

Field Evaluation Air Quality Egg v.2 CO & NO₂ Sensors



Background

- From 12/31/2015 to 02/23/2016, three **Air Quality Egg v.2** sensor devices, each with a carbon monoxide (CO) and a nitrogen dioxide (NO₂) sensors were deployed in Rubidoux and run side-by-side with Federal Reference Method (FRM; EPA approved) instruments measuring the same pollutants
- Air Quality Egg v.2 (3 units tested):
 - Each unit has two electrochemical gas sensors (**non-FRM**) by spec-sensors (<http://www.spec-sensors.com/>) to measure CO (ppm) and NO₂ (ppb)
 - **Unit cost: ~\$240**
 - Time resolution: 1-min
 - Units IDs: AQE1, AQE2, AQE3
- SCAQMD FRM/FEM instruments:
 - CO instrument; **cost: ~\$10,000**
 - Time resolution: 1-min
 - NOx instrument; **cost: ~\$11,000**
 - Time resolution: 1-min
 - Meteorological station (wind speed, wind direction temperature, relative humidity, and pressure); **cost: ~\$5,000**
 - Time resolution: 1-min

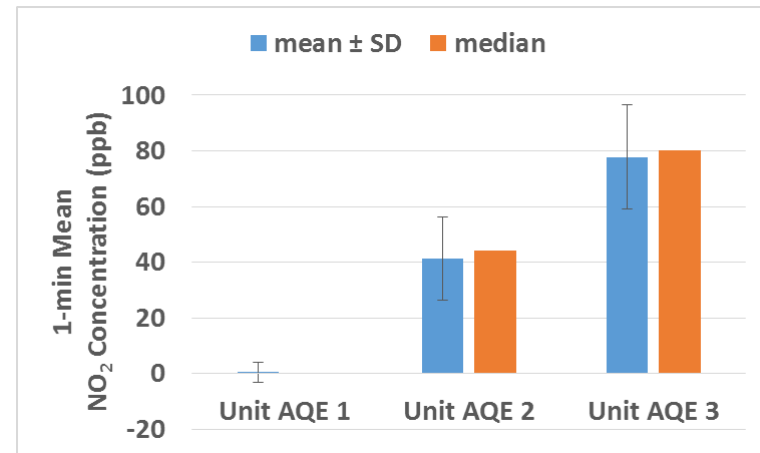
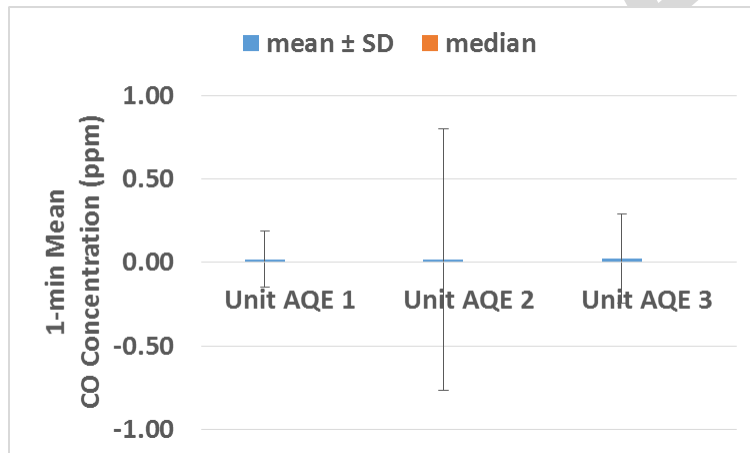


Data validation & recovery

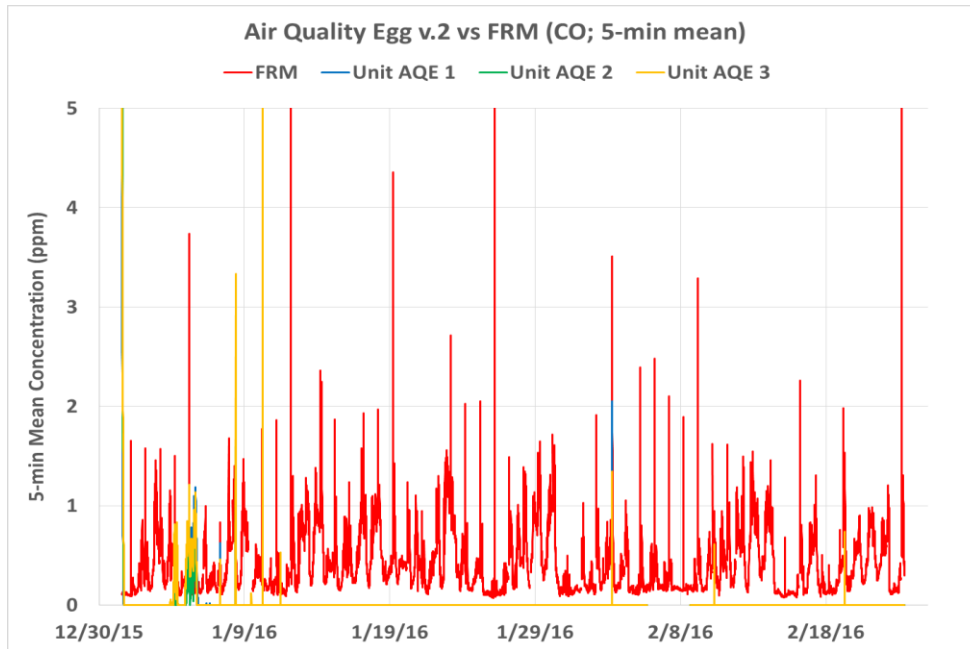
- Basic QA/QC procedures were used to validate the collected data (i.e. obvious outliers, negative values and invalid data-points were eliminated from the data-set)
- Data recovery for both CO & NO₂ from all three units AQE1, AQE2 and AQE3, was close to 100%

Air Quality Egg v.2; intra-model variability

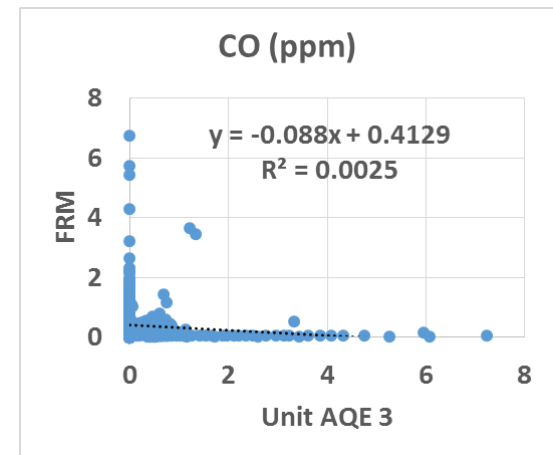
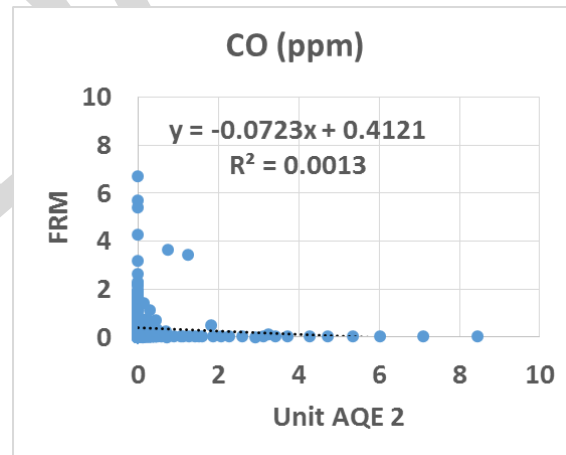
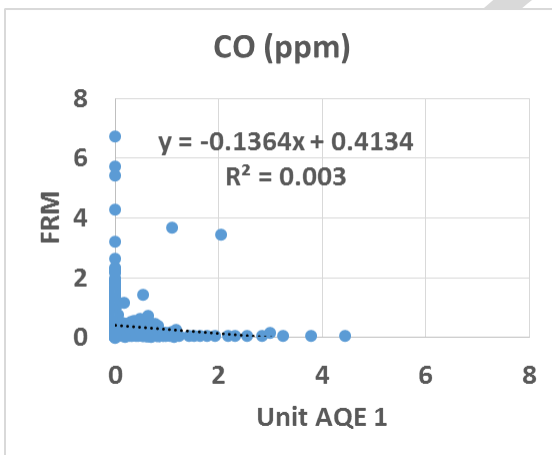
- A large measurement variability was observed between the three AQE v.2 units, each one measuring CO and NO₂



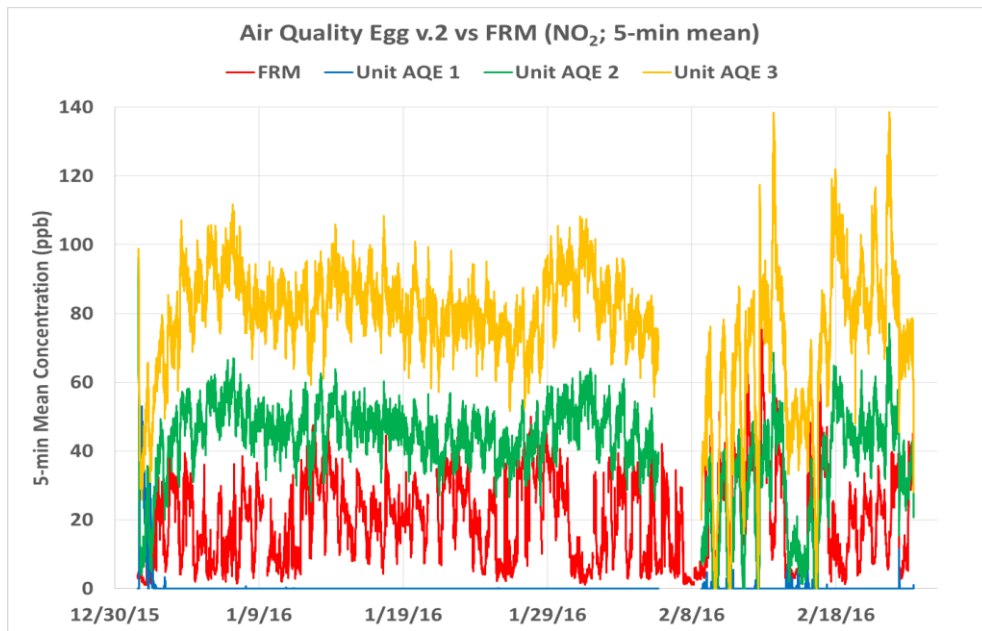
Air Quality Egg v.2 vs FRM (CO; 5-min mean)



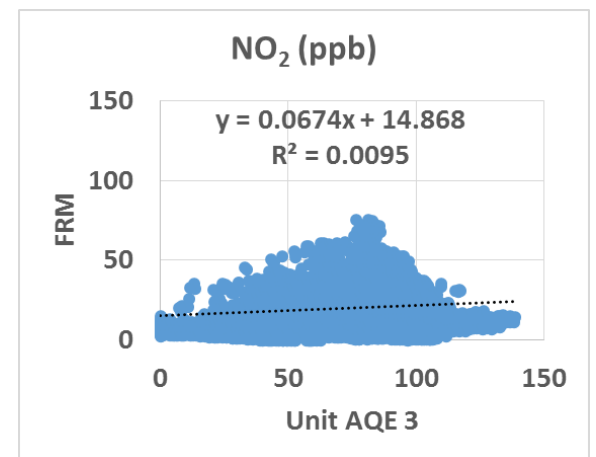
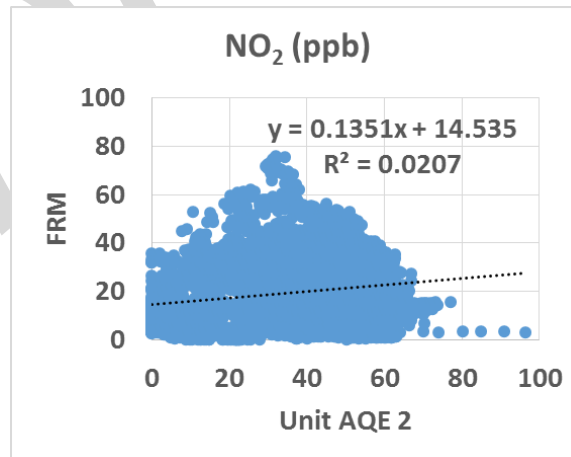
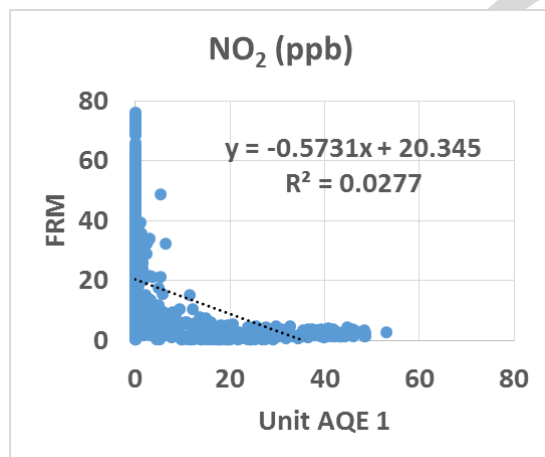
- CO measurements from all three AQE v.2 units do not correlate with the corresponding FRM data ($R^2 \sim 0.0$)



Air Quality Egg v.2 vs FRM (NO₂; 5-min mean)



- NO₂ measurements from all three AQE v.2 units do not correlate with the corresponding FRM data ($R^2 \sim 0.0$)



Discussion

- Overall, the three Air Quality Egg v.2 sensor devices tested, each one measuring CO and NO₂, were reliable (i.e. no down time over a period of about two months) with a high data recovery ~100%, but showed substantial intra-model variability
- There is a complete lack of correlation between the CO and NO₂ sensor data and the corresponding FRM data ($R^2 \sim 0.0$)
- It should be noted that no sensor calibration was performed by SCAQMD Staff prior to the beginning of this field testing
- Chamber testing under known target/interferent gas concentrations and controlled (temperature and relative humidity) conditions is necessary to fully evaluate the performance of the three Air Quality Egg v.2 units
- All results are still preliminary