USEPA sensor performance evaluation checklist*

Select your test sites

- ☐ **Consider sites where reference monitoring equipment is already available:** Testers may wish to avoid procuring FRM/FEM equipment by developing relationships with state, local, or tribal air quality agencies to colocate sensors near FRM/FEM monitors at existing air quality monitoring sites.
- ☐ **Choose at least two sites in different climatic regions:** Select at least two sites located in climate regions that are not adjacent for the greatest possible variation in $PM_{2.5}$ variables.
- ☐ **Target at least one day with a 24-hour average $PM_{2.5}$ concentration of ≥ 25 µg/m³:** Target sites with adequate $PM_{2.5}$ exposure to ensure statistics are comparable across sites and that a low R^2 does not occur due solely to low $PM_{2.5}$ concentration ranges.

Perform technical setup

- ☐ **Establish reference monitors:** If not already set up at a test site, install the FRM/FEM, T, and RH monitors at the test site. Reference monitors should be 2 to 15 meters from the ground, more than 1 meter from supporting structures, and a minimum of 10 meters from trees and roadways
- ☐ **Time zone settings:** Adjust all instrument times to a common standard clock (e.g. NIST time).
- ☐ **Configure all devices for consistent sampling interval:** Consider whether data from any instrument reports an average; if so, understand if the data average is 'time ending' or 'time beginning'.
- ☐ **Connectivity:** For testing purposes, the USEPA recommends that measurements be logged internally on each instrument or through a central data acquisition system. If an internet or cellular connection is needed to operate the sensor, this information should be reported.
- ☐ **Understand if any calibration will be applied by the sensors**: If data from the sensors will typically be calibrated before use by end-users, the USEPA recommends issuing a secondary report using calibrated data. Primary performance testing should be based on raw (uncalibrated) data outputs.
- ☐ **Conduct a one-point flow rate verification check on FRM/FEM monitor:** Record the date of the check.

Install your air sensors

- ☐ **Install LCS at the test site:** Use sensors in the same condition as received from the manufacturer.
- ☐ **Take photographs of the equipment setup:** Include these in your documentation.
- ☐ **Record information about the equipment and set-up, including:**
  - ☐ **Parameters measured** (e.g., pollutant(s) and units)
  - ☐ **Sampling time interval** (e.g., 15-minute, 1-hour, 24-hour)
  - ☐ **Data storage and transmission method(s)** (e.g. where data are stored/transmitted, the form of data stored—raw and/or corrected/cleaned data)
  - ☐ **Data analysis/data correction scripts** (e.g., Jupyter Notebook, R Markdown)
  - ☐ **Location of final reported data and its format** (e.g., website shows raw data and corrected data on the user interface, data provided as .csv, expanded definitions of data headers)
  - ☐ **Data correction approach (if applicable) including:**
    - ☐ **How the data are corrected** (e.g., manufacturer derived multilinear correction)
    - ☐ **Variables used to correct the data** (e.g., RH, T)
    - ☐ **Where the correction variable(s) comes from** (e.g., onboard RH sensor)
    - ☐ **How the data are validated or calibrated** (e.g., RH sensor calibrated by manufacturer)

Conduct field testing

- ☐ **Verify that all equipment is reporting measurements.**
- ☐ **Allow all equipment to run for at least 30 consecutive days:** All equipment should be running during the same time period to allow for comparable results
- ☐ **Follow manufacturer maintenance recommendations for all equipment throughout testing:** Record and report all maintenance or troubleshooting performed, including dates/times
- ☐ **Record and report the rationale for missing or invalidated data:** Target at least 75% uptime for all instruments (i.e. all equipment reporting at least 23 valid 24-hour pairs of time-matched data points)
- ☐ **Generate a field testing report for each deployment:** Each deployment should have a separate report
- ☐ **Generate a secondary report for calibrated data, if this is how the sensors will be operated.**

* Note that the above is a summarized version of the testing protocols provided by USEPA. For the full protocols, please refer to the USEPA Performance Testing Protocols Metrics and Target Values for Fine Particulate Matter Air Sensors (February 2021).