AQ-SPEC

Air Quality Sensor Performance Evaluation Center

Sensor Description

Manufacturer/Model:
Igienair Zaack AQI

Pollutant: CO

Measurement Range:
0 - 20 ppm

Type: Electrochemical

Time Resolution: 30-sec

Additional Information

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

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

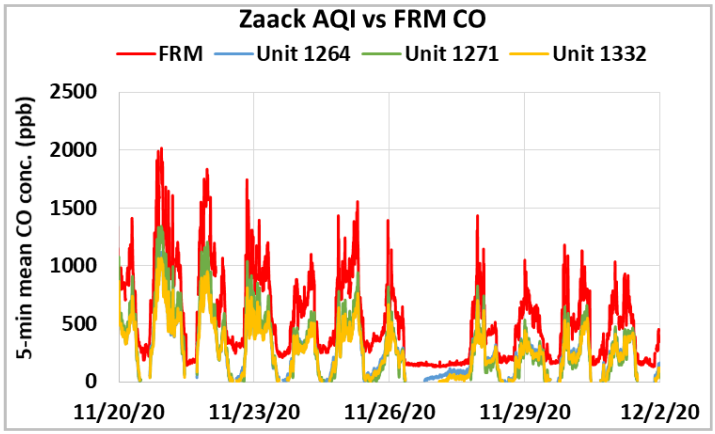
AQ-SPEC website:
http://www.aqmd.gov/aq-spec

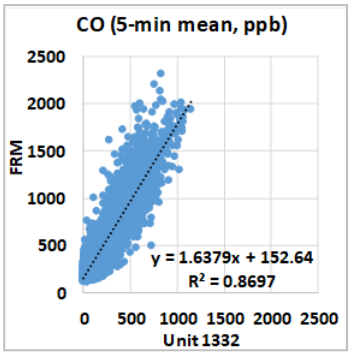
Evaluation Summary

- Moderate intra-model variability was observed among the three Zaack AQI units at different CO concentrations.
- The three Zaack AQI units showed moderate accuracy compared to the FRM CO monitor, for a concentration range between 2 to 35 ppm.
- Units demonstrated high precision in all of the tested environmental conditions (CO conc., T and RH). However, the Zaack AQI units were susceptible to weather conditions (e.g. high temperature & RH).
- CO data recovery from the three Zaack AQI units was 64-87% in the field.
- Zaack AQI units showed strong correlations with the FRM CO in the field (R^2: 0.84-0.87) and very strong correlations in the lab (R^2 > 0.98).

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 64-87%.





Coefficient of Determination (R^2) quantifies how the three sensors followed the CO 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.

Laboratory Evaluation Highlights

Accuracy

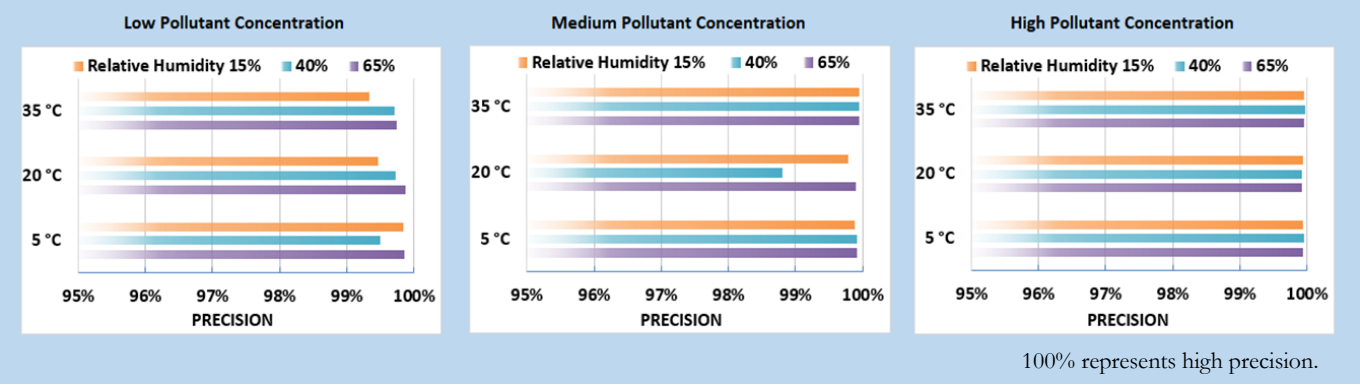
$$A\,(\%) = 100 - \frac{|\bar{X} - \bar{R}|}{\bar{R}} * 100$$

Steady State (#)	Sensor mean (ppb)	FRM T300U (ppb)	Accuracy (%)
1	0.87	2.03	42.8%
2	4.53	7.71	58.8%
3	8.57	15.19	56.4%
4	14.11	25.29	55.8%
5	17.78	35.41	50.2%

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.

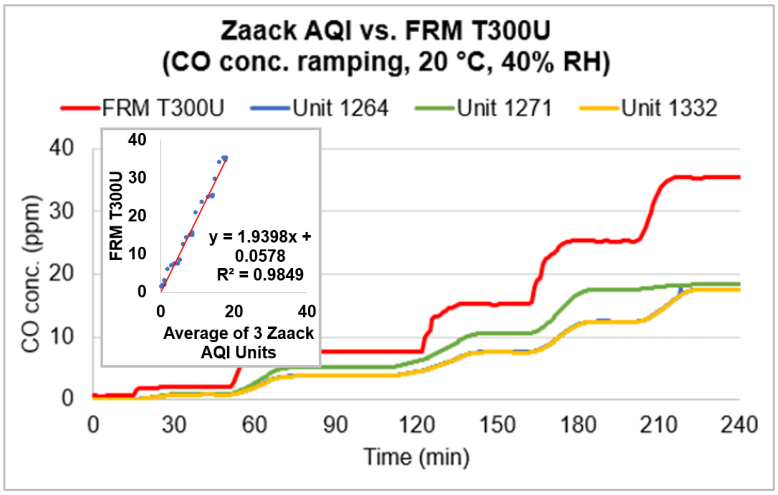
Precision



100% represents high precision.

Sensor's ability of generating precise measurements of CO 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 ($R^2 > 0.98$) at 20 °C and 40% RH.

Climate Susceptibility (linear correlation R^2)

R^2	5 °C	20 °C	35 °C
15%	0.99	0.99	0.98
40%	0.99	0.98	0.98
65%	0.99	0.98	0.97

From the laboratory studies, high temperature and high humidity had a slight negative effect on the Zaack AQI's linear correlation with the FRM CO.

Observed Interferents

Low and high temperature and humidity.