Sensor Description

Manufacturer/Model: RTI/MicroPEM

Pollutants: PM$_{2.5}$ mass

Measurement Range: 0 - 1 mg/m$^3$

Type: Optical

Evaluation Summary

- Overall, the three RTI MicroPEM sensors showed low accuracy, compared to FEM GRIMM for a concentration range between 0 to 250 µg/m$^3$. 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 had excellent correlation with the FEM GRIMM from both the field ($R^2$ ~ 0.65-0.90) and laboratory studies ($R^2$ > 0.99).

Field Evaluation Highlights

- Deployment period 02/10/2015 - 04/14/2015: the three RTI MicroPEM sensors had coefficient of determination between 0.65 and 0.90, compared to the PM$_{2.5}$ mass concentration monitored by FEM GRIMM and 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.

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

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

\[ A(\%) = 100 - \frac{|X - R|}{R} \times 100 \]

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

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. The higher the positive value (close to 100%), the higher the sensor’s accuracy.

Precision (PM$_{2.5}$)

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 good correlation 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.

All documents, reports, data, and other information provided in this document are for informational use only. Mention of trade names or commercial products does not constitute endorsement or recommendation. The South Coast AQMD’s AQ-SPEC program, as a government agency, recommends the interested parties to make purchase decisions based on their application.