

## Question

Which form of house fragrance affects the amount of PM 2.5 in your house the most?

## Background and Purpose

House fragrances are used widely among the world, and we wanted to know which one was most harmful to the air quality. Particulate matter (PM 2.5) is a type of air pollutant that can cause health issues like headaches and nausea. According to the World Health Organization, good air quality should have PM 2.5 levels below 35 micrograms per cubic meter on a 24-hour average basis and below 12 micrograms per cubic meter on an annual average basis.

Candles, wax melts, and aerosols are common sources of indoor air pollution that can emit harmful particles and chemicals.

Candles, in particular, can emit harmful smoke when lit or burnt out, contributing to indoor air pollution. Wax melts also contain chemicals that evaporate and contribute to indoor air pollution. Aerosols release chemicals into the atmosphere upon use, contributing to outdoor and indoor air pollution. By understanding the impact of these common household items on indoor air quality and PM 2.5 levels, we can determine which house fragrance is the best to use and take steps to reduce our exposure to harmful particles.

## Hypothesis

If we use aerosol as a house fragrance then, it will release the most amount of PM 2.5 because aerosols use chemicals that contain a lot of PM 2.5 which become airborne when released.

# House Fragrances

Kayle Andriolo, Kayleigh Starman  
Capital High School, Honors Biology 1, Mrs. Urban

## Materials, Procedure, and Variables

### Materials:

- Room / Space
- Candles
- Wax Melter and Wax
- Aerosol fragrances & dispenser
- Lighter
- PM 2.5 readers
- Phone/Computer

**Independent Variable:** Type of House fragrance (Areoles, Wax, and Candles)

**Dependent Variable:** The levels of PM 2.5 in the room / space.

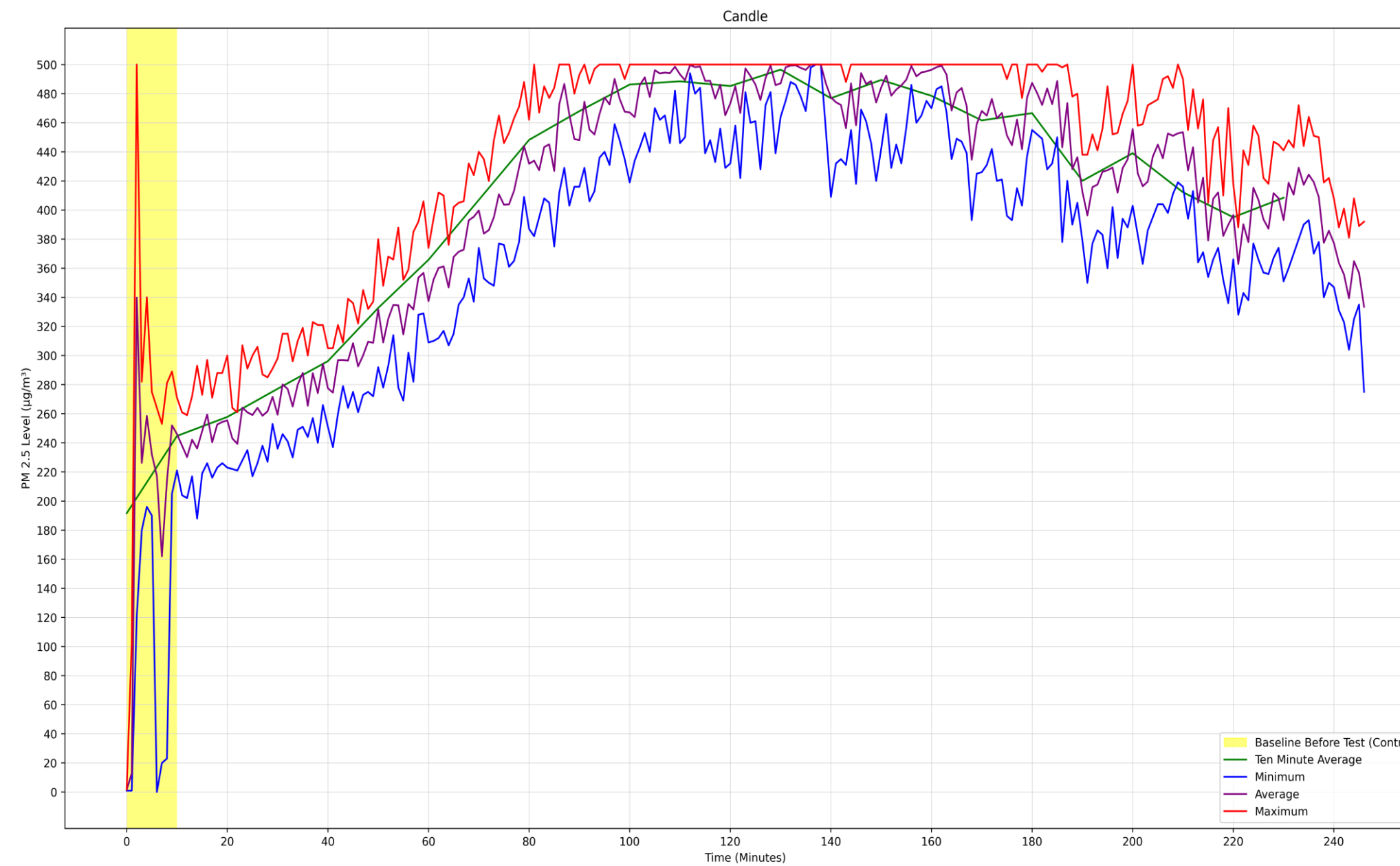
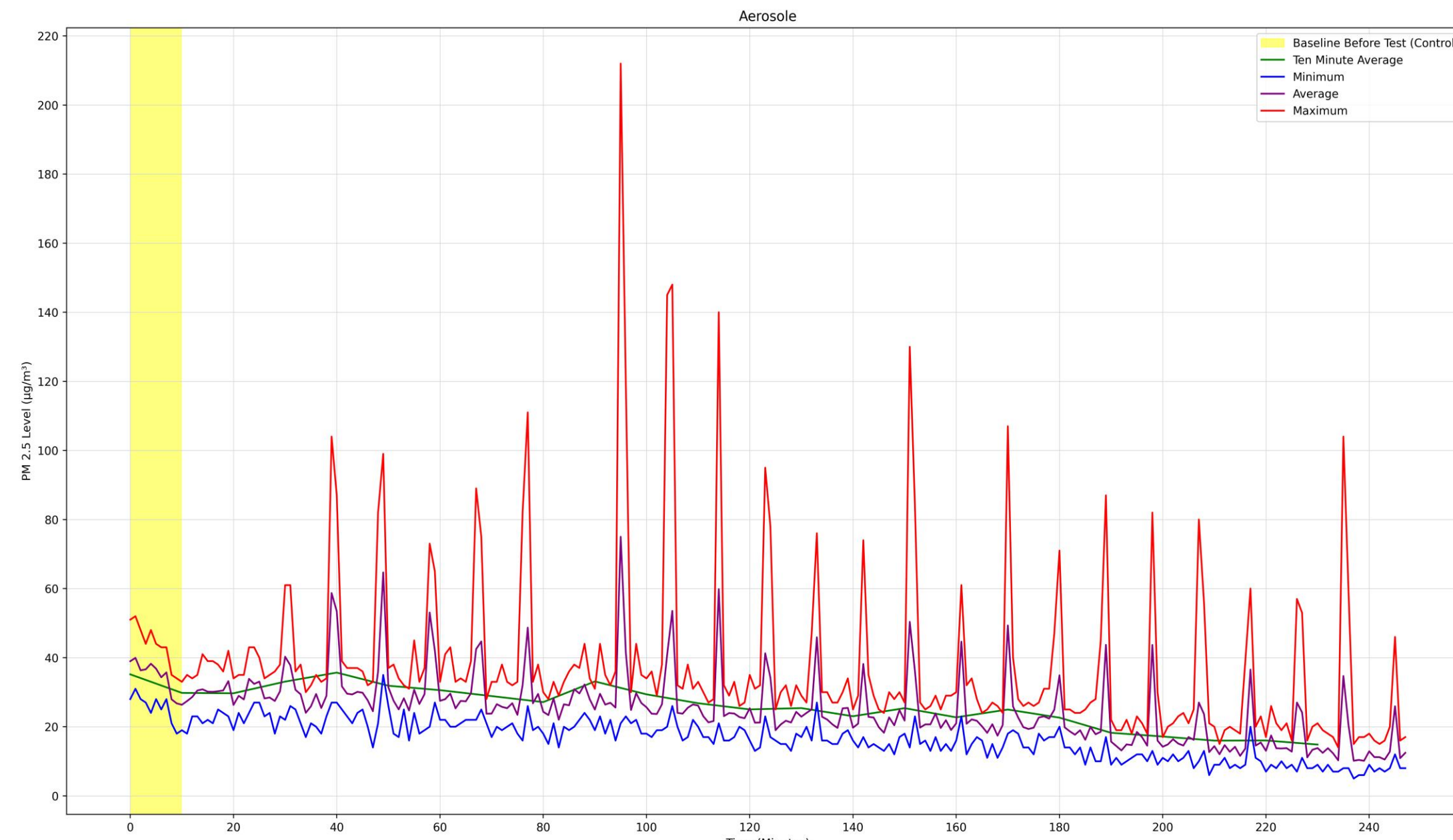
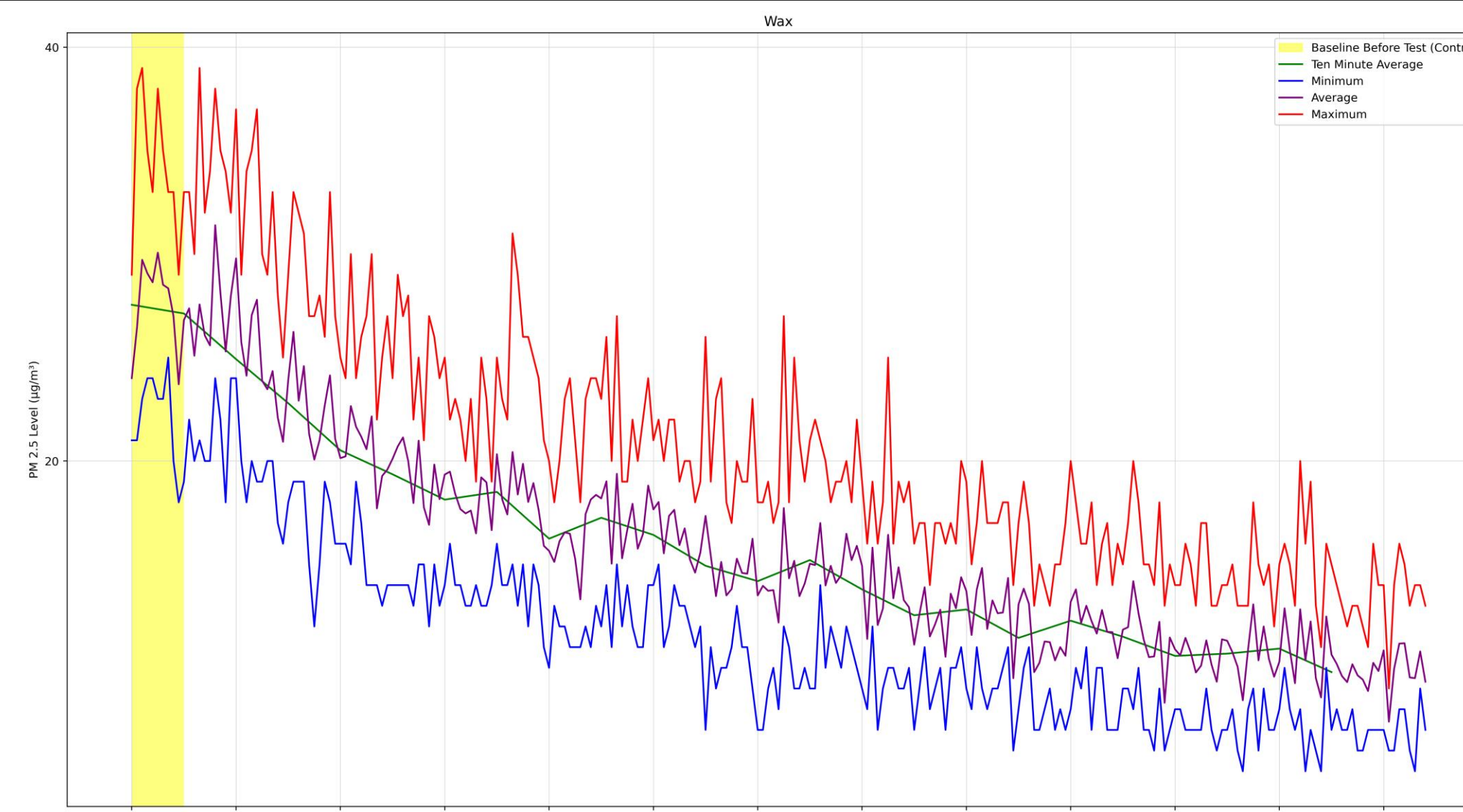
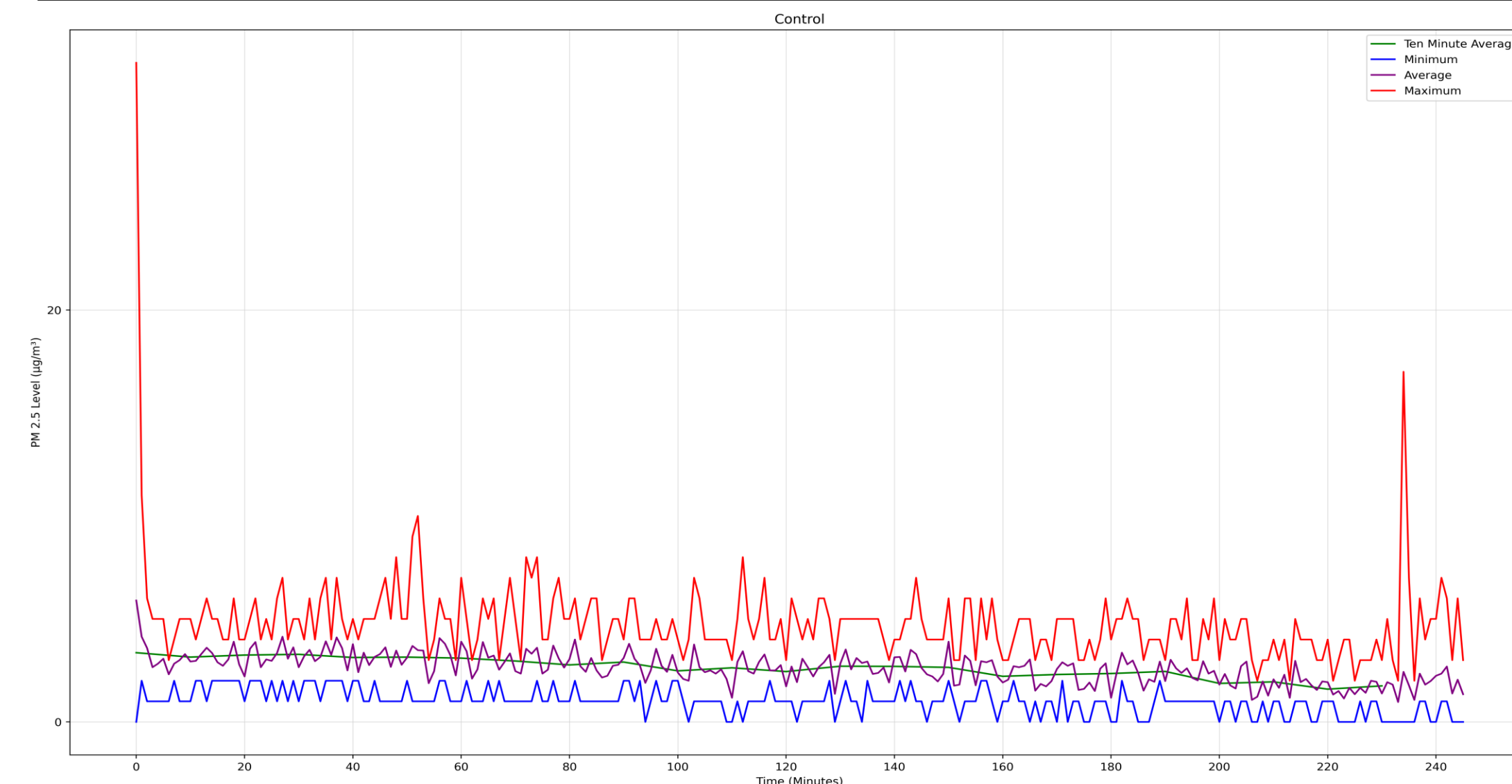
**Constants:** The room/space tested in, how long we gathered results, airing out the room before testing, distance from house fragrance to PM reader, starting PM 2.5 levels (As close to the original as possible), same sent.

### Procedure:

- Air out the room the test will be ran in to get a stable PM 2.5 level.
- Obtain first the type of house fragrance that will be tested.
- Set up PM 2.5 reader, connect it to a phone and begin recording the result.
- Either light or turn on the chosen house fragrance type, chosen in step 2.
- Let the chosen type of house fragrance burn or run for 4 hours.
- Download the results and save them.
- Extinguish or turn of the chosen type of house fragrance and repeat step 1.
- Continue steps 1-7 for the following days until all types of house fragrances have been tested 2 times each.
- Analyze the data and finalize the experiment.

## Results

Over the course of a 4-Hour period, candles released the most amount of PM 2.5 with the aerosol coming in second and wax coming in last.



## Conclusions

This experiment did not support our hypothesis because out of the different forms of house fragrances, the candle released the most amount of Particulate Matter (PM 2.5) as supported by the data. The data shows that the wax melt had a downward trend in PM 2.5 going from about 27µg/m<sup>3</sup> to about 10µg/m<sup>3</sup> in the 4-hour span. The candle had a significant upward trend going from about 190µg/m<sup>3</sup> to well over 500µg/m<sup>3</sup>. Aerosol had a continuous trend at about 30µg/m<sup>3</sup> with major spikes every nine minutes when the aerosol was sprayed increasing the PM 2.5 between 100-210µg/m<sup>3</sup> for about 2 minutes until it dissipated. During the experiment, we also noticed that the aerosol gave off the most amount of scent, the candle gave out the least amount of scent, and the wax melt was in the middle of the spectrum. We can conclude that if someone wants to use one of these home fragrances, they should use wax and a wax melter. However, this experiment did include a couple errors that could have affected the results. One of these errors included that the experiment was ran in the afternoon typically when people cook dinner. It has been proven that cooking releases PM 2.5 which could have altered our results. To fix this issue, we could run the experiment during the day when no one is cooking. Another cause of error in our experiment is that the room being tested is attached to the rest of the house. This could cause PM 2.5 admitted from other things in the house to bleed into the room being test affecting the results. To solve this problem, we would run the experiment in an isolated space sealed from the outside world.

## References

"Air Fresheners and Indoor Air Quality." *Air Fresheners and Indoor Air Quality | Environmental Health & Safety | UMass Amherst*, <https://ehs.umass.edu/air-fresheners-and-indoor-air-quality>.

"Air Fresheners and Indoor Air Quality." *Air Fresheners and Indoor Air Quality | Environmental Health & Safety | UMass Amherst*, <https://ehs.umass.edu/air-fresheners-and-indoor-air-quality>.

"Air Fresheners and Indoor Air Quality." *Air Fresheners and Indoor Air Quality | Environmental Health & Safety | UMass Amherst*, <https://ehs.umass.edu/air-fresheners-and-indoor-air-quality>.

"Aqi Basics." *AQI Basics | AirNow.gov*, AirNow.gov, U.S. EPA, <https://www.airnow.gov/aqi/aqi-basics/>.

Education, UCAR Center for Science. "Center for Science Education." *Aerosols: Tiny Particulates in the Air | Center for Science Education*, <https://scied.ucar.edu/learning-zone/air-quality/aerosols#:~:text=Aerosols%20are%20part%20of%20air%20pollution&text=Aerosols%20are%20a%20part%20of,many%20parts%20of%20the%20world>.

"Research and Development." *EPA*, Environmental Protection Agency, <https://nepis.epa.gov/>.

Shehab, M A, and F D Pope. "Effects of Short-Term Exposure to Particulate Matter Air Pollution on Cognitive Performance." *Scientific Reports*, U.S. National Library of Medicine, 3 June 2019, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6546704/%C2%A0/>.

"Air Fresheners and Indoor Air Quality." *Air Fresheners and Indoor Air Quality | Environmental Health & Safety | UMass Amherst*, <https://ehs.umass.edu/air-fresheners-and-indoor-air-quality>.