Field Evaluation of UNI-TEC SENS-IT Sensor
• From 7/1/2015 to 7/31/2015, nine SENS-IT gaseous sensors were deployed in Rubidoux and were run side-by-side SCAQMD Federal Reference/Equivalent Method (FRM/FEM) instruments measuring the same pollutants

• SENS-IT (9 units tested):
  ➢ Gaseous sensors (metal oxide; non-FRM, non-FEM)
  ➢ Single pollutant measurements [i.e. 3 units for CO (ppm); 3 units for NO₂ (ppb); 3 units for Ozone (ppb)]
  ➢ Unit cost: ~$2,200
  ➢ Time resolution: 1-min
  ➢ Units IDs:
    • NO₂ sensors: U194, U144, U068
    • Ozone sensors: U190, U057, U059
    • CO sensors: U197, U247, U245

• SCAQMD FRM/FEM instruments:
  ➢ CO instrument; cost: ~$10,000
    ➢ Time resolution: 1-min
  ➢ NOx instrument; cost: ~$11,000
    ➢ Time resolution: 1-min
  ➢ O₃ instrument; cost: ~$7,000
    ➢ 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)
- For all units/pollutants tested data recovery was very high (i.e. >99%)

SENS-IT; intra-model variability

- Relatively low intra-model variability was observed for all SENS-IT sensors. However, unit U197 (measuring CO) provided invalid data.
Overall, all NO$_2$ measurements correlate fairly well with the corresponding FRM data (0.57<$R^2<$0.62), but the three SENS-IT sensors largely overestimated measured NO$_2$ concentrations.
• NO₂ measurements correlate fairly well with the corresponding FRM data (0.60<R²<0.65), but the three SENS-IT sensors largely overestimated measured NO₂ concentrations.
Ozone measurements correlate very well with the corresponding FEM data (0.72<\(R^2\)<0.83), but the three SENS-IT sensors underestimated measured Ozone concentrations.
Ozone measurements correlate very well with the corresponding FEM data (0.72 < $R^2$ < 0.83), but the three SENS-IT sensors underestimated measured Ozone concentrations.
Ozone measurements correlate well with the corresponding FEM data ($0.63<R^2<0.72$)
SENS-IT vs FRM (CO; 5-min mean)

- Poor correlation between CO measurements and the corresponding FRM data ($0.33 < R^2 < 0.43$)
Discussion

- Data recovery from the tested SENS-IT Sensors was very high (i.e. no down time over a period of one month)
- Overall, all SENS-IT devices were characterized by low intra-model variability despite the fact that one CO unit produced invalid data
- Despite the good correlation ($R^2$) between the NO$_2$ sensors and the corresponding FRM instrument, the magnitude of the NO$_2$ sensor measurements was largely overestimated. Conversely, although the Ozone sensors were well correlated with a substantially more expensive FEM instrument, the magnitude of the Ozone sensor measurements was underestimated
- The CO sensors correlate poorly with the corresponding FRM monitor
- It should be noted that no sensor calibration had been performed by SCAQMD Staff prior to the beginning of this field testing
- Laboratory chamber testing under temperature- and relative humidity- controlled conditions, known individual gas concentrations and known concentrations of interferent gas mixtures is necessary to fully evaluate the performance of these Unitec SENS-IT sensors

- All results are still preliminary