San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

Technical Evaluation of Sensor Technology (TEST) Program

AirBeam Sensor
2020 – 4th Quarter

Introduction and Sensor Profile

This analysis report is focused on assessing the performance of the AirBeam sensor as part of the San Joaquin Valley Air Pollution Control District's (District's) Technical Evaluation of Sensor Technology (TEST) Program. The AirBeam sensor measures particulate matter (PM1, PM2.5, and PM10) using a light scattering method. As air is drawn through a sensing chamber, light from a laser scatters off of particles in the air stream. The AirBeam sensor also measures temperature and relative humidity.

Background and Approach of Evaluation Test

As part of the District's effort to evaluate the performance of a variety of low-cost sensors in the Valley, the District installed three AirBeam sensors at the Clovis-Villa air monitoring site in order to compare its performance with that of the regulatory PM2.5 monitor there. The AirBeam sensors first began reporting data on May 3, 2019. The datasets analyzed for this report include hourly and 24-hour average PM2.5 data collected from the AirBeam sensors and the regulatory Federal Equivalent Method (FEM) MetOne BAM-1020 continuous PM2.5 monitor at the Clovis-Villa site. 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

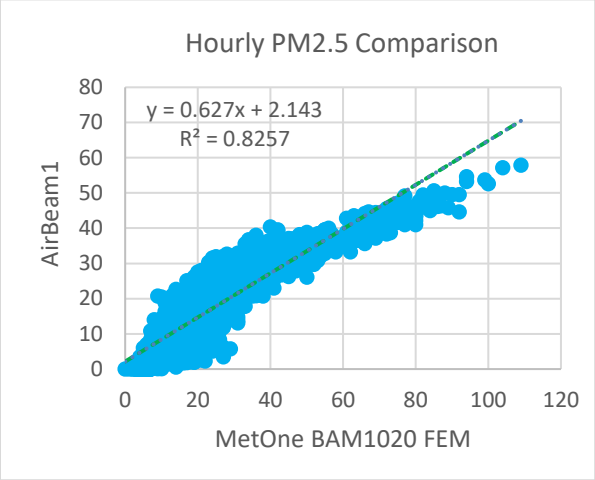
The analysis for this report covers the time period of October 1, 2020 through December 31, 2020 (2020 – 4th quarter). During this period, hourly data was removed from the calculation of bias when either the AirBeam sensor or regulatory monitor did not have a valid hourly sample. For the 24-hour averages, only days with 18 or more valid hourly samples (75% or greater completeness) are included.

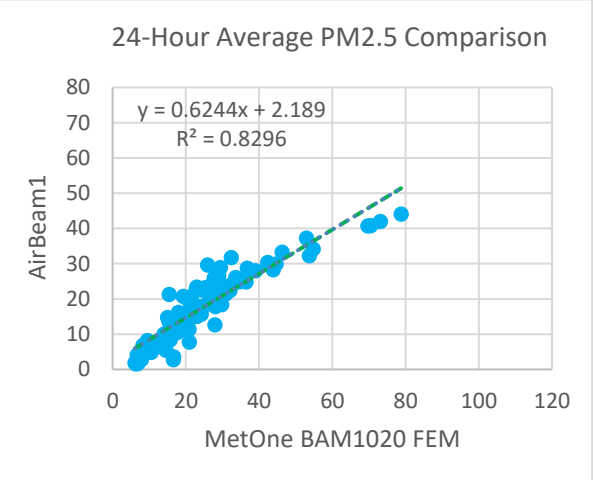
Seasonally, PM2.5 is typically highest during the winter months and lowest during the summer months. Weather systems can influence PM2.5 levels by either trapping pollutants near the surface or dispersing them. Generally, California's weather pattern is characterized by high pressure systems and low pressure systems that move through the region every two to four days in alternating fashion however the high pressure systems that built over the region in October 2020 remained in place for longer durations of time. Much of October was characterized by elevated PM2.5 levels due to the combination of extended periods of strong stability and wildfire smoke impacts. Wildfire activity subsided in November 2020 and PM2.5 concentrations were able to decrease through the month. An alternating pattern of high and low pressures systems moved through region during December, however, the trajectories of most of the low pressure systems that passed through were such that they did not provide good dispersion for the Valley. Thus the majority of December was governed by stability and elevated PM2.5 levels.

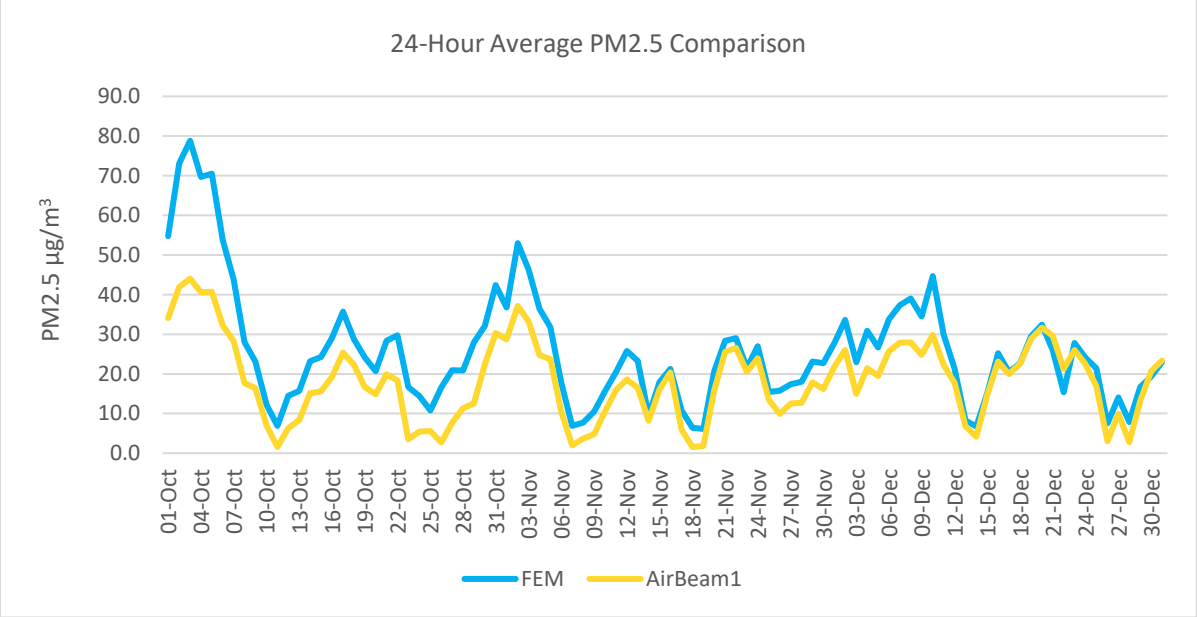
Analysis of AirBeam Sensor Performance

AirBeam1

For the 24-hour average, AirBeam data had a low bias of 7.5 µg/m^3 during the October 1, 2020 through December 31, 2020 period. For the hourly average, AirBeam data had a low bias of 7.4 µg/m^3 over the same period.







Non-Reporting Analyzers

AirBeam0 and AirBeam2

Data from these sensors was not available for the October 1, 2020, through December 31, 2020, period. These sensors will be included in future analysis reports if the data becomes available.

Statistical Summary

The following table provides a statistical summary of the PM2.5 data collected during the analysis period of this report.

Clovis-Villa	Average 24-hr	Max 1-hr	Max 24-hr	1-hr R2	1-hr Slope	1-hr Intercept	24-hr R2	24-hr Slope	24-hr Intercept
AirBeam0	---	---	---	---	---	---	---	---	---
AirBeam1	18.3	59.7	44.0	0.8257	0.627	2.143	0.8296	0.6244	2.189
AirBeam2	---	---	---	---	---	---	---	---	---
FEM	25.8	171	78.8						