Laboratory Evaluation
2B Technologies
Personal Ozone Monitor (POM)

South Coast AQMD

AQ-SPEC
Air Quality Sensor Performance Evaluation Center

Background

Three **2B Technologies Personal Ozone Monitor (POM)** (units IDs: 1043, 1105 and 1106) were field-tested at the South Coast AQMD Rubidoux fixed ambient monitoring station (07/29/2015 to 09/09/2015) under ambient weather conditions. Now, three new POMs (units ID: 1148, 1122, 1141) have been evaluated in the South Coast AQMD Chemistry Laboratory under controlled ozone concentration, temperature, and relative humidity.

2B Technologies POM (*3 units tested*):

- Ozone sensors (UV absorption, FEM)
- Each unit measures: Ozone (ppb)

Unit cost: ~$4,500

- Time resolution: 10-sec to 1-hr
- Units IDs: 1148, 1122, 1141

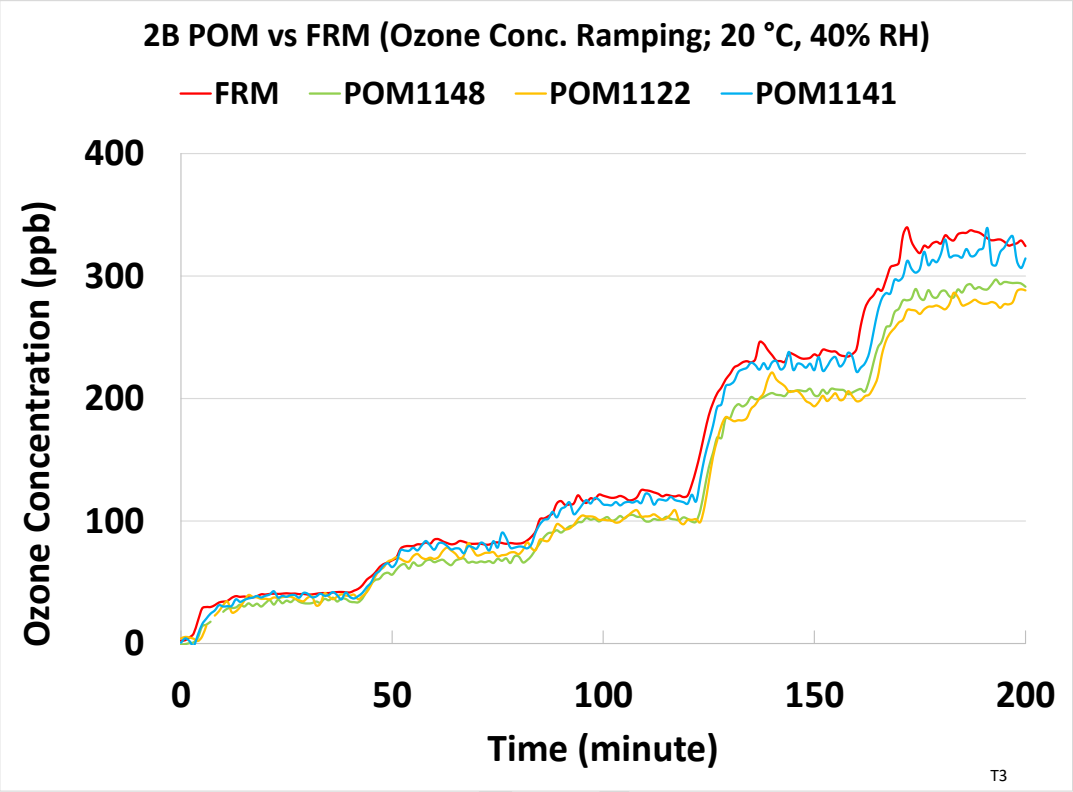
FRM instrument:

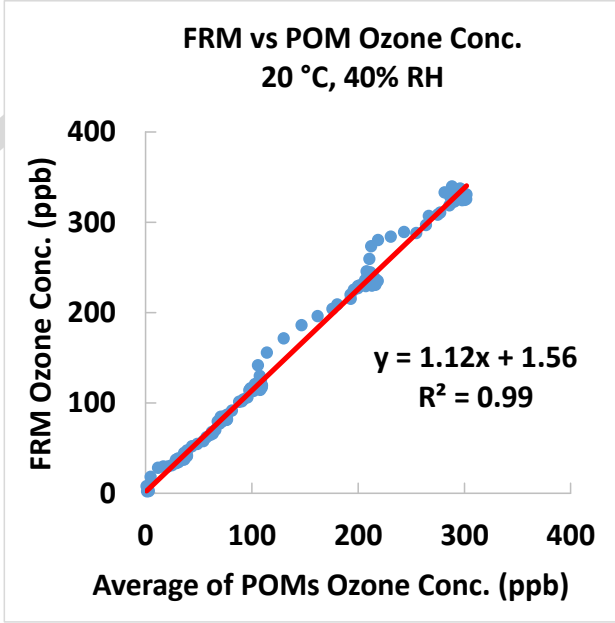
- Ozone FRM (Serinus 10, American Ecotech, Providence, RI)

Instrument cost: ~$7,000

- Time resolution: 1-min

Coefficient of Determination: POM vs FRM





- Three POM units tracked well with the ozone conc. change as recorded by FRM.
- POM units slightly underestimated the ozone conc. as recorded by FRM.

- In ozone concentration range of 0-350 ppb, the three POM units showed very strong correlations with the corresponding FRM data ($R^2 > 0.99$) at 20 °C and 40% RH.

POM Accuracy

- Accuracy (20 °C and 40% RH)

Steady State (#)	Sensor mean (ppb)	FRM (ppb)	Accuracy (%)
1	37.1	41.0	90.5
2	73.8	82.1	89.9
3	107.1	120.8	88.6
4	212.7	235.0	90.5
5	296.8	330.9	89.7

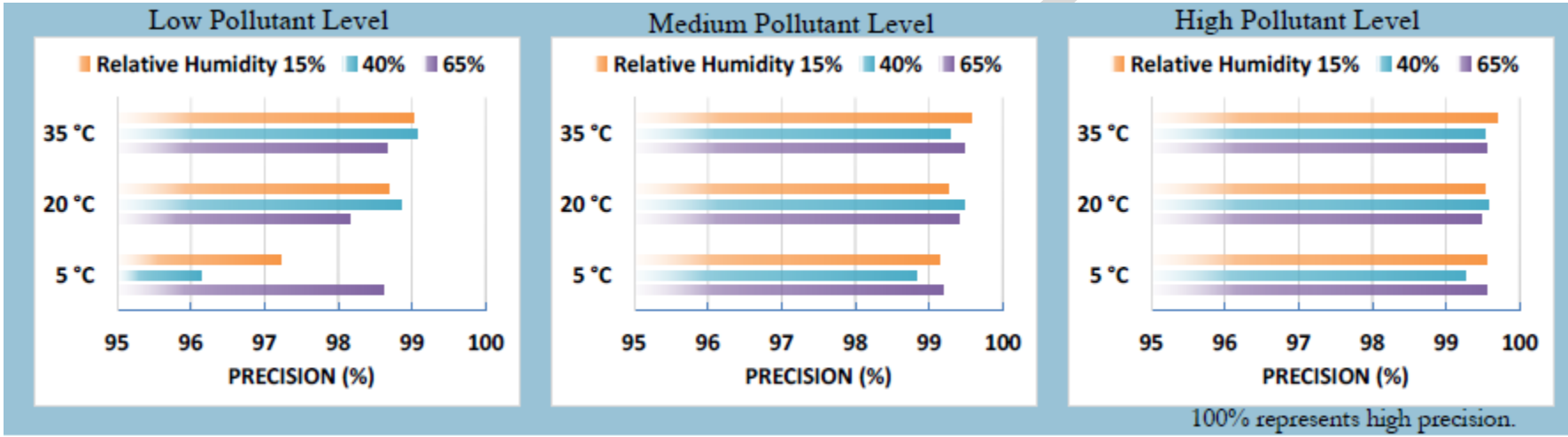
- The three POM units showed high accuracy compared to the FRM at 20 °C and 40% RH. Accuracy ranges from 89.7 to 90.5%.

POM Data Recovery & Intra-model Variability

- Data recovery for ozone from 1148, 1122, and 1141 was 100%, 94.2%, and 100%, respectively.
- Low ozone measurement variations were observed among the three POM units at 20 °C and 40% RH.

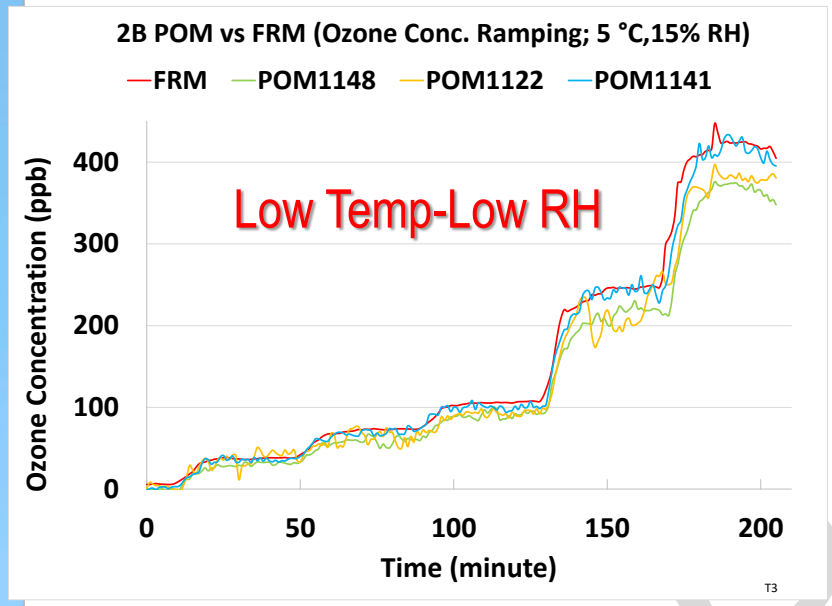
POM Precision

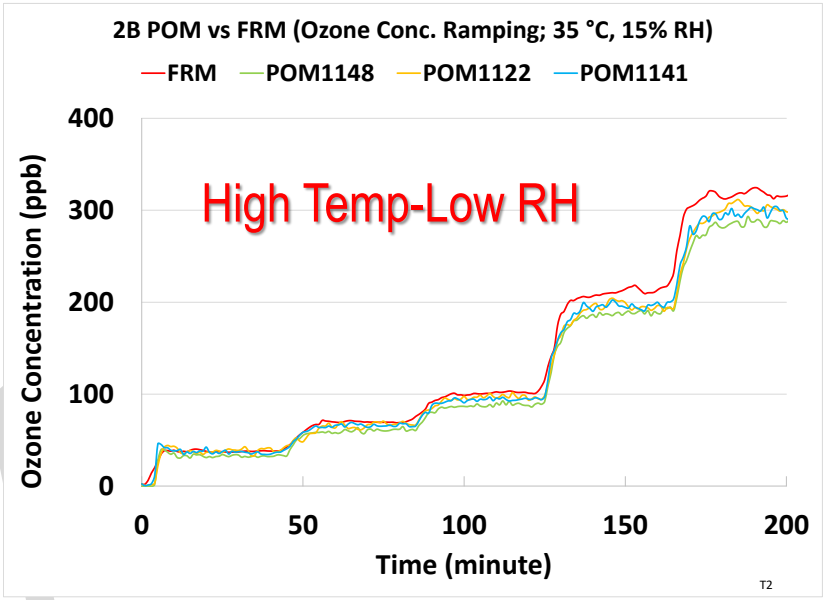
- Precision (Effect of ozone conc.,temperature and relative humidity)

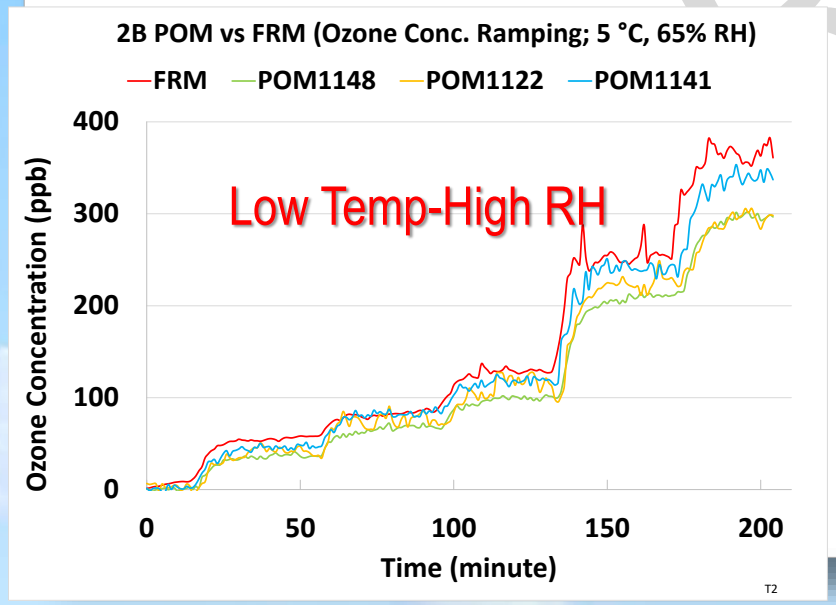


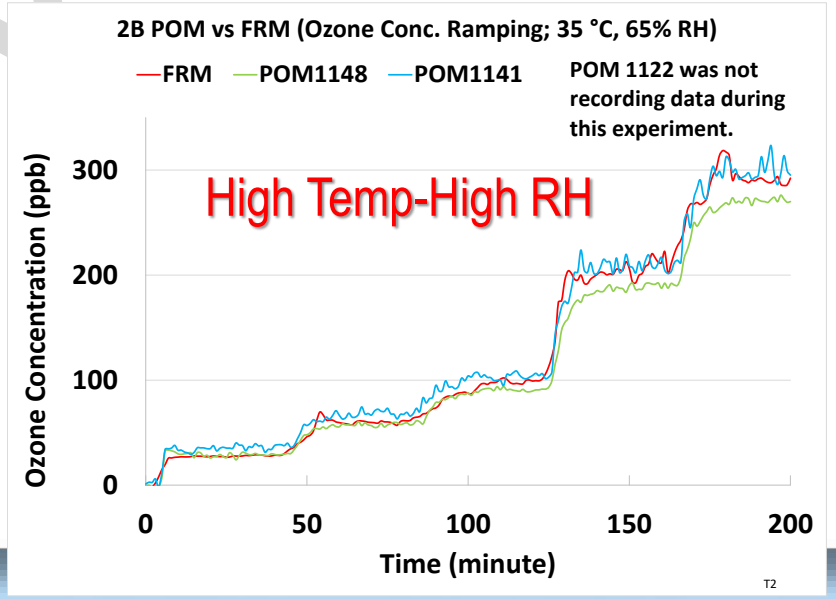
- The three POM units exhibited high precision during almost all tested conditions (ozone concentration, T and RH). POM 1122 experienced some instability at 5 °C, 40% RH and 20 °C, 65% RH.
- FRM's precision was also high across all conditions.

POM Climate Susceptibility

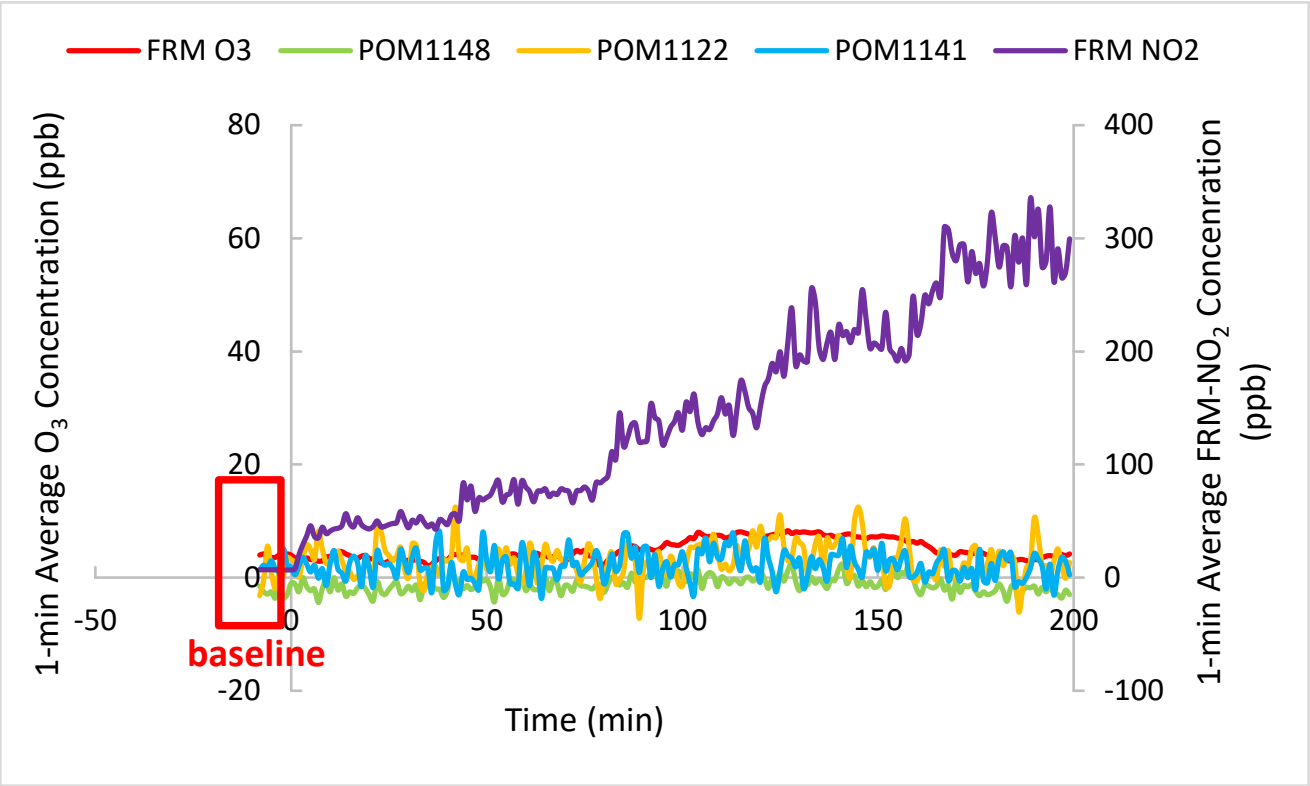








NO_2 Interferent



In the laboratory, the effect of NO_2 interferent is evaluated by exposing sensors to increasing concentrations of NO_2 at 20 °C and 40% RH. As shown in the figure, both the FRM and sensors maintained their baseline readings throughout the NO_2 concentration ramping from 0 to 300 ppb.

Discussion

- **Accuracy**: The three POM units showed high accuracy compared to the FRM at 20 °C and 40% RH. Accuracy ranges from 89.7 to 90.5%. (refer to slide 4)
- **Precision**: The three POM units exhibited high precision during almost all tested conditions (ozone concentration, T and RH). POM 1122 experienced some instability at 5 °C, 40% RH and 20 °C, 65% RH. (refer to slide 5 and 6)
- **Intra-model Variability**: Low ozone measurement variations were observed among the three POM units at 20 °C and 40% RH. (refer to slide 4)
- **Data Recovery**: Data recovery for ozone from 1148, 1122, and 1141 was 100%, 94.2%, and 100%, respectively. (refer to slide 4)
- **Baseline:** The three POM units reported baseline values close to 0 ppb.
- **Coefficient of Determination**: POM units showed excellent correlation/linear response with the corresponding FRM ozone measurement data ($R^2 > 0.99$) between 0-400 ppb at 20 °C and 40% RH. (refer to slide 3)
- **Interferent:** Sensors were inert to NO_2 at 20 °C and 40% RH. When NO_2 was increased from 0 to 300 ppb, the sensors maintained their baseline readings.
- **Drift** : POM units had negligible drift over the course of laboratory testing.
- **Climate susceptibility**: From the laboratory studies, temperature and relative humidity had little effect on the sensors' performance. (refer to slide 6)