

American Lung Association.

Indoor Air Quality Monitoring Guidance for Schools

Low-cost air quality monitors (also referred to as air pollution monitors, air sensors, air quality sensors, air pollutant meters or detectors, or similar) are devices that use one or more sensors to detect, monitor, and report on specific air pollutants and/or environmental factors. Schools can utilize continuous indoor air quality (IAQ) monitoring to collect real-time data, assess ventilation performance, assess mitigation strategies such as effectiveness of portable air cleaners, detect sudden changes in IAQ, and track long-term trends. Air pollution monitors (monitors) can transmit near real-time results on one or more air pollutants or environmental factors to computers, phones, or cloud databases. Other monitoring and testing options include professional, calibrated handheld devices that provide data only at a specific moment in time and professional performance testing and in-depth analysis.

The American Lung Association recognizes several limitations in the use of IAQ monitors in schools:

1. There are no nationally recognized standards or recommendations on the use of monitors in schools.
2. There are no nationwide thresholds and standards for most indoor air pollutants. Currently, nationally accepted indoor concentration recommendations exist for radon, temperature, and relative humidity. "It is important to understand that there are currently no widely accepted air concentration limits for most pollutants indoor[s] and therefore levels that trigger an alert of a potential problem are determined by the manufacturer of the monitor".[1]
3. Limited information is available on how well some monitors detect air pollutants indoors.
4. There is variability in accuracy among monitors. "There is limited information on the accuracy and precision of low-cost air pollutant monitors currently available in the marketplace. The accuracy (measure of closeness to what is actually in air) and precision (measure of how well each air reading repeats) of some monitors can be impacted by a number of factors such as where the monitor is placed in the indoor space, time in use, methods of processing the data, temperature, and relative humidity, as well as the presence of multiple contaminants in the air. In addition, the accuracy and precision of pollutant detecting monitors can also vary across manufacturers as well as within product lines made by the same company".[1]
5. Monitors do not give a complete representation of IAQ and only detect pollutants or environmental factors for which they are designed in locations where they are placed and at times when they are in operation.
6. Monitors cannot replace highly trained professionals with calibrated, hand-held equipment to conduct professional testing.

Monitors may complement and should be used in concert with IAQ best practices of 1) source control, 2) ventilation, and 3) air cleaning/filtration in helping to improve a school building's IAQ. These IAQ best practices in schools are outside the scope of this document but can be found in such resources EPA's Improving Air Quality webpage and the American Lung Association's Indoor Air at Home, Work and School webpage. The data from these monitors can be tracked, analyzed, compiled, and shared. Data may contribute to decision-making when responding to IAQ issues and communicating and planning with school leadership.

Improving Indoor Air Quality: The 3 Step Approach	
Step 1 >> Source Control	Eliminate or reduce the source of pollutant(s)
Step 2 >> Ventilation	Increase ventilation to dilute pollutant(s)
Step 3 >> Air Cleaning	Clean the air to capture pollutant(s)

The American Lung Association recognizes several benefits in the use of monitors in schools:

1. Baseline and routine surveillance screening for levels of specific air pollutants and/or environmental factors.
2. Identifying the potential need to take action to improve IAQ.
3. Evaluating the efficacy of recent school improvements, such as upgraded HVAC systems or in-room HEPA air cleaners.
4. Providing data for planning and future facilities maintenance, repairs, replacements, or upgrades.
5. Comparing indoor pollutant levels to outdoors to help determine whether outdoor air is affecting indoor air quality.
6. Establishing a baseline of indoor air pollutant levels to identify changes over time and support future decision-making.

The American Lung Association's Indoor Air Quality Monitoring Guidance for Schools is designed as a checklist for your school as it plans for the use of air quality monitors. It is based on national standards and recommendations from the Environmental Protection Agency (EPA), American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), and Underwriters Laboratories (UL) and clearly cited throughout this document. This guidance is also consistent with the September 2026 released New York School Environmental Health Program Indoor Air Quality Monitoring Tool Program.[2] Where no national standards or recommendations exist, that is also clearly noted within this document.

1. Why should my school monitor its IAQ?

Your school should identify one or more reasons for monitoring its air. Below are possible reasons to consider.

- ☐ Establish an IAQ baseline
- ☐ Assess classroom ventilation
- ☐ Screen for elevated levels of specific indoor pollutants, such a s particulate matter (PM2.5), carbon dioxide (CO_2), carbon monoxide (CO), volatile organic compounds (VOCs), and/or radon
- ☐ Investigate occupant complaints
- ☐ Monitor the impacts of outdoor air pollution events (e.g. wildfire smoke, dust events)
- ☐ Assess improvements after corrective action
- ☐ Other_____

2. What should my school consider when selecting air quality monitors?

There are numerous manufacturers and different air quality monitors on the market. When considering which monitors are best for your school, there are several considerations.[3]

1. Choose CO_2 monitors that meet with ASHRAE Standard 62.1-2025, Ventilation for Acceptable Indoor Air Quality **minimum performance specifications**.
2. Prioritize NDIR (Non-Dispersive Infra-Red) sensors for CO_2 monitoring, as they provide direct measurements instead of estimating CO_2 levels.
3. Choose CO monitoring equipment that complies at minimum with UL 2034 Ed. 5-2024 - Single and Multiple Station Carbon Monoxide Alarms - Published Date: August 7, 2024
4. Verify the frequency of data collection, how many data points the device can store, how the sensors store data, how the data is reported, and whether the data can be downloaded/exported.
5. Consider connectivity options to the building automation system.
6. Consider data communication options (e.g. cellular, Wifi, PoE).
7. Consider the typical lifespan of a monitor. Monitors have a limited lifespan and can become less reliable over time. Manufacturers may provide an estimate of how long their product can be operated before it needs to be serviced or replaced.
8. Consider the limits of detection, accuracy, and precision of the monitor you are selecting. (Accuracy is a measure of closeness to what is actually in air. Precision is a measure of how well each air reading repeats.)
9. Consider sensor measurement range, operating environmental conditions, calibration, and maintenance requirements.
10. Think about the upfront cost of the monitors, but also ongoing costs like batteries and cloud storage.

The cost of a monitor does not necessarily indicate how well it will perform. The cost of most monitors vary due to their additional features such as display quality, housing, the number and type of sensors used in the monitor, power source, internet connectivity, and/or how the information received from the sensor is processed.

3. What should my school monitor?

Most monitors sold in the U.S. are designed to detect gases or particles in the air such as PM2.5, radon, CO, CO_2, formaldehyde, VOCs, or environmental factors such as temperature and humidity. Deciding which parameters to monitor is not easy or straightforward.* There are no national standards or thresholds for many indoor air pollutants.

Below is a list of possible pollutants and environmental factors (aka parameters) to consider. Please see the table, *Indoor Air Monitoring in Schools Guidance Parameters, Prioritization, Thresholds, Interpretation, Recommended Actions, and Reporting*, on page 13 for a list of prioritized parameters, along with an explanation of each, thresholds, action levels and recommendations, along with how to document in reports.

- Carbon Dioxide (CO_2)
- Carbon Monoxide (CO)
- Differential Pressure
- Formaldehyde
- Outdoor Particulate Matter (PM2.5)
- Particulate Matter (PM2.5)
- Radon
- Relative Humidity (RH)
- Temperature
- Total Volatile Organic Compounds (TVOC)**

*ASHRAE identifies CO_2, humidity, PM2.5, temperature, and other parameters as potential components of an educational-facility monitoring system, but specifically cautions that VOC monitoring should be applied carefully.
**Do not use TVOC as a measure of "overall chemical safety." A TVOC number does not tell a school which VOCs are present, the source of the VOC, if that VOC is harmful to human health, or whether a particular chemical concentration exceeds a health-based limit.

4. How many monitors are needed for my school building?

There is no universally established national requirement such as "one monitor per classroom." ASHRAE's *Design Guidance for Education Facilities: Prioritization for Advanced Indoor Air Quality* recommends **10% of classrooms plus central air-handling locations** as a base-minimum approach for developing a building IAQ profile.[4] Use this easy formula to determine the number of monitors needed for your classrooms:

Total number of classrooms x 0.10 = Number of monitors needed for classrooms

In selecting this representative coverage, consider this tiered approach:

Tier 1 — Monitor First

- ☐ Classrooms with IAQ complaints
- ☐ Rooms with unusually high occupancy
- ☐ Special education classrooms
- ☐ Portable classrooms
- ☐ Rooms served by different HVAC systems
- ☐ Older buildings
- ☐ Rooms affected by wildfire smoke
- ☐ Rooms near pollutant sources
- ☐ Rooms with known HVAC problems

Tier 2 — Select Representative Classrooms

- ☐ Different floors of the school building
- ☐ Different wings
- ☐ Different HVAC zones
- ☐ Rooms with exterior versus interior exposure
- ☐ Different building ages
- ☐ Different orientations
- ☐ Different occupancy levels

Tier 3 — Other Spaces

- ☐ Administrative areas
- ☐ Art rooms
- ☐ Auditorium
- ☐ Cafeteria
- ☐ Copier room
- ☐ Gymnasium
- ☐ Health office
- ☐ Industrial Arts rooms
- ☐ Library
- ☐ Music rooms
- ☐ Science rooms

5. Where should monitors be placed?

Always follow the manufacturer's instructions for monitor placement. There are specific and different recommendations for the time of year, building conditions, and placement of radon measurement equipment. For more information on radon measurement in schools, see the Lung Association's Radon Measurement Guidance for Schools. Use the following EPA guidance on monitor placement to ensure accurate monitoring results:

- ☐ Approximately 3–6 feet above the floor, in the occupied "breathing zone"
- ☐ In a location with unrestricted airflow (ideally 270° unobstructed flow at sensor; no less than 180°)
- ☐ Away from walls/corners when practical
- ☐ Away from direct sunlight
- ☐ Away from doors and windows
- ☐ Away from HVAC supply and return vents
- ☐ Away from fans
- ☐ Away from portable air cleaners
- ☐ Away from obvious pollutant sources
- ☐ Where students cannot easily tamper with the device

Consider placing one or more monitors outdoors in an area that can provide information about background conditions or outdoor contaminant sources that may impact the IAQ in the school. For example, you can compare indoor air PM2.5 with outdoor PM2.5 to provide clues (not causation) of the source. Airnow.gov may also provide useful information regarding local ambient air quality. Thorough review of comparable data gathered over many days and conditions is the preferred approach for interpretation; here are some examples for illustration only:

Indoor PM2.5 Reading	Outdoor PM2.5 Reading	Possible Interpretation
8	7	Low indoor PM2.5/outdoor PM2.5
20	19	Likely outdoor influence
30	8	Possible indoor source
45	9	Strong indication of indoor source/event

6. How frequently should my school collect data?

There is currently no recommended measuring interval from either EPA or ASHRAE. The New York School Environmental Health Program Indoor Air Quality Monitoring Tool Program recommends that schools monitor IAQ twice a year, at a minimum, in both the heating (October 1 to March 31) and cooling (April 1 to September 30) seasons for at least five consecutive occupied school days. Additional monitoring may be needed in response to pollution events or occupant concerns.

For most school applications, measuring every **5, 10, or 15** minutes may be a good balance between useful information and data volume. **Do not rely solely on single, instantaneous readings.** A single reading such as CO_2 = 1,450 ppm (parts per million) is much less informative than CO_2 averaged at 1,450 ppm for 60 minutes while the classroom was occupied.

7. How long should my school monitor its IAQ?

ASHRAE's *Design Guidance for Education Facilities: Prioritization for Advanced Indoor Air Quality* recommends the following.[4]

To establish a baseline:

For schools establishing a comprehensive building IAQ baseline, measure for **6 months or more**. This allows for:

- When the building is both occupied and unoccupied
- Different days of the week
- Different weather conditions
- Normal occupancy
- HVAC operating cycles

During outdoor pollution events to:

- Monitor the infiltration of wildfire smoke and other outdoor pollutants into occupied school spaces.
- Assess the effectiveness of HVAC filtration and air-cleaning interventions during pollution events.
- Enable rapid, evidence-based operational decisions to reduce occupant exposure.
- Document indoor environmental conditions to support health protection, risk communication, and continuous improvement of school IAQ management practices.
- Provide data-driven communication to school administrators, families and staff about indoor air conditions and the effectiveness of measures taken to protect students and staff.

After corrective action:

- Continue to monitor for **at least 2–4 weeks after an intervention**, preferably during comparable occupancy and weather conditions.

8. How to interpret the monitor data?

> "There are currently no widely accepted performance criteria used to standardize how measurements are made by low-cost air pollutant monitors, or what threshold limits are used to determine the alert cues used for the various low-cost air pollutant monitors. It is important to note that air pollutant concentrations do not necessarily directly translate to health outcomes and that for most pollutants there are no widely accepted indoor health-based standards or thresholds at this time to use in comparison."[1] Levels that triggers an alert of a potential problem are determined by the manufacturer of the monitor.

There are no nationally accepted indoor air concentration limits for CO, CO_2, PM2.5, or VOCs; however, there are for radon, temperature, and relative humidity. The following summarizes the recommended action level for radon and ranges of temperature and relative humidity. Refer to *Indoor Air Monitoring in Schools Guidance Parameters, Prioritization, Thresholds, Interpretation, Recommended Actions, and Reporting*, on **page 13** for an explanation of CO, CO_2, indoor PM2.5, outdoor PM2.5, radon, relative humidity, temperature, and VOCs, reason for monitoring, action thresholds, interpretation, recommended action levels, how to document in reports, and example report documentation.

Radon Action Level for Indoor Environments

The average concentration of radon in outdoor air is 0.4 pCi/L (picoCuries per liter). EPA and the Lung Association recommend homes and buildings be fixed if the radon level is 4.0 pCi/L or more. Because there is no known safe level of exposure to radon, EPA and the Lung Association recommend considering fixing your home or building for radon levels between 2.0 pCi/L and 4.0 pCi/L.[5]

Recommended Ranges of Temperature and Relative Humidity[6]

Recommendations apply for people clothed in typical summer and winter clothing, at light, mainly sedentary activity.

Relative Humidity	Winter Temperature	Summer Temperature
30%	68.5°F - 75.5°F	74.0°F - 80.0°F
40%	68.0°F - 75.0°F	73.5°F - 80.0°F
50%	68.0°F - 74.5°F	73.0°F - 79.0°F
60%	67.5°F - 74.0°F	73.0°F - 78.5°F



There are currently no widely accepted air concentration limits for most pollutants indoors. Therefore, levels that trigger an alert of a potential program are determined by the manufacturer of the monitor. These are sometimes indicated like a stoplight: Green, Yellow, and Red. The American Lung Association **does not recommend using color-based systems** for screening or action thresholds because there is no standardized definition of what the colors mean. Rather, the American Lung Association recommends utilizing actual measurement readings for interpretation, action, and documentation.

9. How does my school establish data quality assurance/quality control for monitoring?

EPA recommends that every school establish data quality assurance and quality control for their monitoring.[3] Below is guidance for your school to consider.

1. Write a quality assurance/quality control plan. Include:
   - Who will be trained to set up the monitors, conduct maintenance, and data management procedures?
   - Who will document the data from the monitors?
   - How frequently will the monitors be calibrated, if recommended by manufacturer?
   - How and when will the batteries be replaced?

2. Address “sensor drift” which is the gradual change in monitor readings over time, even when the actual concentration of the pollutant has not changed. This can occur due to aging of sensor components, exposure to contaminants, extreme temperature and humidity over time, and/or physical wear and tear of the device. Sensor drift can lead to false alarms, unnecessary HVAC adjustments, missed IAQ problems, incorrect assessment of ventilation performance, or inaccurate long-term trend data. Sensor drift can be managed through routine calibration against a reference instrument, periodic replacement of sensors, and co-location studies where field monitors are periodically compared against higher-grade reference monitors.

3. What is the monitor device maintenance schedule? Below is a suggested schedule your school may wish to consider.

Before deployment

- ☐ Record manufacturer and model
- ☐ Record serial number
- ☐ Record sensor type
- ☐ Record firmware version
- ☐ Record installation date
- ☐ Record location
- ☐ Record room number
- ☐ Record HVAC zone
- ☐ Confirm time/date settings
- ☐ Confirm Wi-Fi/data connection
- ☐ Confirm measurement units
- ☐ Before deploying numerous monitors, place all monitors together in the same location for 24-72 hours. Look for unusually high/low readings, missing data, and inconsistent responses. This can help identify sensor-to-sensor differences.

Monthly

- ☐ Check monitor connectivity
- ☐ Check missing data
- ☐ Inspect physical condition of sensors
- ☐ Check for tampering
- ☐ Check battery/power
- ☐ Review unusual readings

Quarterly

- ☐ Review sensor performance
- ☐ Review trends
- ☐ Inspect placement
- ☐ Verify room/HVAC information
- ☐ Review dashboard alerts

Annually

- ☐ Review manufacturer's maintenance requirements
- ☐ Consider deploying all monitors together in the same location for 24-72 hours. Look for unusually high/low readings, missing data, and inconsistent responses. This can help identify sensor-to-sensor differences.
- ☐ Evaluate sensor replacement needs
- ☐ Review monitoring locations
- ☐ Review thresholds
- ☐ Review the overall monitoring program

10. How does my school ensure sufficient data?

Schools should ensure there is sufficient data before using monitor results to make decisions. EPA recommends:

- For daily reports, at least **75% of the expected data should be available** for the results to be considered representative.[3]
- For long-term reporting, schools should aim for at least **80% of expected data**.[3]
- For Immediately Dangerous to Life or Health (IDLH) exposures, even brief periods of high levels are enough to warrant immediate action. IDLH is defined as acute or short-term exposures to high concentrations of some airborne chemicals, such as CO, that have the ability to quickly overwhelm students and staff, resulting in a wide spectrum of undesirable health outcomes that may include irritation of the eyes and respiratory tract, severe irreversible health effects, impairment of the ability to escape from the exposure environment, and, in extreme cases, death.
- Missing data: If a monitor has too much missing or unreliable data—for example, only 42% of the expected data is available—the dashboard should clearly state "**Insufficient data — do not interpret**." Schools should not calculate or report an average when there is insufficient valid data.

11. Does my school need a monitoring dashboard?

ASHRAE recommends that schools have a monitoring dashboard and that it contains three levels.[4] However, the frequency of public reporting of school monitor data should be determined by your school.

Level 1 — Staff/facilities dashboard

- Current/daily maximum CO_2
- Current/daily maximum CO if applicable
- Current/daily maximum PM2.5
- Temperature
- Relative humidity
- 24-hour trend
- 7-day trend
- Alerts
- Sensor status

Level 2 — School administrator dashboard

- Classrooms needing attention
- Percentage of rooms meeting ventilation target
- Rooms with repeated PM2.5 elevations
- HVAC zones with recurring problems
- Unresolved alerts
- Corrective actions (both past and scheduled)
- Trend overtime

Level 3 — Public dashboard

Keep it simple. Avoid sharing a large amount of raw data.

Show:

- Building
- Room
- Parameter
- Current/Recent Reading
- Status
- Last Updated

A note about public dashboards: A key consideration is determining how much real-time information should be shared with the public. For example, if air quality monitor data are displayed live, people may see a spike in readings before staff have had an opportunity to investigate the cause, determine whether it poses a concern, and take any needed corrective action.

Some results may also require explanation or context to be properly understood. Without that context, data can be misinterpreted, particularly if it is shared or discussed by others. In addition, monitoring equipment and data systems can occasionally produce inaccurate readings, so unusual results should be verified before conclusions are drawn.

Because inaccurate data can create unnecessary confusion or concern, it is important to establish a process for reviewing and validating monitoring data before it is released to the public. This process should ensure that reasonably reliable information is shared in a timely manner. To promote transparency, information about decisions to temporarily withhold data and the outcome of those reviews should also be made publicly available.

Consider including this disclaimer on all dashboards, which is consistent with EPA's current explanation of the limitations of monitors: Indoor air quality monitors provide information about certain pollutants and environmental conditions. They do not measure every indoor air pollutant and cannot determine on their own whether a space is safe or unsafe for any individual. Monitor readings can be influenced by factors such as placement, temperature, humidity, the number of people in a space, and building ventilation. Elevated readings can help identify conditions that may need further investigation or corrective action.

12. When should my school seek a professional IAQ test?

A monitor is not a substitute for testing by properly trained staff/professionals using calibrated professional-grade hand-held devices. Your school should consider hiring a professional when:

- An IAQ emergency is declared
- Persistent high readings cannot be explained
- Multiple classrooms show the same problem
- There is suspected combustion exposure
- There is a suspected chemical release
- There is suspected mold/moisture damage, depending on magnitude (See Mold in Schools and Commercial Buildings | US EPA)
- There are persistent occupant complaints
- HVAC problems cannot be corrected by routine maintenance
- Screening testing shows elevated radon levels or radon testing is required by state law
- Formaldehyde/VOC exposure is suspected
- A major renovation/construction project is involved
- The school needs exposure assessment rather than screening

Indoor Air Monitoring in Schools Guidance

Parameters, Prioritization, Thresholds, Interpretation, Recommended Action Pathway, and Reporting

Parameter	Priority	Reason for Monitoring	Action Thresholds	Interpretation	Recommended Action	How to Document the Report	Example Report Documentation	Additional Considerations
Carbon Dioxide (CO_2)	Essential	EPA suggests using CO_2 as an indicator of airflow, to help identify insufficient ventilation. **Source of CO_2:** Human respiration is the primary source of CO_2 in normally occupied classrooms. **Health Impact:** In the classroom, elevated CO_2 is linked to sleepiness, headaches, reduced concentration, and lower academic performance.	**Source:** New York State School Environmental Health Program,[2] EPA,[3] CDC,[10] UL[11] <800 ppm <1000 ppm 1000-1499 ppm 1500-1999 ppm >2000 ppm	 Excellent ventilation Generally acceptable Elevated High Very high	 **Continue** monitoring **Continue** monitoring **Investigate** ventilation **Investigate:** Priority ventilation/ corrective action **Action:** Significant ventilation concern/act promptly NOTE: ASHRAE and Minnesota Department of Health[7] recommend ventilation of 15cfm of outdoor air per person.	**For each classroom report daily:** • Occupied 8-hour average • Maximum • % of occupied time ≥1,000 ppm • % of occupied time ≥1,500 ppm	**Classroom #204** • 875 ppm • 1,620 ppm • Time ≥1,000 ppm: 18% • Time ≥1,500 ppm: 2%	

Parameter	Priority	Reason for Monitoring	Action Thresholds	Interpretation	Recommended Action	How to Document the Report	Example Report Documentation	Additional Considerations
Carbon Monoxide (CO)	Optional	**Source of CO:** CO results from incomplete combustion of carbon-containing fuels. Sources in and around schools include propane- or gas-powered HVAC units, water heaters, stoves, construction, cleaning, landscaping equipment, and vehicles. **Health Impact:** CO can cause dizziness, confusion, impaired vision, or flu-like symptoms. High levels can lead to loss of consciousness or even death. Prolonged low-level exposure may have long-term health effects.	**Source:** World Health Organization set health-based indoor CO guidelines:[9] • 8.7 ppm for 8-hour average • 26 ppm for 1-hour average CDC set indoor worker CO exposure recommendations:[10] • 35 ppm for 8-hour Indoor CO concentrations should remain as low as reasonably achievable. **Suggested guidelines for CO indoors:**			**For each classroom report daily:** • Occupied 8-hour average • Maximum • % time > 9 ppm to < 35 ppm • % to > 35 ppm	**Classroom #204** • 1.8 ppm • 2.3 ppm • 0% • 0% If any level exceeds 2 ppm, full printout of the days' time-stamped values should be available for the permanent record.	The EPA National Ambient Air Quality Standards[8] for CO apply to **outdoor ambient air**, not directly to classroom indoor air. Caution should be taken not to compare outdoor PM regulations to indoor PM concentrations. • 9 ppm for 8-hour average • 35 ppm for 1-hour average.
			0 to 2 ppm	**Good:** Typical background indoor levels	**Continue** monitoring			
			2 to 5 ppm	**Fair:** Minor but a source is likely	**Watch:** Look for source/trend			
			5 to 9 ppm	**Poor:** Indicative of combustion source that should be identified and addressed.	**Investigate:** Address source; if unable to identify, ventilate affected area, address with professional assistance.			
			> 9 ppm to < 35 ppm	**Greater urgency:**	**Action:** Ventilate affected area if not evacuated. Conduct immediate investigation and abatement; if unable to do so, declare emergency.			
			> 35 ppm through UL2034 alarm conditions	**Emergency:**	**ACTION:** Immediately evacuate building. Engage health professionals to evaluate occupants. Address the hazard with professional assistance.			

Parameter	Priority	Reason for Monitoring	Action Thresholds	Interpretation	Recommended Action	How to Document the Report	Example Report Documentation	Additional Considerations
Indoor Particulate Matter (PM2.5)	Essential	**Sources of indoor PM2.5:** • Outdoor air • Wildfire smoke • Outdoor traffic • Combustion bi-products • Printing • Dust • Cooking • Art activities • Cleaning • Construction resuspension **Health Impacts:** Exposure is linked to: • Eye, nose, and throat irritation • Coughing, wheezing, chest tightness, and shortness of breath • Increased asthma and other respiratory symptoms • Reduced lung function • Increased respiratory infections, risk of heart attacks • Increased development and worsening of COPD • Lung cancer • Reduced concentration, academic performance	**Source:** New York State School Environmental Health Program PM2.5 guidelines are: [2] • <15 µg/m^3 • 15-35 µg/m^3 • >35 µg/m^3 **Proposed guidelines for PM2.5 indoors:** 0–15 µg/m^3 while occupied 16-25 µg/m^3 while occupied 26-35 µg/m^3 while occupied >35 µg/m^3 while occupied	 Generally low Elevated High Very high** ** This should **not** be interpreted as a safe indoor limit. Rather, indoor thresholds require context. For example, someone could be vacuuming during the unoccupied conditions while the HVAC is on recirculate mode, causing a very high reading. The important part of this guidance is ***% of occupied time above action threshold***.	 **Continue** monitoring **Watch:** Look for source/trend **Investigate** and consider mitigation **Action:** Prompt investigation/ mitigation. If indoor PM2.5 is elevated: 1. Check outdoor ambient air quality levels 2. Check for wildfire smoke and other outdoor sources of PM pollution 3. Minimize indoor particle-generating activities 4. Ensure doors and windows are closed 5. Check HVAC filtration 6. Consider portable HEPA air cleaners	**For each classroom report daily:** • Occupied 1-hour average • Occupied 8-hour average • Occupied maximum • % time >35 µg/m3 while occupied	**Classroom #204** • 7 µg/m^3 • 5 µg/m^3 • 8 µg/m^3 • 0%	EPA specifically recommends PM2.5 sensors during wildfire events to identify trends and evaluate whether interventions are reducing indoor PM2.5. The EPA National Ambient Air Quality Standard for PM2.5 applies to 24-hour **outdoor ambient air**, not directly to classroom indoor air.

Parameter	Priority	Reason for Monitoring	Action Thresholds	Interpretation	Recommended Action	How to Document the Report	Example Report Documentation	Additional Considerations
Outdoor PM2.5	Recommended as comparison	**Outdoor** monitors can provide information about background conditions or outdoor contaminant sources that may impact the IAQ in the school. For example, you can compare indoor air PM2.5 with outdoor PM2.5 to provide clues (not causation) of the source. Airnow.gov may also provide useful information regarding local ambient air quality. **Sources of outdoor PM2.5:** • Wildfire and wood smoke • Vehicle exhaust • Agricultural activities • Construction and road dust • Industrial facilities and power plants **Health Impacts:** Exposure is linked to: • Eye, nose, and throat irritation • Coughing, wheezing, chest tightness, and shortness of breath • Increased asthma and other respiratory symptoms • Reduced lung function • Increased respiratory infections, risk of heart attacks • Increased development and worsening of COPD • Lung cancer • Reduced concentration, academic performance	The EPA National Ambient Air Quality Standard for PM2.5 applies to 24-hour **outdoor ambient air**, not directly to classroom indoor air. **24-hour concentration stated as Air Quality Index:** 0-50 51-100 101-150 >151-200 201-300 >301	Good Moderate Unhealthy for sensitive groups Unhealthy Very unhealthy Hazardous	**Continue** monitoring **Watch:** Look for source/trend **Investigate** and consider mitigation **Investigate** and consider mitigation **Action:** Prompt investigation/ mitigation. Look for outdoor and indoor sources. **Action:** Emergency conditions. Avoid all physical activity outdoors. Sensitive groups should remain indoors. Keep indoor particle levels low. **If outdoor PM2.5 is elevated:** 1. Check outdoor ambient air quality 2. Check wildfire smoke 3. Check HVAC filtration 4. Check doors/windows 5. Consider portable HEPA air cleaners 6. Minimize indoor particle-generating activities	**For schoolwide report daily:** • Air Quality Index (24-hour concentration) • Local outdoor pollution events	**School building report:** • AQI = 143 • Local outdoor pollution events: 0.5 miles from interstate	EPA and others provide guidance for recess, physical education, field trips, and athletics based on Air Quality Index and wildfire smoke. 1. EPA's Air Quality and Outdoor Activity Guidance for Schools 2. Minnesota Outdoor Air Quality Guidance for Schools and Childcare 3. Oregon guidance for youth outdoor activities during wildfire smoke, air pollution events

Parameter	Priority	Reason for Monitoring	Action Thresholds	Interpretation	Recommended Action	How to Document the Report	Example Report Documentation	Additional Considerations
Radon	Essential Radon measurement in schools is required in some states	**Source:** Radon is a naturally occurring radioactive gas produced by the breakdown of uranium in soil, rock, and groundwater. It can enter buildings through cracks and openings in foundations and accumulate indoors. **Health Impacts:** Radon is the second leading cause of lung cancer in the United States, and the leading cause among those who have never smoked. Children are known to be more sensitive to radiation, so high radon in the school environment should be detected and mitigated. Radon can be a long-term hazard for school staff who regularly occupy what may be areas of highest risk.	**Source:** EPA[5] <2.0 pCi/L 2.0 – 3.9 pCi/L >4.0 - < 19.9 pCi/L > 20 - < 99.9 pCi/L >= 100.0 pCi/L	Good – not "safe" but typical levels found indoors Fair – minor but a source is likely Elevated – indicative of source that should be identified and mitigated. Urgency Emergency	**Continue retesting** – at least every 5 years or as required by law **Consider** mitigation if confirmed since more exposure poses more risk **Confirm** result and mitigate problem with professional assistance **Action** – Confirm result while simultaneously arranging for prompt mitigation. Retest every 2 years after mitigation. **ACTION** – Immediately relocate occupants from affected area(s). Address the hazard promptly with professional assistance. Retest every 2 years after mitigation.			The Lung Association recommends that professional consensus standards be followed for testing and mitigation of schools. For more information on radon measurement in schools, see the Lung Association's Radon Measurement Guidance for Schools.

Parameter	Priority	Reason for Monitoring	Action Thresholds	Interpretation	Recommended Action	How to Document the Report	Example Report Documentation	Additional Considerations
Relative Humidity (RH)	Essential	RH plays a key role in classroom comfort and health. **Source and Health Impacts:** RH over 60% promotes mold, mildew, dust mites, and bacterial growth. This can cause allergies, respiratory (breathing) problems, and bad odors. RH below 30% can cause dry eyes and skin, sore throat, irritated sinuses, and nosebleeds.	**Source:** ASHRAE's preferred school range 30-60%[4] New York State Environmental Health Program recommends:[2] 45% - 55% Between 30% - 45% or Between 55% - 60% < 30% or > 60%	Excellent Good Needs improvement	**Continue** monitoring **Watch:** Look for source/ trend **Investigate** and consider mitigation to improve RH. **Flag and document:** Persistent RH <30% Persistent RH >60% Condensation Evidence of moisture	**For each classroom report daily:** Occupied 8-hour average Maximum % time <30% or >60%	**Classroom #204** 48% 57% 0%	A monitor should not be used to diagnose mold. The school should conduct a physical building investigation and repair/correct the source of water intrusion, if elevated humidity is accompanied by: water intrusion, condensation, musty odors, visible mold, or wet building materials.
Temperature	Essential	**Source:** • Outdoor weather (extreme heat or cold) • Solar heat gains from direct sunlight or insufficient shading • HVAC system issues • Inadequate ventilation or airflow • Poor building insulation or air leads • Internal heat sources (high occupancy, computers, lighting) • Control or thermostat problems **Health Impacts:** • Heat stress, dehydration, and headaches • Cold-related discomfort, shivering, and reduced dexterity • Difficulty concentrating and reduced learning performance • Fatigue, irritability, and decreased comfort • Increased absenteeism and health complaints • Exacerbation of exiting health conditions	**Source:** Preferred school operating range 68–78°F (ASHRAE and EPA).[6] New York School Environmental Health Program recommends a range from 68°F to 80°F.[2] 68°F to 72°F 65°F to <68°F or >72°F to 80°F <65°F or >80°F	Excellent Good Needs improvement	**Continue** monitoring **Watch** **Investigate** and consider mitigation **Flag:** Persistent temperature complaints Rapid temperature changes	**For each classroom report daily:** • Occupied 8-hour average • Minimum • Maximum • % time <65% or >80%	**Classroom #204** • 73°F • 69°F • 76°F • 0%	

Parameter	Priority	Reason for Monitoring	Action Thresholds	Interpretation	Recommended Action	How to Document the Report	Example Report Documentation	Additional Considerations
Total Volatile Organic Compounds (TVOC)	Optional	**Source:** VOCs can be released from building materials, cleaning products, and stored paints and chemicals, 3D printers. **Health Impacts:** • Eye, nose, and throat irritation • Headaches • Dizziness • Asthma symptoms or flare-ups • Fatigue and difficulty concentrating • Nausea or discomfort from strong odors	**Source:** There are no current standards for TVOC. "An indoor air level of 500 µg/m^3 is … consistent with the use of low-emitting materials and the presence of a well-designed HVAC providing adequate ventilation volume."[11] TVOC is a combined estimate of many VOCs. It does not identify specific chemicals or determine whether a health-based limit has been exceeded. ***NOTE:*** TVOC can be reported in ppb (parts per billion) or µg/m 3 (micrograms per cubic meter). Some monitors display both. There is no single exact conversation between these two measurements.	Do not use TVOC as a stand-alone pass/fail metric. ASHRAE specifically states that VOC monitoring should be carefully applied.	If TVOC is monitored, consider using the data: 1. As a screening indicator to identify changes 2. As a trend indicator 3. To **investigate** potential sources 4. To monitor TVOC levels before, during, and after 3D printer use • Do not diagnose a specific chemical exposure from a TVOC reading • Consider professional testing when warranted	**For each classroom report daily:** • Document trends • Record unusual readings, along with potential activities that might explain the readings (for example, walls were painted in the room)	**Classroom #204** • Short-term elevation in TVOC was documented after weekend touch-up painting of classroom walls	Areas in schools with VOCs should: • Contain only approved materials, properly stored, for the work or study to be done. Toolkit for Safe Chemical Management in K-12 Schools | US EPA) • Be well-documented as to their contents, with Safety Data Sheets's for all materials properly available, with staff trained on their use. • Be properly ventilated to avoid vapors entering occupied classrooms. • Regular inspection of VOCs and other chemicals should be considered. If any reason exists to suspect a problem and if the source is not easily found and addressed, then a professional evaluation may be indicated.

References

1. New York State School Environmental Health Program. (2026, September). *IAQ monitoring tool program.* https://www.health.ny.gov/environmental/indoors/healthy_schools/iaqprogram
2. U.S. Environmental Protection Agency. (2026, July 20). *Air Sensor Toolbox.* https://www.epa.gov/air-sensor-toolbox
3. American Society of Heating, Refrigerating and Air-Conditioning Engineers. (2023). *Design guidance for education facilities: Prioritization for advanced indoor air quality,* Version 2.0. https://www.ashrae.org/file%20library/technical%20resources/free%20resources/design-guidance-for-education-facilities_version-2.0.pdf
4. U.S. Environmental Protection Agency. (2025, June 12). *What is EPA's action level for radon and what does it mean?* https://www.epa.gov/radon/what-epas-action-level-radon-and-what-does-it-mean
5. American Society of Heating, Refrigerating and Air-Conditioning Engineers. (1992). *Thermal environmental conditions for human occupancy* (ANSI/ASHRAE Standard 55-1992). Accuris Standards Store. https://store.accuristech.com/ashrae/standards/ashrae-55-1992?product_id=10001
6. Minnesota Department of Health. (n.d.). *Carbon dioxide (CO_2) in indoor air* https://www.health.state.mn.us/communities/environment/air/toxins/co2.html
7. U.S. Environmental Protection Agency. (2026). *Carbon monoxide (CO) pollution*. https://www.epa.gov/co-pollution
8. World Health Organization. (2021). *WHO global air quality guidelines: Particulate matter, ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide.* World Health Organization. https://www.who.int/publications/i/item/9789240034228
9. National Institute for Occupational Safety and Health. (2024). *Carbon monoxide (CO): NIOSH pocket guide to chemical hazards.* Centers for Disease Control and Prevention. https://www.cdc.gov/niosh/npg/npgd0105.html
10. Underwriters Laboratories. (2021). *Guidance on the use of integrated indoor air quality sensors* (UL Environment Standard 2906). UL Standards & Engagement. https://www.shopulstandards.com/ProductDetail.aspx?productId=ULE2906_1_S_20210927