

EPA Assistance Agreement Annual Report Summary

Period Covered by the Report: May 1, 2017 to April 30, 2018

Date of Report: August 1, 2018

EPA Agreement Number: RD83618401

Title: Engage, Educate, and Empower California Communities on the Use and Applications of “Low-Cost” Air Monitoring Sensors

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Project Period: May 1, 2016 to April 30, 2019 (2-yr no-cost extension until April 30, 2021 was requested and approved after the reporting period for this report)

Objectives: The overall objective of the proposed research is to provide California communities with the knowledge necessary to appropriately select, use, and maintain “low-cost” sensors and to correctly interpret sensor data. This will be accomplished by pursuing the following four specific aims: (1) develop new methodologies to educate and engage communities on the use and applications of “low-cost” sensors ; (2) conduct testing to characterize the performance of commercially available “low-cost” sensors and to identify candidates for field deployment; (3) deploy the selected sensors in California communities, and interpret the collected data; and (4) communicate the lessons learned to the public through a series of outreach activities.

Progress Summary/Accomplishments (Outputs/Outcomes):

Aim 1. SCAQMD worked with STI (co-Principal Investigator) to develop a draft guidebook for the educational toolkit with a focus on content that encompasses the three major stages of community air monitoring: planning, deployment, and community action. SCAQMD worked with UCLA (co-Principal Investigator), Special Service for Groups (Asian Pacific Forward Movement, Comite Civico del Valle Inc.), other community groups and air pollution control districts that are members of the California Air Pollution Control Officers Association (CAPCOA) to recruit communities in Environmental Justice areas and near specific sources of air pollution in California. **Aim 2.** The SCAQMD Air Quality Sensor Performance Evaluation Center (AQ-SPEC, www.aqmd.gov/aq-spec) conducted a thorough performance characterization of currently commercially available “low-cost” sensors using both field and laboratory testing, and identified particulate matter (PM) and Ozone “low-cost” air monitoring sensor candidates for field deployment. The activities related to this aim have been completed. **Aim 3.** Sensor deployment first began in southern California communities during the fall of 2017. Since then, the SCAQMD received multiple requests from local community groups to participate in this project and decided to expand its efforts to include a total of nine community groups in the southern California region alone. Another two communities in central California were also included in the project for a total of 11 communities. A total of more than 290 low-cost PM sensors have been distributed on a 1-to-1 (host-sensor) basis to community members in those communities and more than 60% of those sensors have already been installed and report fine and coarse particulate matter (PM_{2.5} and PM₁₀) concentration levels (see Figure below).

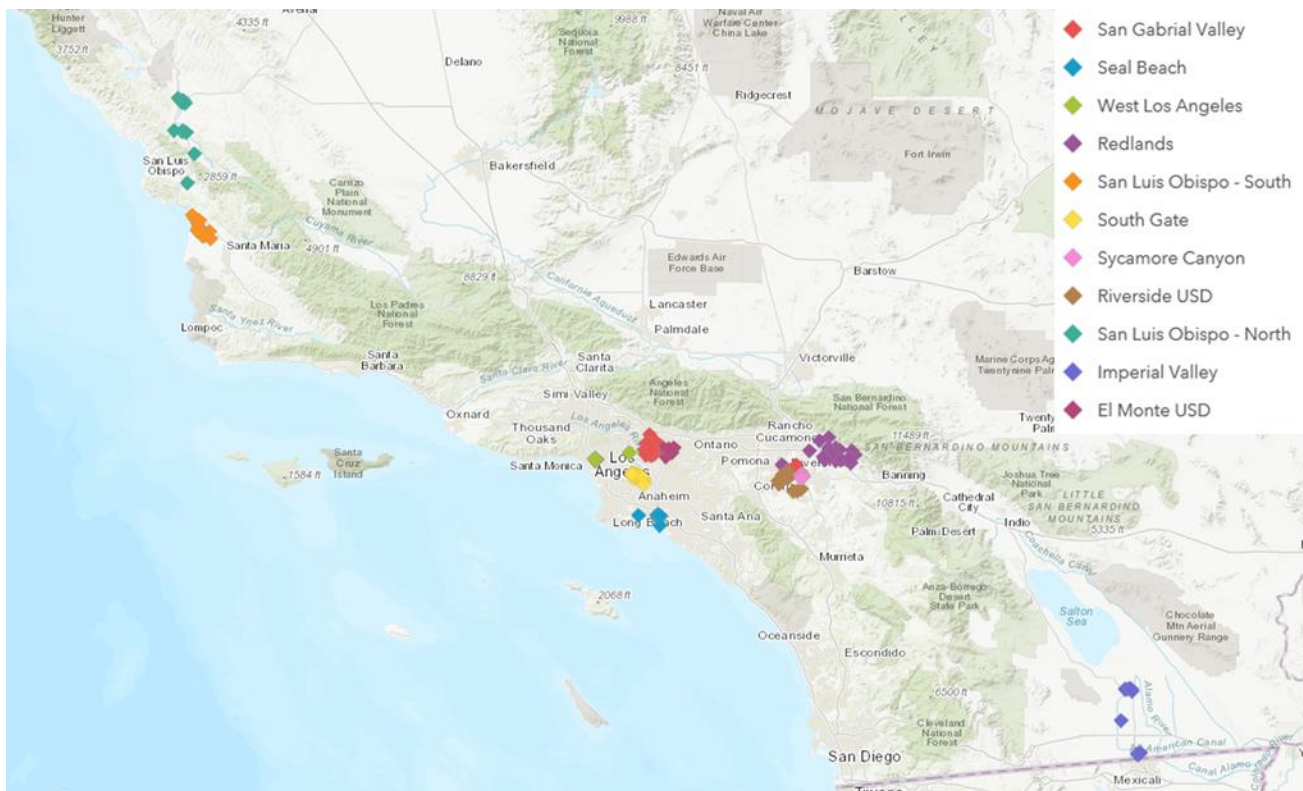


Figure. Sensor deployment in 11 California communities between October 2017 and April 2018.

Sensors are accompanied by copies of the sensor installation guide in English and Spanish, developed by SCAQMD. San Luis Obispo County APCD (SLOCAPCD) partnered with SCAQMD and recruited two communities in central California, one community in the southern part of the county in Nipomo and another community in the northern part of the county in Paso Robles. A total of 50 sensors were distributed to community members in those two communities. Bay Area Air Quality Management District (BAAQMD) has started coordinating the recruitment of two community groups in the San Francisco Bay Area. Santa Barbara County Air Pollution Control District (SBCAPCD) has installed 40 PM sensors measuring PM_{1} , $PM_{2.5}$ and PM_{10} and has started recruiting additional communities/schools in their jurisdiction. To complement and further expand the goal and objectives of Aim 3, SCAQMD partnered with the University of Auckland (New Zealand) and deployed 100 additional sensor devices measuring multiple pollutants (i.e., ozone, nitrogen dioxide, $PM_{2.5}$ and PM_{10}) in southern California communities.

Publications/Presentations:

During this reporting period, there have been two peer-reviewed publications in scientific journals and four podium/poster presentations at conferences:

Hagler GSW, Williams R, Papapostolou V and Polidori A. Air quality sensors and data adjustment algorithms: When is it no longer a measurement? *Environmental Science and Technology*, 2018, 52 (10), pp 5530–5531. DOI: <https://doi.org/10.1021/acs.est.8b01826>

Papapostolou V, Zhang H, Feenstra BJ and Polidori A. Development of an environmental chamber for evaluating the performance of low-cost air quality sensors under controlled conditions. *Atmospheric Environment*, 171: 82-90, **2017**. DOI: <https://doi.org/10.1016/j.atmosenv.2017.10.003>

Papapostolou V, Feenstra B, Zhang H, Polidori A. "Low-cost" Sensors for Measuring Gaseous and Particle Air Pollutants: Performance Results from Three Years of AQ-SPEC Field and Laboratory Testing and Network Applications at the Fenceline and Community Level. Air and Waste Management Association – 2017 Air Quality Measurement Methods and Technology, November 2017, Long Beach, California. (Podium presentation).

Papapostolou V, Zhang H, Feenstra B, Polidori A. Development of an Environmental Chamber for the Laboratory Evaluation of "Low-Cost" Air Quality Sensors. 36th American Association for Aerosol Research, October 2017, Raleigh, North Carolina. (Podium presentation)

Polidori A, Feenstra B, Papapostolou V, Zhang H. Performance Evaluation of "Low-Cost" Sensors for Measuring Gaseous and Particle Air Pollutants: Results from Three Years of Field and Laboratory Testing. 36th American Association for Aerosol Research, October 2017, Raleigh, North Carolina. (Podium presentation)

Feenstra B, Papapostolou V, Pikelnaya O, Zhang H, Polidori A. Spatial and Temporal Variability of Particulate Matter Using a Network of Air Quality Sensors in a Southern California Community. 36th American Association for Aerosol Research, October 2017, Raleigh, North Carolina. (Poster presentation)

Upcoming Activities:

Aim 1. Recruitment of additional communities in southern California and two new communities in northern California is expected to be completed during the beginning of the next reporting cycle. SCAQMD will work with BAAQMD and STI to deploy sensors in the two communities in the San Francisco Bay Area. SCAQMD will work with STI, UCLA, SSG, CCV and CAPCOA to determine how to incorporate sensor-specific information, in the guidebook, the training videos and other educational material. STI will receive and incorporate feedback on the guidebook from SCAQMD, UCLA, Community Groups and CAPCOA. The updated guidebook will then be used and evaluated during the community workshops and the content, structure, and design will be adapted and refined. UCLA plans to pilot test the project documentation for clarity and impact. Community members will be trained on how to operate low-cost sensors and will provide feedback on the use and usefulness of these devices. They will also conduct outreach activities to engage other members of their communities. **Aim 3.** Sensor deployments in all participating communities is expected to be completed by the end of August 2018, and subsequently SCAQMD in collaboration with all partners will commence the process of a thorough validation and interpretation of the collected low-cost sensor data.

Supplemental Keywords: community recruitment, community engagement, community education, community empowerment, sensor testing, sensor selection, sensor deployment, particulate matter, PM2.5, PM10, ozone, data interpretation, public outreach

Relevant website: www.aqmd.gov/aq-spec