Weingart East LA YMCA

AirAware Air Quality Monitoring Quarterly Report

(02/2025 – 04/2025)

Photo of the Weingart East LA YMCA

Prepared by the **AirAware Team**

Weingart East Los Angeles YMCA

AirAware Air Quality Monitoring Quarterly Report - # 2

February 2025 - April 2025

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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 and largely stayed within the Good and Moderate AQI range for outdoor and indoor conditions.
- The two multi-purpose rooms (MPR1 and MPR2) had the highest indoor averages during higher pollution days than other indoor spaces. This may require further investigation by the YMCA.
- Black carbon levels often rose on weekday mornings, likely showing a relationship to early morning traffic in the area.
- Indoor black carbon levels remained ~40% lower than outdoors, which is within the range of expected HVAC filtration efficiency (30%-80%), but should improve after the HVAC upgrade to at least 80%, making it cleaner indoors.

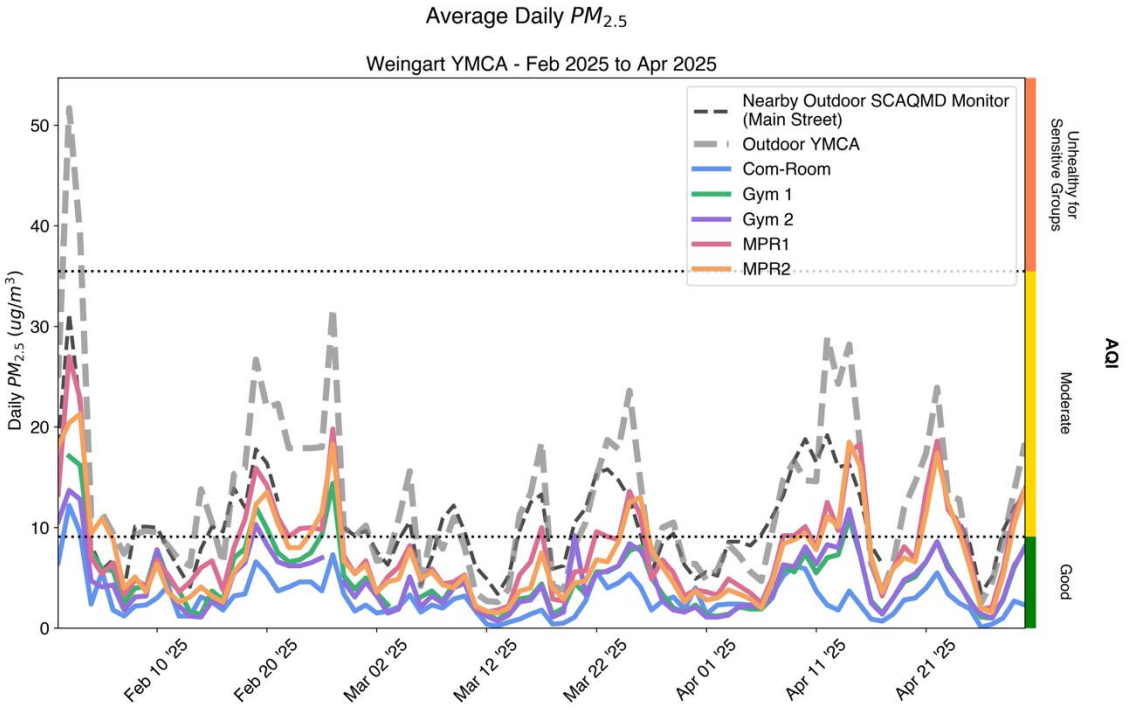
Background

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 in Spring 2025.



This plot shows average daily $PM_{2.5}$ levels across time for both the indoor (solid color lines) and outdoor (dashed grey lines) AirAware monitors from the beginning of February 2025 to the end of April 2025. Data from a nearby regulatory monitor from the South Coast Air Quality Management District is also included. 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.

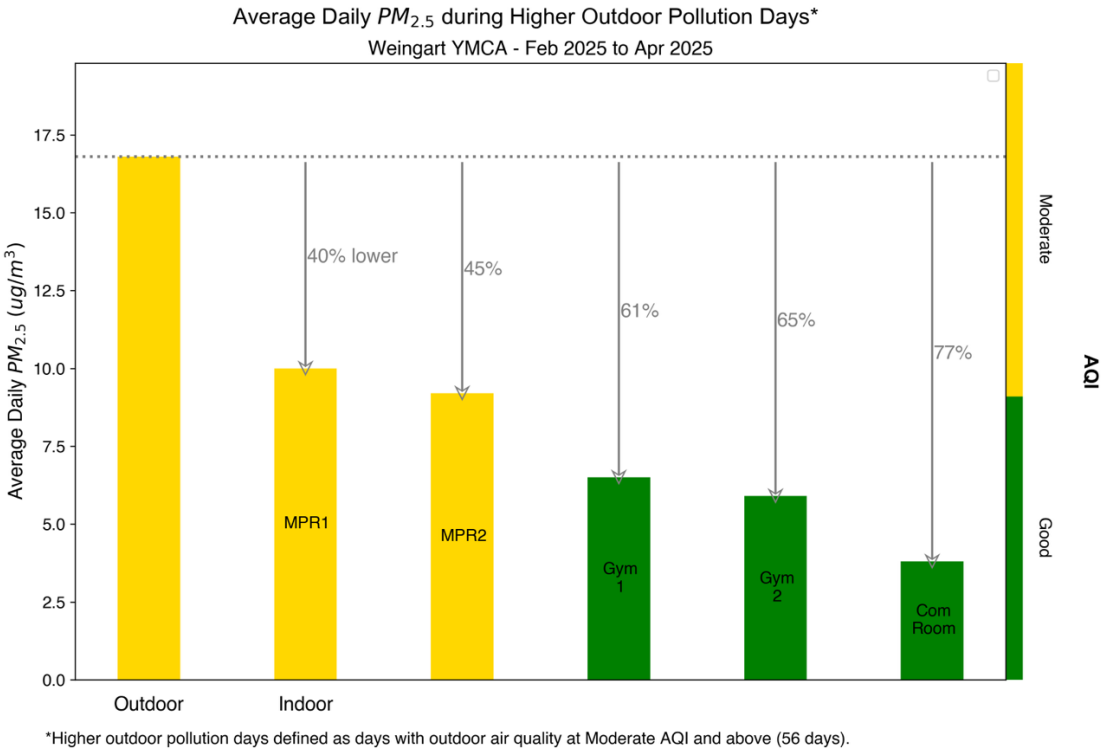
What does this plot tell us?

- From February 2025 to April 2025, $PM_{2.5}$ levels varied across time, and largely stayed within the Good and Moderate AQI range. Indoor levels followed the rise and fall in outdoor air pollution, but at lower concentrations.
- The highest $PM_{2.5}$ levels both indoors and outdoors occurred in early February, with levels rising into the Unhealthy for Sensitive Groups outdoors. These outdoor February measurements are consistent with winter trends in Southern California, where $PM_{2.5}$ levels are higher due to atmospheric conditions and lower winds compared with other seasons.
- The two multi-purpose rooms (MPR1 and MPR2) saw levels in the Moderate AQI more frequently than other indoor areas. This is explored further in the next section.
- The outdoor YMCA monitor often showed higher $PM_{2.5}$ levels than the nearest regulatory monitor from the South Coast Air Quality Management District (SCAQMD). The regulatory monitor is about 2.5 miles Northwest from the YMCA. This may be due to real differences in $PM_{2.5}$ across space, but also could be due to the performance of the

AirAware monitor. The YMCA monitor has not been directly evaluated against the SCAQMD monitor, so we cannot draw conclusions about differences between the two.

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.

For this quarter, we are considering "higher" pollution days to be anything above Good AQI. However, air pollution was acceptable during this time, and only two days saw outdoor levels above Unhealthy for Sensitive Groups. This let us draw conclusions about indoor and outdoor $PM_{2.5}$ comparisons from more data.

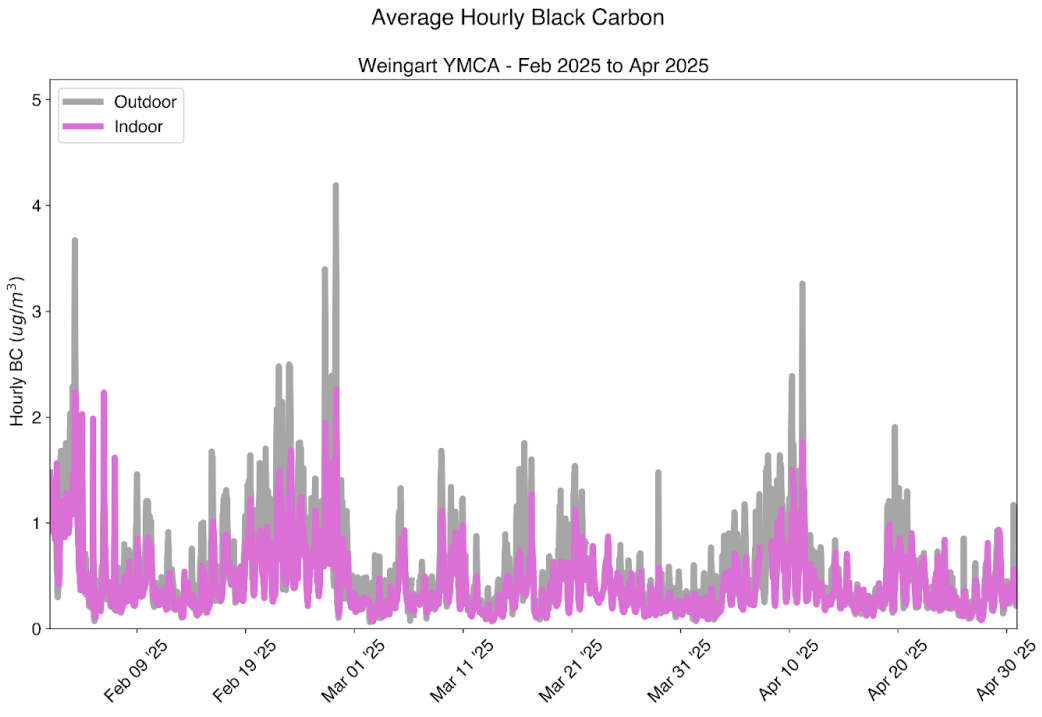
What does this chart tell us?

- On average, we would expect indoor levels to be between 30% and 80% lower than outdoor levels, depending on currently installed HVAC filtration. For this first quarter, all average indoor levels during higher pollution days were within this expected range. This means the HVAC filtration system is working as expected.

- The two multi-purpose rooms (MPR1 and MPR2) had the highest indoor averages during higher pollution days, and were the only indoor sites that reported averages within the same Moderate AQI category as outdoor, importantly highlighting that when outdoor air was polluted, so was indoor air in both MPR1 and MPR2. **What could be causing these elevated indoor levels?**

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 trends across time and space across Spring 2025. **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 that continued exposure at these lower levels can have detrimental health impacts.

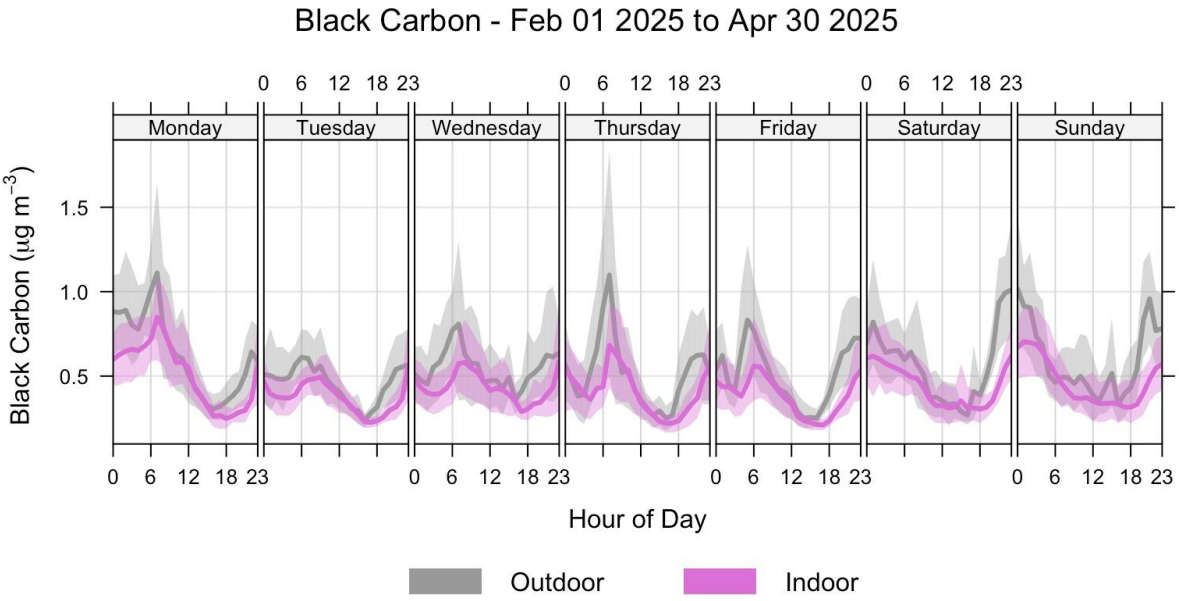


This plot shows average hourly black carbon levels across time for both the indoor (pink) and outdoor (grey) monitors from the beginning of February 2025 to the end of April 2025. Any gaps in the data are due to routine monitor maintenance or brief operational issues.

What does this chart tell us?

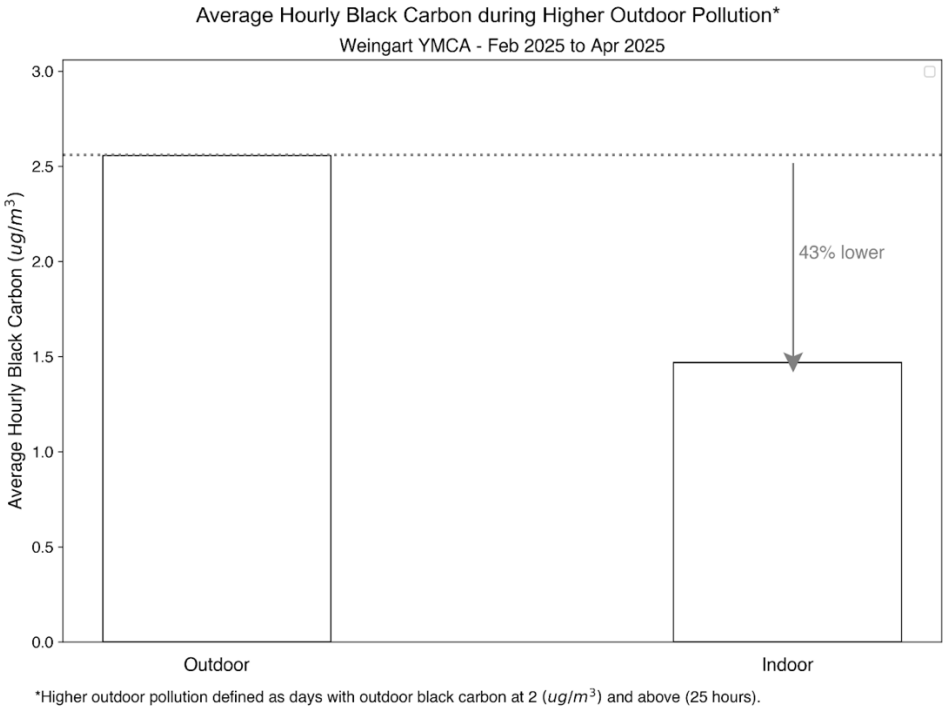
- Hourly black carbon levels varied across time, fluctuating across the day. Indoor levels followed the rise and fall of the outdoors, but were lower in concentration to varying extents. This relationship is explored more in the next plot.

- Levels remained fairly low in comparison to Quarter 1 (previous report), but outdoor black carbon showed some periodic spikes in the early morning (~7AM), predominantly in February. The next plot shows these patterns in more detail.



This plot shows the "average week of black carbon" for the quarter for both outdoor (grey) and indoor (pink) monitors. Levels are shown across different hours of the day and days of the week. The horizontal (x) axis uses 0-23hr notation, where 0=12AM, 18 = 6PM, and 23 = 11PM. All hours are shown in Standard Time (i.e., not Daylight Savings Time).

- Black carbon levels follow a general trend across the day, rising gradually overnight and lowering in the afternoon. This is due to the natural changes in the atmosphere across the day (there is more 'room' for pollutants to mix during the daytime when temperatures rise and this phenomenon means concentrations are often lower - the opposite is true during the nighttime)
- Additional rises in black carbon occurred between 6 and 8AM, predominantly on weekdays, with the highest levels on Monday and Thursday. These peaks are likely due to early morning traffic, a source of black carbon.



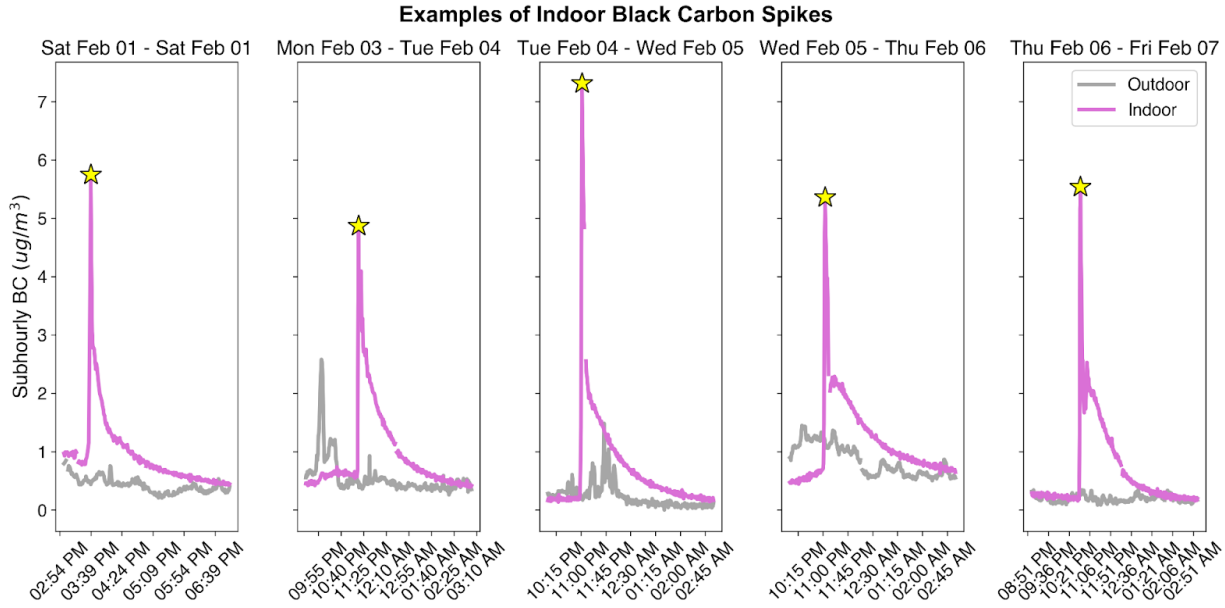
This bar chart compares average daily outdoor (grey) and indoor (pink) black carbon levels during periods of higher outdoor pollution. The arrow from the grey dashed line and coinciding percentage indicates how much lower the average indoor level is compared to outdoor black carbon.

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, the average indoor black carbon level during higher outdoor pollution was within this expected range, but on the lower end.

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.

The brief spikes in indoor black carbon we noticed last quarter also appear this quarter, but only in early February. These peaks appear unrelated to outdoor levels, and often occur overnight around 11PM local time. Given the insight that these peaks haven't occurred in March and April, **what activities in the YMCA could be contributing to these trends** (these may be scheduled or automated)?