

AQ-SPEC

Air Quality Sensor Performance Evaluation Center

Evaluation Summary

Sensor Description

Manufacturer/Model:
Wicked Device/Air Quality
Egg 2022 Model

Pollutants:
PM_{1.0} (only analyzed from
field evaluation), PM_{2.5}, PM₁₀
mass concentration, and CO
(ppm)

Time Resolution:
1-min



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>

- The accuracy of the Air Quality Egg 2022 Model sensors for PM_{2.5} was 63.9% to 96.5% and the accuracy was higher at higher PM_{2.5} concentrations. The Air Quality Egg 2022 Model sensors overestimated PM_{2.5} at concentrations < 100 µg/m³ and underestimated PM_{2.5} at concentrations > 100 µg/m³ compared to the T640x in the lab.
- The Air Quality Egg 2022 Model sensors exhibited high precision for all conc., T/RH combinations for PM_{2.5}.
- The Air Quality Egg 2022 Model sensors showed low intra-model variability for PM_{2.5} in the lab.
- Data recovery was > 99% from all units tested in the field and laboratory evaluations.
- For PM_{1.0}, Air Quality Egg 2022 Model sensors showed strong correlations, strong to very strong correlations for PM_{2.5} and very weak to moderate correlations for PM₁₀ with the reference instruments from the field; and very strong correlations with the reference instruments in the laboratory studies ($R^2 > 0.99$ for PM_{2.5}).
- The same Air Quality Egg 2022 Model units were tested both in the field (1st stage of testing) and in the laboratory (2nd stage of testing) against ref. instruments.

Field Evaluation Highlights

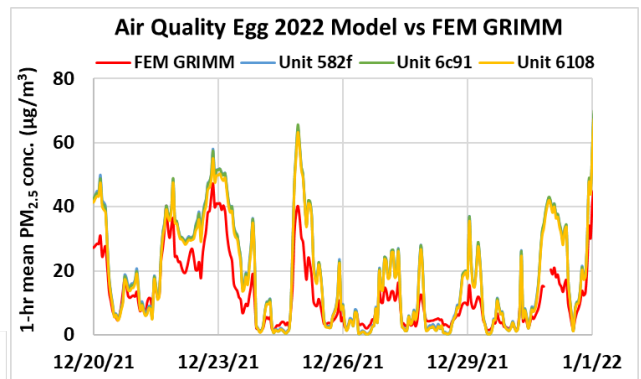
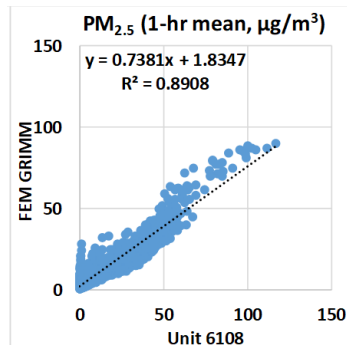
- Deployment period 11/20/2021 - 01/19/2022: the Air Quality Egg 2022 Model sensors showed strong to very strong correlations with the PM_{1.0} and PM_{2.5} mass conc. as recorded by GRIMM and T640 and very weak to moderate correlations with the corresponding BAM, GRIMM and T640 data for PM₁₀ mass conc.
- Data recovery from the units was ~ 99%.

1-hr mean, all ref. inst.

PM_{1.0}: 0.85 < R² < 0.90

PM_{2.5}: 0.80 < R² < 0.91

PM₁₀: 0.29 < R² < 0.54



Coefficient of Determination (R²) quantifies how the two sensors followed the PM_{1.0}, PM_{2.5}, or PM₁₀ concentration change by the reference instruments.

An R² 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})

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

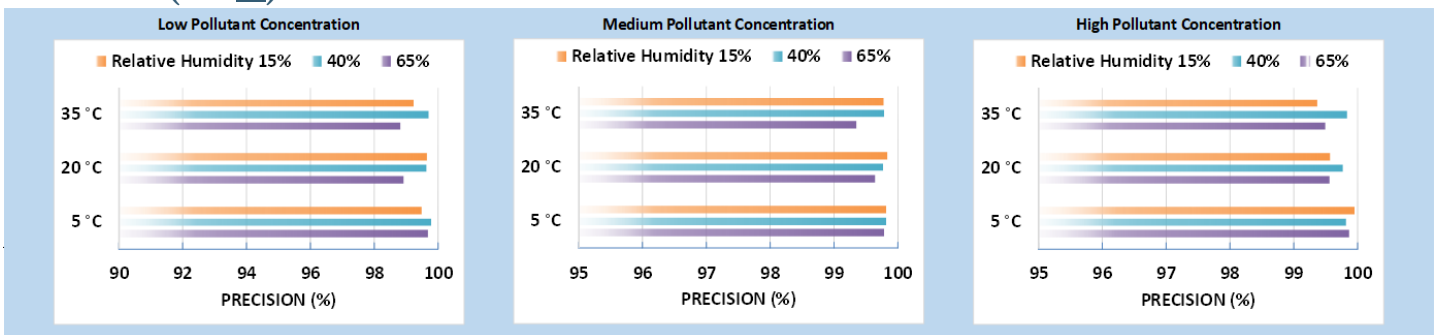
Steady State #	Sensor Mean (µg/m ³)	FEM T640x (µg/m ³)	Accuracy (%)
1	12.4	9.1	63.9
2	57.0	50.4	86.8
3	110.6	99.3	88.6
4	190.6	197.5	96.5
5	271.0	301.6	89.9

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 sensor's overestimation by more than two fold. The higher the positive value (close to 100%), the higher the sensor's accuracy.



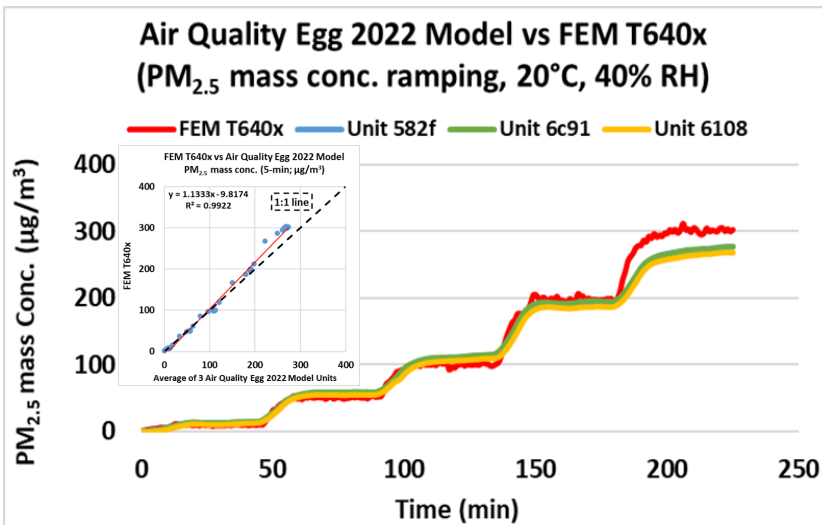
Precision (PM_{2.5})



100% represents high precision.

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).

Coefficient of Determination



The Air Quality Egg 2022 Model sensors showed very strong correlations with the corresponding FEM PM_{2.5} data ($R^2 > 0.99$) at 20 °C and 40% RH.

At the time of testing, the reference monitor did not report PM_{1.0}.

Climate Susceptibility

From the laboratory studies, temperature and relative humidity had minimal effect on the Air Quality Egg 2022 Model sensors' precision. The sensors showed enhanced PM_{2.5} concentrations at high RH values.

Observed Interferents

N/A



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