

AQ-SPEC

Air Quality Sensor Performance Evaluation Center

Evaluation Summary

Sensor Description

Manufacturer/Model:

AS-LUNG/
Portable

Pollutants:

PM₁, PM_{2.5} and PM₁₀ mass concentration

Measurement Range:

0 - 1000 µg/m³

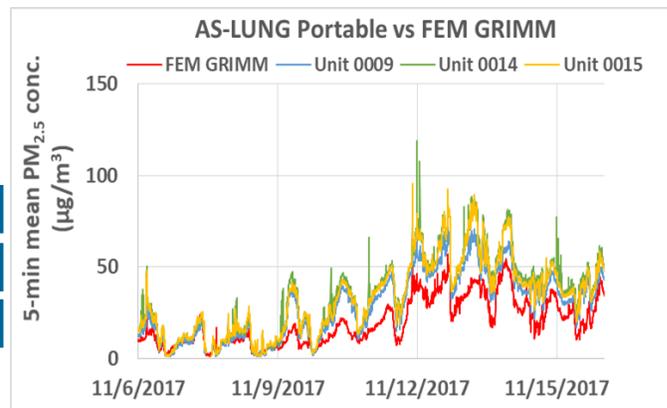
Type: Optical



- Overall, the AS-LUNG Portable sensors showed low to high accuracy, as compared to the reference instrument for PM_{1.0} and PM_{2.5}, for a con. range between 0 to ~300 µg/m³. Accuracy increased as PM_{2.5} conc. increased.
- The AS-LUNG Portable sensors exhibited high precision for all T/RH combinations and all PM concentrations.
- The AS-LUNG Portable sensors (IDs: 0009, 0014 and 0015) showed low intra-model variability.
- Data recovery was ~ 85% and 100% from all units in the field and in the laboratory, respectively
- For PM_{1.0} and PM_{2.5}, the AS-LUNG Portable sensors showed strong correlations with GRIMM (PM_{1.0} R² ~ 0.86) and the FEM GRIMM and FEM BAM from the field (PM_{2.5} R² > 0.77 and PM_{2.5} R² > 0.82, respectively) and very strong correlations with GRIMM in the laboratory studies (PM_{1.0} R² > 0.99 and PM_{2.5} R² > 0.99).

Field Evaluation Highlights

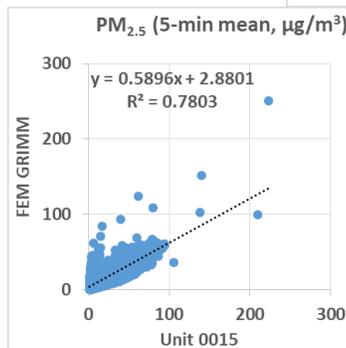
- Deployment period 10/06/2017 - 12/14/2017: the three AS-LUNG Portable sensors showed strong correlations with PM_{1.0} and PM_{2.5} mass conc. as monitored by the reference instruments GRIMM and BAM. PM₁₀ mass conc. showed very weak correlations with the corresponding GRIMM and BAM data
- The units showed good data recovery and very low intra-model variability.



PM_{1.0}: 0.86 <R² < 0.87

PM_{2.5}: 0.77 <R² < 0.84

PM₁₀: 0.09 <R² < 0.14



Coefficient of Determination (R²) quantifies how the three sensors followed the PM_{2.5} concentration change by FEM.

An R² approaching the value of 1 reflects a near perfect agreement, whereas a value of 0 indicates a complete lack of correlation.

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>

Laboratory Evaluation Highlights

Accuracy (PM_{2.5})

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

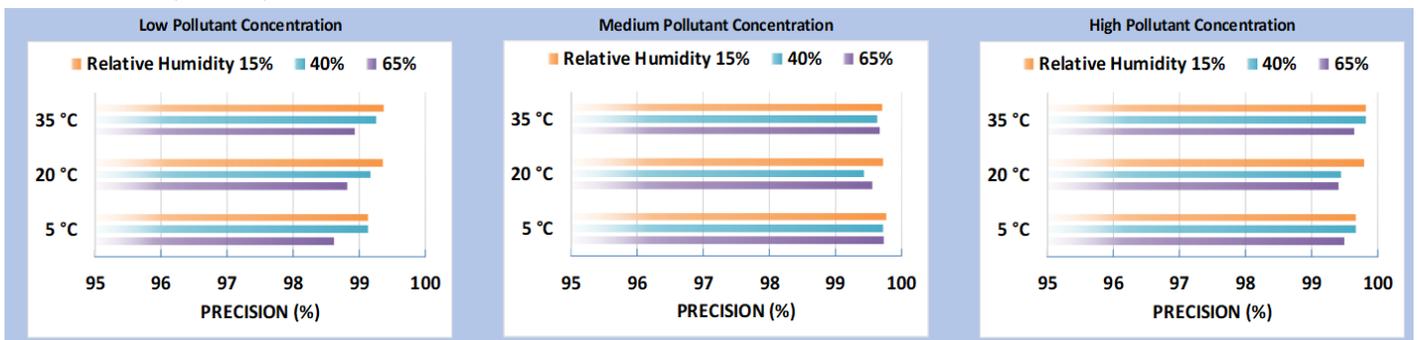
Steady state #	Sensor Mean (µg/m ³)	FEM GRIMM (µg/m ³)	Accuracy (%)
1	19.0	9.9	8.7
2	28.7	14.2	2.5
3	56.3	43.4	70.4
4	160.1	132.1	78.8
5	300.8	267.4	87.5

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.

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



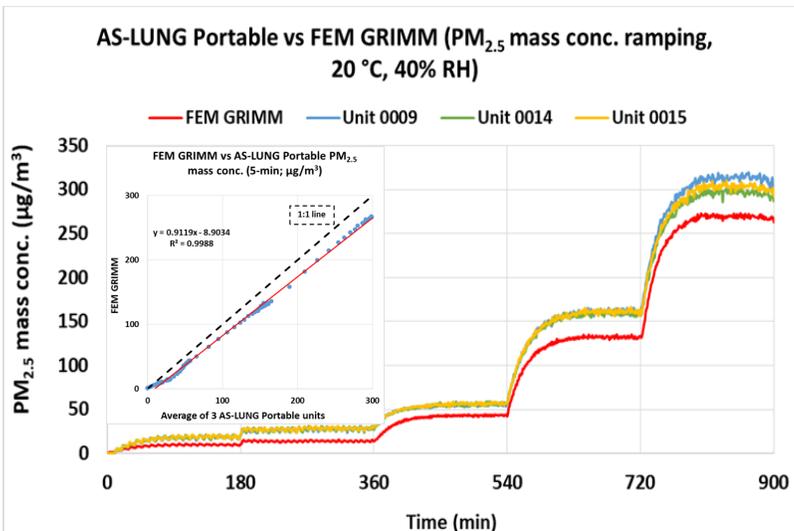
Precision (PM_{2.5})



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%) cold and humid (5 °C and 65%), hot and humid (35 °C and 65%), or hot and dry (35 °C and 15%).

Coefficient of Determination



The AS-LUNG Portable sensors showed very strong correlations with the corresponding FEM PM_{2.5} data ($R^2 > 0.99$) at 20 °C and 40% RH.

For conc. ramping experiments of PM_{1.0}, please see the lab report.

Climate Susceptibility

From the laboratory studies, temperature and relative humidity had minimal effect on the AS-LUNG Portable sensor performance.

Observed Interferents

N/A



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