San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

# Technical Evaluation of Sensor Technology (TEST) Program

***Dylos Sensor***
***2022 – 3rd Quarter***
***(Final Report)***

## ***Introduction and Sensor Profile***

This analysis report is focused on assessing the performance of the Dylos DC1100 sensor as a part of the District's Technical Evaluation of Sensor Technology (TEST) Program. The Dylos sensor uses optical laser-based particle counting methodology to estimate the concentration of PM2.5 and PM10. The Dylos sensor counts and measures the size of the individual particles to calculate a mass concentration.

## ***Background and Approach of Evaluation Test***

In May 2019, the District installed three Dylos sensors at the Clovis-Villa air monitoring station for the purpose of testing the Dylos sensors in the San Joaquin Valley and comparing the performance of the collocated Dylos sensors to the Federal Equivalent Method (FEM) PM2.5 analyzer. The data sets analyzed for this report compare PM2.5 data collected from the Dylos sensors and the MetOne BAM-1020 FEM monitor collocated at the regulatory air monitoring 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 2022 through August 2022 (2022 – 3rd Quarter). During this period, hourly data was removed from the calculation of bias when either the Dylos 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.

Of the three Dylos sensors collocated at the Clovis site, only Dylos 1 and Dylos 2 were in operation during the 2022 3rd quarter. Dylos 1 stopped operating and was removed on August 29th and the Dylos 2 stopped operating and was removed on July 21st. Although there is not a 75% completeness or greater for the 3rd quarter, this analysis covers the period when the Dylos sensors were in operation. For the scatter plots and line graph, all available data are shown.

Seasonally, PM2.5 is typically highest during the winter months and lowest during the summer months. Weather systems influence PM2.5 levels by either trapping pollutants near the surface or dispersing them. Generally, California's experiences weather patterns that alternate between high pressure systems and low pressure systems that move through the region every two to four days. High pressure systems dominated much of the 3rd quarter of 2022 wherein strong atmospheric stability and long stretches of triple digit temperatures presided over the Valley. Indeed, only two low pressure systems brought improved dispersion, lower temperatures, and a bit of precipitation during the quarter – one during the first week of July and the other during the third week of September. Under the hot and stagnant conditions,

ozone concentrations rose on the clear-sky days. In contrast, an influx of monsoonal moisture and remnants of Hurricane Kay provided cloud cover over the area at the end of July through early August. The clouds blocked sunlight, decreased ozone formation and lowered temperatures across the Valley during that period. Wildfires also impacted air quality during the 3rd quarter. Smoke from wildfires in the Sierra Nevada and in southern California infiltrated the Valley in mid-July and early September and PM2.5 concentrations increased as a result.

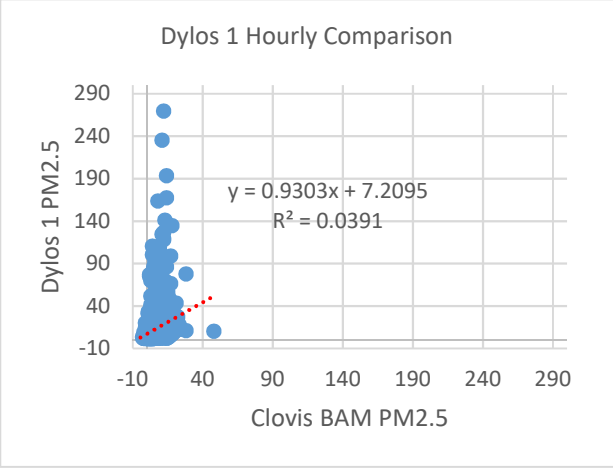
Overall, the Dylos sensors operating during this period had high results compared to the regulatory monitor. The Dylos 1 had a 24-hour bias of 13.7 µg/m$^3$, while Dylos 2 had a 24-Hr bias of 131.5 µg/m$^3$.

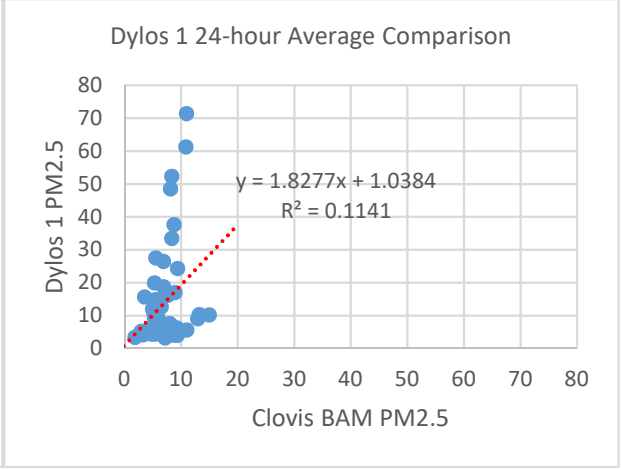
***As of this period, all Dylos sensors operated by the District have stopped operating and will not be replaced. This is the final quarterly analysis report for this sensor model.***

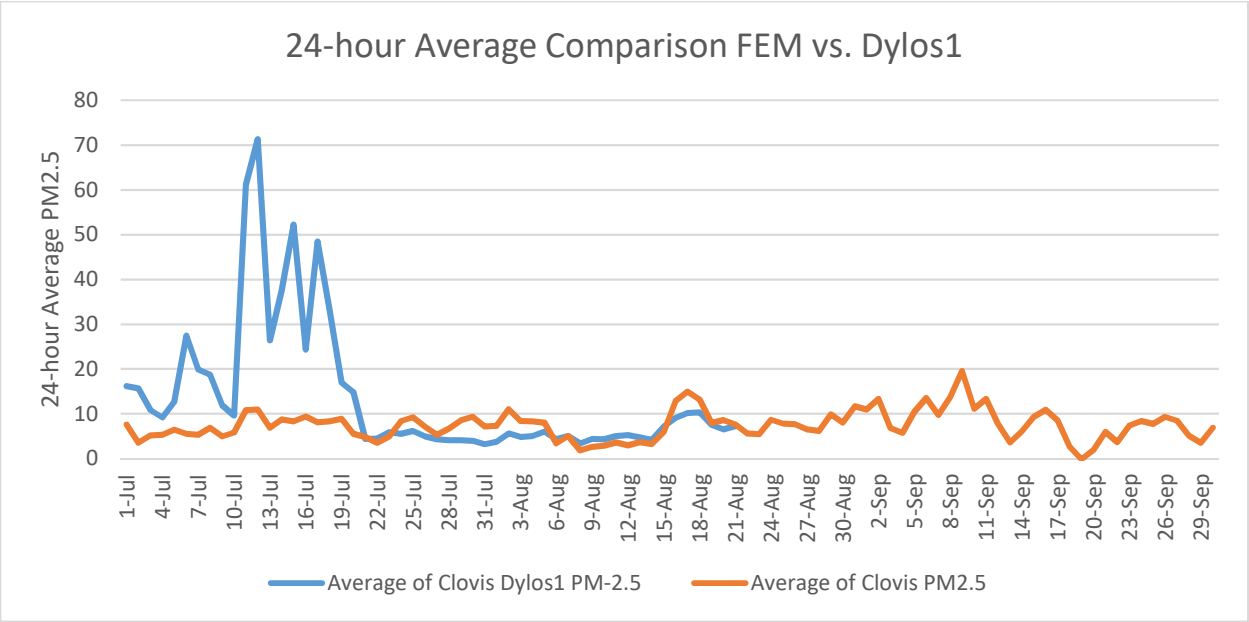
## ***Analysis of Dylos Sensor Performance***

### Dylos 1

For the 24-hour average, Dylos1 sensor data showed a high bias of 13.73 µg/m$^3$ and the hourly data showed a high bias of 6.72 µg/m$^3$ during the July 1, 2022 through September 30, 2022, period. Due to sensor malfunction, the Dylos 1 had intermittent data for the last week it operated in August. It finally stopped operating all together and was removed on August 29th, 2022.

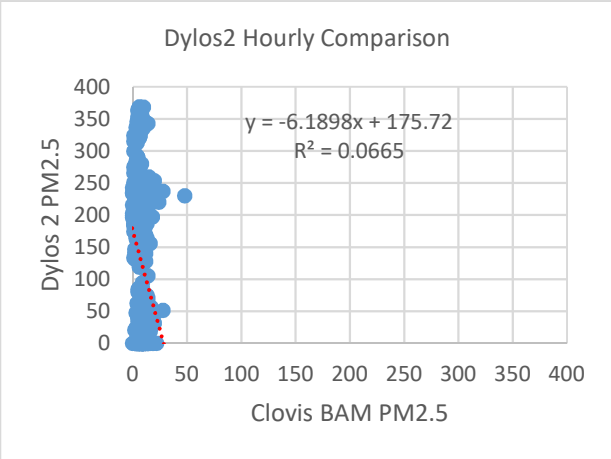


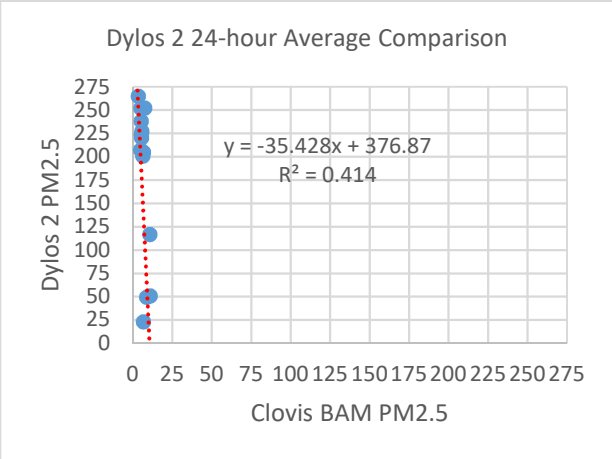



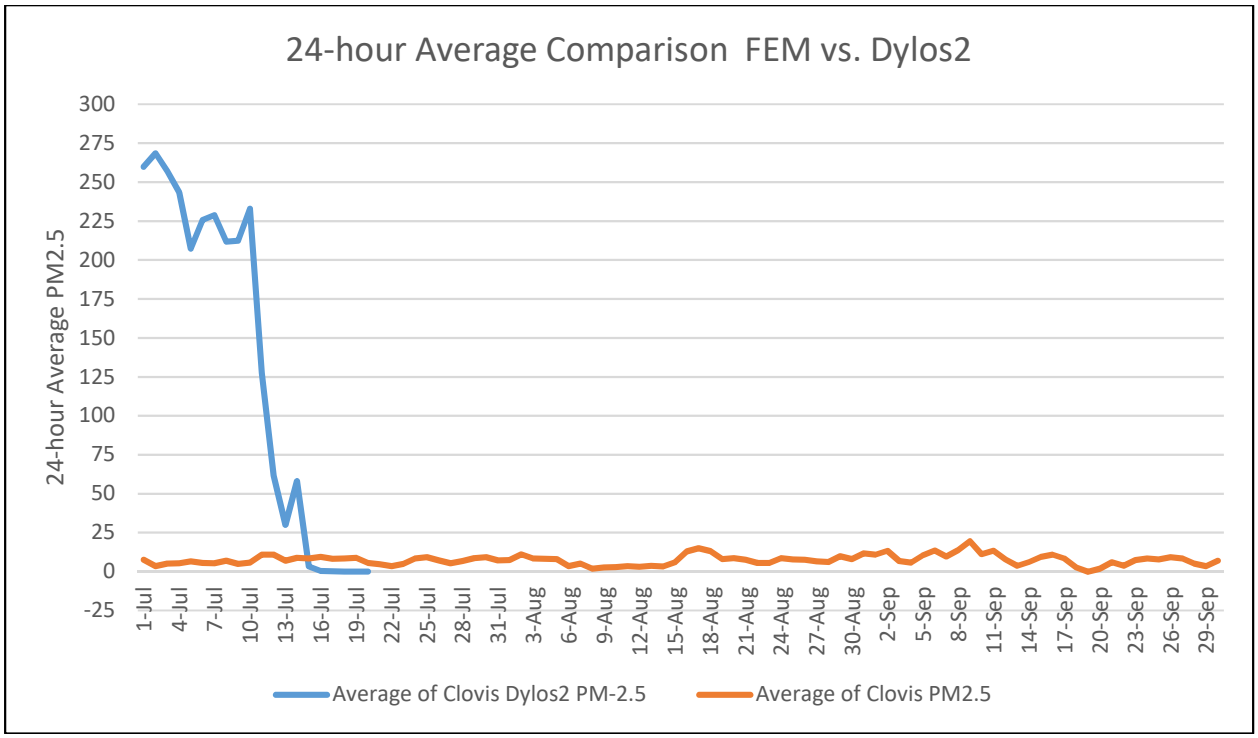



**Dylos 2**

For the 24-hour average, Dylos1 sensor data showed a high bias of 13.73 µg/m$^3$ and the hourly data showed a high bias of 6.72 µg/m$^3$ during the July 1, 2022 through September 30, 2022, period. Due to sensor malfunction, the Dylos 2 had multiple days where it recorded a concentration of zero for multiple hours. It finally stopped operating all together and was removed on July 21st, 2022.






## ***Non-Reporting Sites***

**Dylos 1, Dylos 2, and Dylos 3**

These sensors sustained a hardware failures and are no longer operating. There is no planned replacement of these sensors.

## ***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 $R^2$ | 1-hr Slope | 1-hr Intercept | 24-hr $R^2$ | 24-hr Slope | 24-hr Intercept |
|---|---|---|---|---|---|---|---|---|---|
| Dylos 1 | 13.73 | 269.66 | 71.33 | 0.0391 | 0.9303 | 7.2095 | 0.1141 | 1.8277 | 1.0384 |
| Dylos 2 | 131.47 | 368.82 | 268.56 | 0.0665 | -6.1898 | 175.72 | 0.414 | -35.428 | 376.87 |
| FEM | 7.44 | 48 | 19.57 | | | | | | |