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Staying on Track: Air Pollution & Exercise on Campus

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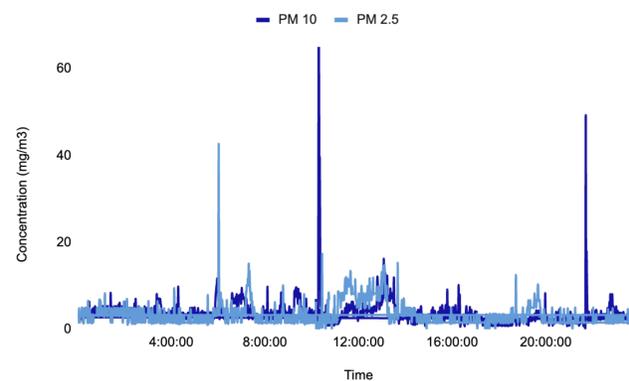
Selah Willis, Sabina Williams, Nicole Lyons, Karly Anderson, Haley McBride, and Dr. Jim Johnston

Which exercise location on campus has the lowest levels of PM_{2.5} & PM₁₀? What time of day is the lowest concentration of pollutants?

How does it affect health?

PM_{2.5} can be detrimental to health. These particles are so small that they can bypass many of the body's natural defense systems and make it to the deepest parts of your lungs.² Long term exposure can lead to chronic bronchitis, reduced lung function and increased mortality from lung cancer and heart disease. The amount of particulate matter in the air is especially important when you are exercising.³ When you exercise your muscles are working hard, and as a result, your body uses more oxygen. To compensate for the decreased oxygen, your breathing will increase.⁴ This increase in breath rate also increases the exposure experienced when exercising in a polluted environment.

PM Levels in the Indoor Track Over a 24-Hour Period

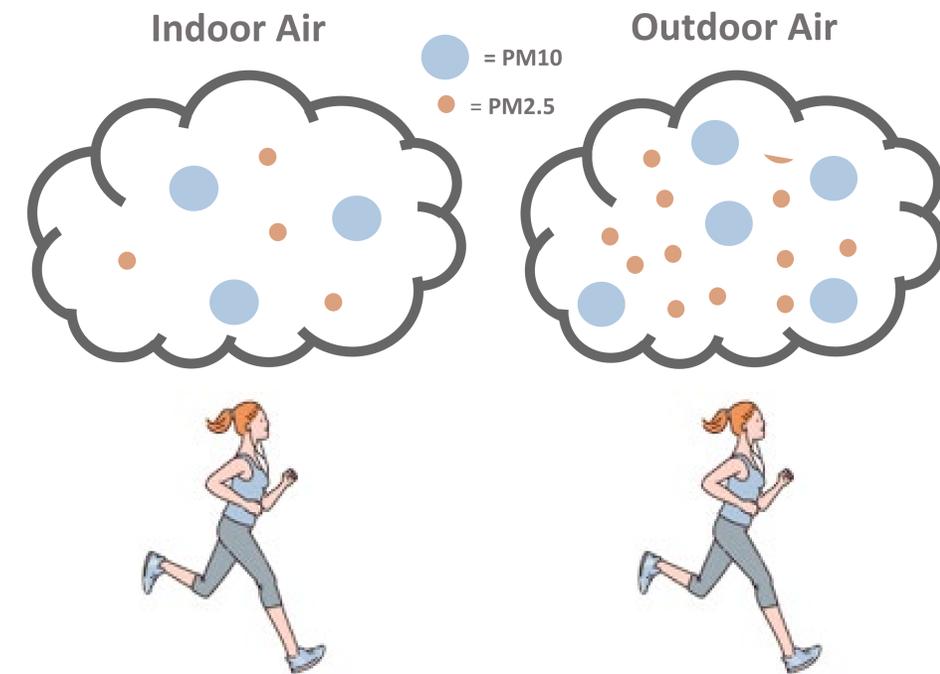


Sampling Methods

Air was sampled on February 3rd using Leland pumps to measure PM mass and SidePaks to determine particulate matter concentration over time. Air was sampled in the indoor track, the student gym, and outdoors. The samples ran for 24 hours and were then collected. The Leland pumps were pre and post calibrated to ensure the impaction plates were collecting the correct size micron. Using the Leland pump results, a correction factor was applied to the SidePak readings.

Conclusions

The average concentration of outdoor PM₁₀ and PM_{2.5} at the track was 22.47 µg/m³ and 14.1 µg/m³ respectively. For indoor air the concentration of PM₁₀ was 13.35 µg/m³ and PM_{2.5} was 4.91µg/m³.



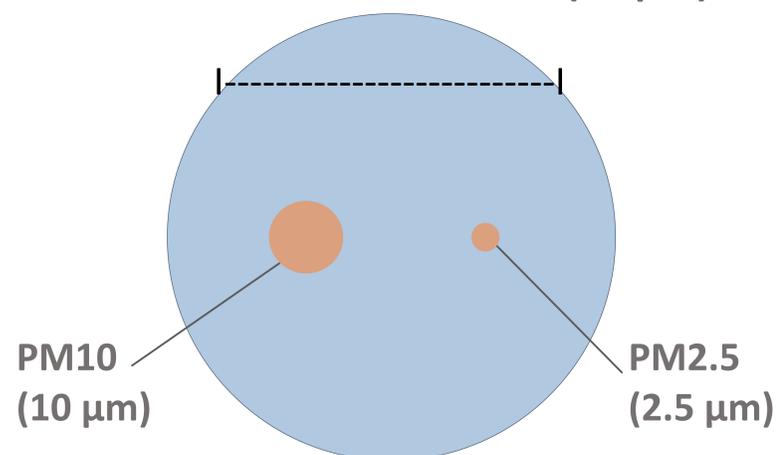
Ratio comparison of measured PM in indoor vs. outdoor air

Using our pump data, it was concluded that when considering particulate matter, it is safer to exercise in a enclosed environment when compared to outdoor exercise. According to the data we collected, the indoor track has the lowest amount of particulate matter in the air, making it the best place on campus to exercise with the least amount of stress on the lungs. The time of day where pollution was lowest in the track, on average, was between the hours of 11 pm and 6 am. Although all locations are below the EPA's standards and recommendations, there is still PM_{2.5} and PM₁₀ exposure in all locations. In order to reduce exposure, we recommend exercising inside and exercising early in the morning before 6 am.

What are PM2.5 and PM10?

PM stands for particulate matter. At certain sizes and levels particulate matter is an air pollutant. These are microscopic particles that come from crustal materials, road dust, combustion, and other natural sources.¹ The number after PM describes the size of the particle in microns (µm). PM_{2.5}, for example, includes all particles smaller than 2.5 microns. You may have heard these pollutants called other names. PM_{2.5} is often referred to as fine particulate matter and PM₁₀ is also called coarse particulate matter.

Human Hair Cross Section (60 µm)



¹Cdc.gov. 2019. Particle Pollution | Air | CDC. [online] Available at: <https://www.cdc.gov/air/particulate_matter.html> [Accessed 2 March 2022].
²NRDC. 2014. The Particulates of PM 2.5. [online] Available at: <https://www.nrdc.org/onearth/particulates-pm-25> [Accessed 2 March 2022].
³US EPA. 2021. Health and Environmental Effects of Particulate Matter (PM) | US EPA. [online] Available at: <https://www.epa.gov/pm-pollution/health-and-environmental-effects-particulate-matter-pm> [Accessed 2 March 2022].
⁴Your lungs and exercise." Breathe (Sheffield, England) vol. 12,1 (2016): 97-100. doi:10.1183/20734735.ELF121