Evaluation Summary

- Overall, the accuracy of the Aeroqual AQY v1.0 sensors was fairly constant (~73% to 85%) over the range of PM$_{2.5}$ mass concentration tested. Overall, the Aeroqual AQY v1.0 sensors underestimated PM$_{2.5}$ measurements from FEM GRIMM in the laboratory experiments at 20 °C and 40% RH.
- The Aeroqual AQY v1.0 sensors exhibited high precision for all T/RH combinations and all PM concentrations.
- The Aeroqual AQY v1.0 sensors (IDs: 1085, 1094 and 1104) showed low to moderate intra-model variability for the field and laboratory evaluations.
- Data recovery was ~ 100% from all units in the field and laboratory evaluations.
- For PM$_{2.5}$, the Aeroqual AQY v1.0 sensors showed strong correlations with the corresponding FEM GRIMM data (0.77 < $R^2$ < 0.85) in the field evaluations and very strong correlations with FEM GRIMM in the laboratory evaluations ($R^2 > 0.99$ for PM$_{2.5}$).
- The same three Aeroqual AQY v1.0 units were tested both in the field (1st stage of testing) and in the laboratory (2nd stage of testing).

Field Evaluation Highlights

- Deployment period 02/20/2020 - 04/22/2020: the three Aeroqual AQY v1.0 sensors showed strong correlations with the corresponding FEM GRIMM for PM$_{2.5}$ mass concentrations.
- The units showed low intra-model variability and data recovery was ~ 100%.

Coefficient of Determination ($R^2$) quantifies how the three sensors followed the PM$_{2.5}$ 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$_{2.5}$)

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

<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>7.3</td>
<td>8.7</td>
<td>84.3</td>
</tr>
<tr>
<td>2</td>
<td>12.7</td>
<td>14.8</td>
<td>85.4</td>
</tr>
<tr>
<td>3</td>
<td>36.6</td>
<td>48.1</td>
<td>76.1</td>
</tr>
<tr>
<td>4</td>
<td>109.4</td>
<td>149.4</td>
<td>73.3</td>
</tr>
<tr>
<td>5</td>
<td>190.3</td>
<td>250.3</td>
<td>76.0</td>
</tr>
</tbody>
</table>

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

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

Sensor’s ability to generate precise measurements of PM$_{2.5}$ 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% RH), cold and humid (5 °C and 65% RH), hot and humid (35 °C and 65% RH), or hot and dry (35 °C and 15% RH).

Precision (PM$_{2.5}$)

From the laboratory studies, temperature and relative humidity had minimal effect on the Aeroqual AQY v1.0 sensors’ precision. At the set-points of RH changes, the sensors showed spiked conc. changes for all PM levels at 5 °C and showed significant concentration variation for all PM levels at 5 °C/65% RH.

Observed Interferents

N/A

Climate Susceptibility

From the laboratory studies, temperature and relative humidity had minimal effect on the Aeroqual AQY v1.0 sensors’ precision. At the set-points of RH changes, the sensors showed spiked conc. changes for all PM levels at 5 °C and showed significant concentration variation for all PM levels at 5 °C/65% RH.

The Aeroqual AQY v1.0 sensors showed very strong correlations with the corresponding FEM PM$_{2.5}$ data ($R^2 > 0.99$) at 20 °C/40% RH.

Coefficient of Determination

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. As a Government Agency, the South Coast AQMD and its AQ-SPEC program highly recommend interested entities to make use and purchase decisions based on the requirements of their study design, the technical aspects and features of their specific project applications.