

PADEP Delaware County Community Monitoring Project

Bureau of Air Quality
August 2026





Pennsylvania
Department of
Environmental Protection

Background

- Focus – At-risk Communities in Delaware County – Chester Township and Marcus Hook, historically underserved
- Goal – understand concentration gradient of pollution in those areas and pollution sources contributing
- Outline – Using at least 32 mid-cost sensors, collect data for two (2) years and evaluate for patterns
- DEP Project Partners: Johns Hopkins University; Delaware Valley Regional Planning Commission; Delaware County Planning Dept.; University of Pennsylvania-Center of Excellence in Environmental Toxicology



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Sensors

- Quant-AQ: [QuantAQ website](#)
- Two Models: The Modulair-PM and Modulair
- Power Source: Either plug-in or solar
- Connectivity: Cellular, no Wi-Fi required

Modulair-PM

- PM_{10} , $PM_{2.5}$, and PM_{10}

Modulair

- PM_{10} , $PM_{2.5}$, and PM_{10}
- Ozone (O_3)
- Carbon Monoxide (CO)
- Nitrogen Oxide (NO)
- Nitrogen Dioxide (NO_2)
- Add-On Sonic Anemometer





Sensor Qualification “gold star, ship it”

```
8 #N is the number of sensors in batch
9 N <- 2
10 sn <- vector(length = N)
11 data <- tibble()
12 parameters <- c("date", "sn", "rh_", "temp_", "pm1_", "pm25_", "pm10_", "co_",
13               "no_", "no2_", "o3_")
14 colnames(data) <- parameters
15
16 for(i in 1:N){
17   temp <- read_csv(file.choose())
18   sn[i] <- unique(temp$sn)
19   temp <- temp %>% select(any_of(c("timestamp", "rh", "sample_rh", "temp", "sn",
20                                 "sample_temp", "pm1", "pm25", "pm10", "co", "no", "no2",
21                                 "o3"))) %>% rename(any_of(c("date" = "timestamp",
22                                                            "rh" = "sample_rh", "temp" = "sample_temp")))
23   temp <- timeAverage(temp, avg.time = "day", interval = "min", data.thresh = 0)
24   temp$sn <- sn[i]
25
26   data <- rbind(data, temp)
27 }
28 rm(i, temp)
29
30 if(ncol(data) == 11){
31   data1 <- pivot_wider(data, id_cols = date, names_from = c(sn), values_from = c(rh, temp,
32                                       pm1, pm25, pm10, co, no, no2, o3))
33 } else {
34   data1 <- pivot_wider(data, id_cols = date, names_from = c(sn), values_from = c(rh, temp,
35                                       pm1, pm25, pm10))
36 }
37
38 for(i in 3:length(parameters)){
39   index <- grep(parameters[i], colnames(data1))
40   data1 <- data1 %>% mutate(tempname = rowMeans(data1[,index], na.rm = TRUE))
```

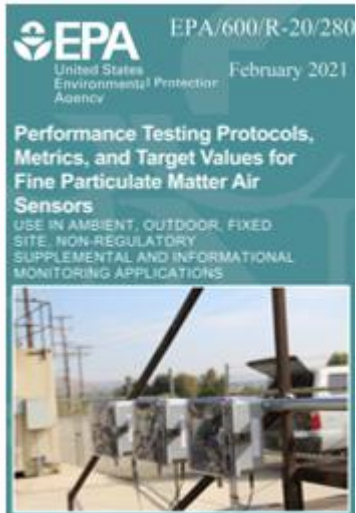
Parameter	Value	Pass/Fail
Serial Number	NA	MOD-PM-00547
rh_Batch_SD	0.471627	PASS!
temp_Batch_SD	0.122341	PASS!
pm1_Batch_SD	1.386782	PASS!
pm25_Batch_SD	1.871463	PASS!
pm10_Batch_SD	122.1645	***FAIL***
rh_Slope:	1.007446	PASS!!!
rh_r^2:	0.999918	PASS!!!
rh_RMSE	0.456651	NA
temp_Slope:	0.988393	PASS!!!
temp_r^2:	0.999858	PASS!!!
temp_RMSE	0.118456	NA
pm1_Slope:	0.880919	PASS!!!
pm1_r^2:	0.996952	PASS!!!
pm1_RMSE	1.342746	NA
pm25_Slope:	1.114853	PASS!!!
pm25_r^2:	0.930841	PASS!!!
pm25_RMSE	1.812036	PASS!!!
pm10_Slope:	1.284969	PASS!!!
pm10_r^2:	0.999988	PASS!!!

Calibration is not a practical option on this equipment. So, in lieu of that, we are using a Qualification process.



Qualification Process

- Sensors are factory-calibrated *prior* to shipment

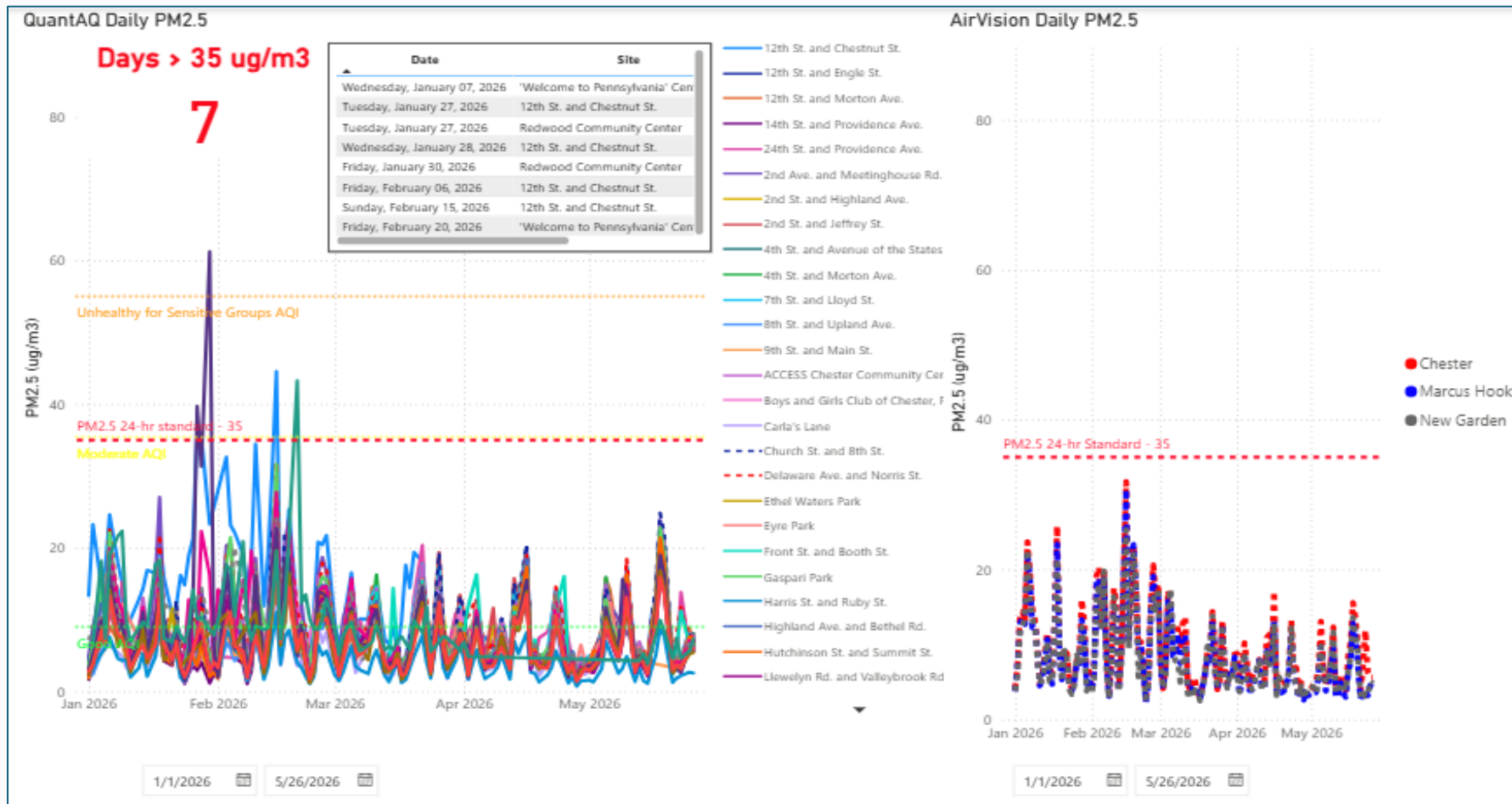


- **Prior** to deployment, DEP collocates groups of sensors and checks that sensors meet at least two EPA target values
- SD, Slope, R2, RMSE

- **After** deployment, data is compared to FRM/FEM equipment at COPAMS at Chester and Marcus Hook
- Vendor has built-in automatic QA/QC checks
- Fog flag used in validation – dew point spread $< 3.75^{\circ}\text{C}$, $\text{PM}_{\text{c}} > 200 \mu\text{g}/\text{m}^3$

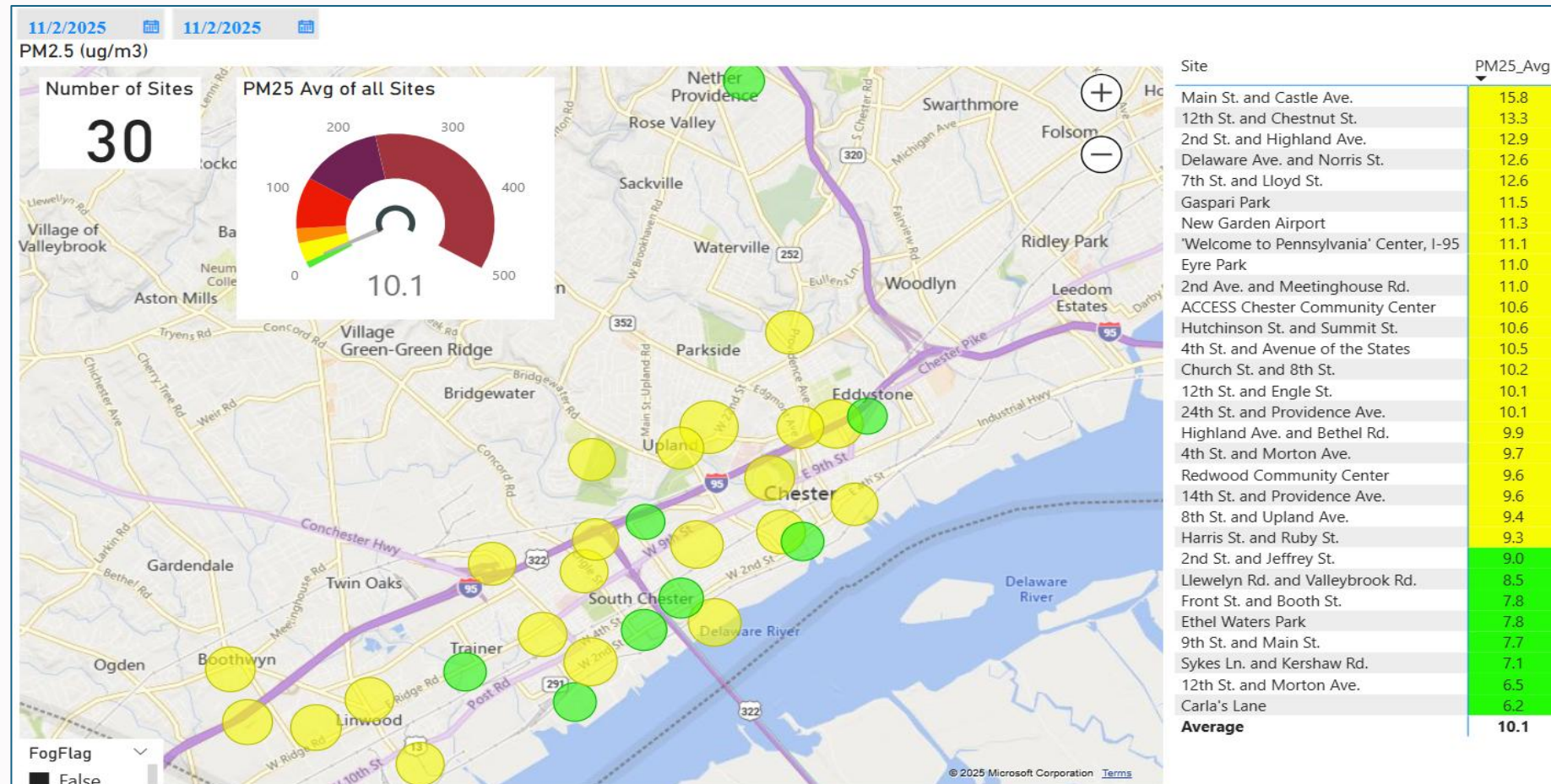


Performance Monitoring





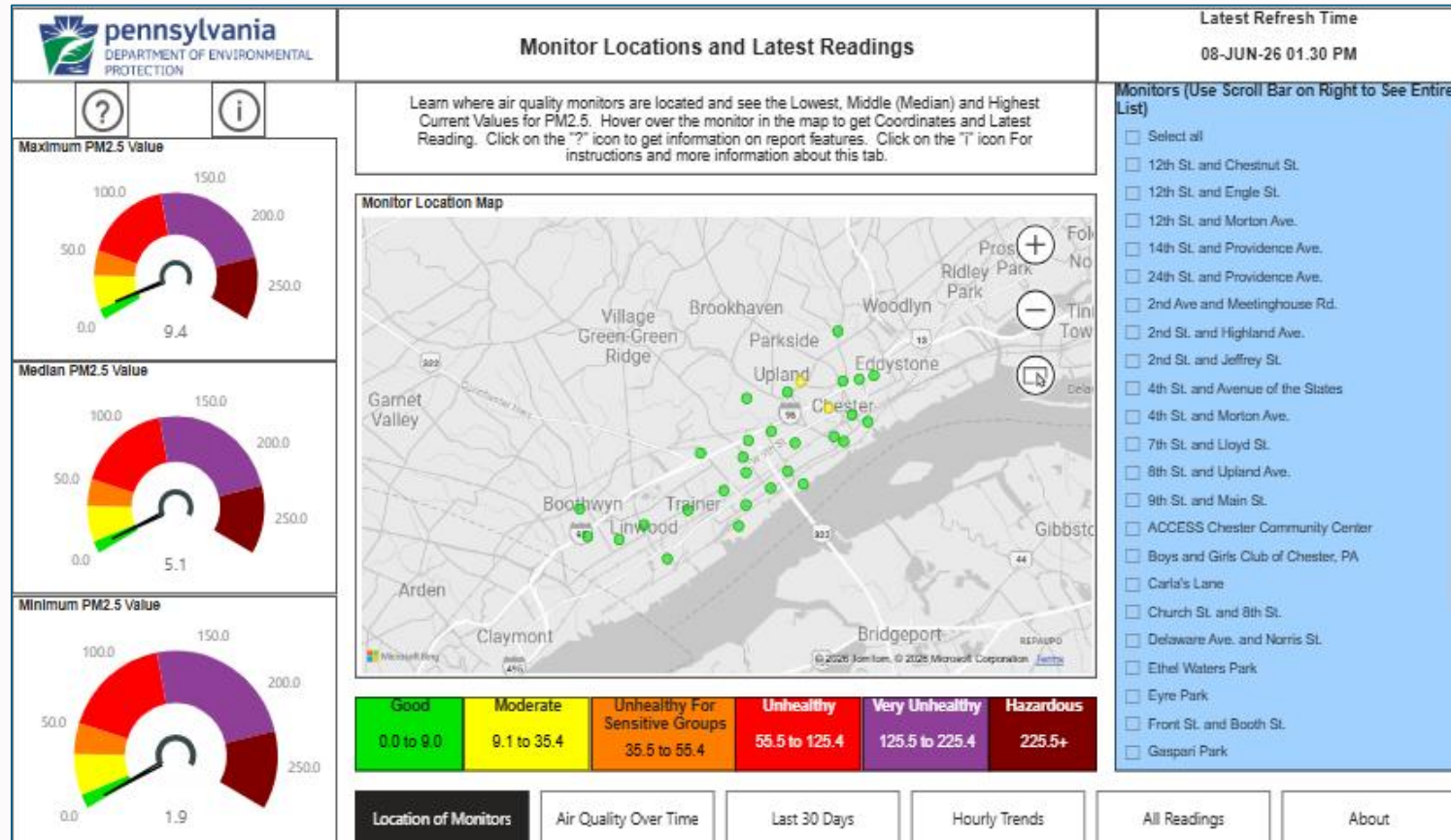
Concentration Mapping





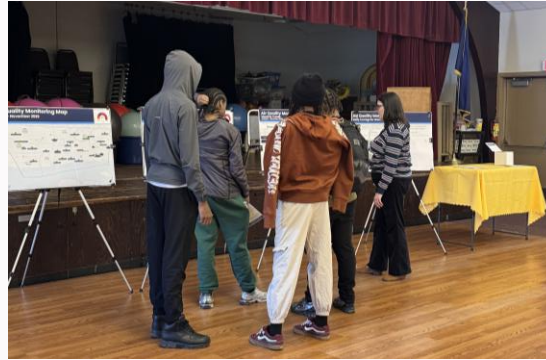
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Data Sharing



- DEP IT developed a dashboard to post nearly live information to the public.
- The intent is to provide access to community members.
- It is designed to communicate patterns to laypeople.
- Hosted on Delaware County's project website: [Air Quality Monitoring](#)
- [DelCo Quant-AQ Report - Power BI Report Server](#)

Community Engagement



- Engagement efforts are led by Delaware County Planning Dept.
- Generating community awareness of project and explanations.
- Opportunities communicate patterns to laypeople.
- Allows for questions to be answered in real time.
- Community can challenge or engage as they see fit.

Date	Number of Engagements
Sat. March 21	40
Sat. March 28	63
Tues. March 31	7
Sat. June 20	TBD (<i>not yet happened as of prep</i>)
SEPTA Transit Bus Campaign	2,260,260 (based on analytics)

* Numbers recorded by DCPD and reported to DEP

Successes

- QAPP established and approved with a minimum of fuss
- Many municipal sites and community organizations willing to help
- Great community visibility





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Challenges

- A LOT of changes from Application to Award to Deployment phases
 - Within DEP
 - In Delaware County government
 - In Chester City government
- Municipal sites along main roads, not so much in residential areas
- Meeting the needs of the Community Engagement
- Understanding DEP/OA requirements
 - License Agreements
 - Grant Agreements/Subawards
 - IT Procurement
 - Changing requirements from OGC



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Get In Touch

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The Department of Environmental Protection's mission is to protect Pennsylvania's air, land and water resources and to provide for the health and safety of its residents and visitors, consistent with the rights and duties established under the Environmental Rights Amendment (Article 1, Section 27 of the Pennsylvania Constitution).