



Technical Evaluation of Sensor Technology (TEST) Program

*AirBeam Sensor
2021 –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 AirBeam1 sensor 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 AirBeam1 sensor 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, 2022 through December 31, 2022, (2021 – 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. This pattern essentially held true during October and PM2.5 concentrations decreased or increased in response to dispersion or lack thereof. During early October, the presence of high pressure systems over the region exacerbated wildfire smoke impacts and kept the Valley's PM2.5 concentrations elevated as a result. In contrast, the low pressure systems that moved through the region thereafter were dispersive enough to help scour pollution out of the Valley. The one exception occurred on October 11 when a low pressure system generated high winds that caused blowing dust across the Valley. November proved to be a more stable month due to the dominance of high pressure systems and poor dispersion. As such, only two dispersive low pressure systems helped improve the Valley's air quality during November. December on the other hand was a much more dispersive month governed by low pressure systems that scoured pollution out of the Valley and helped keep

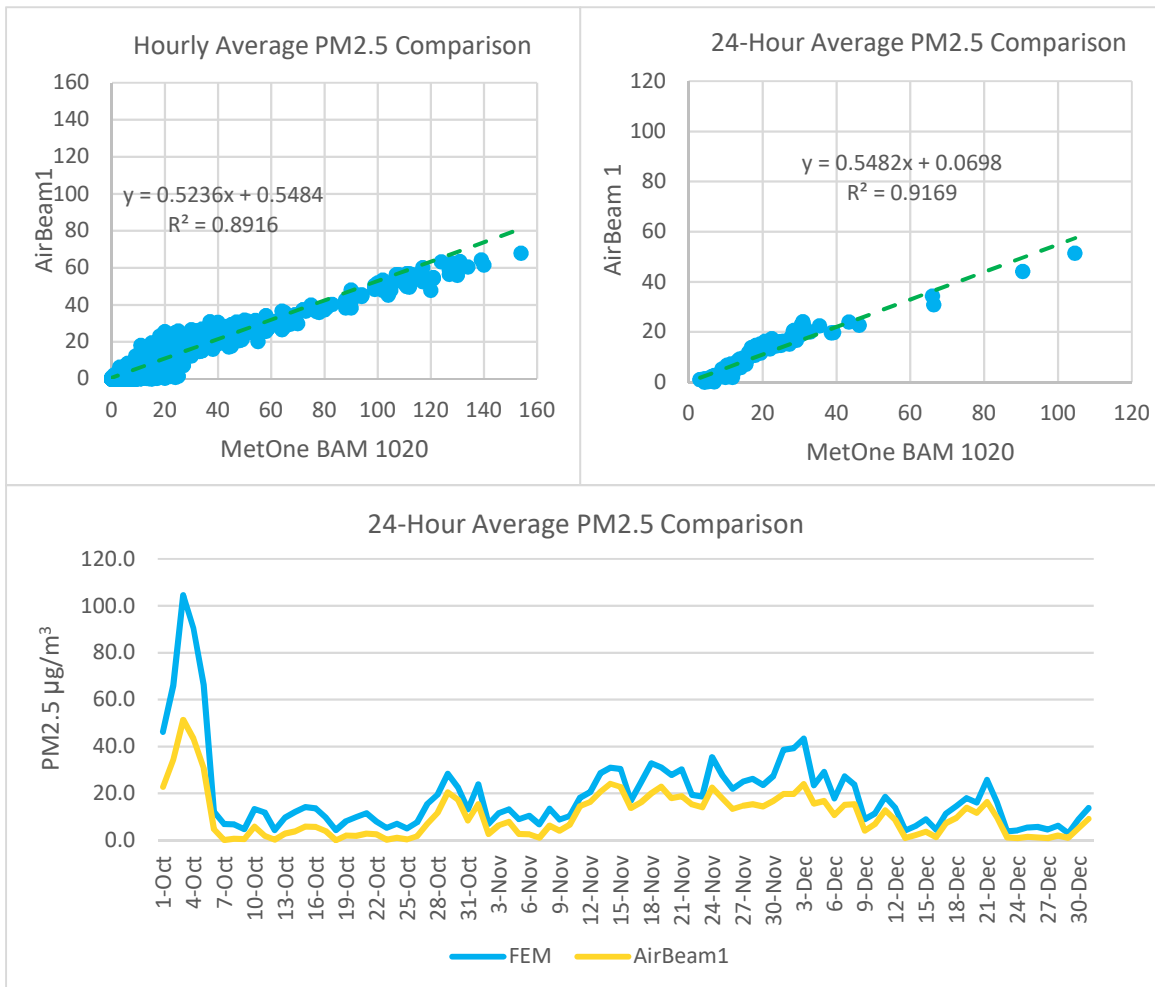
PM2.5 concentrations low. The 4th quarter ended with much improved air quality and good dispersion conditions through the Valley.

During the 2021 4th quarter, the Air Beam 1 sensor and the MetOne BAM1020 monitor responded similarly to the fluctuations in concentrations. Although the instruments essentially mirrored each other regarding the fluctuating patterns, the line chart below shows that the AirBeam1 sensor measured lower compared to the MetOne BAM 1020 monitor.

Analysis of AirBeam Sensor Performance

AirBeam1

For the 24-hour average, AirBeam data had a low bias of -8.6 µg/m³ during the October 1, 2022 through December 31, 2022, period. For the hourly average, AirBeam data had a low bias of -8.6 µg/m³ over the same period.



Non-Reporting Sites

AirBeam0 and AirBeam2

Data from these sensors was not available for the October 1, 2022 through December 31, 2022, 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	10.6	68.0	51.4	0.8916	0.5236	0.5484	0.9169	0.5482	0.0698
AirBeam2	---	---	---	---	---	---	---	---	---
FEM	19.2	154.0	104.6						