

INDOOR AIR QUALITY ASSESSMENT

Centerville Elementary School

658 Bay Lane
Centerville, MA
November 2024



Prepared by:
Massachusetts Department of Public Health
Bureau of Climate and Environmental Health
Division of Environmental Health Regulations and Standards

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EXECUTIVE SUMMARY

The Massachusetts Department of Public Health’s (MDPH) Division of Environmental Health, Regulations and Standards (DEHRS) conducted an Indoor Air Quality (IAQ) assessment of Centerville Elementary School located at 658 Bay Lane in Centerville (Barnstable) on October 25, 2024. This assessment was requested by the Barnstable School District.

Any building can have IAQ issues. These issues can be made worse through conditions common to marginalized communities (Environmental Justice communities or EJ) such as inequitable exposure to outdoor air pollution and a greater likelihood of poor building conditions leading to deterioration of IAQ resulting in higher asthma rates. Centerville Elementary School is not within an EJ community, however the town of Barnstable contains 9 EJ communities (<https://matracking.ehs.state.ma.us/Environmental-Data/ej-vulnerable-health/environmental-justice.html>). Note that the pediatric asthma rate for this school as of 2023 is 7.3%. While this rate is not statistically significantly different from the statewide pediatric asthma prevalence rate, it is, however, lower than the statewide rate of 9.9% (MAEPHT, 2024).

The assessment was conducted by evaluating several key elements within the school: a visual inspection of the heating, cooling, and ventilation (HVAC) systems, water/microbial damage, cleanliness, point sources of respiratory irritants such as chemicals, and electronic measurement of carbon dioxide (CO₂), carbon monoxide (CO), temperature, relative humidity (RH), and small particulate matter (PM_{2.5}) all taken with a Qtrak XP monitor. Data is collected in this manner to identify potential asthma triggers, allergens, and other environmental factors that can cause indoor air quality symptoms. Please refer to the [Indoor Air Quality Manual](#) on the MDPH website for methods, sampling procedures, and interpretation of results.

It is important to note that since this school was last visited in 2013 (<https://www.mass.gov/info-details/indoor-air-quality-reports-cities-and-towns-b#barnstable->

), the Barnstable School District has made the single most important commitment to improving IAQ by replacing all classroom unit ventilators. However, this school building lacks operational *mechanical ventilation* in the majority of rooms. That means limited capacity to remove both typical indoor pollutants as well as outdoor pollutants, such as vehicle exhaust, pollen, mold spores, and wildfire smoke. In addition, excess water vapor during hot, humid weather may also build up in the building and lead to water damage/mold growth to building materials. No obvious signs of mold, including visible mold growth were noted during the assessment, although a number of areas had water-damaged ceiling tiles from current or historic roof or plumbing leaks. Many of the materials used in construction of schools of this age, such as concrete, hard wood, floor tile, and brick, are resistant to mold growth.

(Results and Discussion)

It is also important to note that the roof, exterior doors/frames, and many of the windows are past their service life and in need of replacement. Another noteworthy issue was the condition of the building envelope, which showed signs of damage in many areas, which can allow drafts, pests, and moisture into the building.

As a result of this assessment, there are several findings typical of elementary schools of this age and type, Upon review of these findings, a number of primary recommendations are made to optimize existing systems and improve air exchange.

(Conclusions and Recommendations)

- Have the exhaust system evaluated and repaired by a professional HVAC engineering firm to increase air exchange, remove airborne pollutants, lower humidity, and increase effectiveness of HVAC systems in all rooms.
- Until the HVAC system becomes fully operational, keep at least some windows open in occupied classrooms without mechanical ventilation unless there are outdoor weather (e.g., high relative humidity > 70%; freezing weather) or pollutant conditions causing odors or occupant discomfort.
- Use air purifiers in occupied rooms that lack mechanical ventilation. Facility staff should work with occupants to place air purifiers where they will be most effective, including placing them so the filtered airstream is in the breathing zone of occupants. Units that use HEPA filters with or without carbon filters are good choices for occupied areas; units that may produce ozone should not be used. Maintain all in accordance with manufacturer's instructions.

- Move classroom materials away from univents and exhaust vents in all rooms to ensure proper air circulation and temperature control.
- Replace the roof.
- Replace single-paned windows with modern energy efficient ones.
- Replace ill-fitting/damaged exterior doors and frames.
- Make repairs to the building envelope to restore watertight integrity.
- Install/replace gutters and downspouts to direct water away from the building.

As climate change and global warming intensifies, the urgent need for modern, energy-efficient solutions becomes clear, without significant repair of the building envelope and repair/upgrade of interior HVAC components, building conditions and indoor air quality will continue to degrade.

[\(Conclusions and Recommendations\)](#)

Please note: this report contains a series of recommendations that should serve as Best Practices that apply to most public-school buildings across the Commonwealth and should be shared amongst other buildings in the school district.

BACKGROUND

Building:	Centerville Elementary School (CES)
Address:	658 Bay Lane, Centerville, Massachusetts
Coordinated Via:	Barnstable School District, Barnstable, MA
Reason for Request:	General indoor air quality (IAQ) issues
Date of Assessment:	October 25, 2024
Massachusetts Department of Public Health/Bureau of Climate and Environmental Health (MDPH/BCEH) Staff Conducting Assessment:	Cory Holmes, Environmental Analyst, Division of Environmental Health, Regulations and Standards
Building Description:	The CES is a one-story brick building that was built the 1950s; a two-story addition was constructed in the 1970s. The building contains general classrooms, library, kitchen, cafeteria, gymnasium, faculty workrooms/lounge and office space.
Windows:	Windows in the building are openable.

RESULTS AND DISCUSSION

The following is a summary of indoor air testing results ([Table 1](#))

• Carbon dioxide (CO₂)	<i>a measure of the adequacy of ventilation</i>	Levels were <u>above</u> the MDPH guideline of 800 parts per million (ppm) in 12 of the 31 areas surveyed, indicating a lack of air exchange in some areas. This is likely due to the lack of operational mechanical ventilation in most areas of the school.
• Temperature	<i>a measure of comfort</i>	Was mostly <u>within/close to</u> the MDPH recommended range of 70°F to 78°F in occupied areas.
• Relative humidity	<i>a measure of comfort and, when in excess for an extended period, a way to reflect the potential for mold and fungal growth</i>	Was <u>within</u> the MDPH recommended range of 40 to 60% in most areas tested. This is reflective of outdoor conditions. Relative humidity would be expected to be higher during hot, humid weather, with a non-operational mechanical ventilation system.
• Carbon monoxide (CO)	<i>a product of combustion that can result in acute and long term cardiovascular, respiratory, and neurological symptoms</i>	Levels were non-detect (ND) in all areas tested.
• Particulate matter (PM_{2.5})	<i>a way to measure inhalable particle distribution in the air</i>	Concentrations were <u>below</u> the National Ambient Air Quality Standard (NAAQS) of 35 micrograms per cubic meter (µg/m ³) in all areas tested.

Ventilation

Ventilation refers to both the supply of fresh air and the removal of stale air from a room. The introduction of fresh air into an occupied space will dilute normally occurring pollutants that are generated by occupancy and other activities. In addition, an HVAC system will remove pollutants from a building if operating appropriately. All ventilation systems throughout the building should operate continuously during periods of occupancy.

Most classrooms are equipped with unit ventilators (univent, Picture 1). Univents bring in fresh air from a vent on the outside of the building (Picture 2), filter, heat it, and supply the air through a vent on the top. Some room air is recirculated along with the fresh air through a vent at the bottom (Figure 1). The univents are reported to be controlled by a computerized management system.

Digital thermostats mounted near the hallway door had several parameters listed including carbon dioxide, and relative humidity (Picture 3). The measurement of carbon dioxide is important to adjust outdoor air intake by opening dampers and increasing the fresh air percentage. It was not known at what “trigger” the carbon dioxide sensors were set to. In addition, it is important to note that gas-measuring sensors should be calibrated or replaced

per the manufacturers' instructions to ensure accuracy. It was not clear when the last date of calibration was.

Mechanical ventilation to the gymnasium is provided by an air handling unit located in the corner of the gym (Picture 4). The AHU draws in air from the outside, heats it and distributes it via a wall-mounted vent near the ceiling. A corresponding return vent draws air back into the unit at the floor level. With both supply and return air being introduced and removed from the same corner of the gymnasium, it leads to an issue called short-circuiting (Picture 5). However, across the gym is a wall-mounted exhaust vent that was not functioning (Picture 6). If this exhaust vent could be activated, it would help pull air across the room for more even distribution.

At the time of assessment, exhaust ventilation in most rooms was not operating. It was not known whether these vents were not functional or just deactivated. Exhaust vents in classrooms are located in coat closets (Picture 7) or are wall-mounted (Picture 8). In a number of areas wall mounted exhaust vents were found obstructed by classroom furniture and other items (Pictures 8 and 9). Without proper supply and exhaust ventilation, normally occurring environmental pollutants can build up and lead to indoor air quality/comfort complaints. In addition, without proper exhaust ventilation, excess moisture cannot be removed from the building, which can lead to mold growth conditions over the summer.

One area that did not have upgraded mechanical ventilation was the kitchen. MDPH staff found the unit located at the rear of the cafeteria disconnected and abandoned (Picture 10). Without mechanical ventilation, the only way to introduce fresh air into the kitchen area is via openable windows, which can be limited during periods of heat and high relative humidity, or during winter months due to freezing temperatures.

Cooling is provided in some rooms by wall-mounted mini-split/ductless air conditioners (Picture 11), and in others by portable air conditioners.

The various types of ventilation components as well as devices that can move/redirect airflow that were identified in the building are listed in [Table 2A](#), [Table 2B](#) and [Table 2C](#).

HVAC System Maintenance

- MDPH recommends that filters of at least a Minimum Efficiency Rating Value (MERV) 8 be used as these are adequate to filter out pollen, mold, and similar particulates (ASHRAE, 2012). A univent was opened and the filter examined. Filters used in univents are pleated MERV 8, (Picture 12).
- **It was reported that MERV filters are replaced annually.** MDPH recommends that filters be changed two to four times a year or as per the manufacturers' recommendations.
- **Some of the univents were obstructed by items in front of return vents** (Picture 13) or along the top. To provide mechanical ventilation as designed and to prevent damage

to machinery, both the supply and return vents (along the front/bottom of the unit) should be free and clear of obstructions.

HVAC Types and Specific Conditions

Balancing

To have proper ventilation with a mechanical supply and exhaust system, a system must be balanced to provide an adequate amount of fresh air to the interior of a room while also removing stale air from the room. It is recommended that HVAC systems be re-balanced every five years to ensure adequate air systems function (SMACNA, 1994).

(see [Ventilation pictures](#))

Additional HVAC Conditions:

- **The newly created lactation room does not have an openable window and is not equipped with mechanical supply and exhaust ventilation.** MDPH staff recommend installing a passive make-up air vent in the door and tapping into the ceiling exhaust in the adjacent custodial closet for air exchange.
- **It was not clear if the local exhaust hood for the kitchen was operable.**
- **Air purifiers were also found in classrooms (Picture 14).** Air purifiers should be placed away from walls to ensure proper air intake.
- **An abandoned local exhaust vent was observed in the ceiling of the Teacher's Room (Picture 15).** This vent possibly served as a smoking vent from decades ago (as suggested by reports of cigarette odors). Although the vent is likely not operational, replacement with a *local exhaust* vent should be considered for the photocopiers and lamination machines that are in use in this area to remove excess heat, particulates, and odors.

Water Damage and Moisture Concerns

Please note that the MDPH does not recommend conducting mold testing in a typical water damage remediation. For details, please consult [Guidance Regarding Testing for Mold in Water-Damaged Public Buildings](#) | Mass.gov

The application of a mildewcide to moldy porous materials is not recommended.

Molds are found naturally in our environment both indoors and outdoors. Inside, mold growth may occur when items, particularly porous products such as paper or gypsum wallboard, are exposed to moisture. Typical water sources include leaks, floods, and condensation. To avoid mold growth, dry all water-damaged items and affected areas within 24-48 hours and reduce indoor humidity. Some people with chronic respiratory conditions, such as asthma, are more likely to experience health symptoms associated with molds, including allergic reactions and respiratory irritation. Controlling moisture is the key to preventing mold growth and potential health symptoms.

Hot humid summers are becoming more frequent due to climate change. Massachusetts has experienced hot, humid, and rainy summers in 2018, 2021, and 2023. July of 2021 was the wettest ever recorded in Massachusetts, and the three-month period from June through August, known as the meteorological summer, was the fourth wettest on record, according to the National Oceanic and Atmospheric Administration's (NOAA) Centers for Environmental Information (NOAA, 2021). The summer of 2023 was also hot, and wet, being measured as the second rainiest on record (WBUR, 2023). The summer of 2024 has also had significant stretches of hot, humid weather. These conditions are challenging for buildings, particularly those without central air conditioning.

During these hot and wet summers, extended periods of outdoor relative humidity above 70% occurred. Under these weather periods, public buildings experienced extended periods of water vapor exposure from high relative humidity. When exposed to these conditions, porous materials such as gypsum wallboard, cardboard, and other materials may become prone to developing mold colonization, particularly if located in areas that are prone to developing condensation on floors and walls (e.g., below grade space).

It was reported that a number of proactive actions were taken recently and over the summer by Administrative and Custodial staff to reduce moisture/leaks, monitor conditions, and help prevent mold growth in the building. These included:

- Frequent walkthroughs of the building, particularly after rain events;
- The deployment of dehumidifiers in classrooms most susceptible to moisture. These dehumidifiers are stationed on countertops to allow continuous drainage into sink drains;
- Professional cleaning of area rugs;
- The use of MERV 8 filters in univents, which is adequate to filter out pollen and mold spores (ASHRAE, 2012);
- Making high-efficiency particulate arrestance (HEPA) air purifiers available for use. These remove up to 99% of airborne contaminants as small as 0.1 microns including airborne mold spores;
- Replacement of leaking plumbing fixtures and remediation of water-damaged materials in the 1st floor boys bathroom;
- Trimming back of shrubbery, trees, and large branches around the building, and
- Adding a new roof for this building to a capital repair list.

In addition to these steps, the digital thermostats are part of a computerized management system. This computerized system should be utilized to monitor *real-time measurements* for temperature and relative humidity to track trends and take actions to prevent excess moisture conditions that can lead to mold growth over summer months.

All rooms were assessed for the presence of either mold or visible water damage and an exterior evaluation was conducted to identify potential pathways for water penetration. The following issues were noted.

- **Water-damaged ceiling tiles were found in several locations (Table 1),** which can indicate current/historic roof/plumbing leaks or other water infiltration. Water-damaged ceiling tiles can provide a source of mold and should be replaced after a water leak is discovered and repaired. Suspended ceiling tiles (Picture 16) should be discarded and replaced. Some ceiling tiles are of a type that are adhered directly to

the ceiling substrate (Picture 17). These tiles are difficult to replace and necessitate the destruction of the tile. Furthermore, replacement tiles are most likely obsolete and difficult to obtain.

- **Bowed or sagging ceiling tiles were found in some locations** (Picture 18), particularly along the rear (shaded) side of the building. This is likely the result of moisture exposure from elevated relative humidity conditions. While bowing tiles are not a direct IAQ issue, it is a reminder that long periods of high relative humidity may lead to water damage to other materials, particularly those stored in contact with cooler temperatures such as on uninsulated floors, and in the airstream of air conditioning.
- **Ductless mini-split air conditioners create condensation which needs to be drained.** Drain tubing and associated pumps should be checked periodically to prevent leaks due to clogs or malfunctions. Porous items should not be stored underneath these units.
- **Room 6 had missing/damaged caulking around the sink** (Picture 19), which can lead to water damage and mold growth underneath.
- **The gymnasium had accumulations of dust and debris along the surface of the wall panels near the ceiling** (Picture 20). Although these wall panels are made of a non-porous material that would be resistant to mold growth, the textured surface of the panels make them prone to accumulate debris, including naturally occurring mold spores that can grow if moistened repeatedly, such as during elevated relative humidity conditions over the summer.
- **Musty odors were detected in the gymnasium, which may be due to the curtain mounted on the stage** (Picture 21). It was not known when the last time the curtain was removed and laundered. Porous materials can accumulate dust/debris and absorb moisture over summer months and provide a source for mold growth or musty odors.
- **Missing/damaged mortar around brickwork needs repointing** in several areas (Picture 22).
- **A breach exists around the exterior access door underneath the stairs across from the Staff Room.** This breach was temporarily sealed with tape (Picture 23), to prevent uncontrolled drafts, moisture, and pest entry.
- **Exterior doors/frames were corroded and damaged** creating gaps that allow for uncontrolled drafts, moisture, and pest entry (Pictures 24 through 26). These conditions can make it difficult to control temperature leading to comfort complaints and condensation issues that can lead to mold growth.
- **The roof is past its life expectancy and is need of replacement** (Pictures 27 and 28).
- **Window frames along the front of the building have been replaced.** The remainder of the building has original, single-paned windows that are not energy efficient and in need of replacement.
- **Damaged wood and delaminating paint were found along the roof eaves, trim, and exterior walls,** which can accelerate water damage and rot (Pictures 29 through 35) allowing a pathway for drafts, moisture, and pest entry into the building.
- **Clogged gutters and overhanging branches** were noted near the roof/exterior walls (Pictures 36 and 37).

- Missing/damaged gutters and downspouts were noted (Pictures 38 through 40).
- A clogged drain was found at the bottom of the boiler room stairwell (Picture 41).
- Missing/damaged caulking/sealant around univent fresh air intakes was noted in several areas (Picture 42).

A list of water damage issues identified inside and outside the building is included as [Table 3](#).

(see [Water Damage Pictures](#))

Mold Growth

Porous materials (e.g., gypsum wallboard, ceiling tiles and carpeting) can be dried with fans and heating within 24 to 48 hours of becoming wet (US EPA, 2008).
If porous materials are not dried within this time frame, mold growth may occur.

Sources of Respiratory Irritants/Possible Asthma Triggers

Asthma is a lung disease that can make breathing difficult. Without careful management of asthma, some people can have symptoms, like a tight feeling in the chest, shortness of breath, coughing, or wheezing. Although there is no cure for asthma, people with asthma can live healthy, active lives. A safe and healthy environment helps to reduce asthma symptoms.

Comparison of Local and State-wide Asthma Rates (2023)

Barnstable	Centerville ES	Massachusetts
7.4% of children have asthma.	7.3% of children have asthma.	9.9% of children have asthma.

- **Sometimes, learning tools and personal items in a classroom can be a source of irritants.** For example, a bird or insect nest is a great learning tool for students but may harbor microbes and allergens, as does a fish tank which could be a source of odors. Similarly, food-based projects can attract pests that carry disease or trigger allergies.
- **Dust, a common respiratory and eye irritant, can collect on surfaces and items.** Although janitorial and maintenance staff perform routine cleaning in classrooms, they may not be able to clean as effectively if classroom items are not picked up or surfaces are cluttered.
- Even with a properly functioning ventilation system, it is necessary to reduce the use of materials that can be a source of respiratory irritants to prevent symptoms in individuals who have sensitivity to such pollutants. **Without operational mechanical exhaust in most areas, irritants can linger.**

For guidance on maintaining an asthma-friendly healthy school environment, please consult the MDPH Asthma Prevention and Control Program's [Clearing the Air: An Asthma Toolkit for Healthy Schools](#).

Possible asthma triggers and/or airborne pollutants exist in the building. These are listed below as well as in ([Table 4](#)).

(see [Sources of Respiratory Irritant Pictures](#))

- **Many classrooms had area rugs (Table 1), which are reportedly cleaned over summer months.** Area rugs need to be cleaned regularly to remove dust, debris, and odors. Area rugs should be stored off the floor in a climate-controlled area during the summer to prevent moistening by condensation. Used area rugs should not be brought into the school as they may harbor allergens such as pet dander.
- **An emergency generator was stationed outside the building awaiting hookup (Picture 43).** It is important to note the area of installation and its proximity to openable windows and fresh air intakes. The generator should be set using automatic startup timers for after hours or weekends to prevent exposure to exhaust emissions and noise.
- **Classroom 4 (OT/PT) had damage to the base of the exterior wall (Picture 44).** This breach can serve as a pathway for drafts, particulates, or odors from the wall cavity into the building.
- **Exposure to low levels of total volatile organic compounds (TVOCs)** may produce eye, nose, throat, and/or respiratory irritation in some sensitive individuals. Testing for TVOCs was not conducted, however MDPH staff examined rooms for products containing VOCs. MDPH staff noted hand sanitizers, cleaners, and dry erase materials (Table 1) in use within the building. These products have the potential to be irritants to the eyes, nose, throat, and respiratory system of sensitive individuals. Consult "[Clean Air Is Odor Free](#)" for more information on fragrances in schools and other building.

Other IAQ Issues

Radon

Radon is a naturally occurring radioactive gas that seeps into buildings from the surrounding soil and at elevated levels can increase the risk of lung cancer.

The Environmental Protection Agency (EPA) conducted a National School Radon Survey "in which it discovered nearly one in five schools has at least one schoolroom with a short-term radon level above the action level of 4pCi/L (picocuries per liter) – the level at which the EPA recommends that schools take action to reduce the level" (US EPA, 1993).

The MDPH therefore recommends that every school be tested for radon, and that this testing be conducted during the heating season while school is in session in a manner consistent with US EPA radon testing guidelines. Radon measurement specialists and other

information can be found at www.nrsb.org and <http://aorst-nrpp.com/wp>, with additional information at: <https://www.mass.gov/radon>.

CONCLUSIONS AND RECOMMENDATIONS

Please note: this report contains a series of recommendations that should serve as *Best Practices* that apply to most public-school buildings across the Commonwealth and should be shared amongst other buildings in the Barnstable School District.

Issues typical to many schools were found in this building. However, the lack of operational mechanical ventilation in most classrooms makes controlling temperature, humidity, and airborne contaminants significantly more difficult. Facility staff and occupants need to remain aware of the limitations of the system and use open windows and portable air conditioners to the best that they can be used. If the HVAC system becomes operational, the age of the equipment will make controlling the temperature and airflow more difficult as time goes on.

Short-term recommendations can be implemented as soon as practicable, however **long-term measures** are more complex and will require planning and resources to adequately address overall indoor air quality issues within the building.

Short-term Recommendations

HVAC System		Helpful Links
1.	Have the mechanical exhaust systems evaluated building-wide (e.g., classrooms, kitchen hood, restrooms) for operation and repair.	
2.	Reactivate exhaust vent on wall of gym opposite the AHU/stage area to facilitate air exchange.	
3.	Ensure all univents are on and operating continuously during occupied periods. If univent fan operation is linked to thermostat, work with HVAC vendor to determine a set point to introduce outside air (e.g., 800 ppm carbon dioxide).	
4.	Ensure carbon dioxide sensors are calibrated or replaced periodically per the manufacturers' recommendations to ensure accuracy.	
5.	Operate windows in occupied classrooms without operational mechanical ventilation unless contraindicated by outdoor conditions or occupant concerns. Such conditions may include heavy precipitation, extreme cold, poor outdoor	https://www.airnow.gov/

	air quality, high pollen counts, idling vehicles, or excessive noise.	
6.	Ensure windows are closed tightly at the end of the day as well as during periods of elevated relative humidity (70%) and during freezing weather to prevent pipe bursts.	
7.	Use air purifiers, and place them so the filtered airstream is in the breathing zone of occupants.	
8.	Air purifiers that use HEPA filters, with or without carbon filters, are good choices for occupied areas. Units that may produce ozone should not be used. Maintain all in accordance with manufacturer's instructions.	https://www.epa.gov/indoor-air-quality-iaq/ozone-generators-are-sold-air-cleaners
9.	Change HVAC filters 2-4 times a year using MERV 8 or the best MERV-rating that can work with current equipment.	ANSI/ASHRAE Standard 52.2-2017
10.	During filter changes, clean dust and debris from the inside of HVAC system cabinets.	
11.	Clean dust and debris from vents and personal fans periodically.	
12.	Clean and maintain mini-splits in accordance with manufacturers' instructions.	
13.	Restore local exhaust vent in Staff Room to remove excess heat and odors from photocopiers and lamination machines.	
14.	Remove blockages from univents and exhaust vents.	
15.	Restore mechanical ventilation to kitchen area.	
16.	Consider providing mechanical supply and exhaust ventilation in the lactation room. As an interim measure consider installing a passive make-up air vent in the door and tapping into the adjacent exhaust vent for the custodial closet to provide air exchange.	
17.	Close classroom doors for more effective operation of exhaust vents/air exchange.	
18.	Once mechanical exhaust systems are repaired/activated, have the HVAC system balanced if it has been more than 5 years since the last balancing.	

Water damage

19.	Replace water-damaged suspended ceiling tiles. Repeated water damage to ceiling tiles indicates leaks from the roof or plumbing/HVAC system which should be repaired.	http://www.epa.gov/mold/mold-remediation-schools-and-commercial-buildings-guide
20.	Until roof can be replaced continue to monitor for roof leaks and make repairs as needed.	
21.	Use the computerized HVAC management system to monitor real-time measurements for temperature and relative humidity to track trends and take actions to prevent excess moisture conditions that can lead to mold growth.	
22.	Do not store books, cardboard, or other porous items directly on ground-level floors or up against walls to prevent mold growth due to condensation on cool surfaces, Elevate items with pallets or store on shelving.	
23.	Seal spaces in and around exterior doors with weatherstripping, to prevent drafts, moisture, and pest entry.	
24.	Properly maintain plants to avoid mold and odors. Keep plants away from airflow.	
25.	Use these guidelines to control for moisture and increase comfort in a non-air-conditioned school especially during heatwaves.	• Mold Growth Prevention During Hot, Humid Weather https://www.mass.gov/service-details/preventing-mold-growth-in-massachusetts-schools-during-hot-humid-weather • Remediation and Prevention of Mold Growth and Water Damage in Public Schools https://www.mass.gov/service-details/remediation-and-prevention-of-mold-growth-and-water-damage-in-public-schools-and • Methods for Increasing Comfort in Non-air-conditioned Schools https://www.mass.gov/doc/methods-for-increasing-comfort-in-non-air-conditioned-schools/download
26.	While bowed/sagging ceiling tiles are not a source of mold, they indicate extended exposure to high humidity. Therefore, care should be taken with storage of materials	

	in these areas during hot, humid weather and over the summer.	
27.	During summer months, pull furniture away (1 to 2 inches) from walls to prevent mold growth due to lack of airflow and remove impermeable wall coverings that can trap moisture such as laminated posters.	
28.	Clean tabletop water fountains regularly to prevent odors and use water with low minerals such as deionized or distilled water so as not to leave mineral particles in the air.	
29.	Trim trees, branches, and shrubbery at least 5 feet away from the building.	
30.	Conduct a thorough building envelope evaluation to make repairs/repointing efforts to eliminate leaks. Building occupants should ensure they report active leaks to building management for investigation and repairs.	
31.	Replace missing/damaged caulking around univent air intakes.	
32.	Install/replace weather-stripping around exterior doors.	
33.	Clean out gutters and inspect periodically for proper drainage.	
34.	Make repairs to breach around access door across from Staff Room (Picture 23).	
35.	Make repairs to caulking around sink in Classroom 6.	
36.	Ensure boiler room drain at bottom of stairwell is clear and draining properly.	

Respiratory Irritants/Possible Asthma Triggers

37.	Clean dust from surfaces, including chalk and dry erase dust, frequently using methods that do not aerosolize the dust, including HEPA-equipped vacuuming or wet wiping. Avoid using feather dusters or sweeping dust into the air.	
38.	Replace or launder gym curtain.	
39.	Clean accumulated dust/debris from gym wall panels near ceiling.	
40.	Reduce clutter. Periodically remove unwanted items. Store remaining items neatly and off the floor. Where rooms have a history of moisture issues, consider storing items in waterproof totes.	

41.	Reduce use of products and equipment that create irritating volatile organic compounds (VOCs) and only use in well-ventilated areas. Minimize the use of air fresheners (e.g., plug-ins), deodorizers and scented products.	https://www.mass.gov/cleaner-greener-healthier-schools Clean Air Is Odor Free
42.	Use only District-approved cleaning products. Keep spray bottles properly labeled and out of the reach of children.	
43.	Clean area rugs frequently using a HEPA-equipped vacuum cleaner. Avoid bringing used area rugs into the school.	
44.	Clean classroom learning tools like fish tanks regularly to prevent odors.	
45.	Set timer for emergency generator to test during unoccupied periods to prevent entrainment of exhaust emissions during occupied periods.	
46.	Make repairs to damaged wall in Classroom 4 (OT/PT).	

Other Recommendations to Improve Air Quality Conditions

47.	Test the school for radon by a certified radon measurement specialist during the heating season when school is in session.	Radon measurement specialists and other information can be found at: www.nrsb.org , and http://aarst-nrpp.com/wp
48.	To learn more about radon, review the MDPH's Radon in Schools and Childcare Programs factsheet.	https://www.mass.gov/radon .
49.	Utilize the US EPA's (2000), "Tools for Schools" as an instrument for maintaining a good IAQ environment in the building.	https://www.epa.gov/iaq-schools .
50.	For guidance on maintaining an asthma-friendly healthy school environment, please consult the MDPH Asthma Prevention and Control Program's Clearing the Air: An Asthma Toolkit for Healthy Schools.	https://www.maasthma.org/schooltoolkit
51.	Include an IAQ component in the school's Wellness Advisory Committee program. An IAQ plan should have an IAQ liaison/teacher representative, a member of maintenance/facilities and administration that conduct regular walk-throughs to identify on-going and/or potential environmental issues.	

Long-term Recommendations

52.	Continue with plans for roof replacement.	
53.	Replace single-paned windows that are beyond their service life.	
54.	Replace exterior doors and frames that are damaged and/or beyond their service life.	
55.	Replace gutters and downspouts to provide proper drainage away from the building.	

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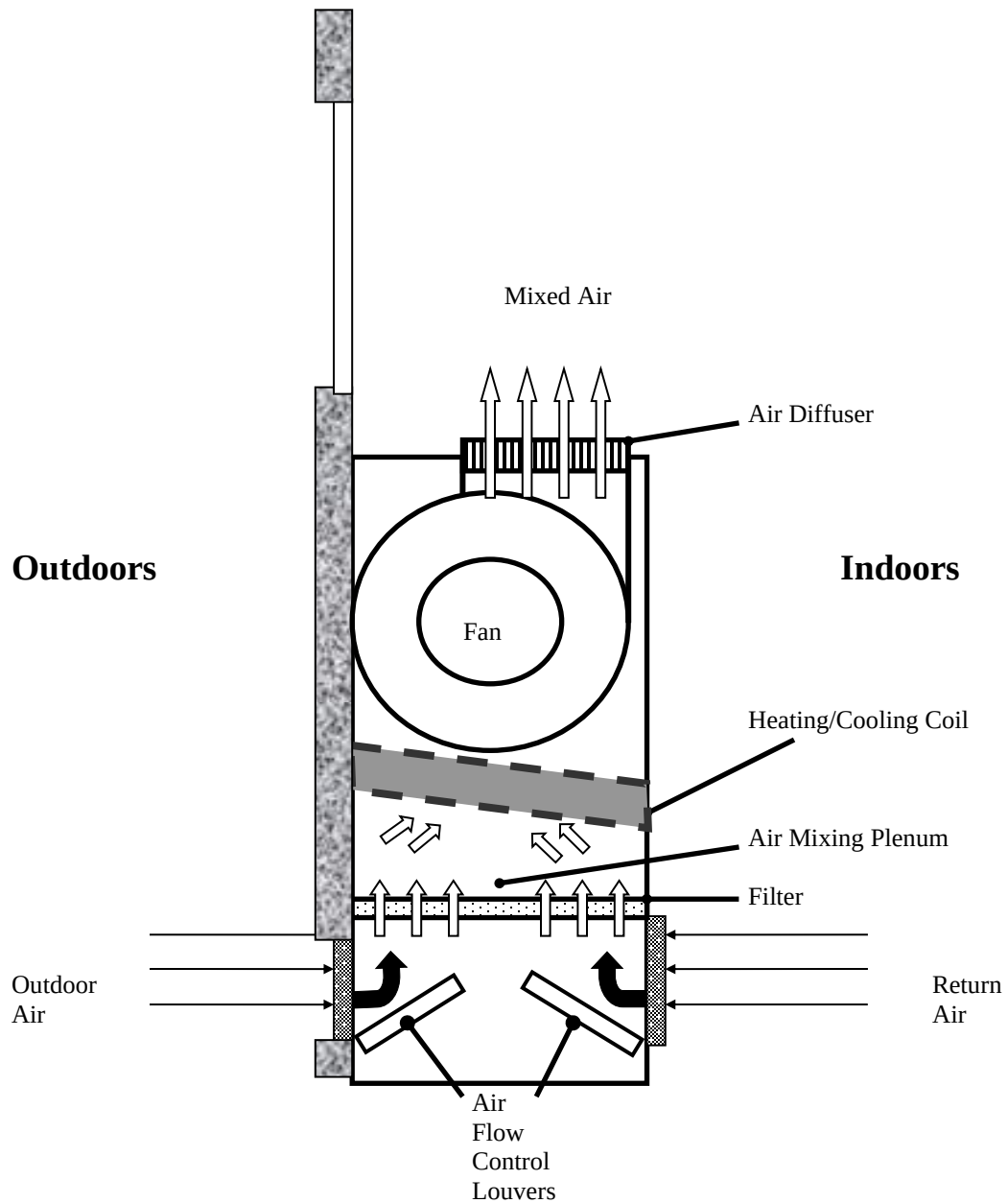
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FIGURES

Figure 1
Unit Ventilator (Univent)



Air Flow

- ← = Fresh Air/Return Air
- ⇐ = Mixed Air

PICTURES

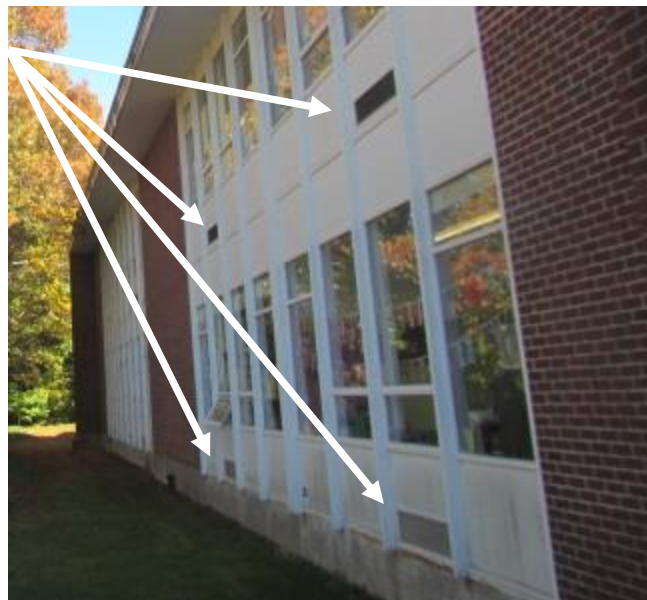
Ventilation Pictures

Picture 1



Univent in classroom

Picture 2



Univent fresh air intakes (arrows)

Picture 3



Digital Thermostat displaying carbon dioxide measurement in parts per million

Picture 4



Air handling unit in corner of gymnasium (stage view)

Picture 5



Short-circuiting of AHU in gymnasium, arrow shows airflow

Picture 6



Exhaust vent on wall of Gym across from the AHU

Picture 7



Exhaust vent in the top of coat closet (arrow)

Picture 8



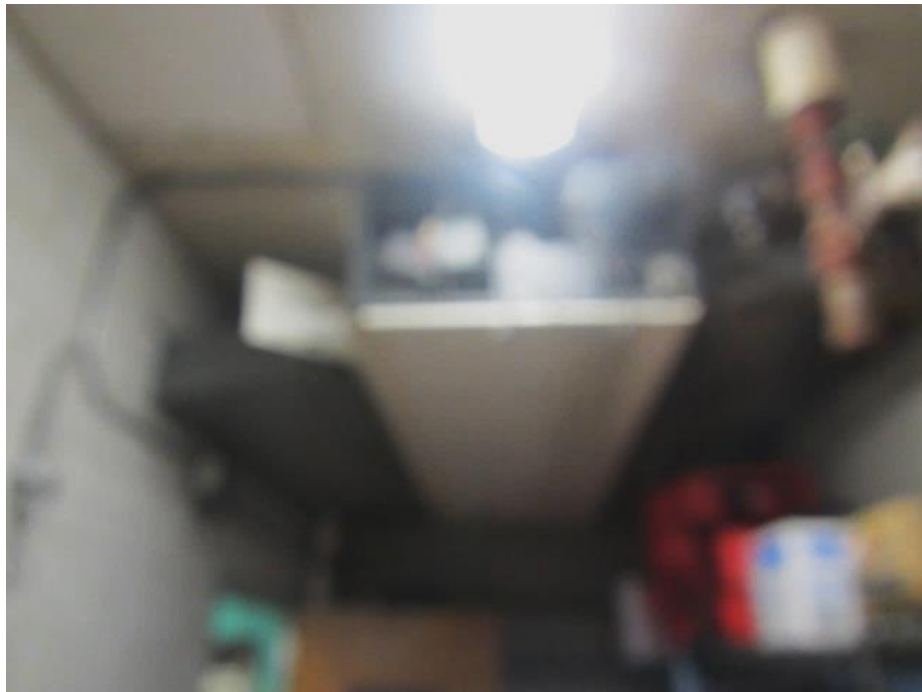
Wall-mounted exhaust vent (arrow) behind bookcase in classroom

Picture 9



Exhaust vent behind shelf in classroom (arrow)

Picture 10



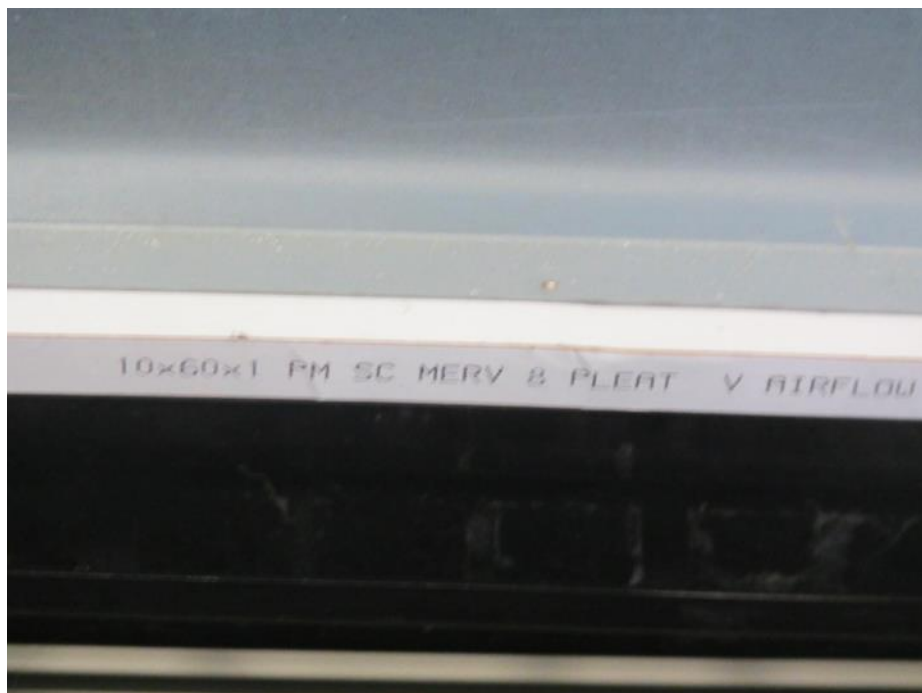
Abandoned/disconnected univent in kitchen area

Picture 11



Wall-mounted mini-split

Picture 12



MERV 8 filter in classroom univent

Picture 13



Univent return vent (bottom front) obstructed by paper preventing airflow into unit

Picture 14



Air purifier in classroom

Picture 15



Abandoned vent in ceiling of Teacher's Room (possible former *smoking* vent)

Water Damage pictures

Picture 16



Water-damaged *suspended* ceiling tile

Picture 17



Water-damaged original ceiling tiles *adhered directly* to ceiling substrate

Picture 18



Bowed ceiling tiles in classroom

Picture 19



Missing/damaged caulking around sink in Classroom 6

Picture 20



Dark staining on wall panels indicating accumulated dust/debris near ceiling of gymnasium

Picture 21



Curtain in gymnasium

Picture 22



Missing/damaged mortar around exterior brick

Picture 23



Breach around exterior door under stairwell across from Staff Room

Picture 24



Corroded exterior door, note damaged weatherstripping below (arrow)

Picture 25



Rotted door frame (filled with foam) and delaminating exterior door

Picture 26



Light penetrating through damaged vent and below exterior door

Picture 27



Roof is past its life expectancy and is need of replacement

Picture 28



Roof is past its life expectancy and is need of replacement

Picture 29



Rotted/delaminating wood along roof/exterior walls

Picture 30



Rotted/delaminating wood along roof

Picture 31



Rotted/delaminating wood along roof

Picture 32



Rotted/delaminating wood along roof

Picture 33



Rotted/delaminating wood along roof

Picture 34



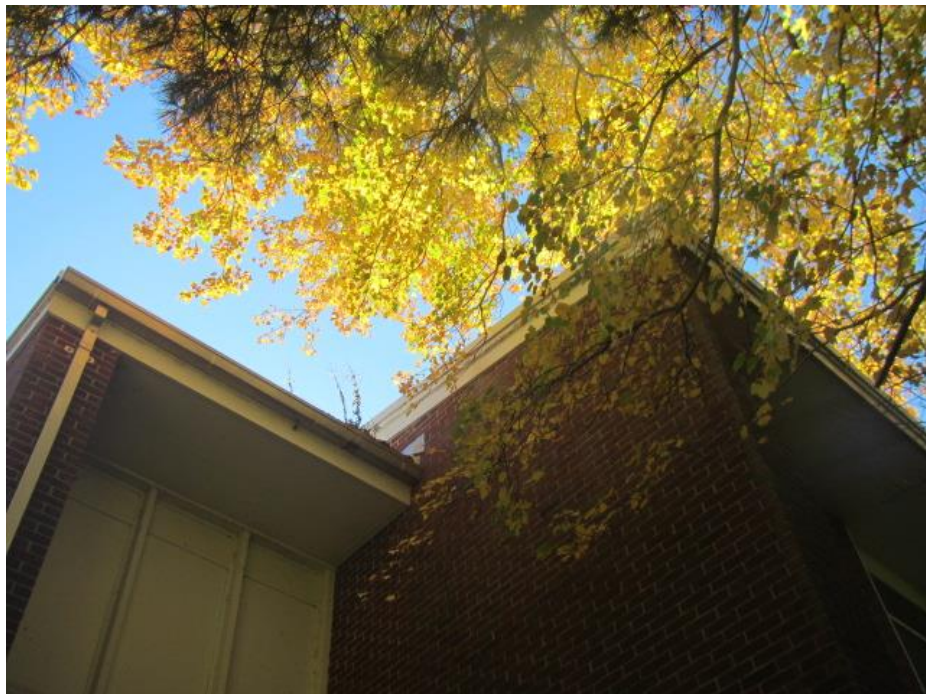
Rotted/delaminating wood along roof

Picture 35



Rotted/delaminating wood along roof

Picture 36



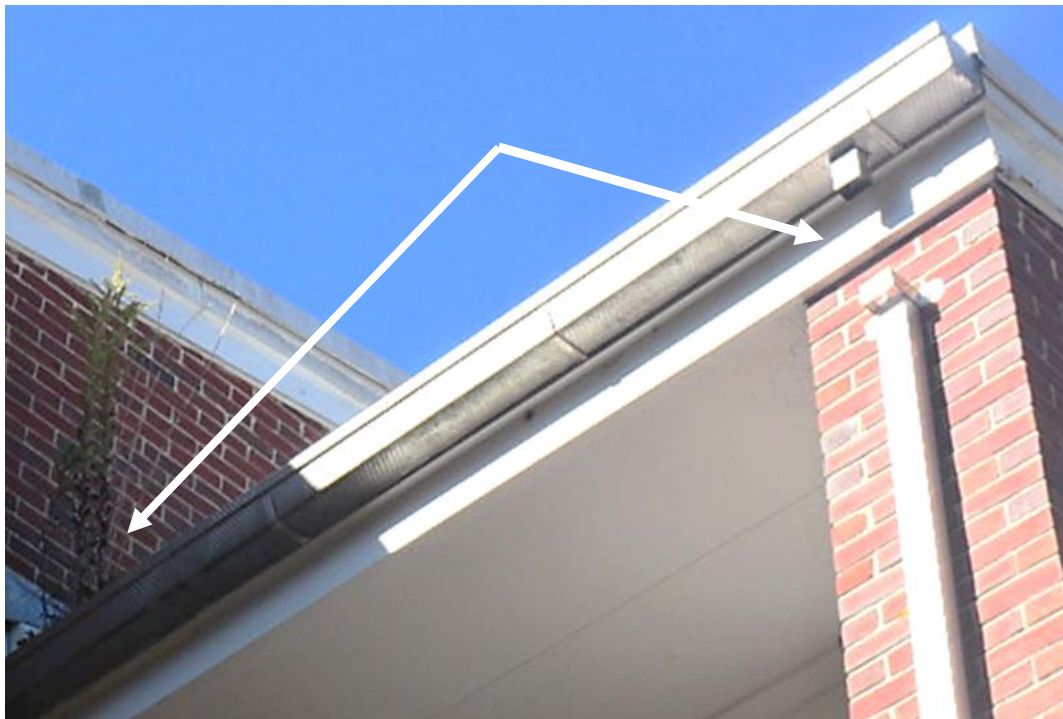
Branches overhanging roof/close proximity to exterior walls

Picture 37



Gutter clogged with debris

Picture 38



Missing/damaged downspout, note plant growth in gutter (arrows)

Picture 39



Missing elbow extension at bottom of downspout to drain water away from building

Picture 40



Abandoned drainage pipe for gutter/downspout system

Picture 41



Clogged drain at bottom of boiler room stairwell

Picture 42



Missing/damaged sealant/caulking around univent fresh air intake

Respiratory Irritants pictures

Picture 43



Emergency Generator

Picture 44



Wall damage in Classroom4 (OT/PT Room)

Table 1
IAQ Testing Results
Centerville Elementary School
Barnstable

[Click to link back to report](#)
Table 1

Location	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	Temp (°F)	Relative Humidity (%)	PM2.5 (µg/m³)	Occupants in Room	Windows Openable	Ventilation		Remarks
								Supply	Exhaust	
Background (outside)	430	ND	57	57	1					Clear, cool & sunny
Health Office	629	ND	69	49	ND	2	Y Open	N	Y off	Minisplit, exhaust not functioning
1	826	ND	69	51	2	19	Y	Y	Y Blocked	Loose CT, 6 WD CTs, AP
2	1260	ND	69	52	ND	22	Y	Y Off	Y Off	Area rug, AP, 2 WD CTs in classroom, 2 WD CT in boys' restroom, 5 WD CT in girls' restroom, possible RR wall exhausts-sealed
3	790	ND	67	48	ND	11	Y	Y	Y Off	AP, CP-countertop, area rug, PF, upholstered furniture
4 OT/PT	904	ND	69	51	ND	4	Y	Y	Y	Interior wall damage, AP
5	908	ND	68	49	ND	17	Y	Y Blocked front	Y Off/weak	AP, area rug, WD CT, PF

ppm = parts per million

µg/m³ = micrograms per cubic meter

ND = non-detect

AP = air purifier

CP = cleaning products

CT = ceiling tile

DO = door open

PF = personal fan

UV = univent

WD = water-damaged

Comfort Guidelines

Carbon Dioxide: <800 ppm = preferable

> 800 ppm = indicative of ventilation problems

Temperature: 70 - 78 °F

Relative Humidity: 40 - 60%

Table 1
Test Results (continued)...

Location	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	Temp (°F)	Relative Humidity (%)	PM2.5 (µg/m³)	Occupants in Room	Windows Openable	Ventilation		Remarks
								Supply	Exhaust	
6	935	ND	68	49	ND	13	Y	Y	Y Off/weak	WD near sink, 2 WD CTs, PF, CP-countertop, AP, PF
Gym	794	ND	67	53	ND	0	Y	Y	Y	Space under exterior door, dark/dusty debris along ceiling/wall junction -rec cleaning, musty odors – old curtain?
Gym Hallway										WD CTs
Boys Restroom								N	Y Off	
ESL	692	ND	69	47	ND	1	Y	Y	Y Off	AP, area rug, bowed CTs
12	606	ND	74	41	ND	1	Y	Y	Y	17 occupants gone ~6 minutes, PF, area rug, AP, bowed CTs
14	820	ND	76	42	ND	13	Y Open	Y	Y	Area rug, AP, PF, bowed CTs
15	828	ND	69	47	ND	15	Y Open	Y	Y Off	Area rug, dehumidifier (draining in sink), AP, bowed CTs
16	609	ND	73	44	ND	0	Y	Y	Y	Area rug, AP, CP sink, bowed CTs
17	683	ND	69	48	ND	0	Y	Y	Y Off	AP, area rug, AP, bowed CTs

ppm = parts per million

µg/m³ = micrograms per cubic meter

ND = non-detect

AP = air purifier

CP = cleaning products

CT = ceiling tile

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Table 1
Test Results (continued)...

Location	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	Temp (°F)	Relative Humidity (%)	PM2.5 (µg/m³)	Occupants in Room	Windows Openable	Ventilation		Remarks
								Supply	Exhaust	
19	701	ND	68	49	ND	7	Y	Y Blocked front	Y Off	AP, bowed CTs
Staff Room	941	ND	75	44	ND	4	Y	Y	Y Off	Restroom exhaust off, AP, laminator and photocopier, abandoned exhaust vent (old smoking vent) in ceiling-source of possible odors
Reading Room	702	ND	74	43	ND	1	Y	N	N	
Library	717	ND	74	44	ND	2	Y	Y	Y, Off	Bowed CTs, AP
Councilors Office	1027	ND	73	47	ND	1	Y	N	N	PF, area rug
Stairwell Access across from Staff room										Breach in wall, temporarily sealed-moisture/drafts
Lactation Room	776	ND	70	50	ND	0	N	N	N	PF, AP, area rug, open CT, recommend louvered vent in door (supply), tapping into adjacent exhaust
20	612	ND	71	44	ND	1	Y Open	Y	Y Off	AP, PF-dusty, bowed CTs
21	1229	ND	68	49	ND	24	Y	Y	Y	AP, PF, bird nest, DO aquarium

ppm = parts per million

µg/m³ = micrograms per cubic meter

ND = non-detect

AP = air purifier

CP = cleaning products

CT = ceiling tile

DO = door open

PF = personal fan

UV = univent

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Table 1
Test Results (continued)...

Location	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	Temp (°F)	Relative Humidity (%)	PM2.5 (µg/m³)	Occupants in Room	Windows Openable	Ventilation		Remarks
								Supply	Exhaust	
22	649	ND	71	44	ND	17	Y Open	Y	Y Off	PF, AP, DO, bowed CTs
23	697	ND	67	47	ND	20	Y	Y Blocked front	Y Off	Area rug, AP – on, bowed CTs, PF, items in front of UV, DO
24	794	ND	72	44	ND	21	Y Open	Y	Y	AP, PF-on, area rug, DO, CP
2 nd Floor Hallway										WD CTs
25	509	ND	68	43	ND	22	Y	Y	Y	AP, area rug, aquarium, bowed CTs, class just returned from lunch
26	786	ND	73	44	ND	20	Y	Y	Y	PF, area rug, DO, bowed CTs
27	475	ND	67	41	ND	1	Y	Y	Y	AF, AP, DO, bowed CT
Conference Room	788	ND	71	51	ND	0	Y	N	N	9 WD CTs (former stage area)
Cafeteria	939	ND	70	51	7	3	Y	Y	Y	Lunch just ended
Kitchen	996	ND	72	50	14	2	Y	N*	N	Floor drains, Kitchen Hood-not operating, univent abandoned*

ppm = parts per million

µg/m³ = micrograms per cubic meter

ND = non-detect

AP = air purifier

CP = cleaning products

CT = ceiling tile

DO = door open

PF = personal fan

UV = univent

WD = water-damaged

Comfort Guidelines

Carbon Dioxide: <800 ppm = preferable

> 800 ppm = indicative of ventilation problems

Temperature: 70 - 78 °F

Relative Humidity: 40 - 60%

Table 2A
Supply Ventilation
Types and/or Components

[\(Click to link back to report\)](#)

Table 2A

Equipment Present in Building (X = Yes)	Type of Heating/Cooling Ventilation Equipment	Fresh Air Supply (X = Yes)	Type of Location(s)	Air Filters Installed MERV Rating (1-15, U*) (X = Yes)	Comments
X	Univents	X	Classrooms	X, U	
	Rooftop Air Handling Units				
	Outdoor, Ground-Installed Air Handling Units				
	Attic/Crawlspace Air Handling Units				
X	Ceiling-Mounted Air Handling Units (including inside plenum)		Kitchen		Abandoned, not functional
	Basement/Crawlspace-Installed Air Handling Units				
	Mechanical Room-installed Air Handling Units				
	Fan Coil Units				
	Window-Mounted Air Conditioners				
X	Portable air conditioners	X	Classrooms		
	Wall Louver-Controlled Gravity Air Supply				
X	Windows	X	Most rooms		
	Fan in window (blowing in)				
X	Built in wall fan (switched)	X	Staff Room		Former smoking vent?
	Heat recovery ventilator unit				
	Energy recovery ventilator unit				
	Chilled Beam				
	Passive combustion supply vent in basement/boiler room				

*U = Filter Rating underdetermined due to inaccessibility during building visit

Table 2B
Exhaust Vents
Types and/or Components

Table 2B

Equipment Present in Building (X = Yes)	Type of Exhaust Ventilation Equipment	Ducted To Outdoors (X = Yes)	Type of Location(s)	Comments
X	Rooftop Motors/Fans	X	Classrooms and common areas	Not functioning
	Unit Exhaust			
	Ceiling Return Vent			
	Ceiling Return Vent, Plenum			
	Wall Return Vent			
X	Kitchen Stove Hood	X		Not able to determine if operational
X	Restroom Exhaust Vent	X		Not functioning
X	Photocopier Exhaust Vent			
	Garage			
	Chemical Hood(s)			
	Locker Rooms			
	Showers			
	Clothes Dryers			
	Gas Water Heaters			
	Furnace-Flue to Chimney			
	Furnace/Boiler direct vent or power vent (no combustion air supply)			
	Kiln, Pottery			
	Dark Room			
	Generator Room			
	Wood Shop Dust Collector			
	Spray Paint Booths			
	Fan in window (blowing out)			

Table 2C
Free Standing Equipment that Circulates or Filters Air

Table 2C

Equipment Present in Building (X = Yes)	Type of Equipment	Type of Location(s)	Comments
	Floor Fans, pedestal		
X	Floor Fans, portable	Classrooms, offices	
X	Air Purifier (HEPA, other)	Classrooms, offices	
	Floor heaters, portable		
X	Refrigerators, Cold Beverage Vending Machines		
	Radiator, wall-mounted		
	Radiator, floor-mounted		
	Passive Vents (Wall/Door)		

Table 3
Water-Damaged Materials in Building

[\(Click to link back to report\)](#)

Table 3

Found in Building X = Yes	Water-Damaged Materials, Building Components or Stored Materials	Location	Visible Microbial Growth? X = Yes	Musty odor detected? X = Yes	Comments
	Books-other bound materials				
X	Brick walls – broken, missing mortar	exterior			
	Brick walls – blocked weep holes				
	Cardboard boxes				
	Carpet tiles				
X	Carpet - Area rugs				
	Carpet wall-to-wall				
	Ceiling tiles - affixed directly to ceiling surface				
X	Ceiling tiles - bowing-in suspended ceiling	Classrooms	No	No	Particularly in rear/shaded part of building of
X	Ceiling tiles - water-stained in splined ceiling	Classrooms and common areas	No	No	
X	Ceiling tiles - water-stained in suspended ceiling	By windows in a few classrooms	No	No	
	Chairs - laminated				
X	Cloth	Classrooms	No	No	
X	Countertops (around sinks)	Classroom 6			
	Curtains	Gym	No	Yes	
	Dust/debris within AHU, uninvent, HVAC, chilled beam units, etc. (WD through condensation, humidity, or leaks)				
	Efflorescence (i.e., mineral deposits)				
	Engineered woods - particleboard, plywood, Masonite				
	Flooring – loosened tiles				
	Flooring - wooden				
	Furniture - laminated				
X	Furniture - upholstered	Classrooms	No	No	
	Gypsum wallboard - ceiling				
	Gypsum wallboard - restroom wall				
	Gypsum wallboard - interior wall				

Table 3
Water-Damaged Materials in Building
(continued)...

Found in Building X = Yes	Water-Damaged Materials, Building Components or Stored Materials	Location	Visible Microbial Growth? X = Yes	Musty odor detected? X = Yes	Comments
	Gypsum wallboard – located on exterior wall				
	HVAC drain pan – lack of draining				
	HVAC filters				
	Insulation- attic (paper-backed)				
	Insulation - inside air handling unit				
	Insulation - on pipe(s) fiberglass				
	Insulation - on pipe(s) other/plaster-like material				
	Insulation - wall cavity				
	Insulation – ceiling plenum				
	Modular furniture – walls/cloth partitions				
	Musical instrument cases				
	Plaster ceilings				
	Records/files				
	Refrigerator - door gasket				
	Refrigerator - drip pan				
	Refrigerator - Interior surfaces				
	Room divider - ceiling-mounted, sliding				
X	Sink backsplash	Classroom 6	No	No	
	Tables – laminated				
	Wallpaper				
	Wood - attic/roof materials				
	Wood - floor joists in basement ceiling				
	Wood - wall framing				
	Wood - window sills				
	Wood - window-mounted air conditioner framing				
X	OTHER	Exterior trim			Damage in many areas

Table 4

Identification of Asthma Triggers by MDPH During Building Assessments and Recommendations to Reduce or Eliminate from the Indoor Environment

WHAT ARE ENVIRONMENTAL ASTHMA TRIGGERS?

Asthma triggers are any chemical, pollutant, or allergen that can make your asthma worse.

Asthma triggers can also be strong chemical smells, dust, or pets. Your asthma triggers may be different from those of other people. Not all asthma triggers affect people the same way. Environmental asthma triggers are found both indoors and outdoors. DPH link: [Asthma and Your Environment \(mass.gov\)](https://www.mass.gov/info-details/asthma-and-your-environment)

[\(click to link back to report\)](#)

Table 4

Condition Present X = Yes	Possible asthma symptom-inducing environmental pollutant	Recommendation to reduce or eliminate the pollutant
X	Water Damage and/or Mold (allergen)	Identify water source and repair to eliminate. Clean non-porous materials. Remove and replace porous materials susceptible to mold growth. Perform regular water damage assessments as a tool to ensure timely mitigation as needed. Use NIOSH water damage assessment protocol as a guide: NIOSH water damage assessment guideline .
	Moistening of building components during hot, humid weather (>2 days in length) (mold, allergen)	Remove materials not dried in <2 days in a manner consistent with US EPA Mold Removal in Commercial Buildings guideline . Use dehumidification in occupied basement areas and other areas with chronic dampness.
X	Vegetation against exterior of building (water damage-mold)	Remove all vegetation preventing building exterior drying. Remove all vegetation capable of falling onto a building or depositing debris onto the roof.
	Personal humidifiers (lack of proper maintenance) (pollutant and allergen)	Clean and maintain properly. Use distilled water to eliminate metal and water treatment odors. Maintain hydration by increasing water consumption.
	Drains: Floor drains, Sink drains (abandoned use) Water bubblers (abandoned use)	If in use, pour water into drain at least twice a week. If not in use, seal the drain with an appropriate material in accordance with Massachusetts Plumbing Code (248 CMR 10.00).
	Live Animals (turtles, gerbils, birds, rabbits, etc.)	Ensure cleanliness or remove animals from the location.
	Improperly maintained aquariums and terrariums (allergen)	Maintain such equipment properly to eliminate odor. Discontinue use.

Table 4
Identification of Asthma Triggers by MDPH
During Building Assessments and Recommendations to Reduce or Eliminate from the
Indoor Environment

Condition Present X = Yes	Possible asthma symptom-inducing environmental pollutant	Recommendation to reduce or eliminate the pollutant
X	Plants and flowers (allergen and mold)	Keep indoor plants well maintained and not overwatered. Monitor for signs of mold and pests. Ensure water for cut flowers does not become stagnant. Ensure dried plant material is free of odors, mold, and pests and handled carefully If asthma risks are high, eliminate plants and flowers.
X	HVAC system moisture issues (mold, allergen)	Consult ASHRAE's minimum standards for HVAC maintenance and inspection of commercial HVAC systems (https://www.ashrae.org/technical-resources/bookstore/standards-180-and-211).
	HVAC system contaminant issues (allergen)	Consult ASHRAE's minimum standards for HVAC maintenance and inspection of commercial HVAC systems (https://www.ashrae.org/technical-resources/bookstore/standards-180-and-211).
	Indoor swimming pool odors outside of swimming pool (mold, chemical)	Maintain and operate pool HVAC systems to vent odors from building. Ensure locker room exhaust vents are operating during building hours. All doors leading to pool should be rendered airtight and be closed.
X	Pollen (allergen)	Recommend installation of MERV 8 or better filters if HVAC engineer confirms HVAC system can be so equipped without adversely affecting function. Cut grass after hours. Cut grass in a pattern to direct clippings away from exterior wall. Remove trees and shrubs from in front of windows and air intakes.
	Dry air	Maintain hydration. Avoid overheating of air.
	Dust mites (allergen)	Recommendation to remove non-official upholstered furniture, area rugs, pillows, cushions, etc. Cleaning with use of HEPA-filtered vacuum cleaner. Eliminating clutter, storing items in dust and moisture-proof containers, and regularly removing dust through wet wiping.

Table 4
Identification of Asthma Triggers by MDPH
During Building Assessments and Recommendations to Reduce or Eliminate from the
Indoor Environment

Condition Present X = Yes	Possible asthma symptom-inducing environmental pollutant	Recommendation to reduce or eliminate the pollutant
	Pests, including rodents and cockroaches (allergen)	Use of integrated pest management guidelines, including: • Proper disposal of food containers • Proper storage of food products in airtight containers • Elimination of use of food as art projects • Remove pest harborages/clutter • Regular monitoring for pests EPA IPM guideline link
	Latex-containing materials	Remove tennis balls from furniture legs.
	Fragrances (chemical)	Eliminate point sources, such as: • Plug-in air fresheners • Aroma/oil reed diffusers • Scented sprays • Discontinue use of other scented materials • Consult DPH fragrance guideline: Clean air is odor-free
	Strong smells from /use of Chemicals (such as cleaning products) (chemical)	Use building-issued cleaning products. Use products in accordance with manufacturer's instructions including dilution, application, and ventilation. Avoid using products that are stronger than needed for the situation.
	Strong odors from new building materials (carpeting/furniture) (chemical)	Use low VOC-emitting materials. Air out materials (outside or in unoccupied area) prior to installation.
	Tobacco smoke Secondhand Smoke (pollutant)	Eliminate tobacco smoking. Seal all shared wall penetrations.
	Products with a strong odor such as paint, perfume, hairspray, air fresheners, bug-spray, laminators, candles, wax melters, dry erase markers and other VOC-containing products (chemical)	If essential: • Provide proper exhaust ventilation to eject aerosolized product directly outdoors. • Avoid/reduce use during occupied hours. If not necessary, remove and eliminate.
	Vehicle exhaust (pollutant)	Enforce anti-idling regulations and post signs to give notice. Relocate vehicles away from fresh air intakes. Require cars to park face-in at building walls. MA anti-idling law FAQs

Table 4
Identification of Asthma Triggers by MDPH
During Building Assessments and Recommendations to Reduce or Eliminate from the
Indoor Environment

Condition Present X = Yes	Possible asthma symptom-inducing environmental pollutant	Recommendation to reduce or eliminate the pollutant
	Vapors and or fumes from gas, oil, or kerosene stoves (pollutant)	Operate stove hood when stove in use. Install stove hood if not present. Ensure equipment is in good working order.
	Ozone (pollutant)	Eliminate use of ozone generating equipment.
	Window Air Conditioners (if not properly maintained) (allergen)	Equip with proper filter and clean periodically. Clean drip pans. Install in window with weathertight, non-mold-growth sustaining material.
	Pottery (pollutant)	Do not operate kiln during occupied hours. Operate kiln with exhaust system activated. Seal all seams and holes in kiln vent. Ensure kiln exhaust discharge terminates outdoors.
X	Carpeting (allergen)	Clean carpeting in a manner consistent with IICRC standards, including regular vacuuming with a high efficiency particulate air (HEPA) filtered vacuum in combination with annual cleaning or semi-annual cleaning in soiled high traffic areas.
	Sweeping/dusting vs HEPA vacuuming/wet wiping (allergen or pollutant)	Refrain from using feather dusters or brooms. Utilize HEPA vacuums and wet wiping to minimize aerosolizing particulate matter.
X	Lack of adequate air exchange/mechanical ventilation	Make repairs as necessary and ensure all HVAC system components are operating continuously when building is occupied.
	Lack of local exhaust at source of pollution (vocational shop activities, kitchen exhaust hood) (all)	Recommend installation of exhaust ventilation to direct pollutants directly outdoors.
	Renovating buildings while occupied (chemical)	Use all SMACNA guidelines for Renovation While Buildings Are Occupied. For information, visit https://www.mass.gov/service-details/construction-and-renovation-generated-pollutants-in-occupied-buildings .
	Chemistry program chemical storage (chemical)	Repair (if needed) and operate chemical storeroom vents appropriately. Reduce or eliminate unneeded or overstocked chemicals. Store all chemicals in a manner to separate incompatible chemicals. Keep chemical storerooms clean.
X	Photocopiers/duplicating machines	All machines should have dedicated exhaust vents.