**Field and Laboratory Evaluation of Plantower PMS Low-Cost Particulate Matter Sensors**

**Tofigh Sayahi, Dylan Kaufman, Kerry Kelly**

Low-cost particulate matter (PM) sensors are becoming more widely available and are being increasingly deployed in ambient and workplace environments due to their low cost and ability to provide highly resolved spatial and temporal PM data. However, these inexpensive sensors have limitations and need to be characterized for the conditions of use. This study evaluated two models of a low-cost light-scattering PM sensor (the Plantower PMS 3003 and 5003) under controlled laboratory and ambient conditions. An aerosol chamber was designed and used to assess laboratory performance of 242 Plantower PMS 3003 sensors using two different types of particles, representing dust and secondary aerosols. This chamber is capable of providing uniformly distributed particle concentrations to eight low-cost sensors and a reference instrument. Two field evaluations were also conducted in this study: a) The ambient sensor evaluation occurred at two state monitoring stations located in urban residential areas in Salt Lake City, UT and included elevated PM levels caused by cold air pools, fireworks and wildfires. b) 181 sets of two co-located Plantower PMS 5003 sensors (dual sensors) deployed in different parts of Salt Lake City, UT and were evaluated over a period of 14 months in the winter of 2017 to investigate the inter-device agreement of the sensors during periodic episodes of high PM levels associated with several cold air pool events.

The laboratory and ambient assessments allow us to evaluate the performance of the low-cost sensors in terms of precision and accuracy of measurements, limits of detection, drifts and linearity of the response. The laboratory results show high correlations between the reference instrument (TSI DustTrakII) and the PMS 3003 PM2.5 readings (R2>0.978). The long-term ambient evaluation of the PMS 3003 also showed high inter-sensor correlations (R2>0.975) and very good agreements with FEMs (R2>0.882). In addition, comparing the slopes of the linear relationships for the dual sensors showed that 76% of these slopes agreed within 15% of each other.