AQ-SPEC

Air Quality Sensor Performance Evaluation Center

Sensor Description

Manufacturer/Model:
RTI/MicroPEM

Pollutants:
$PM_{2.5}$ mass

Measurement Range:
0 - 1 mg/m³

Type: Optical

Additional Information

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

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

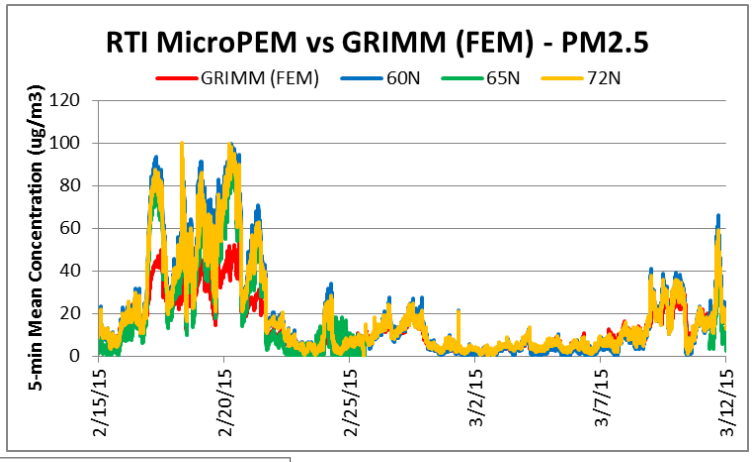
AQ-SPEC website:
http://www.aqmd.gov/aq-spec

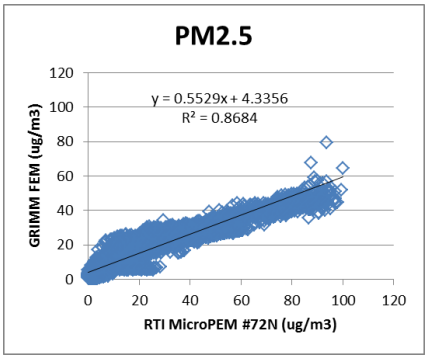
Evaluation Summary

- Overall, the three RTI MciroPEM sensors showed low accuracy, compared to FEM GRIMM for a concentration range between 0 to 250 µg/m³. RTI units overestimated GRIMM's reading.
- The RTI units exhibited good precision during various T-RH-$PM_{2.5}$ combinations, except for the case of low temperature (5 °C) and high RH (65%).
- The RTI MicroPEM showed low intra-model variability.
- Data recovery was 100% from all units.
- For $PM_{2.5}$ mass conc., the RTI MicroPEM sensors showed strong correlations with the FEM GRIMM from the field ($R^2 > 0.80$) and very strong correlations from the laboratory studies ($R^2 = 0.99$).

Field Evaluation Highlights

- Deployment period 02/10/2015 - 04/14/2015: the three RTI MicroPEM sensors showed moderate to strong correlations as compared to the $PM_{2.5}$ mass concentration monitored by FEM GRIMM and FEM BAM.
- The units showed ~80% data recovery for 60N and 72N, 30% data recovery for 65N due to reprogramming issues. The units had good intra-model variability.





Coefficient of determination (R^2) quantifies how the three sensors followed the ozone concentration change by FEM.

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

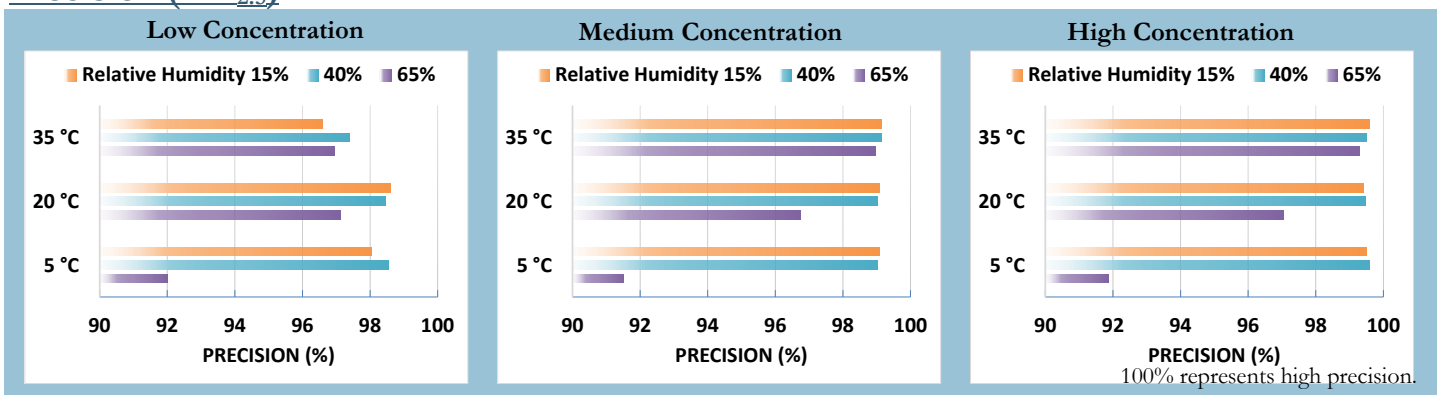
$$A\,(\%) = 100 - \frac{|\bar{X} - \bar{R}|}{\bar{R}} * 100$$

Steady State (#)	Sensor mean (µg/m³)	FEM GRIMM (µg/m³)	Accuracy (%)
1	20.2	8.9	-27.0
2	50.1	19.8	-53.0
3	91.3	37.8	-41.5
4	379.1	139	-72.7
5	727.1	241.2	-101.5

Accuracy was evaluated by a concentration ramping experiment at 20 °C and 40%. The sensor's readings at each ramping steady state are compared to 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.

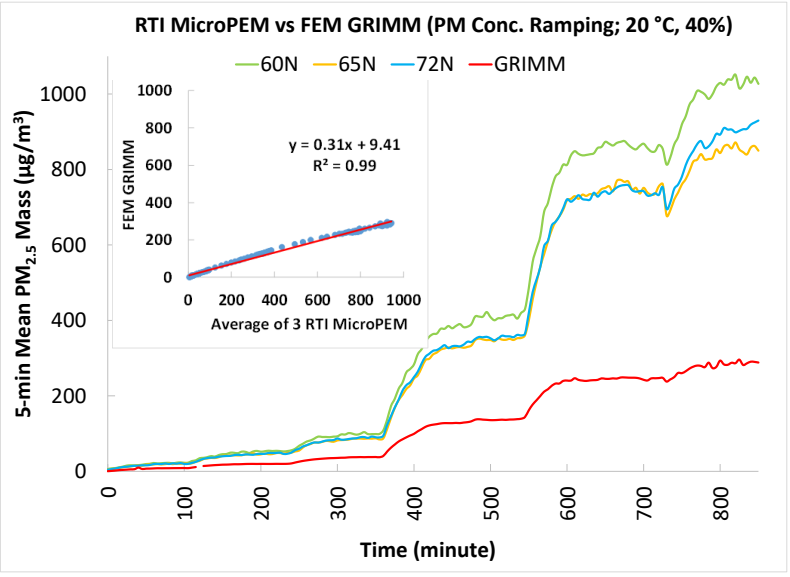
Precision ($PM_{2.5}$)



100% represents high precision.

Sensor's ability to generate precise measurements of ozone 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 RTI MicroPEM sensors showed very strong correlations with the corresponding FEM $PM_{2.5}$ data (R^2 = 0.99) at 20 °C and 40% RH from 0 - 250 µg/m³.

Climate Susceptibility

From the laboratory studies, low temperature and high relative humidity had negative effect on the precision of RTI MicroPEM sensors.

Observed Interferents

High RH.