

# AQ-SPEC

## Air Quality Sensor Performance Evaluation Center

### Sensor Description

Manufacturer/Model:  
Aeroqual  
Model AQY v0.5

Pollutants:  
NO<sub>2</sub>

Measurement Range:  
0 - 500 ppb

Type: Gas Sensitive  
Electrochemical (GSE)



### 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>

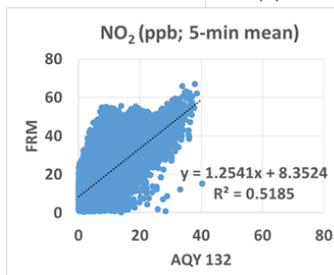
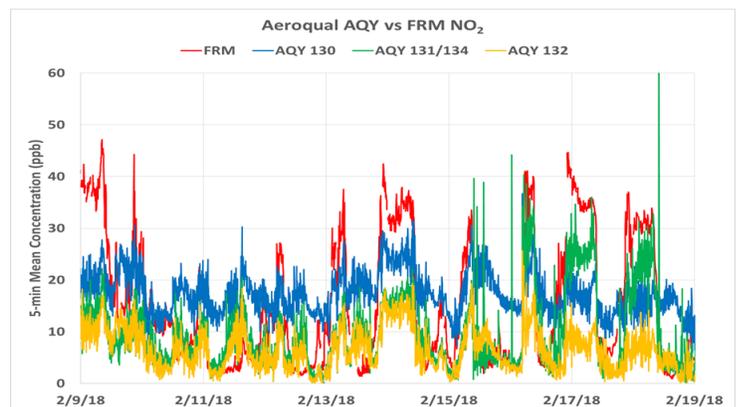
## Evaluation Summary

- Overall, the three Aeroqual AQY sensors (Units 130, 131 and 132) showed low accuracy in the laboratory studies. They underestimated the FRM NO<sub>2</sub> measurements for a concentration range between 0 to 150 ppb.
- The three Aeroqual AQY sensors exhibited moderate to high precision for most of the tested T/RH combinations in the environmental chamber, except at low NO<sub>2</sub> concentration under all T/RH combinations, in which precision could not be determined.
- The Aeroqual AQY sensors (Units 130 and 132) showed moderate intra-model variability in the field deployment and low to moderate intra-model variability in the laboratory testing (Units 130, 131 and 132).
- The Aeroqual AQY sensors had good data recovery (> 85 % for 5-min average in the field, and 100% for 1-min average in the laboratory).
- For NO<sub>2</sub>, the Aeroqual AQY sensors (Units 130 and 132) showed moderate correlations with the reference instrument in the field ( $R^2 \sim 0.50$ ) and very strong correlations with the FRM instrument in the laboratory studies ( $R^2 > 0.98$ , Units 130, 131 and 132).

## Field Evaluation Highlights

- Deployment period 12/22/2017- 03/27/2018: the Aeroqual AQY sensors (units IDs: 130 and 132) showed moderate correlations with NO<sub>2</sub> concentration changes as measured by the FRM instrument.
- The units showed > 85% data recovery as well as moderate intra-model variability.

$R^2 \sim 0.50$



Coefficient of Determination ( $R^2$ ) quantifies how the two sensors (Units 130 and 132) followed the NO<sub>2</sub> concentration change measured by the FRM instrument.

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

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

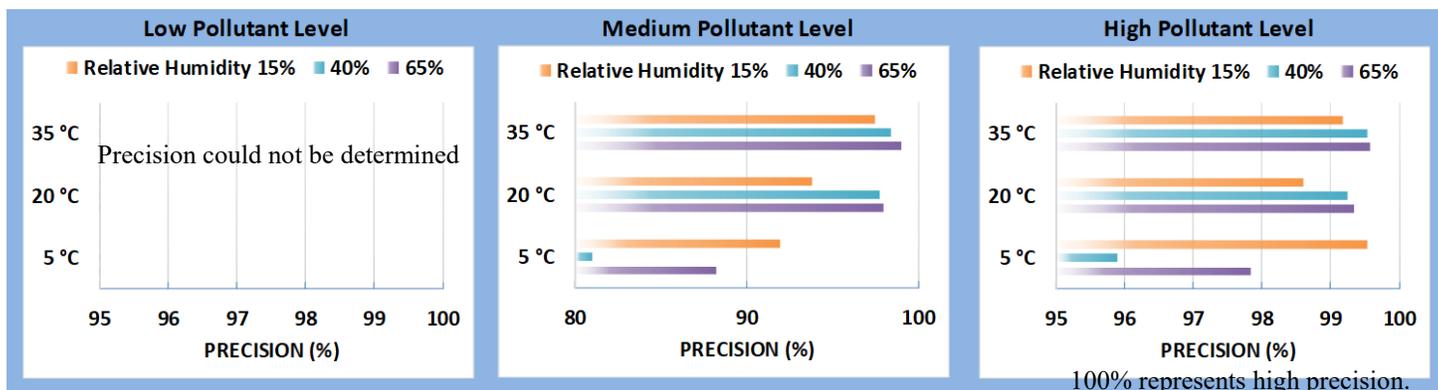
Steady State (#)	Sensor mean (ppb)	FRM (ppb)	Accuracy (%)
1	N/A	14.4	N/A
2	0.9	34.1	2.6
3	10.2	75.9	13.4
4	20.6	123.0	16.7
5	32.2	170.0	18.9

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

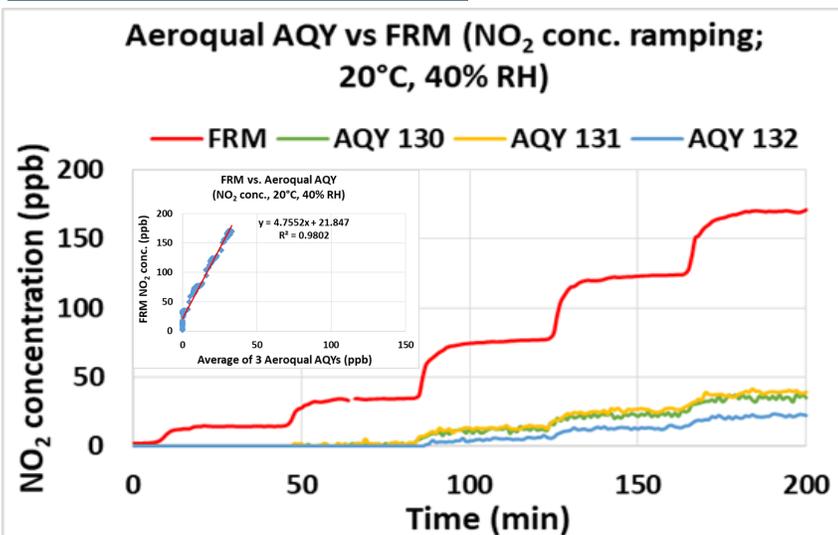


## Precision (NO<sub>2</sub>)



Sensor's ability of generating precise measurements of NO<sub>2</sub> 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 three Aeroqual AQY sensors showed very strong correlations with the corresponding FRM data ( $R^2 > 0.98$ ) at 20 °C and 40% RH.

## Climate Susceptibility (R<sup>2</sup>)

R <sup>2</sup>	5 °C	20 °C	35 °C
15%	0.920	0.960	0.983
40%	0.802	0.980	0.986
65%	0.921	0.968	0.994

## Observed Interferents

Ozone interfered with the NO<sub>2</sub> measurements



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