San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

Technical Evaluation of Sensor Technology (TEST) Program

AirBeam Sensor
2021 –1st 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

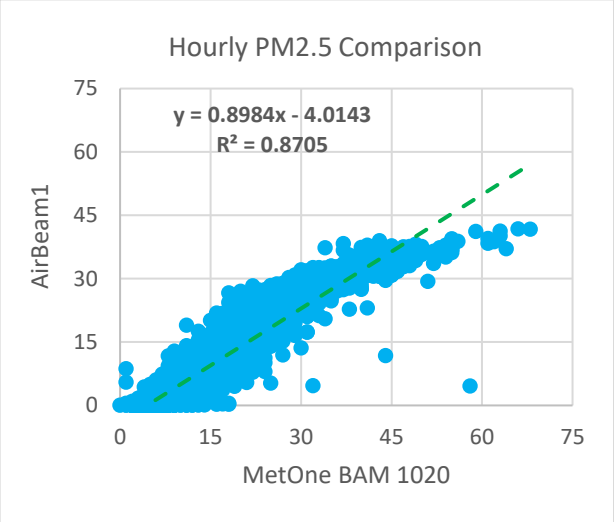
The analysis for this report covers the time period of January 1, 2021, through March 31, 2021, (2021 – 1st quarter). During this period, hourly data was removed from the calculation of bias when either the AirBeam sensor or regulatory monitor did not have a valid hourly sample. For the 24-hour averages, only days with 18 or more valid hourly samples (75% or greater completeness) are included.

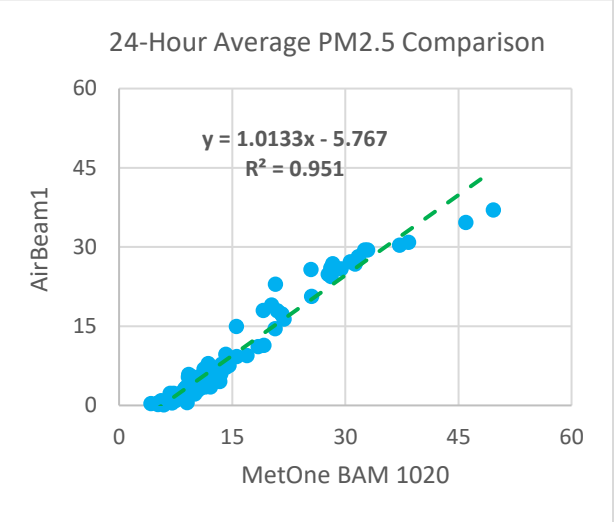
Seasonally, PM2.5 is typically highest during the winter months and lowest during the summer months. Generally, California's weather pattern is characterized by high pressure systems and low pressure systems that move through the region every two to four days in alternating fashion, however the beginning of the quarter did not start out that way. The first 2 ½ weeks of January were dominated by strong high pressure which kept PM2.5 concentrations elevated during that period. By the third week of January, the weather pattern became more active as low pressure systems began making their way into California. With the exception of a four day stretch of stable conditions during early February, an alternating pattern of high and low pressures systems rendered overall better dispersion conditions across the Valley through the end of the quarter. Indeed, the high pressure systems that developed over the region during February and March were weaker and short-lived compared to those that dominated during January. Thus PM2.5 levels had decreased significantly by the time quarter one ended.

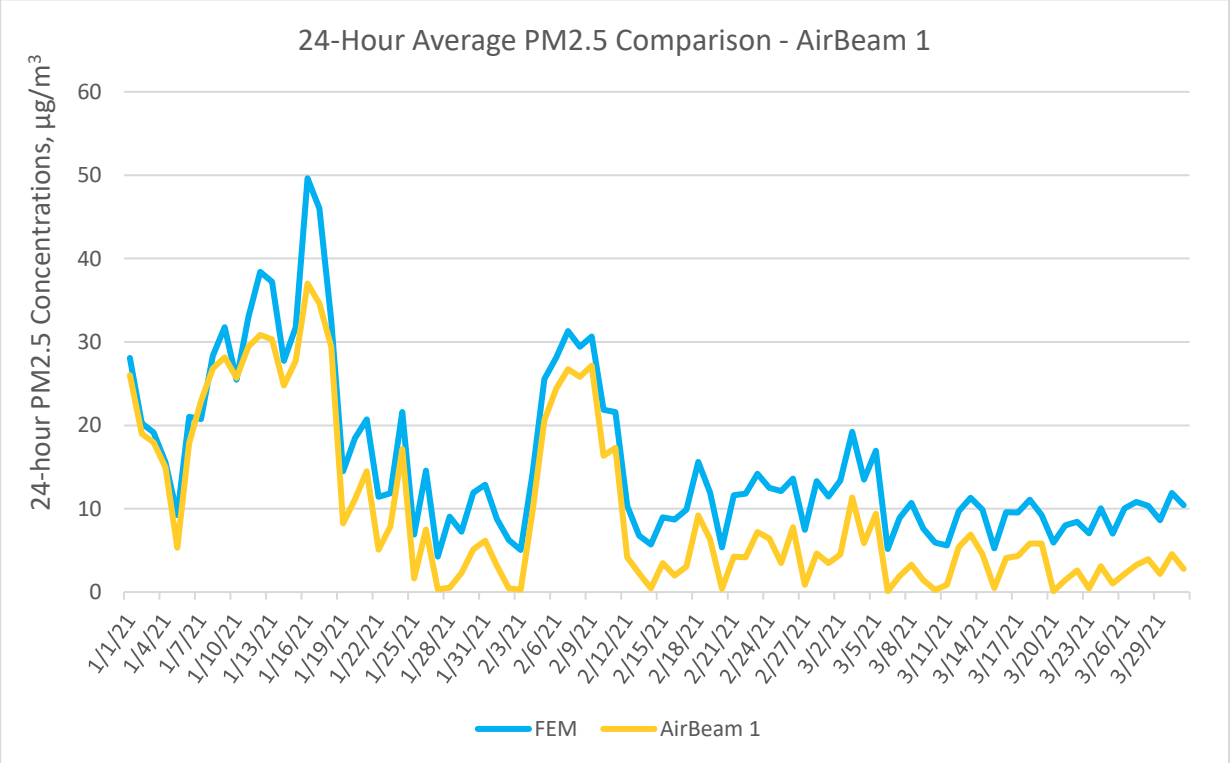
Analysis of AirBeam Sensor Performance

AirBeam1

For the 24-hour average, AirBeam data had a low bias of 5.6 µg/m^3 during the January 1, 2021, through March 31, 2021, period. For the hourly average, AirBeam data had a low bias of 5.6 µg/m^3 over the same period.







Non-Reporting Sites

AirBeam0 and AirBeam2

Data from these sensors was not available for the January 1, 2021, through March 31, 2021, period. These sensors sustained a hardware failure and are no longer operating.

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	9.8	41.7	37.0	0.8705	0.8984	-4.0143	0.951	1.0133	-5.767
AirBeam2	---	---	---	---	---	---	---	---	---
FEM	15.4	68.0	49.6						