# AQ-SPEC

## Air Quality Sensor Performance Evaluation Center

## Sensor Description

Manufacturer/Model:
IQAir AirVisual Pro

Pollutants:
$PM_{2.5}$
$PM_{10}$
$CO_2$
VOC
Type: Optical

Time Resolution: 10 second


## Additional Information

**Field evaluation report:**
http://www.aqmd.gov/aq-spec/evaluations/field

**Lab evaluation report:**
http://www.aqmd.gov/aq-spec/evaluations/laboratory

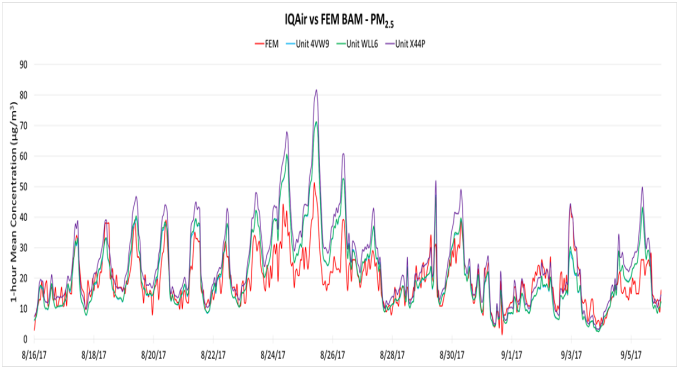
**AQ-SPEC website:**
http://www.aqmd.gov/aq-spec

## Evaluation Summary

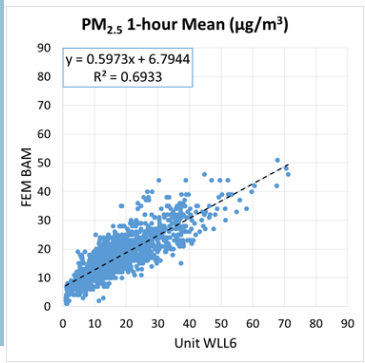
- Overall, the three IQAir AirVisual Pro sensors showed low accuracy. They overestimated the FEM GRIMM $PM_{2.5}$ measurements for a concentration range between 0 to 250 µg/m³.
- The three IQAir AirVisual Pro sensors exhibited high precision for all T/RH combinations tested in the environmental chamber.
- IQAir AirVisual Pro sensors (units IDs: 4VW9, WLL6, X44P) showed low intra-model variability in the field deployment as well as in the laboratory testing.
- IQAir AirVisual Pro sensors had good data recovery (>98% for 5-min average in the field, and 100% for 1-min average in the laboratory).
- For $PM_{2.5}$, the IQAir AirVisual Pro sensors showed strong correlations with the reference instrument from the field ($R^2$ ~ 0.70) and very strong correlations with laboratory studies ($R^2$ > 0.99).

## Field Evaluation Highlights

- Deployment period 08/02/2017– 10/05/2017: the three IQAir AirVisual Pro sensors (units IDs: 4VW9, WLL6, X44P) showed strong correlations with $PM_{2.5}$ concentration change as monitored by FEM BAM.
- The units showed > 98% data recovery as well as low intra-model variability.



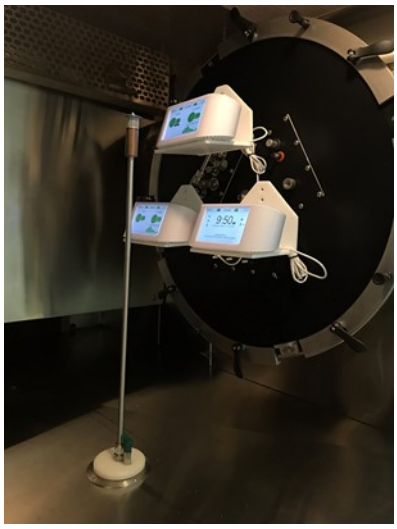

**$R^2$ ~0.70**




Coefficient of Determination ($R^2$) quantifies how the three sensors followed the PM concentration change by the reference instruments.

An $R^2$ approaching the value of 1 reflects a near perfect agreement, whereas a value of 0 indicates a complete lack of correlation.

# Laboratory Evaluation Highlights



## Accuracy ($PM_{2.5}$)

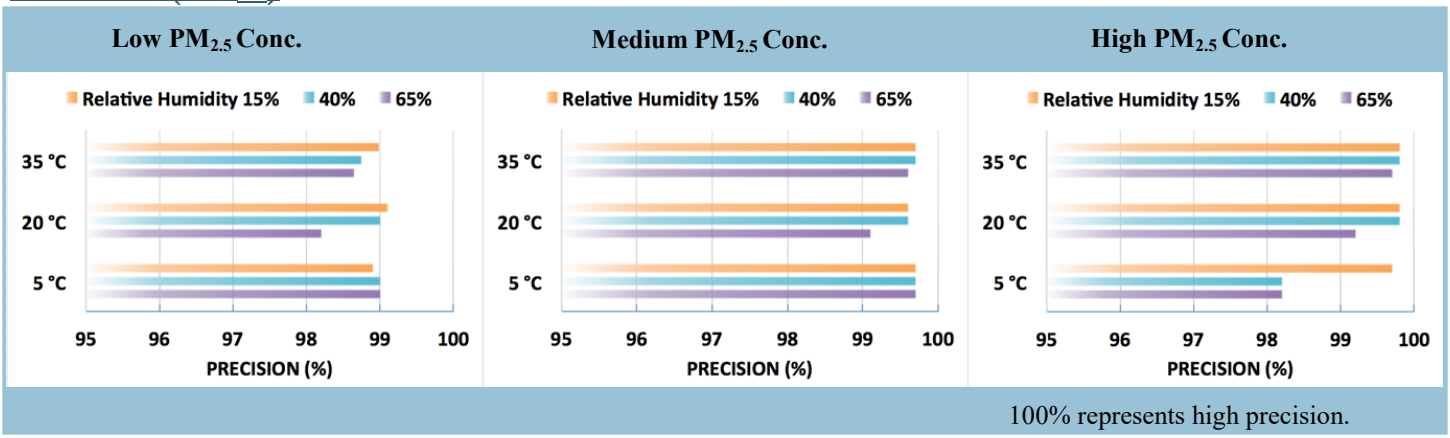
$$A\,(\%) = 100 - \frac{|\bar{X} - \bar{R}|}{\bar{R}} * 100$$

| Steady State (#) | Sensor mean (µg/m³) | GRIMM (µg/m³) | Accuracy (%) |
|---|---|---|---|
| 1 | 21.3 | 10.9 | 5.2 |
| 2 | 69.0 | 33.5 | -6.2 |
| 3 | 154.6 | 79.3 | 5.0 |
| 4 | 288.6 | 153.0 | 11.4 |
| 5 | 440.0 | 228.5 | 7.4 |

Accuracy was evaluated in a concentration ramping experiment at 20 °C and 40%. The sensor's readings at each ramping steady state condition are compared to those from the reference instrument.

Negative % means sensors' overestimation by more than two fold. The higher the positive value (close to 100%), the higher the sensor's accuracy.

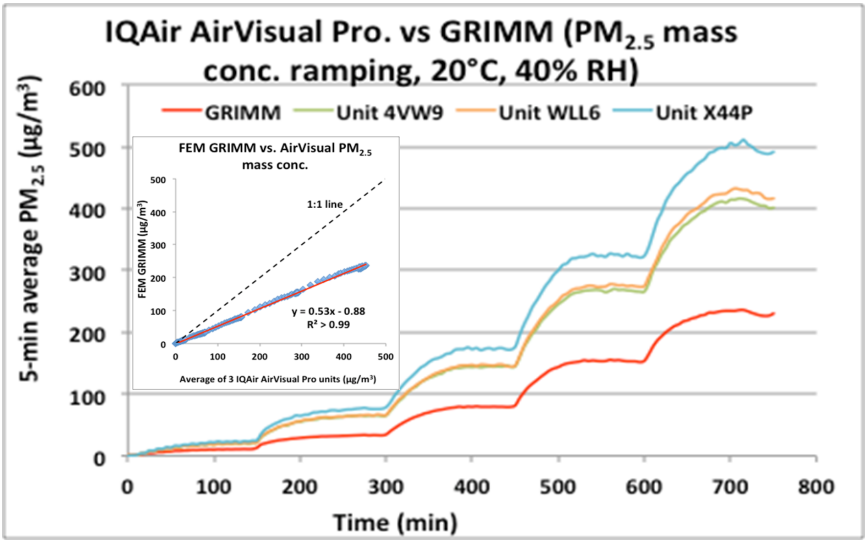
## Precision ($PM_{2.5}$)




100% represents high precision.

Sensor's ability at generating precise measurements of PM concentration at low, medium, and high pollutant levels were evaluated under 9 combinations of T and RH, including extreme weather conditions like cold and dry (5 °C and 15%), cold and humid (5 °C and 65%), hot and humid (35 °C and 65%), or hot and dry (35 °C and 15%).

## Coefficient of Determination




The three IQAir AirVisual Pro sensors showed very strong correlations with the corresponding FEM $PM_{2.5}$ data ($R^2 > 0.99$) at 20 °C and 40% RH.

## Climate Susceptibility

From the laboratory studies, temperature and relative humidity had minimal effect on the IQAir AirVisual Pro sensors' precision. At the set-points of RH changes, IQAir AirVisual Pro reported spiked changes in concentrations.

## Observed Interferents

N/A