**Sensor Description**

- Manufacturer/Model: Igienair Zaack AQI
- Pollutant: NO₂
- Measurement Range: 0 - 20 ppm
- Type: Electrochemical
- Time Resolution: 30-sec

**Evaluation Summary**

- Low to moderate intra-model variability was observed among the three Zaack AQI units at different NO₂ concentrations.
- The three Zaack AQI units showed moderate accuracy compared to the FRM NO₂ monitor, for a concentration range between 15 to 300 ppb.
- Units demonstrated high precision in all of the tested environmental conditions (NO₂ conc., T and RH). However, the Zaack AQI units were susceptible to weather conditions (e.g. high temperature & RH).
- NO₂ data recovery from the three Zaack AQI units was 94-99% in the field.
- Zaack AQI units showed moderate correlations with the FRM NO₂ in the field ($R^2$: 0.53-0.58) and very strong correlations in the lab ($R^2 > 0.99$).

**Field Evaluation Highlights**

- Deployment period 11/13/2020 - 01/08/2021: the three Zaack AQI units had a strong correlation with the FRM instrument.
- Data recovery from the Zaack AQI units was 94-99%.

**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

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

Quantifies how the three sensors followed the NO₂ concentration change by FRM.

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

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

<table>
<thead>
<tr>
<th>Steady State (#)</th>
<th>Sensor mean (ppb)</th>
<th>FRM T200 (ppb)</th>
<th>Accuracy (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10.55</td>
<td>13.86</td>
<td>76.1%</td>
</tr>
<tr>
<td>2</td>
<td>35.18</td>
<td>50.06</td>
<td>70.3%</td>
</tr>
<tr>
<td>3</td>
<td>66.27</td>
<td>102.51</td>
<td>64.7%</td>
</tr>
<tr>
<td>4</td>
<td>128.59</td>
<td>200.19</td>
<td>64.2%</td>
</tr>
<tr>
<td>5</td>
<td>195.56</td>
<td>297.23</td>
<td>65.8%</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 by more than two fold. The higher the positive value (close to 100%), the higher the sensor’s accuracy.

Sensor’s ability of generating precise measurements of NO\textsubscript{2} 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 Zaack AQI units showed very strong correlations with the corresponding FRM data (R\textsuperscript{2} > 0.99) at 20 °C and 40% RH.

Climate Susceptibility (linear correlation R\textsuperscript{2})

<table>
<thead>
<tr>
<th>R\textsuperscript{2}</th>
<th>5 °C</th>
<th>20 °C</th>
<th>35 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>15%</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>40%</td>
<td>0.99</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>65%</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

From the laboratory studies, temperature and humidity had negligible effect on the Zaack AQI’s linear correlation with the FRM NO\textsubscript{2}.

Observed Interferents

Low and high temperature and humidity, O\textsubscript{3}.

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