San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

Technical Evaluation of Sensor Technology (TEST) Program

PurpleAir PA-II Sensor
2017 – 4th Quarter

Introduction and Sensor Profile

This analysis report is focused on assessing the performance of the PurpleAir PA-II sensor as a part of the District's Technical Evaluation of Sensor Technology (TEST) Program. The PurpleAir PA-II sensor uses an optical laser-based particle counting methodology to estimate the mass of varying diameters of particulate matter, including PM1, PM2.5, and PM10. The PA-II sensor also measures temperature, pressure, and relative humidity.

Background and Approach of Evaluation Test

In November of 2017, the National Aeronautics and Space Administration (NASA) began an air quality study to compare the performance of PurpleAir sensors to regulatory PM2.5 analyzers. The study is focused on the conditions in the San Joaquin Valley and is based at the California Air Resources Board (CARB) air monitoring sites of Fresno-Garland, Visalia-Church, and Bakersfield-California. The data sets compare PurpleAir sensor PM2.5 data to that of the regulatory PM2.5 data that is collocated at the three CARB sites. The scatter plots and time series graphs below show how the datasets compare for both hourly values and the 24-hour average.

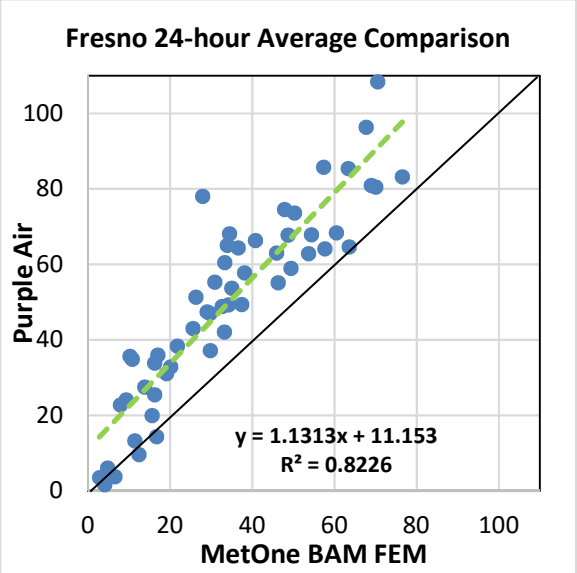
Overview of Analysis Findings from Current Period

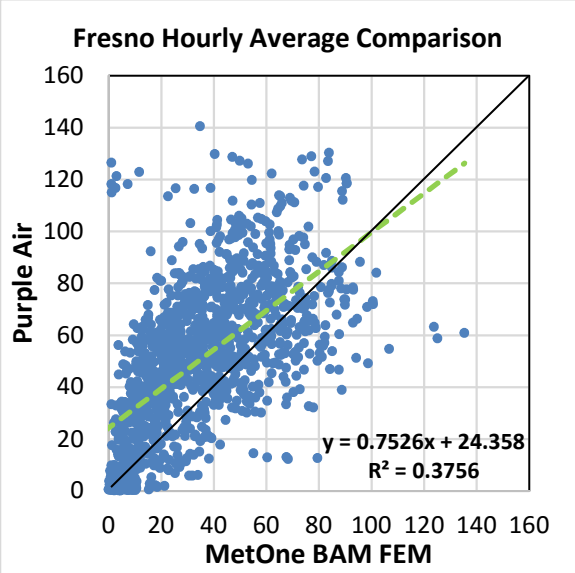
The analysis for this report covers the time period from November 3, 2017 through December 31, 2017. During the winter season of 2017-2018, incredibly poor dispersive conditions combined excessive smoke emissions from the Thomas fire in southern California caused very high PM2.5 at times during this period. Satellite imagery tracked smoke up the Pacific coast and through numerous passes until it infiltrated the Central Valley. During this analysis period, PurpleAir PM2.5 data trended higher in the hourly averages as well as the daily averages across all three locations.

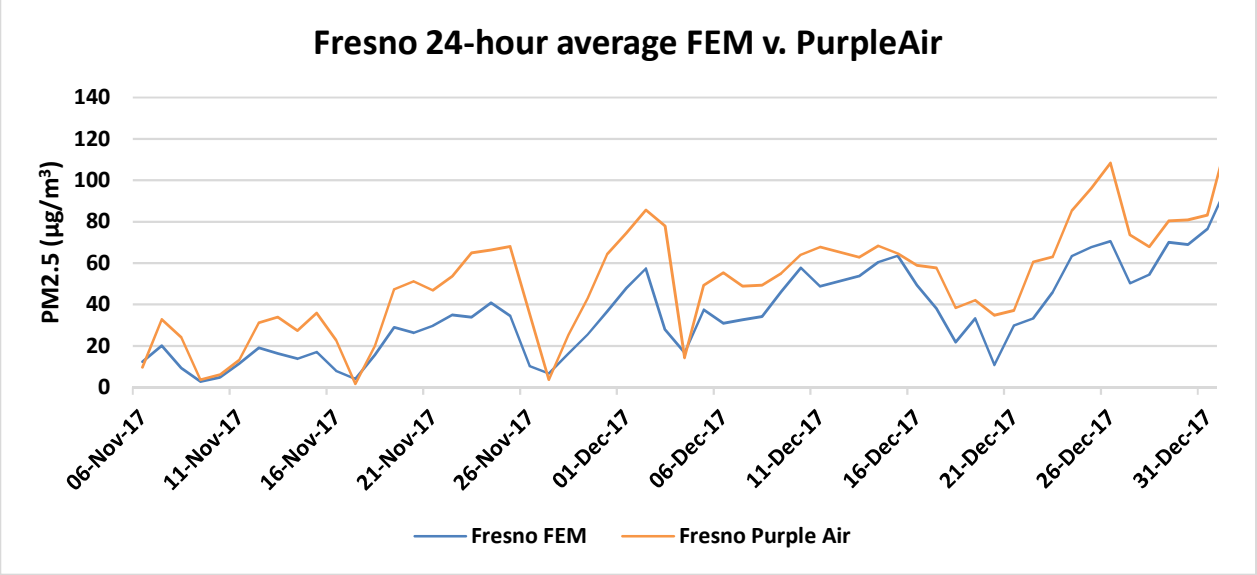
Site Specific Analysis of PurpleAir PA-II Sensor Performance

Fresno-Garland

For the 24-hour average, PurpleAir data had a 15.37 µg/m^3 high bias from November 6, 2017 through December 31, 2017. For the hourly average, PurpleAir data had a 15.82 µg/m^3 high bias over the same period.

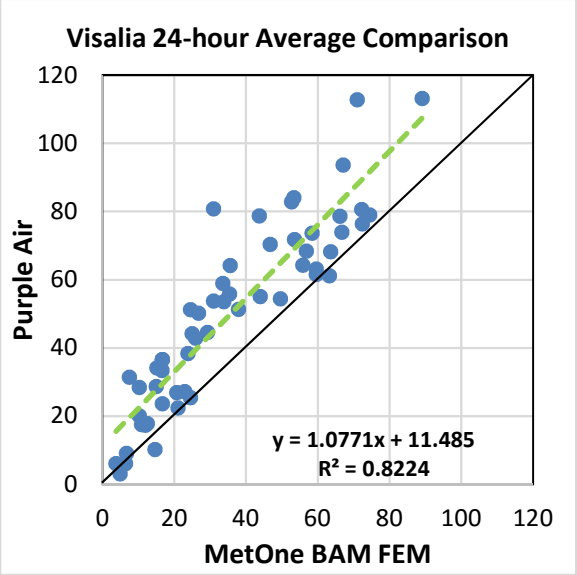


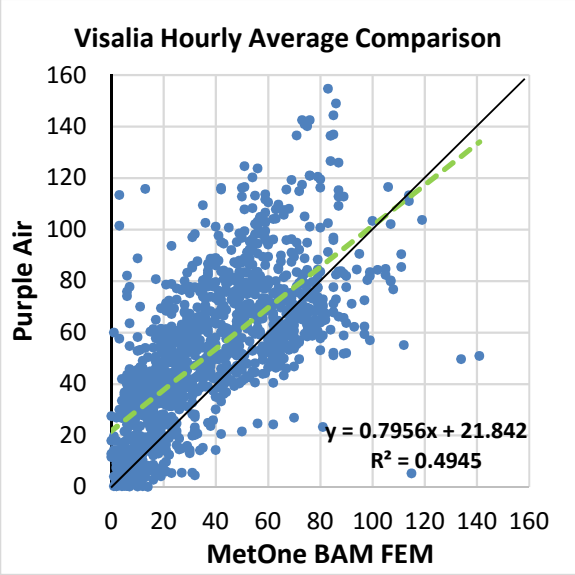


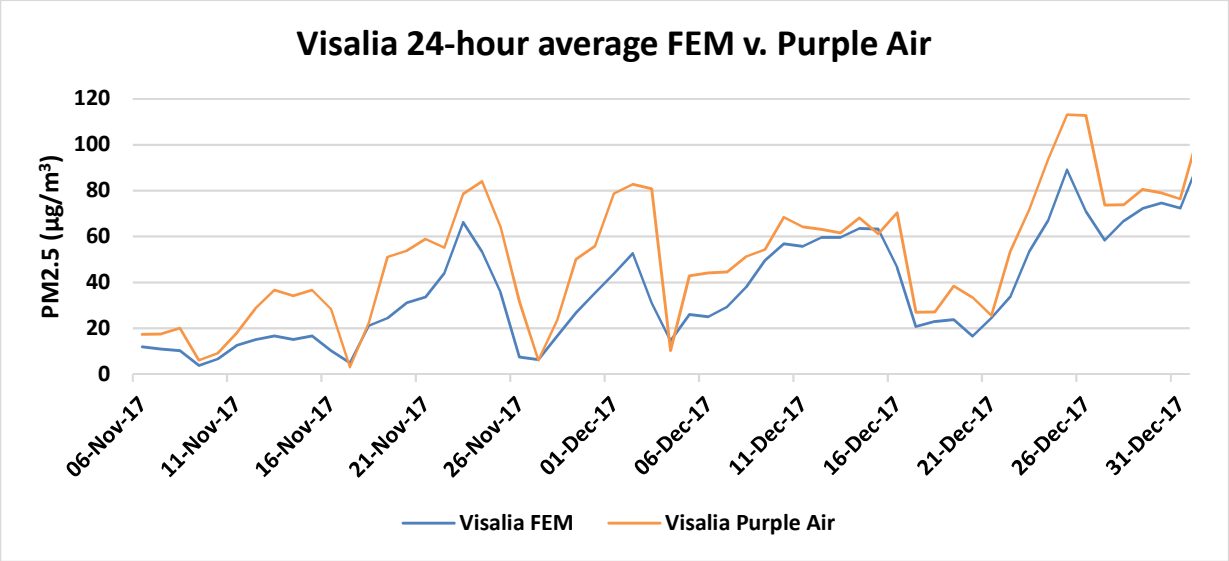


Visalia-Church

For the 24-hour average, PurpleAir data had a 14.26 µg/m^3 high bias from November 6, 2017 through December 31, 2017. For the hourly average, PurpleAir data had a 14.41 µg/m^3 high bias over the same period.

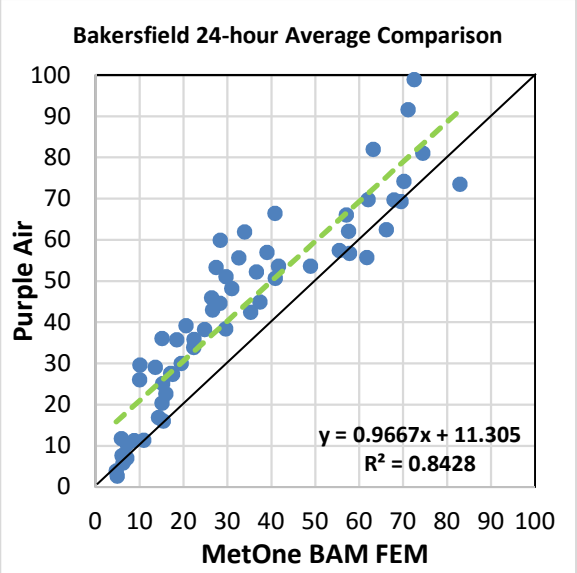


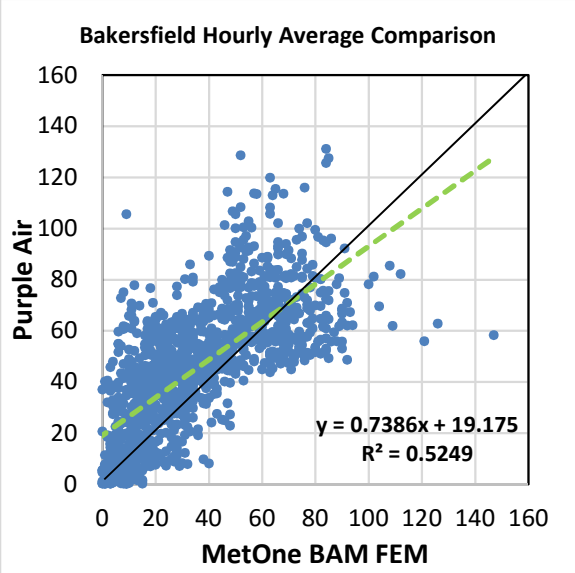


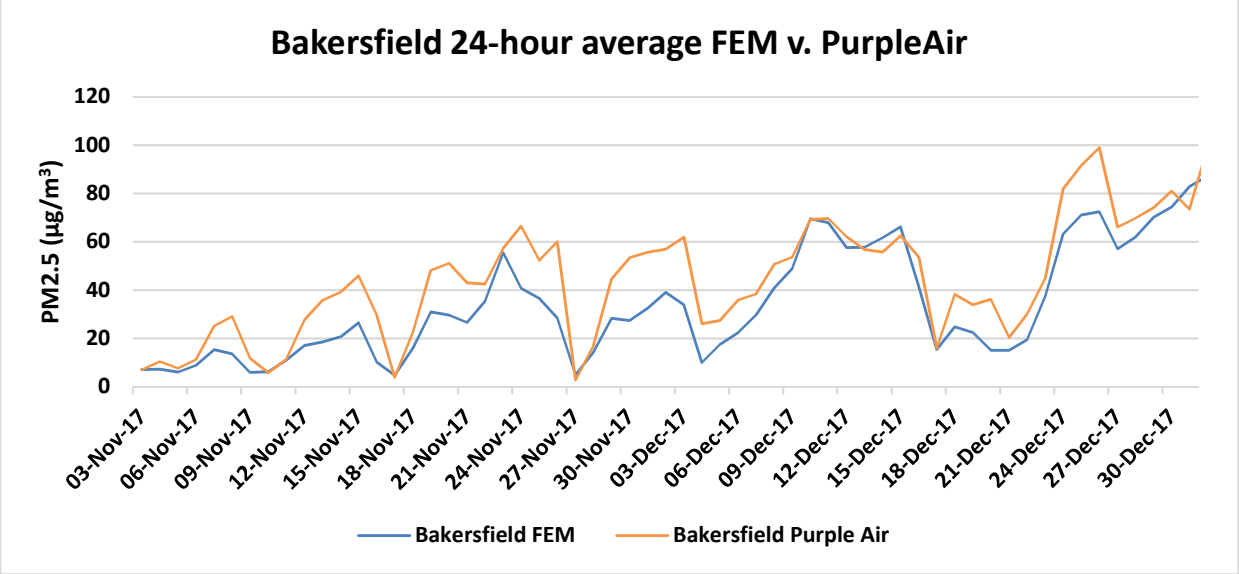


Bakersfield-California

For the 24-hour average, PurpleAir data had a 10.20 µg/m^3 high bias from November 3, 2017 through December 31, 2017. For the hourly average, PurpleAir data had a 10.46 µg/m^3 high bias over the same period.







Statistical Summary

The following table provides a statistical summary of the data collected during the analysis period of this report.

Statistic	Fresno-Garland	Visalia-Church	Bakersfield-Cal
FEM Avg	34.43	36.06	33.11
Sensor Avg	49.80	50.32	43.31
FEM 1-hr Max	135.4	141	147
Sensor 1-hr Max	140.50	154.69	131.07
FEM 24-hr Max	76.5	89.1	82.9
Sensor 24-hr Max	108.36	113.11	98.93
1-hr R^2	0.3756	0.4945	0.5249
1-hr Slope	0.7526	0.7956	0.7386
1-hr Intercept	24.358	21.842	19.175
24-hr R^2	0.8226	0.8224	0.8428
24-hr Slope	1.1313	1.0771	0.9667
24-hr Intercept	11.153	11.485	11.305