form that building occupants, including custodial staff, should be using to report problems, such leaks, broken windows, and sanitation problems.

• The form titled "Roach Trap Monitoring" is an example of a form for a specific pest. This can be used for any type of pest that regularly enters and is also being trapped in an active monitoring program.

• The last form, "Pest Control Trouble Log", is another version of the form that building occupants can use to report pests and the pest manager can use to learn about complaints.

Feel free to reproduce and use these forms or use them as templates for your own custom forms. Most importantly, always keep records of pests and pest control actions.

Appendix C: Resources

The University of Florida hosts Pest Management University, a cooperative effort with the Department of Agriculture, offering certificates of continuing education: https://pestmanagementuniversity.org/

Provides guidance and tools for IPM program implementation, such as: https://schoolipm.ifas.ufl.edu/toolbox.html

UFl also hosts a Listserv: https://schoolipm.ifas.ufl.edu/Florida/list.htm

The IPM Institute has a special section for school IPM. https://ipminstitute.org/projects/#national-school-ipm

School IPM 2020: https://ipminstitute.org/projects/stop-school-pests-online-ipm-training-for-school-employees/school-ipm-2020/

Starting a school IPM program: https://ipminstitute.org/wp-content/uploads/2016/05/IPM-Standards-for-Schools-V3.2.pdf

Training courses: Annual Basic Online IPM Course – https://www.sia-jpa.org/resources/hot-topics/integrated-pest-management-ipm-training-available-online/

The Pest Defense for Healthy Schools (Online/In Person) - https://ipminstitute.org/projects/stop-school-pests-online-ipm-training-for-school-employees/

Other:

Online IPM course for Food Staff – https://www.aibinternational.com/en/Training/Food-Safety-Quality/GMP-Sanitation-Training/Online-Training/Integrated-Pest-Management-Online

IPM Training offered by Boston Housing Authority (BHA) – http://sites.bu.edu/masslocalinstitute/2014/11/04/integrated-pest-management-training/

IPM Training for School Coordinators in NJ - https://pestmanagement.rutgers.edu/school/training/

Appendix D: Pesticides of Concern

Product Name	Type of Pesticide	Sample Target Pests	Known Health Effects
Acephate	Insecticide	Cockroaches and ants.	Headache, flu-like symptoms, cancer, reproductive disruption and irritation to nervous system.
Bendiocarb (Ficam)	Insecticide	Ants, fleas, ticks, cockroaches, silverfish and crickets.	Diarrhea, muscle weakness, dizziness, headache, blurred vision, spasms, sweating and sensory and behavioral disruption.
Cldorpyrifos	Insecticide	Ants, termites, fleas, cockroaches and mosquitoes.	Headache, nausea, dizziness, abdominal cramps, vision impairment, weight loss, vertigo, convulsions, toxic psychosis, drowsiness, twitching muscles, mental confusion and peripheral neuropathy.
Cypermethin	Insecticide	Ants and cockroaches.	Allergic dermatitis and flu-like symptoms.
2,4-D	Herbicide	Broadleaf weeds	Vomiting, diarrhea, anorexia, ulcers, damage to liver and kidney and nervous system damage.
Dicambra	Herbicide	Broadleaf weeds	Skin irritation, vomiting, coughing, dizziness, sensory and behavioral disruption, spasms and sweating.
MCPP (Mecoprop)	Herbicide	Broadleaf weeds	Skin irritation, vomiting, coughing, dizziness, sensory and behavioral disruption, spasms and sweating.

Source: *Pesticides in Schools: Reducing the Risks*, New York State Board of Regents' Advisory Committee on Environmental Quality of Schools, February, 1996.

These pesticides were found used in schools in NY in 1996

MA prohibits:

CHEMICALS CATEGORIZED BY US EPA AS LIST-1: INERTS INGREDIENTS OF TOXICOLOGICAL CONCERN

Pursuant to Section 11 of "An Act Protecting Children and Families from Harmful Pesticides," pesticide products containing "List-1: Inert ingredients of Toxicological Concern" or any equivalent categorization by the U.S. EPA are not eligible for use on the outdoor grounds of any school, day care center or school age childcare program.

Pesticide products containing an inert ingredient categorized in "List 1: Inert Ingredients of Toxicological Concern" are required to place the chemical's common name on the front of the pesticide product label. Therefore, pesticide products containing "List-1" inert ingredients can be readily identified by the product user simply by reading the front of the product label.

According to U.S. EPA, there are currently approximately 160 products that contain one of eight remaining List-1 inert ingredients. The following table lists the common names of these inert ingredients. EPA also maintains the "List-1: Inerts of Toxicological Concern" on the internet at the following web address: http://www.epa.gov/opprd001/inerts/lists.htm

Please note that the list maintained by US EPA does not contain the eighth inert ingredient, Malachite Green. EPA chooses not to list Malachite Green due to the fact that use of this eighth remaining List-1 inert ingredient will cease once the existing stocks of pesticides containing it are depleted.

Pesticide products containing these chemical names can not be used outdoors or on school property.
Adipic acid, bis(2-ethylhexyl) ester
benzene, chloro
Ethylene glycol monoethyl ether
Hexane
Hydroquinone
Isophorone
Phenol
Phthalic acid, bis(2-ethylhexyl) ester C1980
(updated AUG 2004)

PESTICIDES CLASSIFIED AS KNOWN, LIKELY, OR PROBABLE HUMAN CARCINOGENS BY THE U.S. EPA AS OF SEPTEMBER 24, 2008*

Pursuant to MGL c132B, Section 6G., of the Massachusetts Pesticide Control Act, pesticide products containing chemicals classified as known, likely, or probable human carcinogens by the U.S. EPA or equivalently categorized by the Department of Agricultural Resources, are not eligible for use outdoors on the facility grounds of any school, day care center or school age childcare program.

Periodically the U.S. EPA publishes a list of pesticides evaluated for carcinogenic potential. The following table is based on the EPA list dated September 24th 2008. Once the EPA makes an updated list available, the Department of Agricultural Resources will update the following table to reflect any changes.

Should you wish to obtain the entire list of pesticides evaluated for carcinogenic potential you may contact U.S. EPA via the contact information provided below for your convenience.

http://www.epa.gov/pesticides/carlist/

Likely to have uses on school property	Chemical Common Name
	Acetochlor
*	Acifluorfen, Sodium
	Alachlor
	Amitrole
	Arsenic acid, inorganic
	Arsenic pentoxide, inorganic
	Arsenate sodium, inorganic
*	Cacodylic acid
*	Captan
*	Carbaryl
*	Chlorothalonil
	Chromium (VI)
	Clodinafop-propargyl
	Creosote
	Cyproconazole
	Daminozide
	Dichloropropene, 1,3- (Telone II)
	Diclofop-methyl (Hoelon)
*	Diuron
*	Ethoprop
	Ethylene oxide
	Ferbam
*	Fenoxycarb
	Fluthiacet-methyl (Action)
*	Folpet
	Formaldehyde
	Imazalil
	Iodomethane
*	Iprodione (Glycophene)
	Isoxaflutole

	Kresoxim-methyl
	Lactofen (Cobra)
*	Lindane
*	Mancozeb
*	Maneb
*	Metam Sodium
	Methyl isothiocyanate
	Methyl bis(thiocyanate)
	Metiram
	MGK Repellent 326
	Nitrapyrin
*	Metofluthrin
	Oryzalin
	Oxadiazon
	Pentachlorophenol
*	Permethrin
	Pirimicarb
	Pronamide (Kerb)
	Propachlor
	Propargite (Omite)
	Propoxur
	Propylene oxide
	Pyraflufen-Ethyl
	Pymetrozine
*	Pyrethrins
*	Resmethrin
	Spirodiclofen
*	Sulfosulforon
	Telone
	Terrazole
	Tetrachlorvinphos
	Tetraconazole
	Thiabendazole
*	Thiacloprid
	Thiodicarb (Larvin)
	Thiophanate-methly
	Topramezone

	Tralkoxydim
	Tribufos (tribuphos/DEF)
*	Trichlorfon (Triclorphon)
	Triphenyltin hydroxide (TPTH)

* Chemicals contained within pesticide products commonly used on sites found on school property are denoted with an asterisk.

* The Department's table of known, likely or probable human carcinogens is based on the September 24, 2008 U.S. EPA report of chemicals evaluated for carcinogenic potential and includes chemicals which may or may not be actively registered for use in Massachusetts. In addition, the Department's table may not include all the chemicals listed on the U.S. EPA List; especially, when their registrations have long been cancelled. While such pesticides may be classified as known probable or likely human carcinogens, they are no longer registered for use by U.S. EPA or the Massachusetts Pesticide Board Subcommittee and may no longer be found in the channels of trade.

Appendix F: Grants and Contacts

Northeastern IPM Center Grants Programs:

IPM Partnership Grants Program

Pest Management Strategy Plan (PMSP) or Production/Management Profile (PMP) Program

Information on these and previous grants is available here: https://www.northeastipm.org/grant-programs/Aipm-center-grants/

School IPM Contacts for Massachusetts

Department of Agricultural Resources

Taryn LaScola: Taryn.LaScola@state.ma.us

Trevor Battle: trevor.battle@state.ma.us

University of Massachusetts

Mary Owen: mowen@umext.umass.edu

Key contacts for the School IPM Working Group can be found here: https://www.northeastipm.org/working-groups/schools/

Appendix G: Sample Program Outline

Outlined below are actions that schools can take, taken from School IPM preparedness reports prepared by the EPA, Cornell University, and the University of Arizona Extension:

Management

- Establish a school district-wide IPM committee and coordinator to oversee effectiveness of incorporating IPM principles and advise on policy issues and costs of pest management.
- Adopt an official IPM policy for the school to commit to implementing reduced risk, pest mitigation efforts and limit pesticide use to decrease exposure and school-wide pest complaints.
    - Designate official roles for pest management and establish communication protocol.
    - Alert family members of IPM plan and encourage to participate to reduce health risks.
- Create goals and objectives for IPM plan as well as evaluation criteria to assure achievements.
    - Outline respective pest management objectives for each type of location and activity.
    - Conduct toxics and air quality audits annually or semi-annually by an environmental health coordinated or certified inspector to evaluate building designs, working conditions, ventilation systems, potential sources of pollution as well as toxics stored or applied.
- Develop an inspection and monitoring schedule with maintenance for staff and teachers to follow according to respective IPM responsibilities.
- Keep records and write reports on the conditions of school buildings which include but are not limited to results from monitoring, findings from inspections, and recommendations.
- Disclose the use of traps and baits to eliminate pests and warn of any potential exposure risks.
    - School nurses contribute to IPM plans by assessing health risks in school environments and collaborating with staff and students to communicate the environmental health risks.
    - Notify staff and students as soon as possible or at least 24-48 hours in advance of any pesticide treatments with a stated re-entry time to all treated areas.
- Organize an educational training program that consists of educating school staff, teachers, and students about IPM concepts such as understanding pest lifecycles, pest conducive conditions, and prevention methods to prepare for IPM application.

Maintenance

- Conduct inspections and monitor grounds on a regular schedule agreed upon with management.
    - Inspect cafeterias, classrooms, gyms, lockers, fields, lots, and all indoor-outdoor trash disposal areas periodically for the presence of pests.
- Make sure to weatherize buildings and seal pest entryways in a non-toxic and safe manner.
- Repair facilities and structural systems promptly, making sure to contact management as soon as possible to secure funding for the needed services.
- Work with trained staff and management to ensure the use of IPM through targeted long-term and actively updated measures to get rid of pests.
    - Focus on pest prevention strategies in the indoor and outdoor areas of the school.
    - Identify typical pests and the environments they find hospitable within schools.
- Upon the need to use pesticides, coordinate with state contracted IPM contractors or certified pesticide applicators to remove pests and make sure of minimal use of conventional chemicals.
    - Typical pests in schools include mice, cockroaches, wasps, ants, spiders, and termites.

<u>*Indoor*</u>

- *Classrooms, Offices, Labs, Auditoriums, Gymnasiums, Hallways*
    - Allow food and beverages in designated areas, clean up waste present after meal periods.
    - Any indoor plants must be kept healthy and removed if insect infestations appear.
    - Remove any standing water or wet materials that may damage areas if not kept dry.
    - Clean and tidy all storage areas such as closets, cabinets, desks, and lockers.
    - Routinely vacuum all floors, dust windowsills as well as any areas with debris build up.
- *Kitchens, Cafeterias*
    - Sanitize all food prep equipment after use and remove food grease accumulation.
    - All food is to be stored in air tight sealed containers and floor drains cleaned weekly.
    - All waste placed in bag lined trash cans with lids and removed at the end of each day.
    - Place screens on all entrance pathways such as vents, windows, and floor drains.
    - If rodents appear, do not use rodenticide and instead place traps and baits.
- *Plumbing and Maintenance Areas*
    - To deny pests access to water, routinely repair leaks, seal pipe chases, increase ventilation to decrease humidity, clean floor grates.
    - Store any paper products away from wet areas and keep all areas dry.
    - Promptly remove waste, any excess equipment or construction material.

Outdoor

- *Fields, Playgrounds, Lawns, Parking Lots, Ornamental Plants*
  - Drain any standing water on the grounds and acquire pest-resistant plants and equipment.
  - To protect local ecosystem, place waste and recycling receptables in common areas to reduce littering as well as remove diseased plants.
  - To sustain the health of turfs, obtain a mixture of turfs best suited for each area, check for turf or soil damage from mowing practices, and alternate mowing patterns.
  - Alleviate overwatering of turf and plants by watering infrequently and in the morning.
  - Process soil pH tests and determine minimum fertilizer requirements.
  - Keep any vegetation at least 12 inches away from structures and trim tree branches so they are at least 6 feet from buildings.

- *Waste and Recycling Collection Areas*
  - Procure pest-resistant designed waste and recycling containers, separating oil and raw waste in specific receptables with the ability to be resealed.
  - Clean all waste and recycling containers interiorly and exteriorly to remove any spillage or accumulation as well as place them more than 50 feet away from buildings.
  - Do not allow for contents of containers to overflow or be placed on the ground, making sure to have daily service with no overnight waste accumulated.