**Evaluation Summary**

- Overall, the three Shinyei units showed distinct accuracy (from -70.5% to 91.2%) for different PM$_{2.5}$ mass concentration levels over the range of 0 – 180 µg/m$^3$.
- The three Shinyei sensors exhibited high precision for most tested environmental conditions, except at 5 °C and 65%.
- Shinyei sensors showed low intra-model variability as well as good data recovery (100%).
- For PM$_{2.5}$, the Shinyei sensors showed strong to very strong correlations with the reference instrument from both field (R$^2 > 0.88$) and laboratory studies (R$^2 > 0.93$).

**Field Evaluation Highlights**

- Deployment period 02/05/2015 - 04/08/2015: the three Shinyei PM sensors showed strong correlations with the PM$_{2.5}$ concentration change as monitored by FEM instrument.
- The units showed 100% data recovery as well as low intra-model variability.

**Sensor Description**

Manufacturer/Model: Shinyei PM Sensor Evaluation Kit

Pollutants: PM$_{2.5}$

Measurement Range: 0 - 200 µg/m$^3$

Type: Optical

**Additional Information**


Lab evaluation report: [http://www.aqmd.gov/aq-spec/evaluations/laboratory](http://www.aqmd.gov/aq-spec/evaluations/laboratory)

AQ-SPEC website: [http://www.aqmd.gov/aq-spec](http://www.aqmd.gov/aq-spec)

**Coefficient of Determination (R$^2$)**

R$^2 > 0.88$ 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 (µg/m³)</th>
<th>Accuracy (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>13.8</td>
<td>5.1</td>
<td>-70.5</td>
</tr>
<tr>
<td>2</td>
<td>33.0</td>
<td>11.2</td>
<td>-94.6</td>
</tr>
<tr>
<td>3</td>
<td>58.6</td>
<td>20.6</td>
<td>-85.0</td>
</tr>
<tr>
<td>4</td>
<td>142.4</td>
<td>75.3</td>
<td>11.0</td>
</tr>
<tr>
<td>5</td>
<td>181.2</td>
<td>134.9</td>
<td>65.6</td>
</tr>
<tr>
<td>6</td>
<td>197.1</td>
<td>181.2</td>
<td>91.2</td>
</tr>
</tbody>
</table>

Accuracy was evaluated in a concentration ramping experiment at 20 °C and 40%. The sensor’s readings at each ramping steady state were 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

- **Low Pollutant Level**
- **Medium Pollutant Level**
- **High Pollutant Level**

Sensor’s ability of 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 humid (5 °C and 65%), hot and humid (35 °C and 65%), cold and dry (5 °C and 15%), and hot and dry (35 °C and 15%).

### Coefficient of Determination

The three Shinyei sensors showed very strong correlations with the corresponding FEM PM\(_{2.5}\) data \((R^2 = 0.93)\) at 20 °C and 40% RH.

### Climate Susceptibility

From the laboratory studies, temperature and relative humidity did not affect Shinyei units’ precision in most cases. At 5 °C and 65% RH, Shinyei units reported spiked changes in PM\(_{2.5}\) concentrations, resulting into the lowest precision observed around 88%.

### Observed Interferents

Not tested for PM sensors

---

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.