District Initiative to Facilitate Good Citizen Science for Utilizing Personal Air Sensors in the San Joaquin Valley

San Joaquin Valley Air Pollution Control District
Governing Board Meeting

October 19, 2017

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Continuing District Efforts to Meet Public's Demand for Air Quality Information

- Launched Real-time Air Advisory Network (RAAN) in 2010
  - First and still only such system in the nation
  - Provides public access to hourly air quality conditions at local air monitoring sites, along with guidance for outdoor activities
- Neighborhood RAAN
  - Provides public with air quality information by entering address of interest into system
  - Historical archived information for all neighborhoods (WAAQS 2015)
  - System for real-time air quality information for all neighborhoods to be launched in early 2018
- Action plan to assist public with the use of low cost air quality sensors (today)
  - Growing public interest in using personal low cost sensors
  - Need for education and guidance

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Current State of Sensor Technology

- Sensor technology developing at rapid pace in recent years
  - Provides general public ability to measure pollutants at home or business
  - Cost of current sensor technology continuing to become more affordable, some as low as $200
- More technology options available now than ever before, and sensors measure a variety of pollutants
  - Gas parameters (ozone, NO2, CO, SO2)
  - Particulate matter parameters (PM10, PM2.5, PM1.0)
  - Meteorological parameters (temperature, humidity, pressure)
- Many sensors weatherproof, solar powered, connect through cellular networks or Wi-Fi
  - Act as compact and portable air monitoring sites

Current State of Sensor Technology (cont'd)

Assisting Valley Residents with Use of Personal Air Monitoring Sensors

- District has extensive experience with operating and maintaining air monitoring equipment
  - In position to provide education/guidance to citizens and community groups interested in using sensor technologies
- Improvements have been made with sensor technology in recent years, but limitations still exist, including:
  - Accuracy of monitoring technology
  - Manner by which the sensors are used
  - Lack of air monitoring training
- Public education can minimize these limitations, making their use more valuable

Accuracy of Low Cost Sensors

- Many low cost sensors shown to have poor accuracy
  - Not representative of true conditions
  - South Coast AQMD's extensive laboratory tests have concluded that many sensors are less precise than regulatory monitors
- District makes significant effort to ensure air monitoring network follows strict federal quality assurance requirements
  - Equipment maintenance schedules
  - Regular calibration and certification of high precision equipment
  - Ongoing independent audits by ARB and federal EPA
  - Extensive training for District monitoring staff
- Low cost sensors do not follow these strict guidelines, so data can drift from performance standards

Proper Placement of Sensors

- Sensor location can skew data and impact what the collected data may be used for
- Obstructions can lead to overly concentrating emissions not reflective of actual concentrations
- Ambient air monitoring reflective of what individuals are actually exposed to must be free from obstructions
- District network designed for regulatory purposes under CAA
  - Designed for area-wide exposure in large communities
  - Follows strict siting, maintenance, data QA/QC, and instrument quality requirements
- If purpose of sensors is to measure area-wide exposure then low cost sensors must adhere to same strict standards

Quality of Low Cost Sensor Components

- District's air monitoring equipment consists of high precision components and EPA approved pollutant measurement methodologies
  - District regulatory equipment designed by EPA as Federal Reference Method (FRM) or Federal Equivalent Method (FEM)
  - Data from FRM/FEM monitors are considered regulatory, can be compared against federal air quality standards (to determine whether an area is in attainment of a standard)
- Low cost sensors not built with precise components or equipped with EPA approved measurement technologies
  - Measured data not of high quality necessary to compare with federal air quality standards

Interpretation of Data from Low Cost Sensors

- Correct interpretation of data collected from low cost sensors important
  - Incorrect health risk communication can mislead public
  - Many low cost sensors report Air Quality Index (AQI) measurements based on instantaneous or very short-term readings
  - Official EPA AQI is based on averages of 8-hours for ozone and 24-hours for PM
- Some users of low cost sensors compare instantaneous readings to annual PM2.5 standard
  - Inappropriate since annual PM2.5 standard represents average readings for an entire year

District's Initiative Recommendations

- If approved by your Board, District will undertake the following actions:
  - Work in partnership with other agencies to test accuracy of various sensor technologies available to the general public
  - Collocate personal air quality sensors at various District air monitoring sites to compare accuracy
  - Define and share with public information that can reliably be ascertained from personal air quality sensors. For instance, for some sensors, information may only be probative in establishing relative trends in air quality versus providing an accurate absolute measurement of air pollutant concentrations.

District's Initiative Recommendations (cont'd)

- Develop educational materials and guidance documents on the proper placement of monitoring equipment, considering the air quality area of interest
- Provide guidance for how data should be interpreted and used, making clear that collected data will not be used in the framework of regulatory monitoring
- Engage in partnerships and oversight with community groups and businesses who wish to use personal air monitoring sensors for monitoring projects
- Provide public education and training disseminating above information to the public through web-based tools and/or public meetings