San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

Technical Evaluation of Sensor Technology (TEST) Program

AirBeam Sensor
2019 – 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

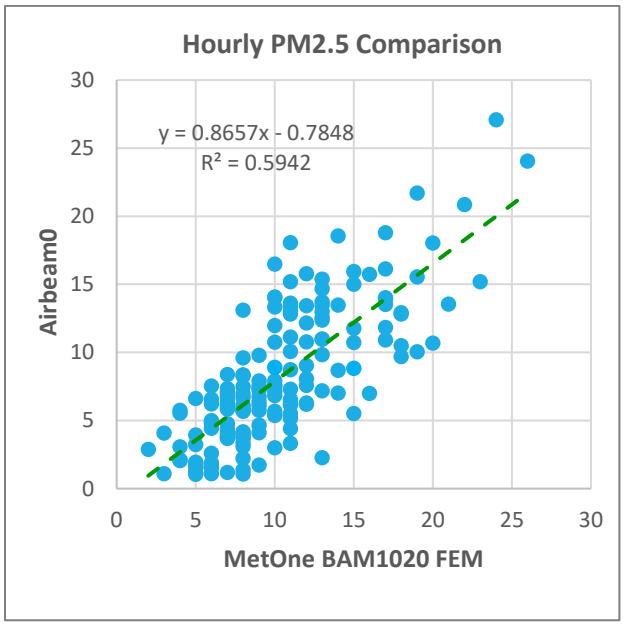
The analysis for this report covers the time period of October 1, 2019, through December 31, 2019 (2019 – 4th quarter). During this period, hourly data was removed from the calculation of bias when either the AirBeam sensor or regulatory monitor did not have a valid hourly sample. For the 24-hour averages, only days with 18 or more valid hourly samples (75% or greater completeness) are included.

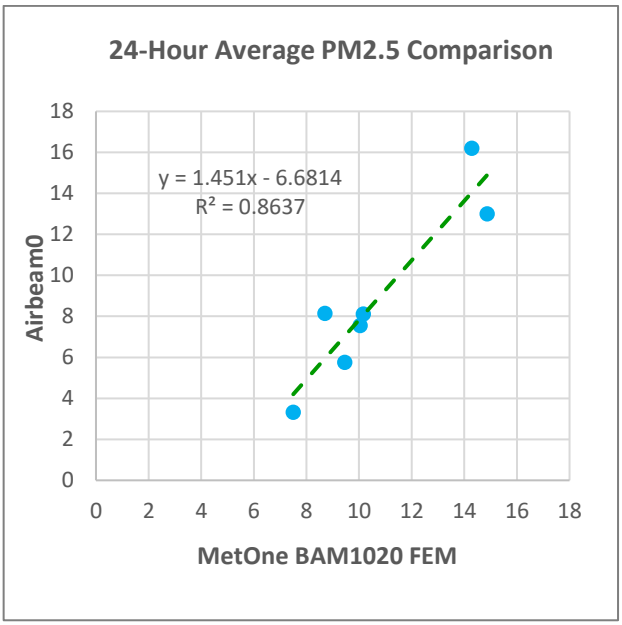
Seasonally, PM2.5 is typically highest during the winter months and lowest during the summer months. Weather systems can also influence PM2.5 levels by either trapping pollutants near the surface or dispersing them. During the 4th quarter of 2019, an alternating pattern of high pressure and low pressure systems moved through the region. The high pressure systems produced stable conditions and poor dispersion, which led to elevated PM2.5 concentrations across the Valley, particularly in the central and southern portions of the District during October and November. The low pressure systems that passed through brought cooler air and dispersive conditions to the Valley which helped lower PM2.5 concentrations. However there were two exceptions - one which occurred in late October and the other in late November. Those two systems were energetic enough to generate gusty winds and cause blowing dust which led to elevated PM concentrations in many Valley locations.

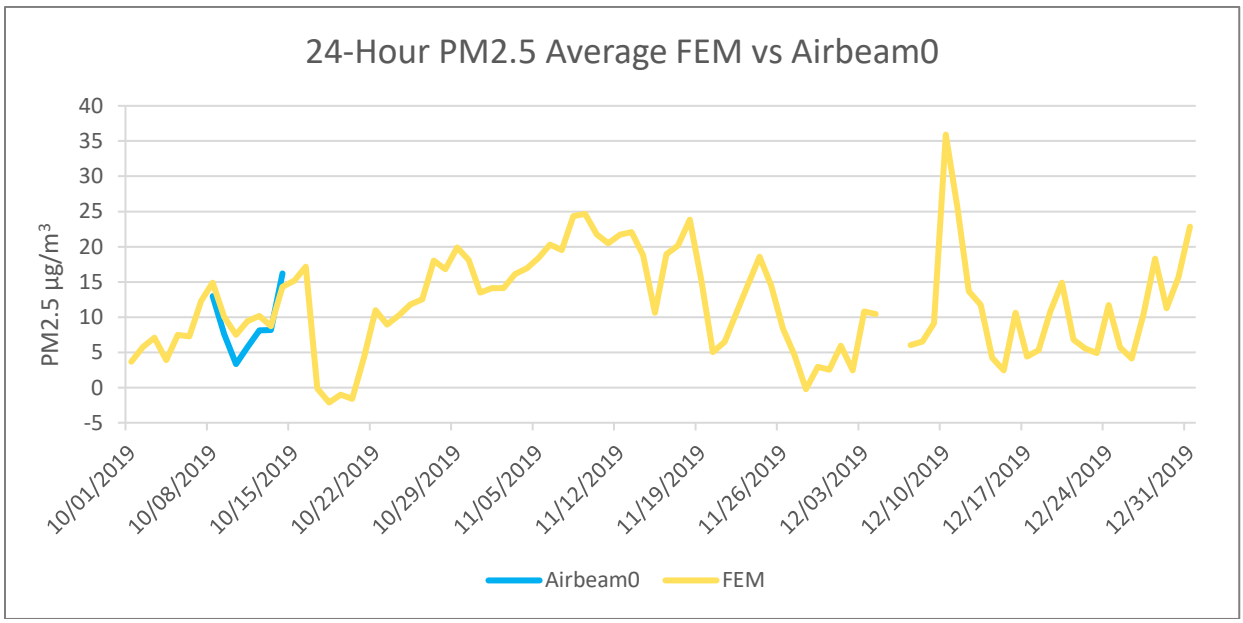
Site Specific Analysis of AirBeam Sensor Performance

AirBeam0

For the 24-hour average, AirBeam data had a low bias 4 µg/m^3 during the October 1, 2019 through December 31, 2019 period. For the hourly average, AirBeam data had a low bias of 2 µg/m^3 over the same period.

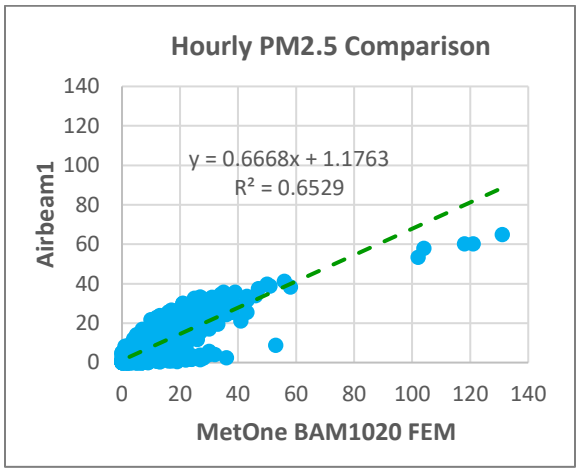


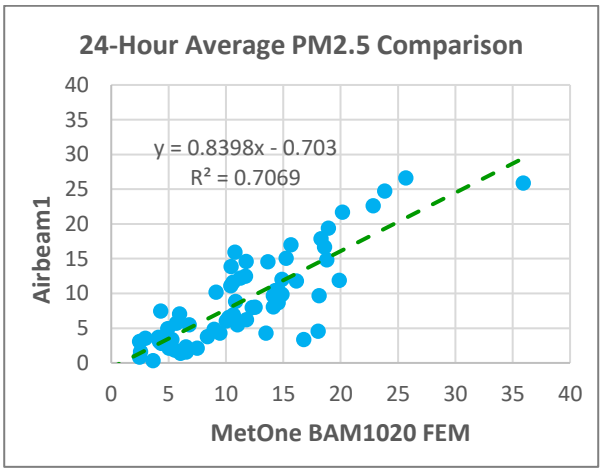


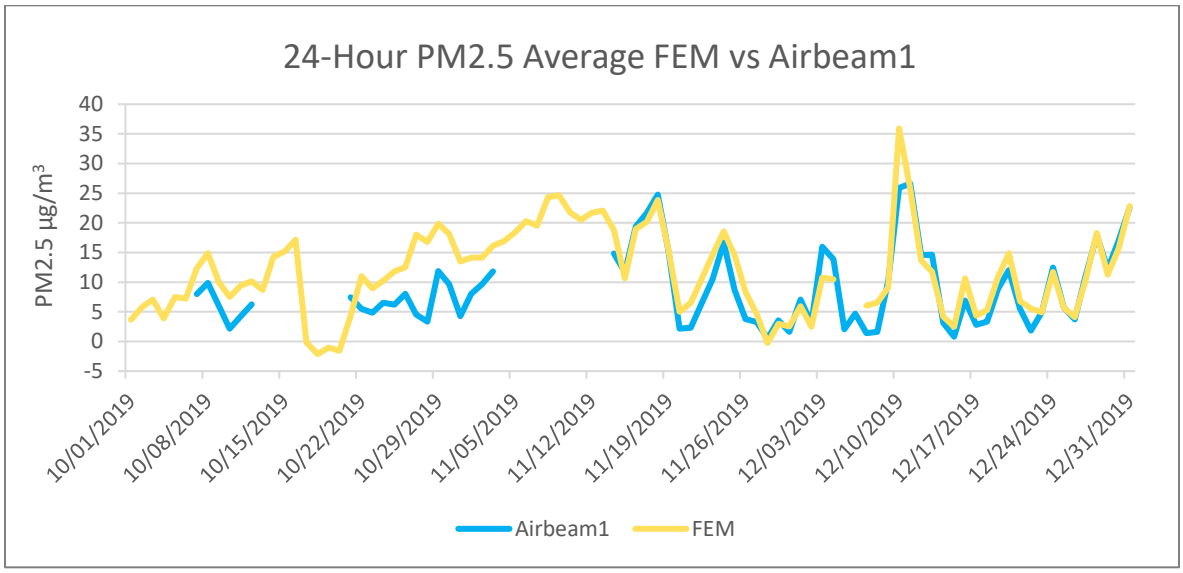


AirBeam1

For the 24-hour average, AirBeam data had a low bias of 3 µg/m^3 during the October 1, 2019 through December 31, 2019 period. For the hourly average, AirBeam data had a low bias of 5 µg/m^3 over the same period.

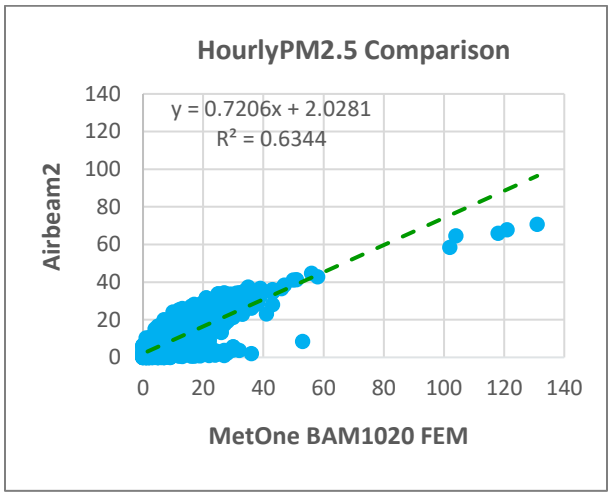


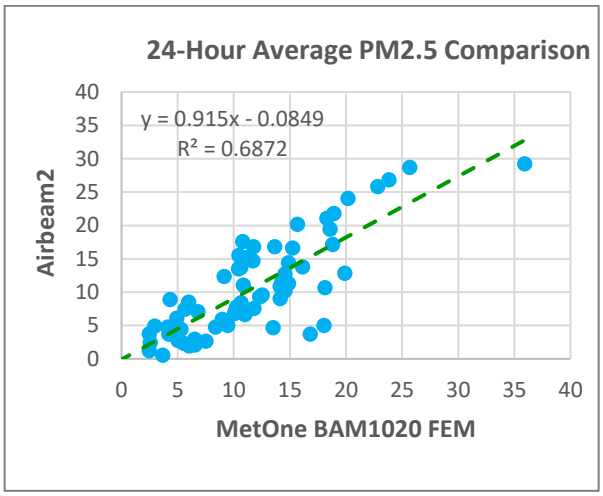


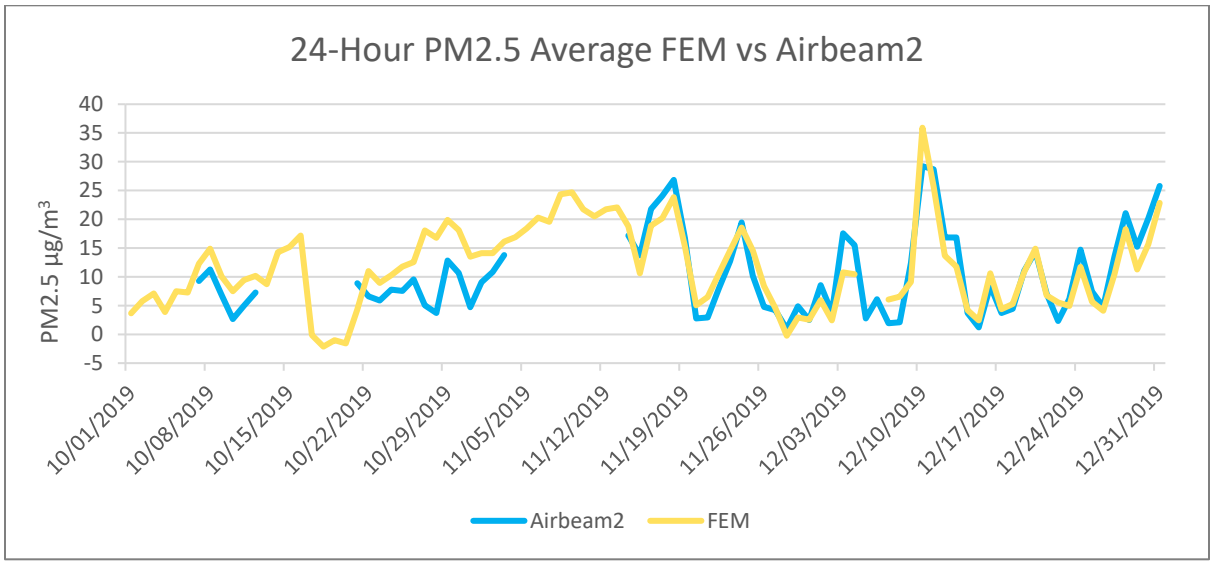


AirBeam2

For the 24-hour average, AirBeam data had a low bias of 1 µg/m^3 during the October 1, 2019 through December 31, 2019 period. For the hourly average, AirBeam data had a low bias of 4 µg/m^3 over the same period.







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	9	27	16	0.5942	0.8657	-0.7848	0.8637	1.451	-6.6814
AirBeam1	9	65	27	0.6529	0.6668	1.1763	0.7069	0.8398	-0.703
AirBeam2	10	71	29	0.6344	0.7206	2.0281	0.6872	0.915	-0.0849
FEM	11	131	36						