Weingart East LA YMCA

AirAware Air Quality Monitoring Quarterly Report

(11/2024 – 01/2025)

Photo of the Weingart East LA YMCA

Prepared by the **AirAware Team**

Weingart East Los Angeles YMCA

AirAware Air Quality Monitoring Quarterly Report - # 1

November 2024 - January 2025

Prepared by the AirAware team

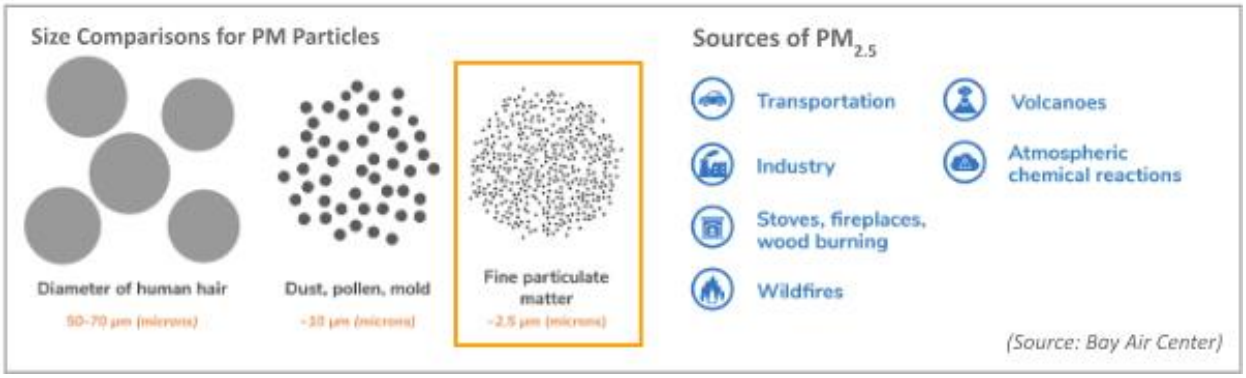
This report summarizes the recent air quality trends observed at your YMCA, focusing on the differences between indoor and outdoor fine particulate matter ($PM_{2.5}$) and black carbon levels.

Key Takeaways

- $PM_{2.5}$ levels varied across time with the majority of indoor levels in the Good and Moderate AQI range, with some days indoors reaching Unhealthy for Sensitive Groups and above during higher outdoor pollution conditions.
- The poor air quality conditions during the Eaton and Palisades wildfires severely impacted indoor air quality, leading to unhealthy indoor levels.
- During three other unhealthy outdoor days caused by common outdoor pollution resulting from stagnant winter weather, indoor air quality was also impacted, highlighting the importance of sustained and effective air filtration in maintaining healthy indoor air quality conditions year round.
- Indoor levels during higher pollution days were only 34% lower than outdoors. With the future HVAC upgrade, we'd expect indoor levels to be at least 80% lower than outdoors.
- Recurring overnight spikes in indoor black carbon (and sometimes $PM_{2.5}$) unrelated to outdoor conditions have been identified and require further investigation by the YMCA.

Background

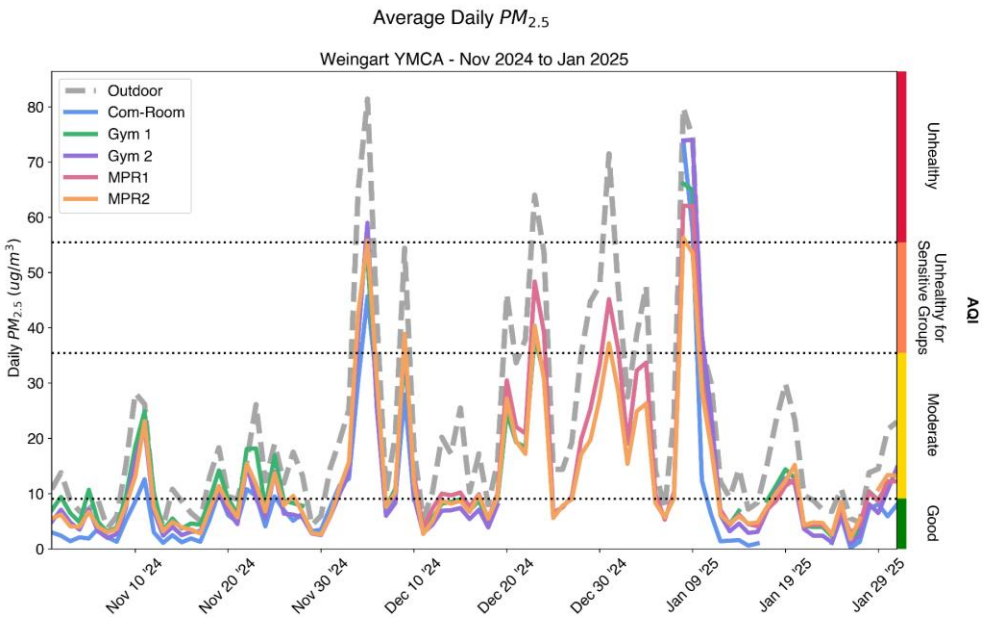
Particulate matter is an air pollutant made of tiny liquid and solid airborne particles that vary in size. Fine particulate matter ($PM_{2.5}$), measured at your YMCA, describes an important subset of particulate matter that is 2.5 microns and smaller in size (~30x smaller than the diameter of a human hair) and predominantly come from sources of combustion (burning of fuels), such as wildfires, residential wood burning, transportation, and industry.



Exposure to $PM_{2.5}$ has various detrimental health effects, such as aggravated asthma, decrease in lung function, increase in respiratory symptoms, and nonfatal heart attacks and premature deaths in people with heart and lung disease. It also impacts the environment through reduced visibility, damaged vegetation, and reduced soil nutrients, among many other impacts. Black carbon (BC), which is also measured at your YMCA, is a subset of $PM_{2.5}$ emitted from fossil fuel and biomass burning. A relevant urban source of BC is diesel exhaust. It has a wide range of negative respiratory, cardiovascular, and other health impacts, as well as detrimental climate effects.

Trends in Fine Particulate Matter ($PM_{2.5}$)

Indoor and outdoor air quality monitoring at the Weingart YMCA has been underway since late Fall 2024. This section explores the trends across time and space over these first three months of monitoring.



This plot shows average daily $PM_{2.5}$ levels across time for both the indoor (solid color lines) and outdoor (dashed grey lines) monitors from the beginning of November 2024 to the end of January 2025. The Air Quality Index (AQI) categories coinciding with $PM_{2.5}$ concentrations are shown on the right with bounds shown across the plot in dashed black lines, helping to provide health context. Any gaps in the data are due to issues in power or WiFi/cellular connectivity.

What does this plot tell us?

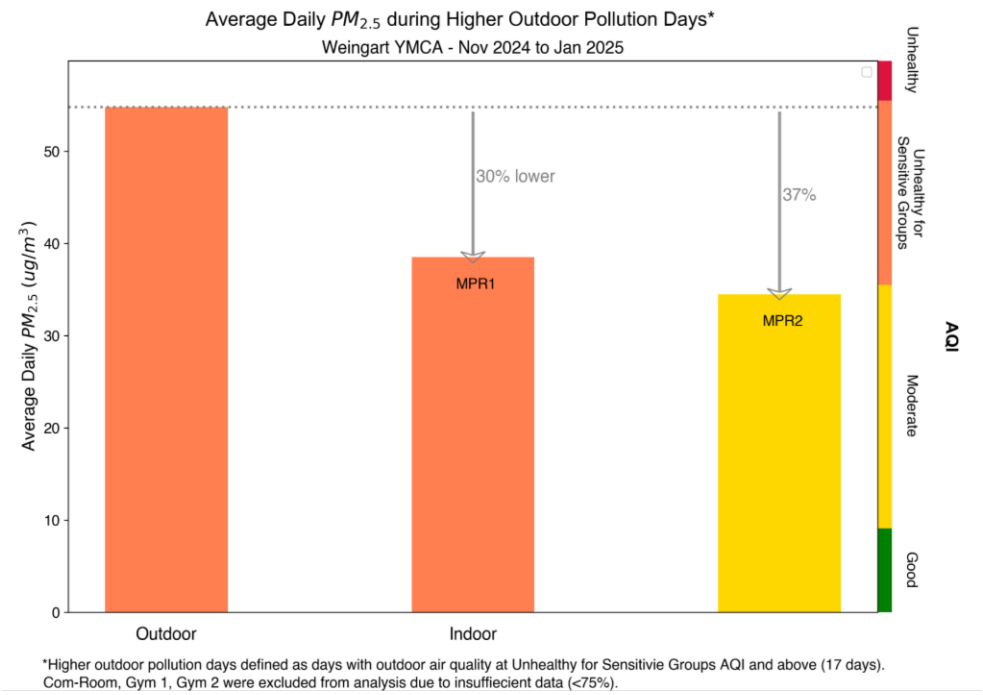
- From November 2024 to January 2025, $PM_{2.5}$ levels varied across time. Indoor levels followed the rise and fall in outdoor air pollution, but at lower concentrations, with the majority of $PM_{2.5}$ indoor levels in the Good and Moderate AQI range. The highest $PM_{2.5}$ levels both indoors and outdoors occurred across December and early January, with levels rising into the Unhealthy for Sensitive Groups and Unhealthy AQI for both indoors and outdoors.

- The high early January levels, caused by wildfire smoke from the Eaton and Palisade wildfires, heavily impacted indoor air quality conditions (indoor AQI was the same as outdoors), and more than during earlier polluted outdoor days. This relationship between indoor and outdoor levels is explored in more detail in the next section.

- Not all poor outdoor air quality days were due to wildfire smoke. Higher levels in early and late December were likely caused by outdoor pollution resulting from stagnant winter weather and were similar or greater than levels seen during wildfire smoke-impacted days. This highlights the importance of sustained and effective air filtration in maintaining healthy indoor air quality conditions year round, not just during wildfire smoke conditions.

Comparison of Indoor and Outdoor $PM_{2.5}$

The relationship between indoor and outdoor $PM_{2.5}$ is important to explore as it can tell us how effective your YMCA is at filtering out particulate matter from outdoor sources and can help highlight indoor air quality concerns and any needs for HVAC improvement.



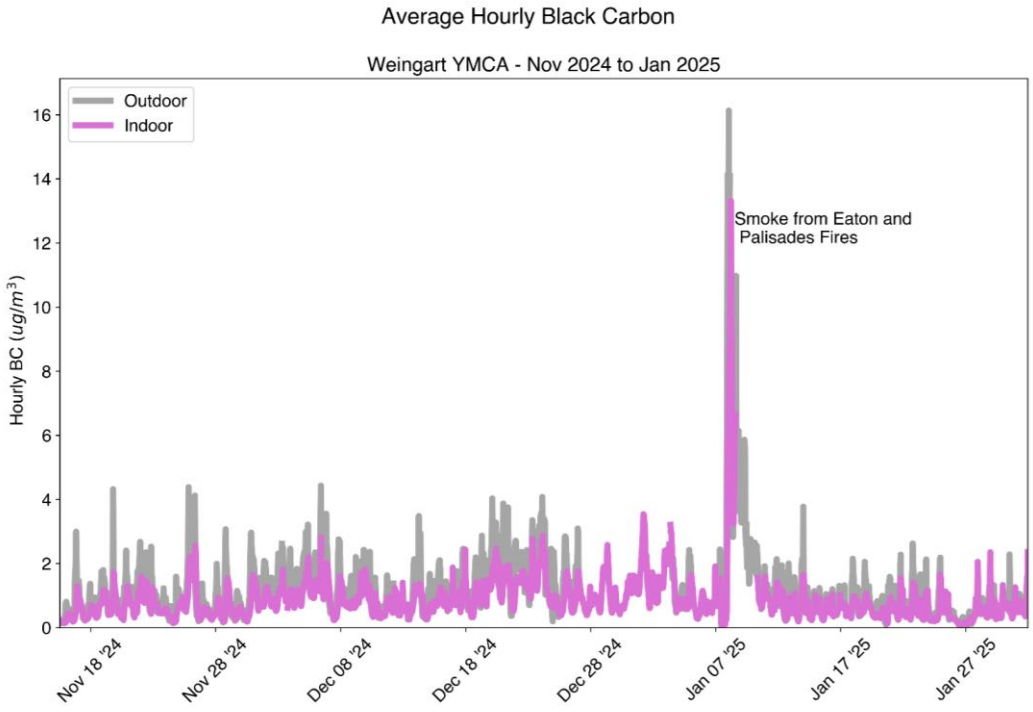
This bar chart compares average daily outdoor (left) and indoor (right) $PM_{2.5}$ levels during higher outdoor pollution days. The color of each bar chart coincides with an AQI category, and the arrows from the grey dashed line and coinciding percentages indicate how much lower average indoor levels are per room compared to outdoor. The indoor spaces are ordered from most to least similar to outdoor levels.

What does this chart tell us?

- In general, we would expect indoor levels to be between 30% and 80% lower than outdoor levels on average, depending on currently installed HVAC filtration. For this first quarter, all average indoor levels during higher pollution days (with sufficient data for analysis) were within this expected range, but on the lower end.
    - Unfortunately, the Com-Room, Gym 1, and Gym 2 monitors were missing data due to monitor powering issues that coincided with this quarter's higher outdoor pollution days. By the next quarter, we expect to have more data to do a more thorough comparison across the indoor spaces.
- Despite being in different AQI levels, both MPR1 and MPR2 averages were shown to overlap and be similar upon further statistical analysis, importantly highlighting that when outdoor air was polluted, so was indoor air in both MPR1 and MPR2.

Trends in Black Carbon

Indoor and outdoor black carbon monitoring at the Weingart YMCA has been underway since early November 2024. This section explores the hourly trends across time and space over these first three months of monitoring. **Note:** While $PM_{2.5}$ concentrations can be compared to the AQI, black carbon does not have official health standards for comparison yet, which limits our review to concentrations only. While black carbon may appear lower in comparison than $PM_{2.5}$, health studies have shown detrimental health impacts at these lower levels over continued exposure.



This plot shows average hourly black carbon levels across time for both the indoor (pink) and outdoor (grey) monitors from the beginning of November 2024 to the end of January 2025. Any gaps in the data are due to routine monitor maintenance or brief operational issues.

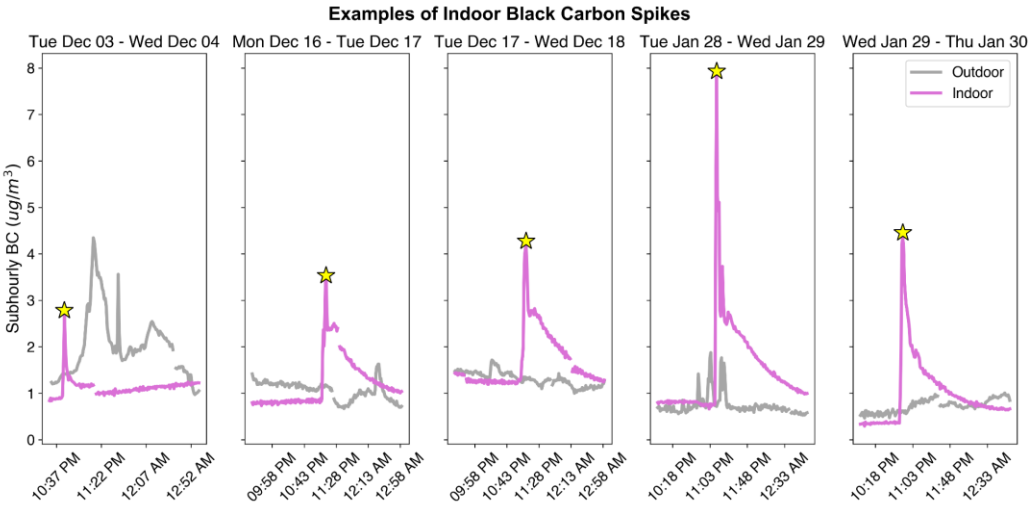
What does this chart tell us?

- From early November 2024 to January 2025, hourly black carbon levels varied across time, fluctuating across the day. Indoor levels followed the rise and fall of the outdoors, but were lower in concentration to varying extents. Future reports will look more closely at the difference between indoor and outdoor.

- Smoke from the Eaton and Palisades fires impacted both outdoor and indoor black carbon levels to a similar extent, with outdoor levels rising to 16 times the outdoor average at their smoke peak, and indoors by 13 times their average. Both indoor and outdoor conditions improved after a few days. With the future HVAC upgrade, we'd expect indoor levels to be much less impacted by higher outdoor pollution.

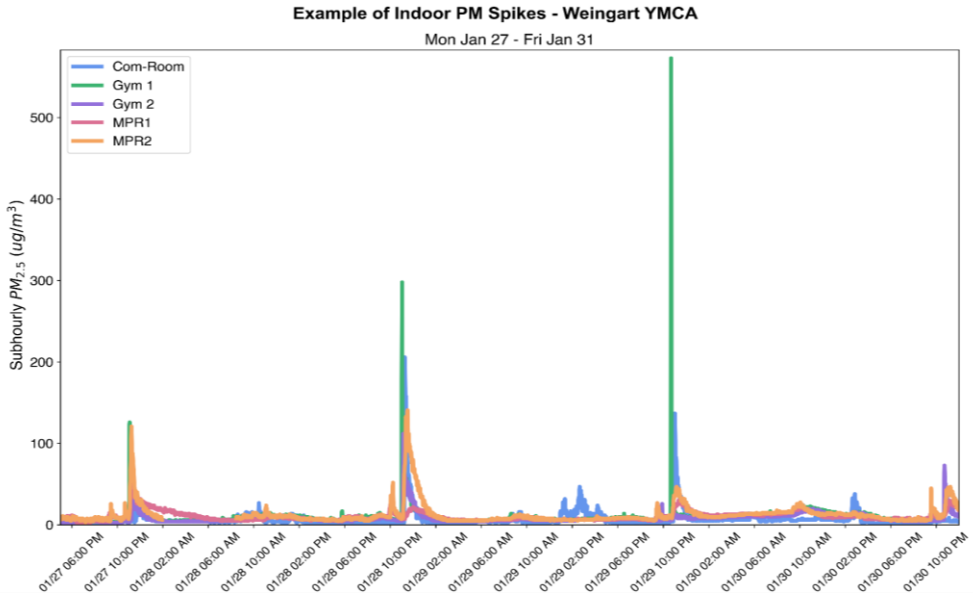
Questions about Indoor Data

Indoor sources and activities can also contribute to higher indoor air quality levels, and exploring these trends can help identify contributing indoor activities or behaviors and provide insight on possible changes to improve indoor air quality.



This plot shows examples of sub-hourly (1-min) indoor BC levels that are characteristic of indoor sources or activities that contribute to higher indoor air quality.

We've noticed brief spikes in indoor black carbon that appear unrelated to outdoor levels, and often occur overnight around 11PM local time. Since these spikes occur pretty routinely, we wanted to hear from you **what activities in the YMCA could be contributing to these trends** (these may be scheduled or automated).



This plot shows examples of sub-hourly (1-min) indoor $PM_{2.5}$ levels that are characteristic of indoor sources or activities that contribute to higher indoor air quality. These spikes coincide with indoor BC spikes. Outdoor $PM_{2.5}$ levels are not collected at the sub hourly level.

A similar trend was also observed for indoor $PM_{2.5}$ across multiple rooms in late January, coinciding with the indoor black carbon spikes.