San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

# Technical Evaluation of Sensor Technology (TEST) Program

***AirBeam Sensor***
***2020 – 3rd 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***

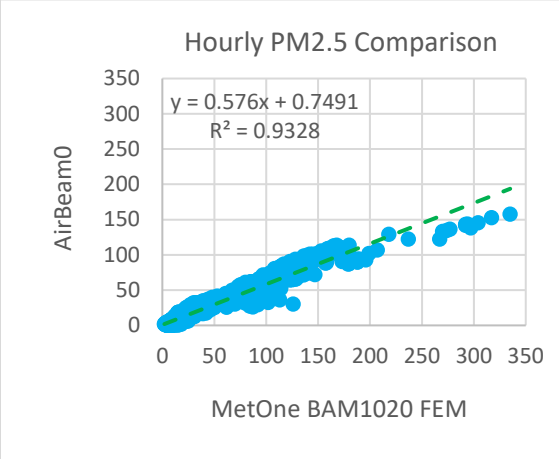
The analysis for this report covers the time period of July 1, 2020 through September 30, 2020 (2020 – 3rd quarter). During this period, hourly data was removed from the calculation of bias when either the AirBeam sensor or regulatory monitor did not have a valid hourly sample. For the 24-hour averages, only days with 18 or more valid hourly samples (75% or greater completeness) are included.

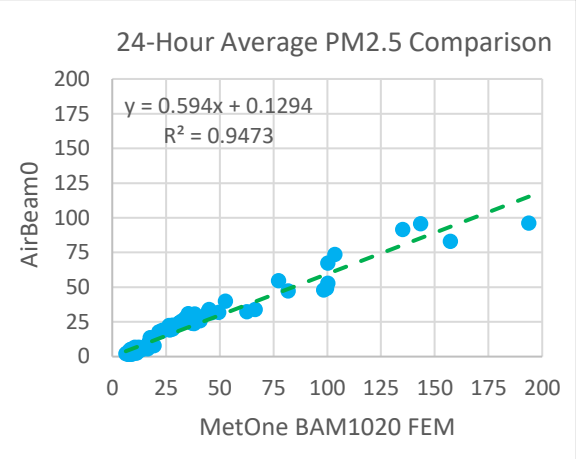
Seasonally, PM2.5 is typically highest during the winter months and lowest during the summer months. Weather systems can influence PM2.5 levels by either trapping pollutants near the surface or dispersing them. Generally, California's weather pattern is characterized by high pressure systems and low pressure systems that move through the region every two to four days in alternating fashion as was the case during the first three weeks in July and the month of September of 2020. In contrast, high pressure patterns became more dominant from late July through August and led to many days of triple digit temperatures and poor dispersion. PM2.5 levels remained low through most of the 3rd quarter until wildfire activity began across the state and smoke drifted into the San Joaquin Valley from all directions during the last week of August and through September. Low pressure systems were prevalent during September but they were short duration systems that brought little rain to quell the wildfires and only dispersed smoke out of the area for brief periods of time. Thus PM2.5 concentrations remained elevated from late August through the end of the 3rd quarter.

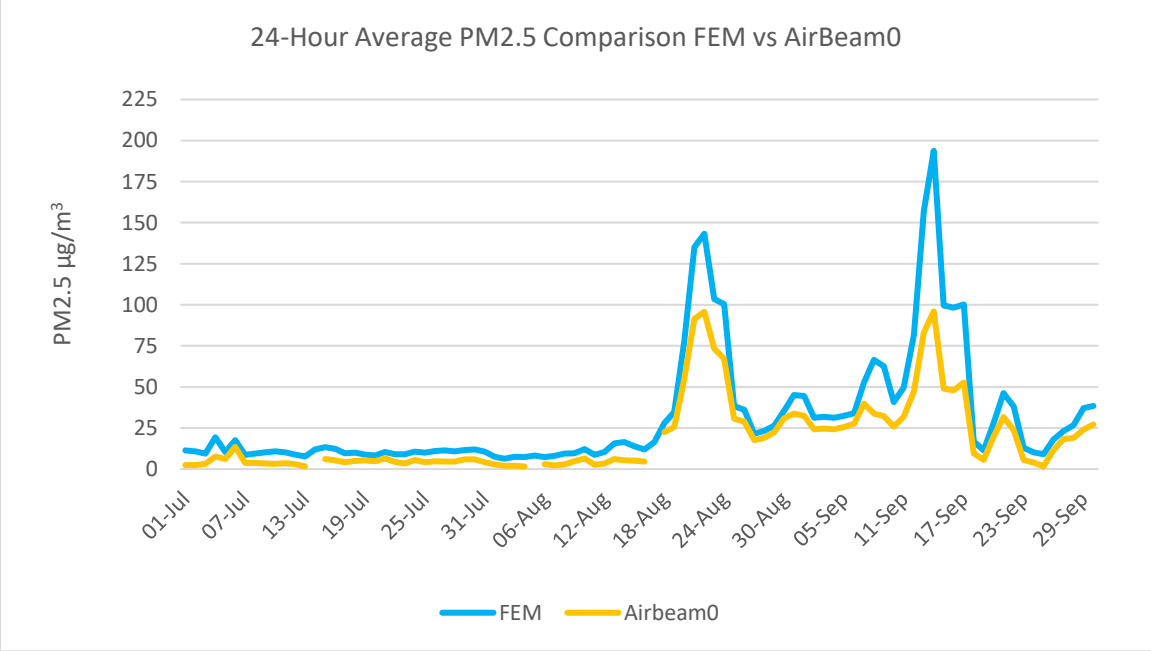
## ***Site Specific Analysis of AirBeam Sensor Performance***

### AirBeam0

For the 24-hour average, AirBeam data had a low bias of -12.6 µg/m$^3$ during the July 1, 2020 through September 30, 2020 period. For the hourly average, AirBeam data had a low bias of -12.7 µg/m$^3$ over the same period.

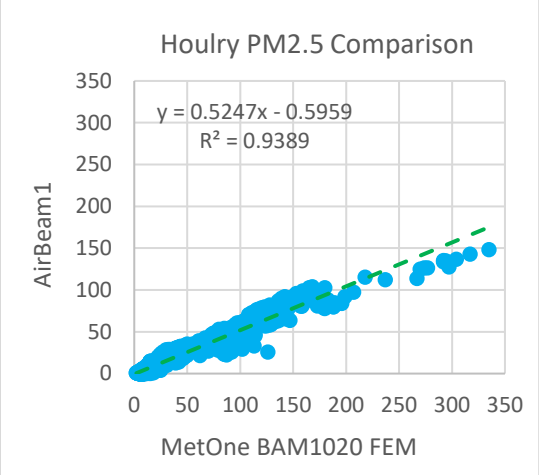


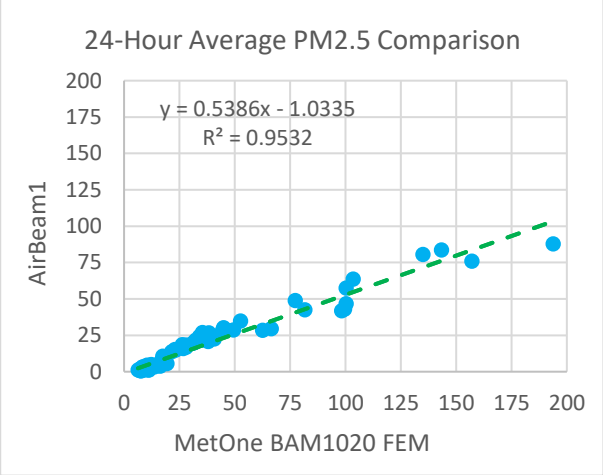



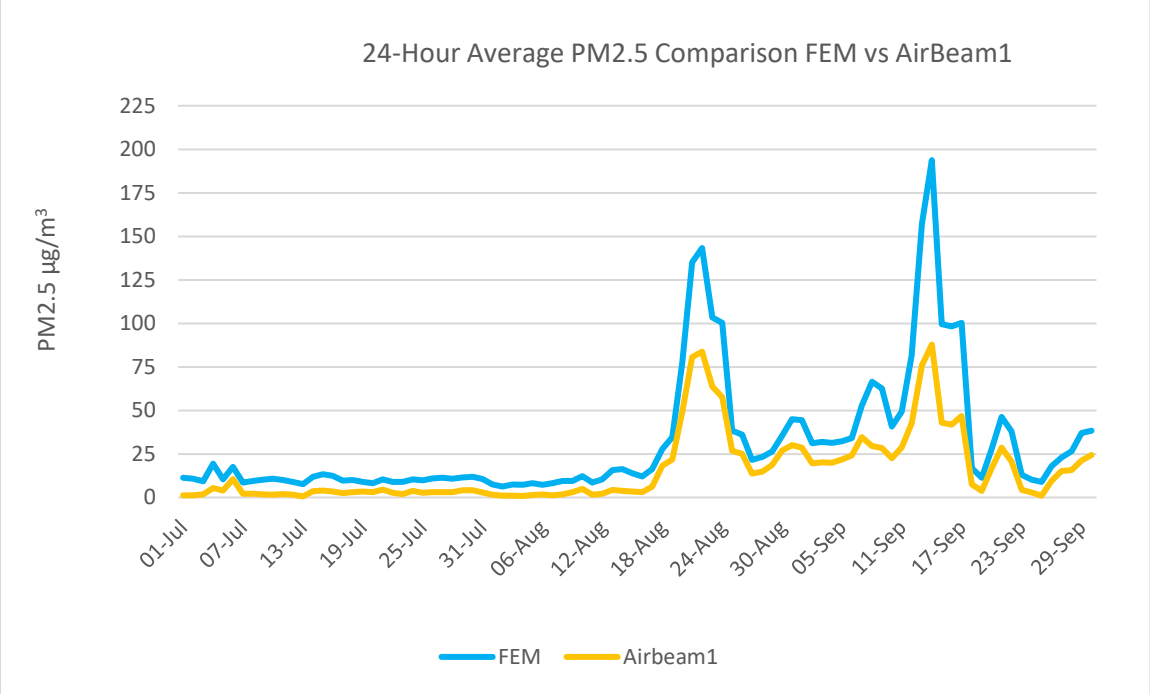



**AirBeam1**

For the 24-hour average, AirBeam data had a low bias of -15.5 µg/m$^3$ during the July 1, 2020 through September 30, 2020 period. For the hourly average, AirBeam data had a low bias of -15.5 µg/m$^3$ over the same period.



## ***Non-Reporting Analyzers***

**AirBeam2**

Data from this sensor was not available for the July 1, 2020, through September 30, 2020, period. This sensor 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 | 19.2 | 157.6 | 96.0 | 0.9328 | 0.576 | 0.7491 | 0.9473 | 0.594 | 0.1294 |
| AirBeam1 | 15.8 | 148.3 | 87.8 | 0.9389 | 0.5247 | -0.5959 | 0.9532 | 0.5386 | -1.0335 |
| AirBeam2 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| FEM | 31.3 | 335.0 | 193.8 | | | | | | |