



Delaware Division of Public Health IAQ Guidance Document for Schools

Scope: This document provides information on the management of indoor air quality (IAQ) in schools to improve environmental conditions for school staff and students. It offers guidance that will help prevent IAQ issues and assist in solving or remediating problems as they arise. The primary audience for this guidance is those responsible for providing a safe and healthy environment within school buildings, though it will provide helpful insight to others. For maximum efficiency, LEAs are encouraged to use the guidance provided to proactively prevent issues and improve conditions.

Introduction: Outdoor air pollution can have negative impacts on human health, and indoor air pollution, if mismanaged, can have significant health impacts. According to the Environmental Protection Agency (EPA), each day one in five Americans occupies a school building with the majority being children. Air pollutants present indoors may be two to five times that of the outside air and can occasionally reach levels as high as 100 times. Many potential IAQ factors can exist in schools, such as animal dander, mold, dust, dirt, and leaks, to name a few. If mismanaged these can lead to many different health impacts including coughing, eye irritation, headaches, allergic reactions, and aggravated asthma.

Successful IAQ management programs take time to develop and implement; IAQ management plans should aim for continual improvement, utilizing state-of-the-art practices as they arise. This allows a flexible response to changes in IAQ management needs.

According to the EPA providing healthy IAQ is proven to decrease student and teacher absences due to IAQ-related sickness and to promote improved productivity and focus for building occupants.

Plan and team building: Establishing an effective team to develop and implement an IAQ plan is the first step in successful IAQ management. A coordinator should be selected, and the team built up from there depending on the size of the building and the issues present. Select team members whose job function and knowledge equip them to address IAQ. The goal is to have a diverse team that can be flexible and effective.

Regular inspection and maintenance are essential for IAQ, so standard operating procedures should be in place to verify that this is done consistently. A schedule is another key piece to completing IAQ-related procedures in timely intervals.

Ventilation: Maximizing ventilation within the system's capabilities helps reduce pollutants while also limiting the spread of viruses and bacteria by diluting the indoor air with fresh air. The ventilation rates will consider outdoor air quality factors when deciding on the optimal amount of outdoor air. School heating, ventilation, and air conditioning (HVAC) systems should operate to provide a minimum outdoor air ventilation rate based on room and class size that meets current guidance from the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). Ensure the HVAC system is in good repair. Routinely check air intakes for blockages, damage, and infiltration of unwanted items and pests. Verify the system is operating efficiently and performing at the designed ventilation.



The ventilation rate can be increased during temporary situations that have a negative impact on IAQ. Monitoring for carbon dioxide (CO₂) can be a useful indicator of how well a space is ventilated. AHSRAE guidance 62.1 appendix D uses 700 parts per million (ppm) above the outside levels as an indicator that a space is inadequately ventilated. ASHRAE guidance 62.1-2007 provides the formula for airflow rates based on CO₂ concentration. When painting, performing renovations, or actions that release air irritants occur such as volatile organic compounds (VOCs), it is recommended to increase ventilation temporality to dilute the fumes present in the air.

Air Filtration: When in good repair the building's HVAC system filters out a large percentage of particles from the outdoor air brought into the building. Utilize current ASHRAE guidance or industry best practices for the specific outdoor air contaminants and nuisance dust present so they are not brought into the building at levels of concern. An observational survey of the outdoor air quality during expected operating hours can be done to identify any sources of contaminants of concern in the local air like bus idling and mold spores.

Carbon Monoxide: Carbon monoxide (CO) levels should follow the NIOSH recommended exposure limit of no more than 9ppm per hour for a duration of 8 hours with no one hour exceeding 35ppm. The goal for ideal IAQ should be set at the outside reference level. Limiting bus idling in areas where the exhaust could enter the building will reduce CO levels.

Temperature and Humidity: Temperature should be maintained within an optimal comfort zone of 68 to 78 degrees Fahrenheit depending on the season. This ensures occupant comfort and decreases issues caused by excessive temperatures, such as decreases in focus and attention for students and teachers. This temperature range also reduces the potential for condensation to form on cold surfaces (piping, exterior walls, roof, or floor.)

Relative humidity should be maintained within 20% to 60% during operation, combined with the temperature to maintain a dew point under 70 degrees Fahrenheit. Action points of 25% and 55% relative humidity are recommended to maintain optimum conditions to prevent moisture, mold growth, and exceedances. AHSRAE guidance recommends keeping the HVAC system in operation year-round and maintaining humidity levels under 65% to prevent moisture and mold issues from developing during extended periods during summer with low occupancy. When temperature and humidity are kept at higher levels maintaining air movement is crucial to prevent mold growth.

Buildings with two pipe systems or systems that have no option to measure or control humidity will need to utilize other means to measure and display humidity throughout the building. If humidity related issues arise they must also utilize other means to bring humidity to acceptable measures.

Addressing moisture and spill problems promptly will prevent humidity, moisture, and additional issues associated with spills. Spills should be cleaned up immediately upon notification of the incident.

Cleaning and Building Supplies: Having regular and routine cleaning will improve the overall IAQ of the building. Have set cleaning procedures indicating when cleaning will be done and



include the proper use of cleaning materials. Cleaning materials should be stored in designated areas and capped when not in use.

The choice of cleaners, paints, and insecticides used inside the school heavily affect IAQ. Many cleaners can cause skin, eye, and respiratory aggravation when used indoors. Choosing cleaners that are more friendly to IAQ. This includes cleaners that do not have a harsh smell and leave elevated VOCs after use. Ones with fragrances, along with air fresheners and perfumes should be avoided as many remain for long periods and are irritants.

Pest Management: A less considered factor that affects IAQ is the presence of pests and the issues associated with infestation. Establishing an integrated pest management (IPM) plan will greatly assist in providing a safer IAQ environment. Instead of using broad pesticide treatments utilize targeted actions such as baits and spot treatments of problem areas. Caulking and sealing areas around pipes, cracks, windows, and sidewalks reduces pest entrance points. Check windows and screens for holes and gaps that would allow entrance into the building.

Maintenance outdoors can directly benefit IPM. Pruning the branches of shrubs and trees can help eliminate pest access into the building. Ensure drains are working properly, and that water is directed away and adequately drained from the building and other structures. Avoid the use of excess fertilizer that can attract pests to the property. If possible, select a mixture of turf types that are adapted well to the school's outdoor environment.

The environmental conditions maintained indoors can also impact IPM. Having designated areas where food is allowed reduces the number of areas with food waste that can attract pests. Storing trash properly and away from doors will attract less pests. Keep areas as dry as possible and empty any containers that have standing water. Ensure that desks and lockers are cleaned routinely. Reducing clutter and eliminating excess paper, packaging, and boxes will allow fewer areas for pests to hide.

Animals in Classrooms: There are many educational reasons to keep animals within certain classrooms, however these benefits should be weighed against the risks of their presence which can have a negative effect on the occupants of the classroom. Choosing animals that produce less dander or are kept in living conditions that introduce fewer IAQ issues is preferred when possible. A best practice is having the animals in the school for as little time as possible. Animal habitats should not be placed near HVAC vents and kept away from ventilation intakes.

Radon: Radon is a naturally occurring radioactive gas from the decay of uranium in the ground. It is widely considered one of the most hazardous indoor pollutants and one of the leading causes of lung cancer among non-smokers. Schools should be tested to assess if radon is a potential IAQ problem. If radon is found in levels of concern mitigation efforts should be enacted as soon as possible.

Asthma: The EPA estimates that nearly 7 million school-aged children have asthma, which equates to roughly 1 in 13 children. An estimated 10.5 million days of school are missed every year due to asthma-related illness. This is estimated by the American College of Allergy, Asthma, and Immunology to be a loss of \$56 billion every year from students missing school due to asthma-related issues. This causes extra academic strain on both the students and teachers. The number of days missed can be reduced by adopting several best practices in the school environment that improve IAQ and asthma triggers.

Asthma triggers that commonly occur in schools include pests, mold, animal dander, use of certain cleaning products, and other chemicals. Executing all the aforementioned practices will help reduce the triggers found within schools.

Indoor Air Quality Monitoring: Establishing indoor air quality monitoring programs is crucial to the success of maintaining good IAQ. Work with industry professionals to establish a program with tests for the school's specific indoor and outdoor air quality concerns these include but are not limited to, ozone, mold spore count, nuisance dust, total VOCs, CO₂, and CO. Routine monitoring should be performed once a semester during regular operating hours.

Resources:

American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). 2022. ANSI/ASHRAE Standard 62.1-2022, Ventilation and Acceptable Indoor Air Quality. <https://www.ashrae.org/technical-resources/bookstore/standards-62-1-62-2>

American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). 2022. ASHRAE Position Document on Indoor Carbon Dioxide. https://www.ashrae.org/file%20library/about/position%20documents/pd_indoorcarbondioxide_2022.pdf

Environmental Protection Agency (EPA). 2023. Indoor Air Quality Tools for Schools Action Kit. <https://www.epa.gov/iaq-schools/indoor-air-quality-tools-schools-action-kit>

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Environmental Protection Agency (EPA). 2023. Indoor Particulate Matter. <https://www.epa.gov/indoor-air-quality-iaq/indoor-particulate-matter>

Environmental Protection Agency (EPA). 2023. Identifying Problems in the Indoor Environments. <https://www.epa.gov/indoor-air-quality-iaq/identifying-problems-indoor-environments>

Environmental Protection Agency (EPA). 2023. Identifying Greener Cleaning Products. <https://www.epa.gov/greenerproducts/identifying-greener-cleaning-products>

Environmental Protection Agency (EPA). 2023. Managing Pests in Schools. <https://www.epa.gov/ipm>

American Lung Association. 2023. Indoor Air Quality in Schools Guide. <https://www.lung.org/clean-air/indoor-air/building-type-air-resources/at-school/iaq-guide#:~:text=Schools%20should%20ideally%20serve%20as,90%25%20of%20their%20time%20indoors.>

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Asthma and Allergy Foundation of America. 2023. Indoor Air Quality and Its Impact on School Children with Asthma. <https://community.aafa.org/blog/indoor-air-quality-and-its-impact-on-school-children-with-asthma>