

# Field Evaluation IQAir AirVisual Pro



**AQ-SPEC**  
Air Quality Sensor Performance Evaluation Center

# Background

- From 08/02/2017 to 10/05/2017, three **IQAir AirVisual Pro** units were deployed at the SCAQMD Rubidoux air monitoring station and were run side-by-side with Federal Equivalent Method (FEM) instruments measuring the same pollutants

## • IQAir AirVisual Pro (3 units)

- Units Measure:
  - PM<sub>2.5</sub> (µg/m<sup>3</sup>) (optical; non-FEM)
  - PM<sub>10</sub> (µg/m<sup>3</sup>) (optical; non-FEM)
  - CO<sub>2</sub> (ppm)
  - VOC (ppb)
  - Ambient Temperature (°F, °C)
  - Relative Humidity (%)
- Time Resolution of 10-seconds
- **Unit Cost: \$269 USD**
- Unit IDs:
  - 4VW9
  - WLL6
  - X44P



## • SCAQMD FEM Instruments

- Beta Attenuation Monitors (BAM)
- Units Measure:
  - PM<sub>2.5</sub> (µg/m<sup>3</sup>) (FEM)
  - PM<sub>10</sub> (µg/m<sup>3</sup>) (FEM)
- Time Resolution of 1-hour
- **Unit Cost: ~\$20,000 USD**

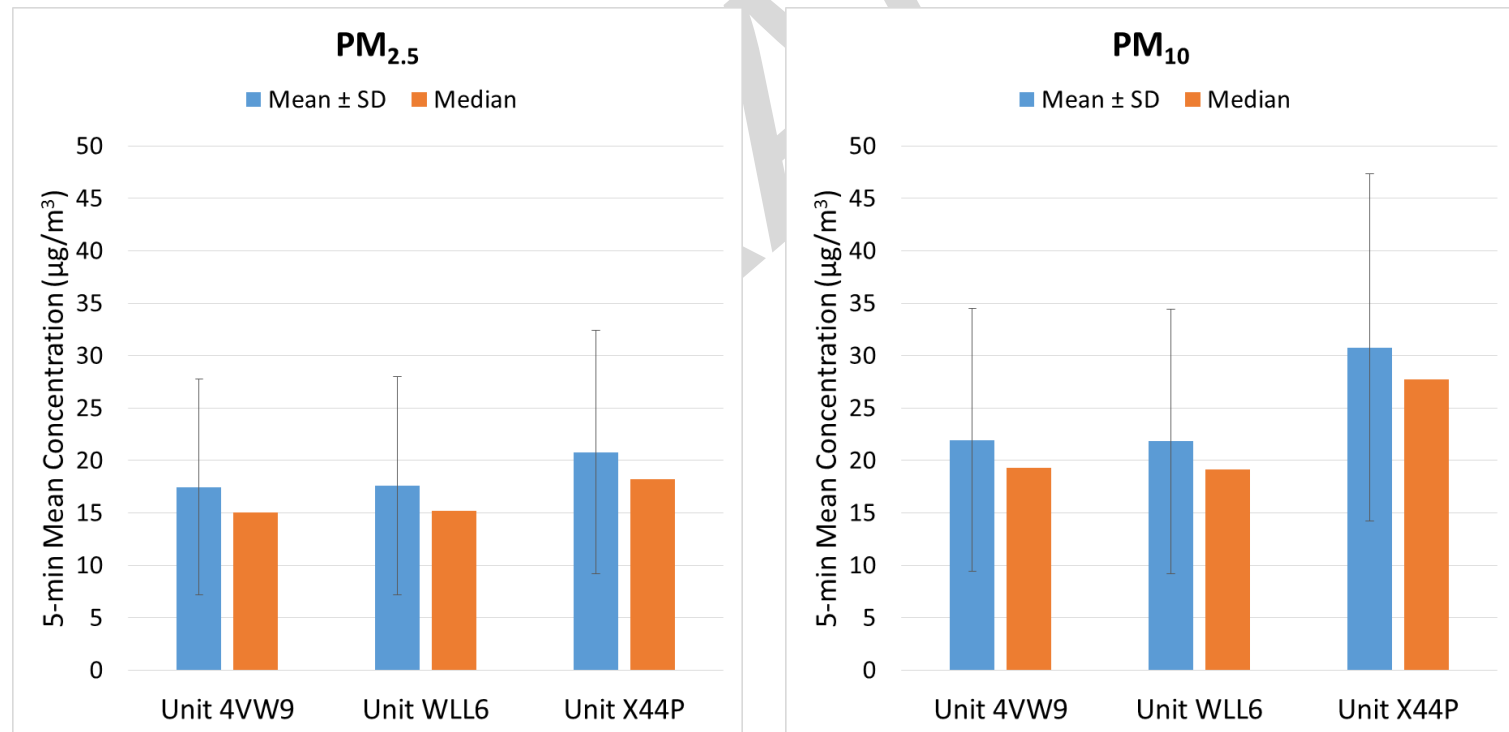


# IQAir – Data Validation & Recovery

- Basic QA/QC procedures were used to validate the collected data (i.e. obvious outliers, negative values, and invalid data points were eliminated from the data set)
- Data recovery for both PM<sub>2.5</sub> and PM<sub>10</sub> from all three units were > 98%

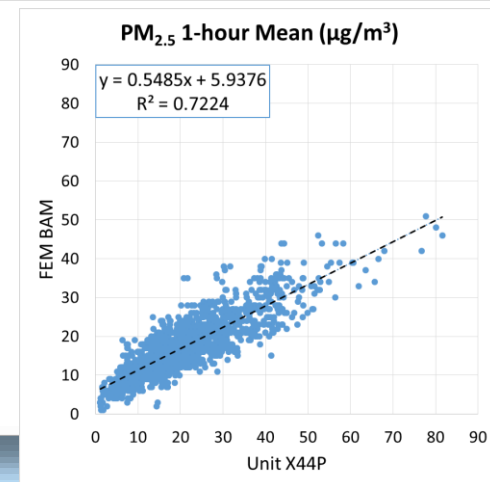
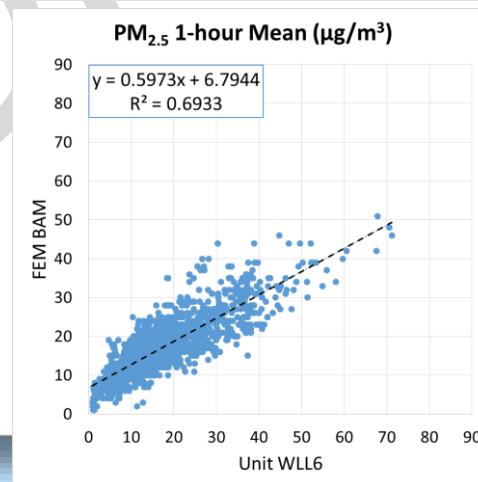
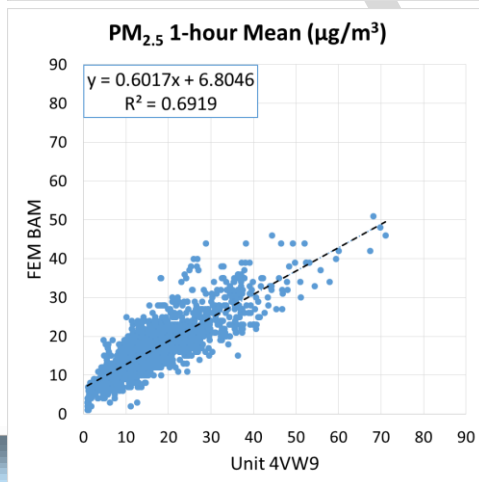
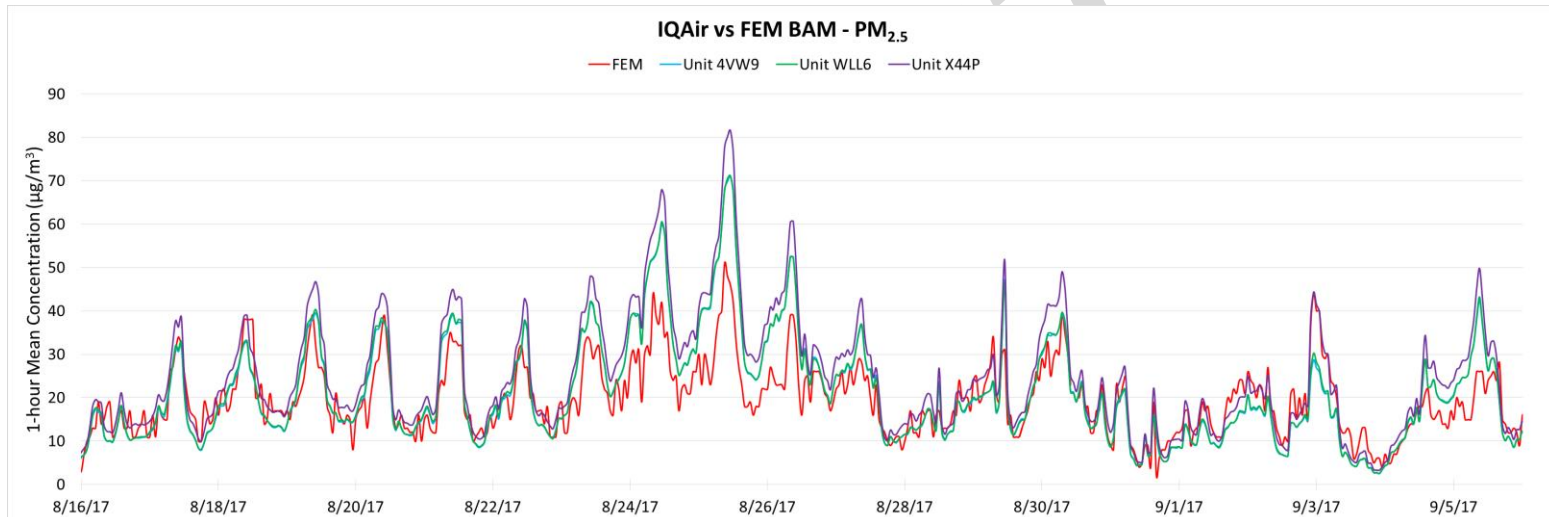
## IQAir – Intramodal Variability

- Very low intramodal variability was observed between two of the three IQAir units for both PM<sub>2.5</sub> and PM<sub>10</sub>, however the remaining unit displayed a larger variability



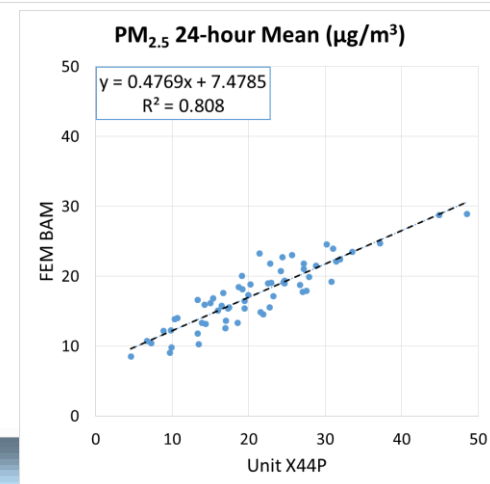
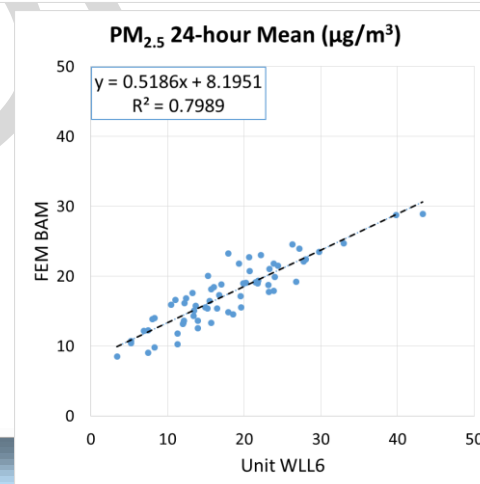
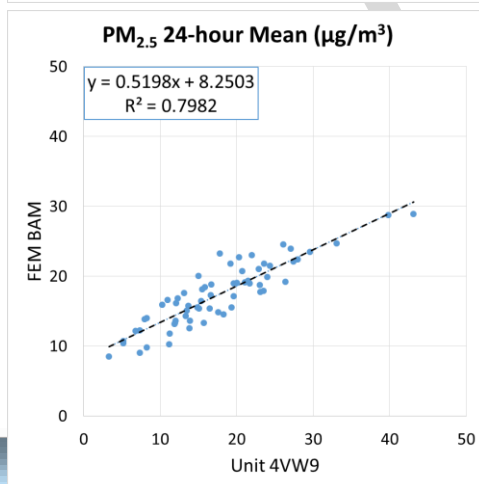
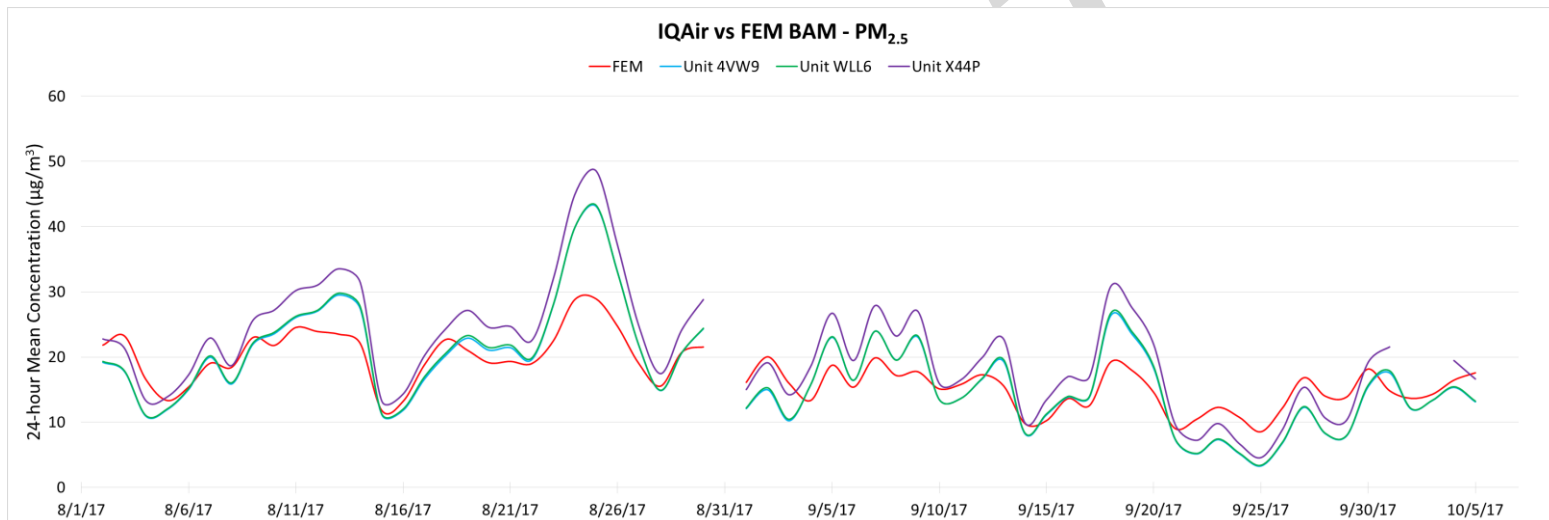
# IQAir vs FEM – PM<sub>2.5</sub> 1-hour Mean

- IQAir 1-hour mean PM<sub>2.5</sub> mass concentration measurements correlated well with the corresponding FEM instrument data with a resulting  $0.69 < R^2 < 0.73$
- The three units tracked the diurnal PM variations recorded by the FEM instrument well
- All three IQAir units generally overestimated the data compared to the corresponding FEM data



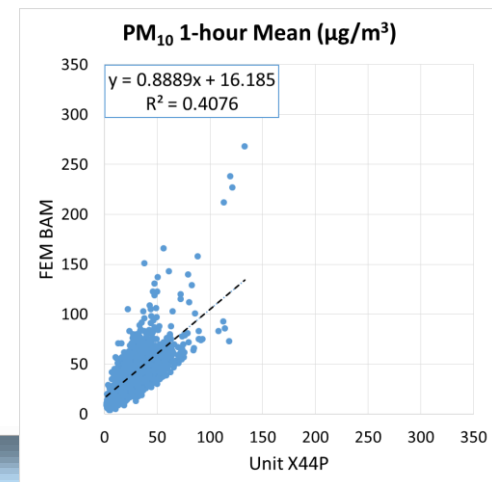
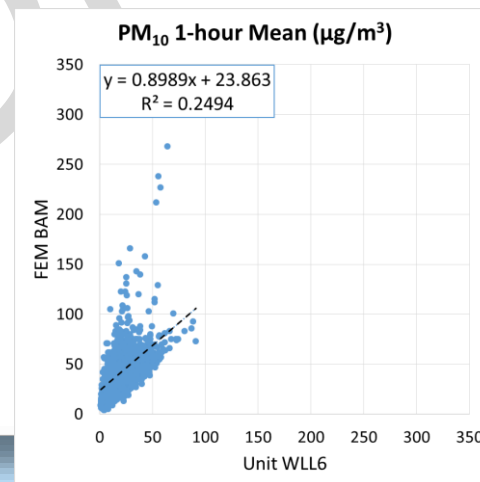
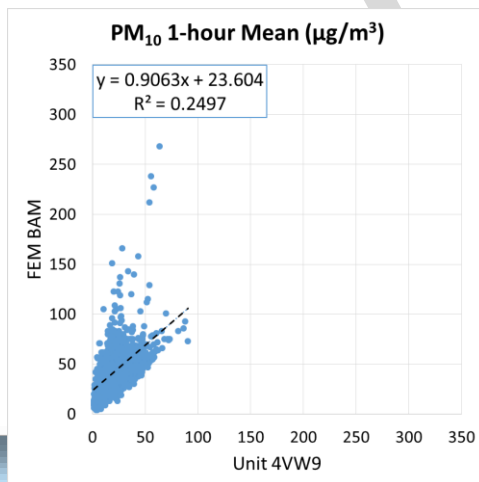
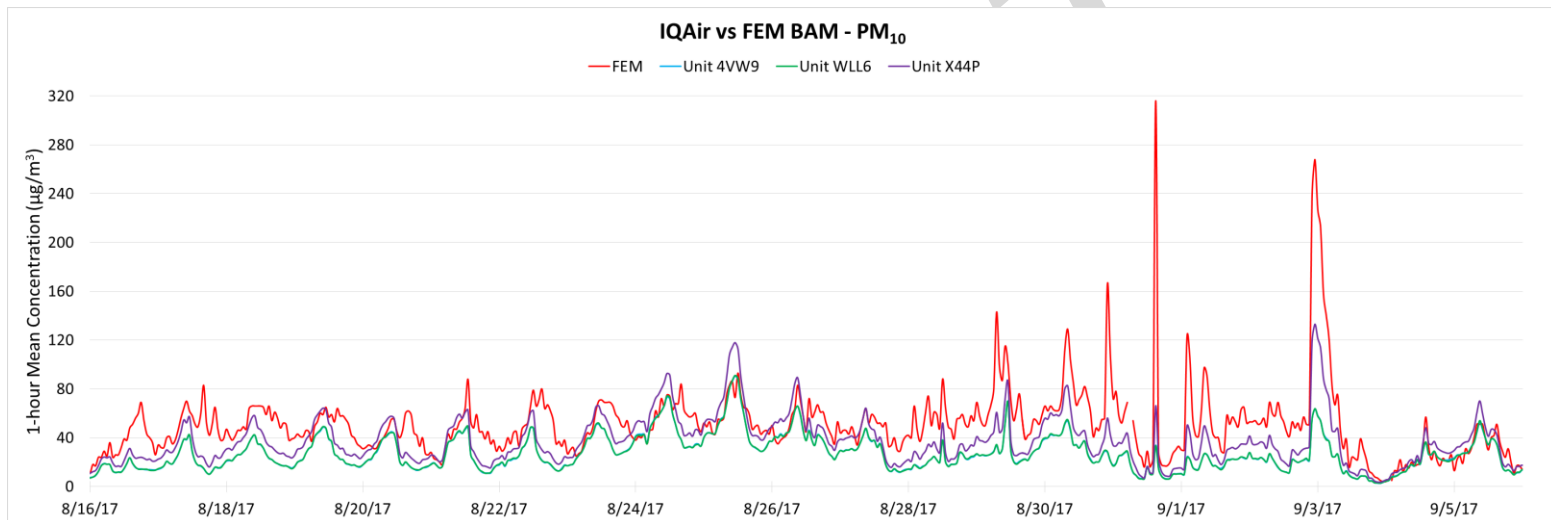
# IQAir vs FEM – PM<sub>2.5</sub> 24-hour Mean

- IQAir 24-hour mean PM<sub>2.5</sub> mass concentration measurements correlated well with the corresponding FEM instrument data with a resulting  $0.79 < R^2 < 0.81$
- The three units tracked the diurnal PM variations recorded by the FEM instrument well
- All three IQAir units generally overestimated the data compared to the corresponding FEM data



# IQAir vs FEM – PM<sub>10</sub> 1-hour Mean

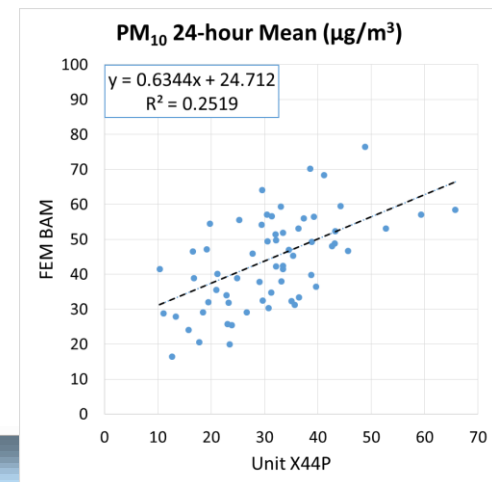
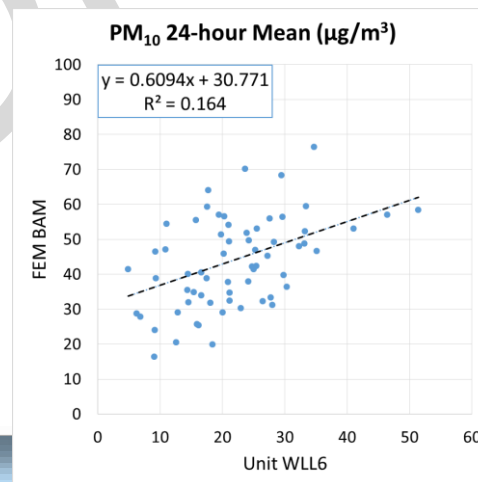
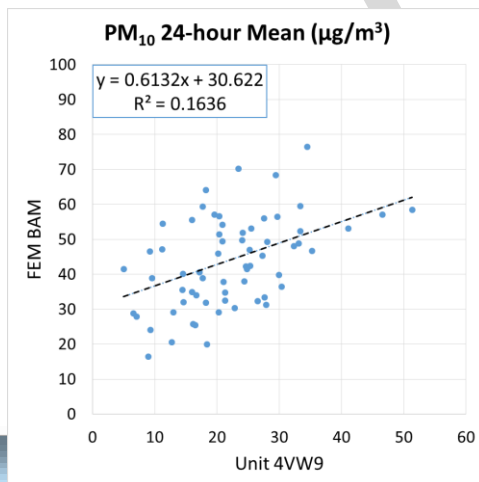
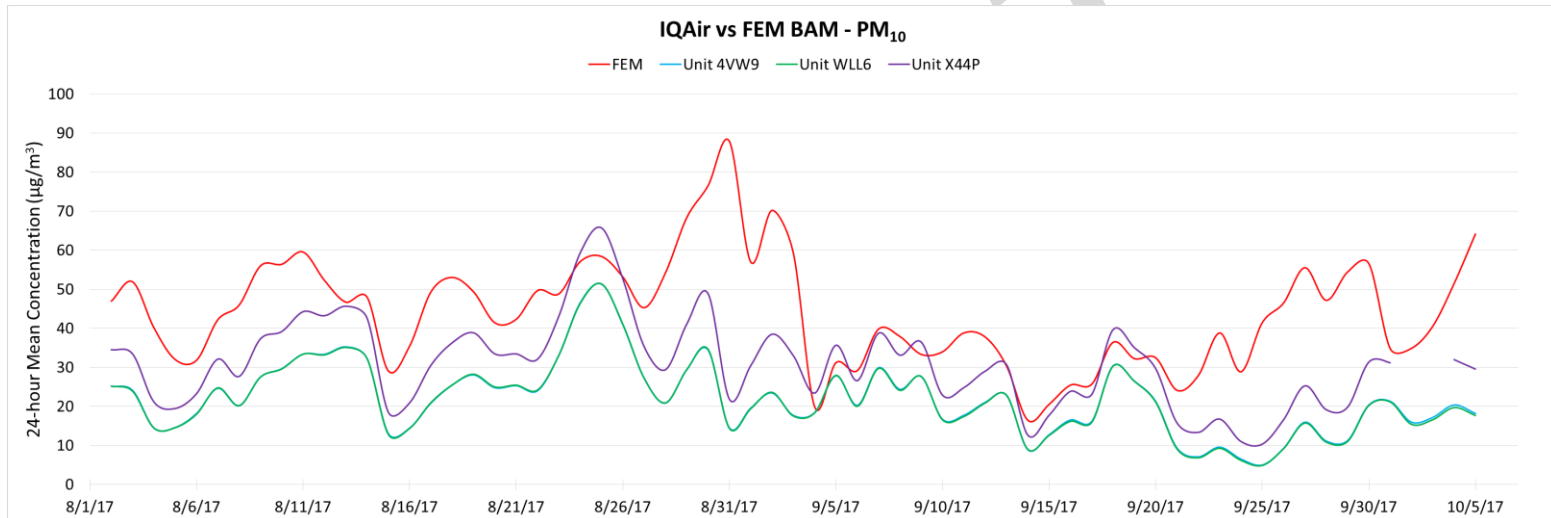
- IQAir 1-hour mean PM<sub>10</sub> mass concentration measurements did not correlate well with the corresponding FEM instrument data with a resulting  $0.24 < R^2 < 0.41$
- The three units tracked the diurnal PM variations recorded by the FEM instrument moderately well
- All three IQAir units generally underestimated the data compared to the corresponding FEM data





# IQAir vs FEM – PM<sub>10</sub> 24-hour Mean

- IQAir 24-hour mean PM<sub>10</sub> mass concentration measurements did not correlate with the corresponding FEM instrument data with a resulting  $0.16 < R^2 < 0.26$
- The three units tracked the diurnal PM variations recorded by the FEM instrument moderately well
- All three IQAir units generally underestimated the data compared to the corresponding FEM data



# Discussion

- Overall, the three IQAir AirVisual Pro units, each measuring PM<sub>2.5</sub> and PM<sub>10</sub>, were very reliable with a data recovery of > 98% across the board
- For both PM<sub>2.5</sub> and PM<sub>10</sub>, the units displayed an overall modest intramodal variability with Unit 4VW9 and Unit WLL6 displaying very low variability and Unit X44P displaying an increased variability
- The IQAir AirVisual Pro PM<sub>2.5</sub> data for both the 1-hour and 24-hour mass concentration mean values correlated well ( $R^2 > 0.69$  and  $R^2 > 0.79$ , respectively) with the corresponding measurements collected using a substantially more expensive FEM instrument
- The IQAir AirVisual Pro PM<sub>10</sub> data for both the 1-hour and 24-hour mass concentration mean values did not correlate well ( $R^2 < 0.41$  and  $R^2 < 0.26$ , respectively) with the corresponding measurements collected using a substantially more expensive FEM instrument, with the units underestimating the values
- No unit calibrations were performed by SCAQMD staff in order to simulate and evaluate a true end-user performance by the units
- Laboratory chamber testing under controlled temperature and relative humidity conditions may be necessary to fully evaluate the performance of the IQAir AirVisual Pro units

All results are still preliminary