



PIRE: Air Quality and Health Summer Internship Showcase

2020 Internship Showcase

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What is Particulate Matter?

- Particulate matter (PM) are inorganic or organic materials suspended in the air
 - All PM concentrations are measured in $\mu\text{g}/\text{m}^3$
- Total Suspended Particles (TSP) accounts for all particulates in the air, while PM10 and PM2.5 are any particles less than $10\mu\text{m}$ and $2.5\mu\text{m}$ in diameter, respectively
- PM can cause difficulty breathing and even permanent lung damage in high concentrations
 - Therefore, it's important to understand common sources of PM both indoor and outdoor





Developing a Personal Exposure Model for Air Pollutions

- Project Goal: Create an exposure model using a low-cost ambient air quality sensor and personal PM sensors and personal tracking tools, such as Global Positioning System and an activity diary. That is more representative of significant exposure events like cooking.
- Previous exposure assessments have been limited to stationary ambient air PM data, which is not as accurate if the sensor is far away and indoor air pollution sources are near the individual.



PM Measuring Devices

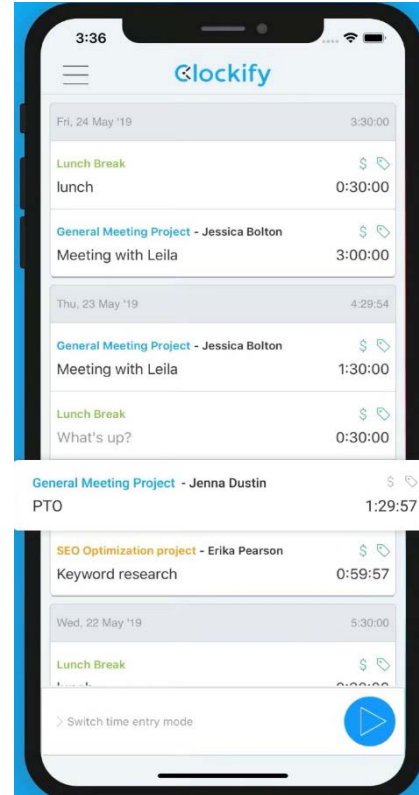


- Wearable PM monitors, developed by RTI International, capable of measuring either PM_{2.5} or PM₁₀
- (Left) MicroPEM first used in 2011
- (Right) Enhanced Children's MicroPEM (ECM), smaller and lighter version of the MicroPEM with a rechargeable battery
- PurpleAir PA-II sensor
- Low-cost air quality sensor (starting at \$229)
- Measures PM₁₀, PM_{2.5}, and PM_{1.0}



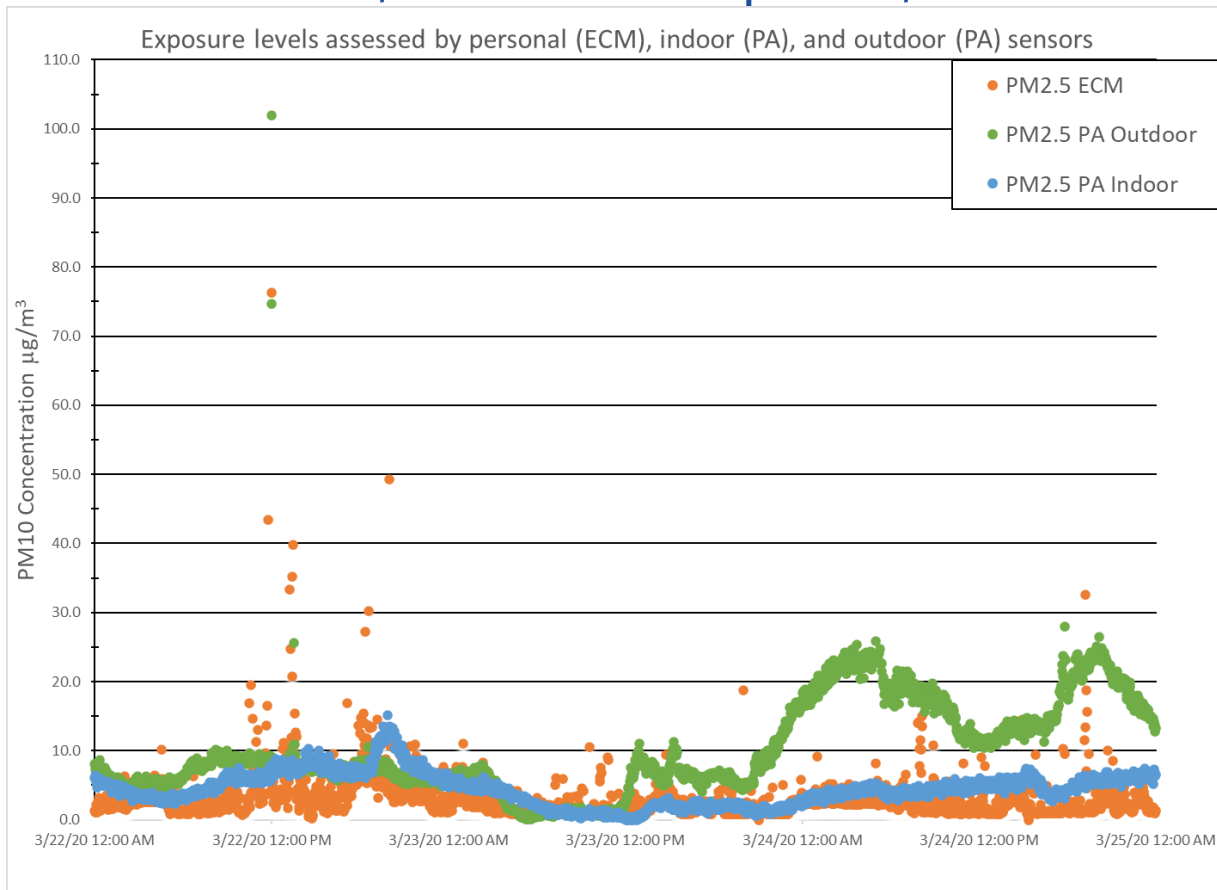
My Role Within the Project

- Compared participant activity logs to cellphone-recorded GPS data
 - Participants recorded their activity logs in the app Clockify
- Created visualizations to compare PM measurements from PurpleAir sensors and ECM devices





Overlaid Data from ECM, Outdoor PurpleAir, and Indoor PurpleAir



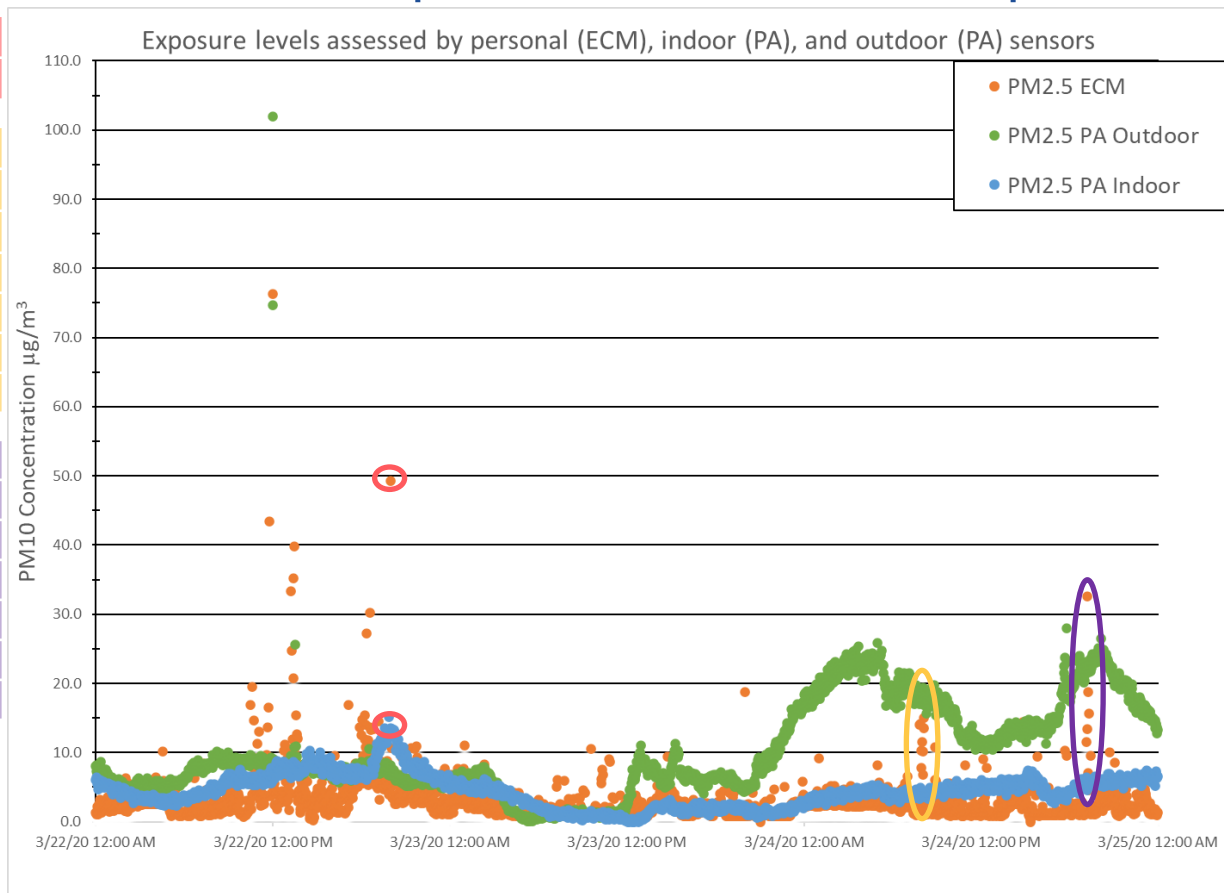


Overlaid Data from ECM, Outdoor PurpleAir, and Indoor PurpleAir

Local Time	PM2.5 ECM	PM2.5 PA Indoor
3/22/20 7:58 PM	49.3	13.2

Local Time	PM2.5 ECM	PM2.5 PA Outdoor
3/24/20 7:50 AM	14.0	17.0
3/24/20 7:52 AM	14.1	17.5
3/24/20 7:54 AM	18.1	19.2
3/24/20 7:56 AM	7.8	17.3
3/24/20 7:58 AM	10.3	19.2
3/24/20 8:00 AM	11.6	18.2

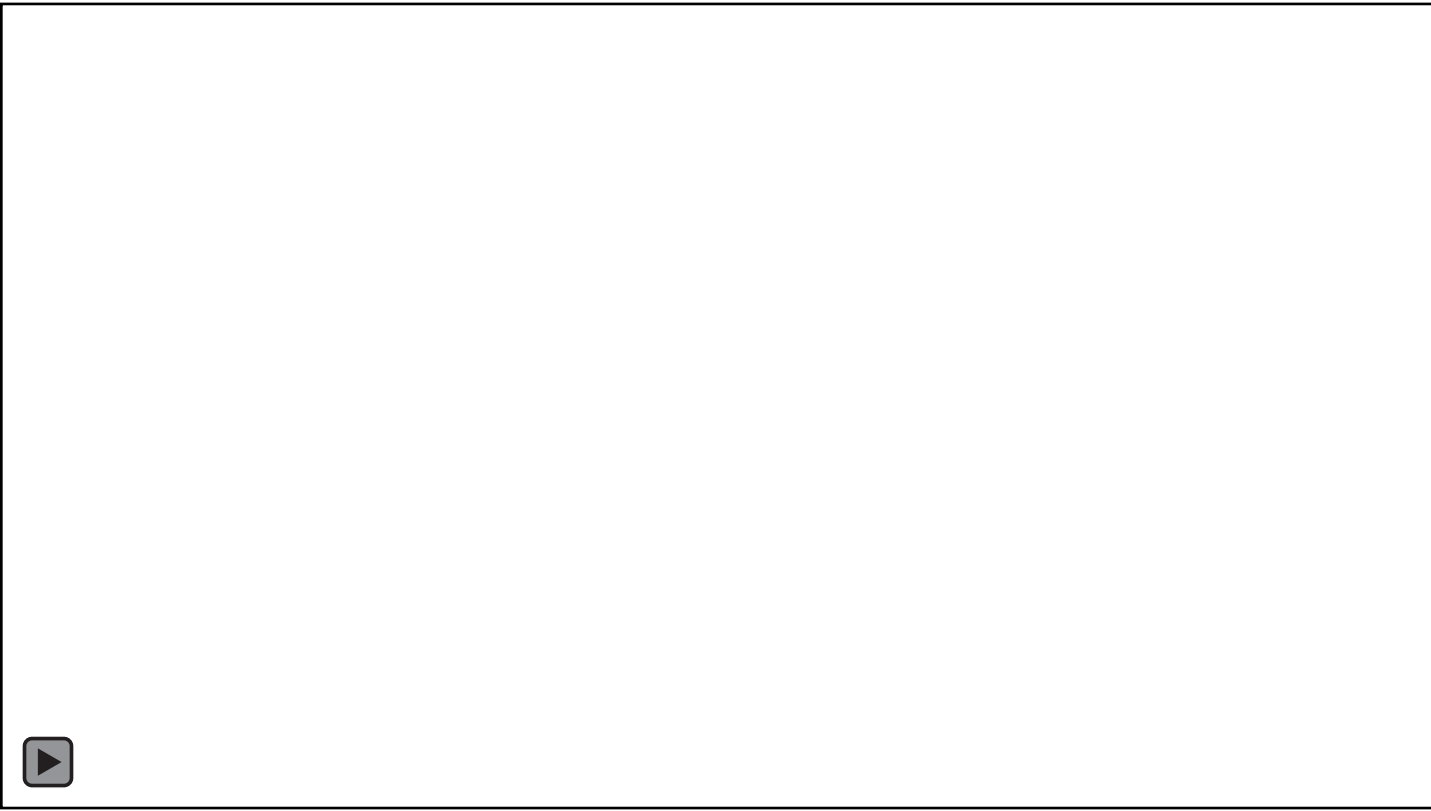
Local Time	PM2.5 ECM	PM2.5 PA Outdoor
3/24/20 7:08 PM	11.5	21.7
3/24/20 7:10 PM	13.4	21.7
3/24/20 7:12 PM	32.5	22.4
3/24/20 7:14 PM	18.8	22.4
3/24/20 7:16 PM	7.1	22.7
3/24/20 7:18 PM	15.7	21.6





Geographic Information System Map—Limitation of a Stationary PM Monitor

As the participant (red dot) moves about the yard, doing yard work, the PurpleAir outdoor sensor (green dot) fails to accurately represent the participant's exposure levels to PM2.5 from its stationary location.



Acknowledgments

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- Thank you, Jon Thornburg, for being a resource for me throughout the summer, helping to clarify any questions I had.
- Thank you, RTI, for this amazing opportunity to be an intern with the company this summer.

Image Sources

- [Clockify_screenshot.jpg](#)
- [PA.jpg](#)
- [PA\(1\).jpg](#)
- [Picture1.emf](#)
- [Stock_Image.jpg](#) (downloaded from Microsoft stock images)



Thank you

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