AQ-SPEC

Air Quality Sensor Performance Evaluation Center

Sensor Description

Manufacturer/Model:
Wicked Device/Air Quality Egg 2022 Model (O_3 & NO_2)

Pollutant:
NO_2

Time Resolution:
1-min

Additional

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

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

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

Evaluation Summary

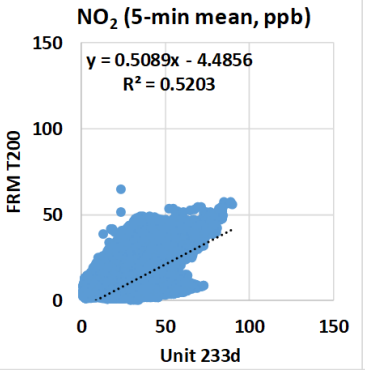
- Overall, the accuracy of the Air Quality Egg 2022 Model sensors ranged from 20.2% to 85.2% and increased as NO_2 conc. increased over the tested concentration range. The sensors overestimated the NO_2 measurements from FRM T200 in the laboratory experiments at 20 °C and 40% RH.
- The Air Quality Egg 2022 Model sensors exhibited high precision for all T/RH combinations and all NO_2 concentrations.
- The Air Quality Egg 2022 Model sensors (IDs: 233d, 1f4e, 8a60) showed high intra-model variability in the laboratory evaluations.
- Data recovery was ~100% from all units in both field and laboratory evaluations.
- The Air Quality Egg 2022 Model sensors showed weak to moderate correlations ($0.38 < R^2 < 0.56$, 5-min mean) with the corresponding FRM T200 data in the field evaluation and very strong correlations with the FRM T200 in the laboratory evaluations ($R^2 = 0.99$).
- The same three Air Quality Egg 2022 Model units were tested both in the field (1st stage of testing) and in the laboratory (2nd stage of testing).

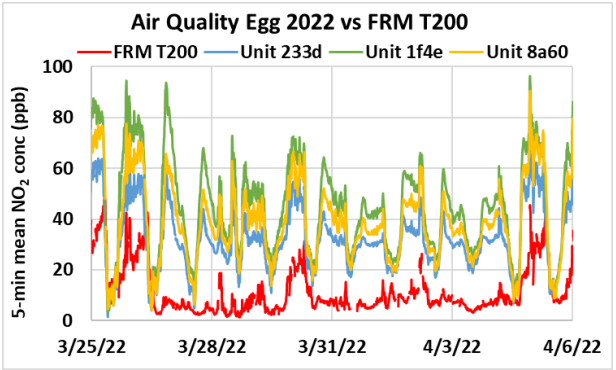
Field Evaluation Highlights

- Deployment period 03/18/2022 to 05/18/2022 : the three Air Quality Egg 2022 Model sensors showed weak to moderate correlations with the corresponding FRM NO_2 data.
- The units exhibited low intra-model variability and data recovery for NO_2 measurements was ~100% from all units.

5-min mean

$0.38 < R^2 < 0.56$





Coefficient of Determination (R^2) quantifies how the three sensors followed the NO_2 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 (NO_2)

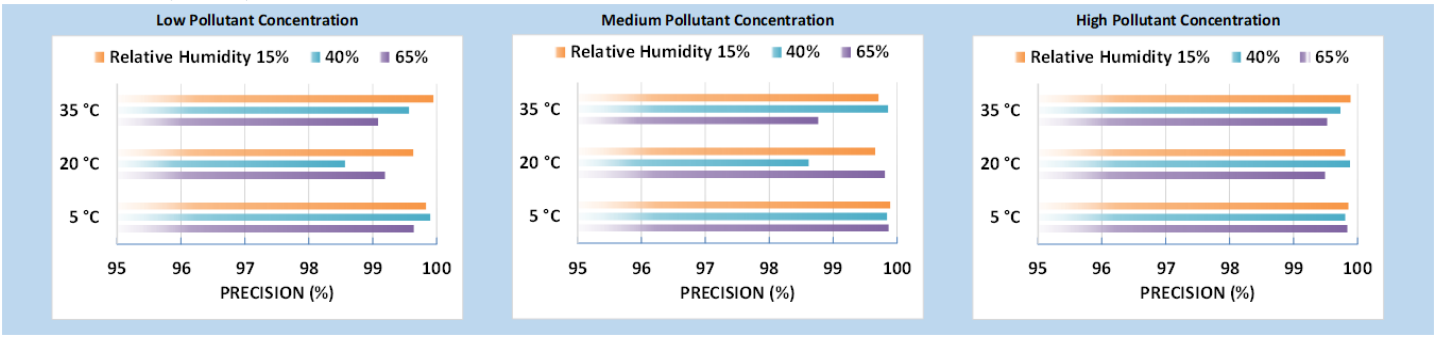
$$A\,(\%) = 100 - \frac{|\bar{X} - \bar{R}|}{\bar{R}} * 100$$

Steady State (#)	Sensor Mean (ppb)	FRM T200 (ppb)	Accuracy (%)
1	49.6	27.6	20.2
2	70.3	49.6	58.2
3	94.4	71.3	67.5
4	128.0	102.6	75.3
5	242.1	210.9	85.2

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.

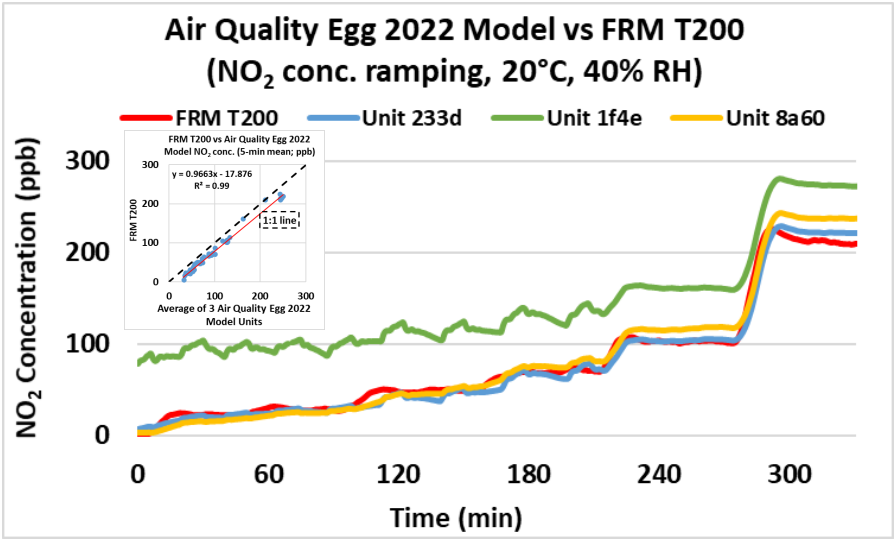
Precision (NO_2)



100% represents high precision.

Sensor's ability to generate precise measurements of NO_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 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).

Coefficient of Determination



The Air Quality Egg 2022 Model sensors showed very strong correlations with the corresponding FRM T200 NO_2 data (R^2 = 0.99) at 20 °C and 40% RH.

Climate Susceptibility

From the laboratory studies, temperature and relative humidity had minimal effect on the precision of NO_2 concentrations as recorded by the Air Quality Egg 2022 Model sensors' NO_2 measurements.

Observed Interferents

Water vapor