Application for the U.S. Environmental Protection Agency solicitation:
"Community-scale Air Toxics Ambient Monitoring".

RFP Number: EPA-OAR-OAQPS-15-01
CATALOG OF FEDERAL DOMESTIC ASSISTANCE (CFDA) Number: 66.034

Project Title:	**Application Of Next Generation Air Monitoring Methods To Characterize Hazardous Air Pollutant Emissions From Refineries and Assess Potential Impacts To Surrounding Communities**
Category:	Community Scale Monitoring
Applicant:	South Coast Air Quality Management District 21865 Copley Drive, Diamond Bar, CA 91765-4178
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Funding Requested from EPA:	**$569,682**
Total Project Cost:	$1,846,650
Cost Sharing:	In-kind contributions by the applicant (SCAQMD) are provided via on-going advanced air monitoring activities, monitoring platforms, and staff resources in the field and in the laboratory.
Project duration:	June 1, 2015 – May 31, 2018
DUNS Number:	0259861590000

Basis and Rationale

Large petrochemical facilities situated in metropolitan areas can make significant contributions to anthropogenic air pollution emissions on a local and regional scale. For example, nitrogen oxides (NOx) and volatile organic compounds (VOCs) from refineries contribute to photochemical ozone formation. Some of these compounds are also known air toxics. For instance formaldehyde (HCHO), either directly emitted by industrial facilities or formed as a secondary product of VOC degradation, is designated by the 2005 National-Scale Air Toxics Assessment (NATA) as a national cancer risk driver (1). Exposure to this and other important air toxics (e.g., benzene) is of particular concern at locations downwind of large industrial complexes, such as in Carson and Wilmington (Los Angeles, California). This area is directly downwind of several refineries, chemical plants, other industrial facilities, and the ports of Long Beach and Los Angeles, and includes environmental justice (EJ) communities that are at a high risk of exposure for a multitude of Hazardous Air Pollutants (HAPs).

The amount of air pollutants released from large industrial facilities is typically estimated using empirical calculations provided by available emission inventories, and is not completely characterized. However, there is a growing body of evidence suggesting that emission inventories for most pollutants, particularly VOCs, are largely underestimated and that "real-life" VOC emissions from petrochemical facilities are much greater than reported (e.g. 2,3). Therefore, improved knowledge of the actual magnitude of VOC and other HAP emissions from industrial facilities and their temporal and spatial distribution is crucial for attaining EPA's air quality standards and for protecting surrounding communities. This challenge is further augmented by the fact that HAPs are usually present at very low ambient concentrations and are difficult to measure with conventional monitoring instruments.

Most available monitoring methods for air toxics are limited to the collection of integrated field samples (e.g., using canisters) followed by laboratory analysis, and do not allow for continuous monitoring or dense spatial coverage, nor do they provide the ability to realistically ascertain total emissions from a facility. Emerging novel technologies, such as optical remote sensing (ORS) and "low-cost" air monitoring sensors (often referred to as "Next Generation Air Monitoring" or NGAM) may represent viable alternatives to reliably measure the atmospheric concentrations of these air toxics in real-time. However, field data obtained using NGAM technology is scarce and significant work is needed to gather long-term monitoring data to ascertain its feasibility, accuracy, and cost-effectiveness, and to fully characterize industrial emissions and their impact of nearby communities. The proposed study is targeted at making significant advancements in these areas and focuses on the following specific objectives:

1. <u>Long-term use of ORS methods to monitor HAP emissions from refineries and to estimate their annual VOC emissions</u>
2. <u>Long-term use of ORS methods and "low-cost" sensors for assessing the impact of industrial HAP emissions on surrounding communities.</u>

The communities of Carson and Wilmington are well known for being characterized by increased ground level VOC concentrations, diesel particulate matter, ultrafine particles, and other air toxics due to their close proximity to refineries, industrial facilities, and the port complex (MATES IV draft report; 4). Many Carson and Wilmington residents live directly downwind from these industrial and commercial sources and, therefore, are at a greater risk of HAP exposure. An examination of eight years of meteorological data collected in Carson revealed that this area experiences a land-sea breeze during daytime, with winds blowing roughly from west/north-west. A reversed wind flow (i.e., from east/south-east) is typically experienced during nighttime hours. Thus, Carson and Wilmington communities located on either side of industrial sources are consistently impacted by increased HAPs emissions (Figure 1).

In the past two years the SCAQMD has conducted two technology demonstration projects to evaluate the capabilities of advanced ORS techniques for monitoring HAPs and other gaseous emissions from petrochemical facilities. During the first project, a Long Path Differential Optical Absorption Spectrometer (LP-DOAS) was used for continuous measurements of aromatic hydrocarbons downwind of the Tesoro refinery fenceline in Carson (5). In addition, a Multi-Axis DOAS (MAX-DOAS) was deployed to measure area-averaged nitrogen dioxide (NO_2) and HCHO fluxes (6, 7). During the second project, a method based on mobile Fourier Transport Infrared Spectroscopy (FTIR) (8) measurements of sunlight (i.e., Solar Occultation Flux, or SOF) was used to monitor total VOC emissions from multiple refineries in the Carson-Wilmington area (9). Increased emissions of benzene and toluene were detected on several occasions, and facility-wide HCHO and VOC emissions at the targeted refineries were three to eight times higher than those reported by emissions inventories (7, 9). Despite these promising results, these pilot studies were only conducted for a limited amount of time, and more extensive measurements are needed to fully characterize/quantify refinery emissions and their impact on surrounding communities.

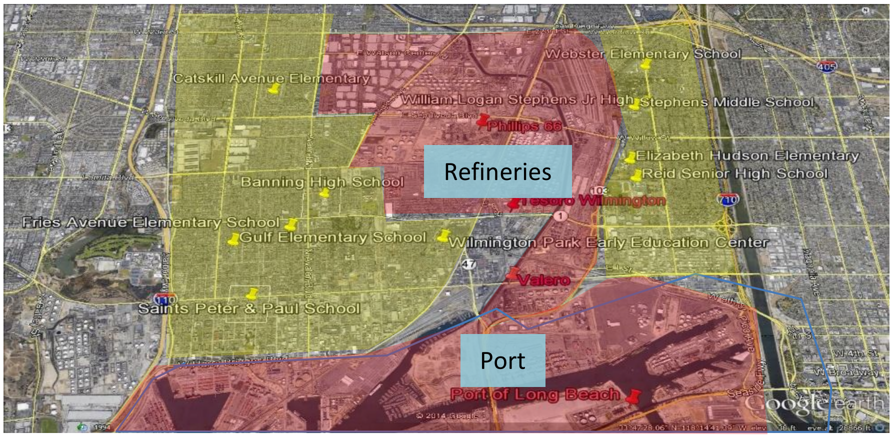

Figure 1. Map of the Carson-Wilmington area. Residential neighborhoods are outlined in yellow while large industrial sources such as refineries and the Port of Long Beach are marked in red.

In addition to ORS instruments, “low-cost” sensors have been considered as a viable alternative for monitoring air toxics around industrial facilities and in residential areas. These devices have the potential to significantly augment and improve current ambient air monitoring capabilities that predominantly rely on the more sophisticated and expensive federal-reference (or federal-equivalent) instruments and methods operating at fixed sites. Given their low cost, these sensors are becoming an attractive means for local environmental groups and individuals to independently evaluate air quality. This new approach is receiving acknowledgement from U.S. EPA and may shift air monitoring towards a different paradigm in which traditional monitoring by air quality agencies is supplemented by community-based monitoring using “low-cost” sensors (10). Because these technologies are quite novel, concrete demonstrations of how sensors can be used to help communities take action to avoid air pollution exposure and risk are still limited. Demonstration projects aimed to providing information on how these technologies can potentially supplement existing local agency air toxics monitoring networks and/or incident responses are also needed.

We therefore propose to perform a comprehensive multi-year study using ORS methods and “low-cost” VOC sensors to monitor HAP emissions from large industrial facilities in the Carson-Wilmington area and their ambient concentrations in neighboring communities. The proposed work will address the following EPA Environmental Priorities: “Addressing Climate Changes and Improving Air Quality” and “Taking Actions on Toxics and Chemical Safety”. Our work will address the objectives specifically mentioned in the 2014-2018 EPA Strategic Plan, namely: “EPA will work to ensure that our efforts to improve air quality consider low-income and minority communities that are disproportionately impacted by pollution.”; “… we focus on relatively high-risk sources… Priority categories include petroleum refining, iron and steel manufacturing, chemical manufacturing…”; “Conduct research to change the paradigm for air pollution monitoring, with a focus on lower cost measurements”.

Technical Approach

Objective 1: Long-term use of ORS methods to monitor HAP emissions from refineries and to estimate their annual VOC emissions. To address this objective, designated SCAQMD staff will conduct continuous mobile measurements of HAPs concentrations around several refineries (e.g., Tesoro and Philip 66) in the Carson-Wilmington area. Emissions from chemical plants and other large industrial facilities will also be monitored. Flux measurement surveys of the targeted air pollutants (e.g., propane, ethylene, propylene and ammonia) will be conducted using the SOF method developed by FluxSense AB (Gotheborg Sweden) (3, 11). This method utilizes the sun as the light source, and gas species that absorb in the infrared portion of the solar spectrum are measured from a mobile platform. Measurements are performed with an infrared spectrometer. From the solar spectra the path-integrated concentrations (column; in mg/m^2) of the targeted species between the sun and the spectrometer are retrieved. The SOF measurement system is built into a van. In order to measure gaseous emissions from a source, the vehicle is driven so that the collected sunlight cuts through the emission plume. Total emission are then calculated by combining the retrieved trace gas columns with wind direction and wind speed information.

These surveys, each lasting for at least two weeks, will be performed seasonally (i.e., winter, spring, summer, and fall) for a period of two years, allowing us to estimate facility-wide emissions of aromatic hydrocarbons and other important VOCs. Such emissions will then be compared with those provided by available emission inventories. The results from this part of the study will provide an unprecedented wealth of flux-emission data to assess the SOF performance over different meteorological conditions and to estimate VOC flux emissions from refineries throughout the year. Continuous measurements over a two year period will provide information on inter-annual variability. SCAQMD is in the process of acquiring a mobile laboratory equipped with a SOF instrument for measuring VOCs and other ORS devices including: a mobile Differential Optical Absorption Spectroscopy (mDOAS) (12) for measuring atmospheric formaldehyde, NO_2 and SO_2; a mobile extractive FTIR (meFTIR) (13, 14) system for measuring ground-level concentrations of alkanes; and a mobile white-cell DOAS (mwDOAS) (15) for measuring ground-level concentrations of aromatic VOCs. We anticipate the ORS laboratory to be ready for deployment in late 2015. This laboratory will provide capabilities for simultaneous mobile measurements of formaldehyde, benzene, toluene, NO_2, SO_2, ethane, propene, total alkanes, methane, ethene, CO, CO_2 and N_2O; and will allow for intercomparisons between different spectroscopic methods. Funds for the purchase of the mobile ORS laboratory will not be provided by EPA and have been secured through other funding sources.

In addition, two Multi Axis- (MAX) DOAS instruments that have already been acquired by the SCAQMD will be placed upwind and downwind of an industrial complex for continuous monitoring of facility averaged emissions of NO_2 and HCHO. Such dual MAX-DOAS approach measures the trace gas amount in a vertical slice perpendicular to the main wind direction, upwind and downwind of the targeted area. The difference between the trace gas content in the two slices, together with wind speed and direction allows the determination of the absolute emission fluxes from the area of interest. Figure 2 illustrates the dual MAX-DOAS measurements setup. Dual MAX-DOAS measurements will be conducted for a minimum of one year.

SCAQMD is currently in the process of acquiring a Light Detection and Ranging (LiDAR) system to measure boundary layer height and real-time wind data. These will be applied to each dual MAX-DOAS measurement point to calculate facility-averaged flux of HCHO and NO_2. In a previous dual MAX-DOAS deployment, data collected during two months of measurements was extrapolated to obtain annual emissions, which might have not accounted for seasonal variations. The operation of the MAX-DOAS systems for at least one year is necessary to provide unprecedented insight into seasonal emission variations from a large industrial source, and to compare its results to those provided by the SOF system.

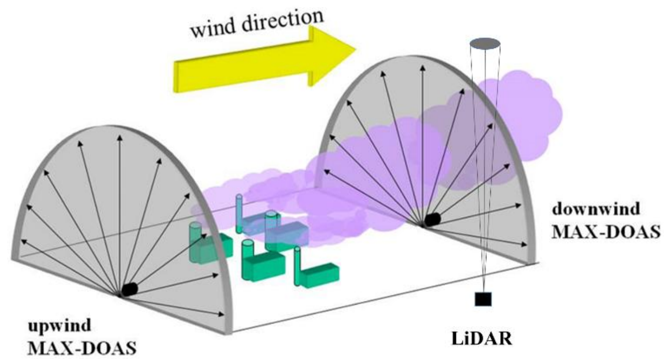

Figure 2. Experimental setup for area-wide emission measurements using the dual MAX-DOAS method.

Objective 2: Long-term use of ORS methods and "low-cost" sensors for assessing the impact of industrial HAP emissions on surrounding communities. To estimate the potential impact of refinery emissions on surrounding communities, measurement surveys will also be conducted in communities upwind and downwind of the selected refineries in the Carson-Wilmington area. For this purpose, the same suite of ORS instruments described in the previous section (i.e., SOF, mDOAS, mwDOAS, and meFTIR) will be used to take mobile VOC measurements. Also in this case each measurement survey will last for at least two weeks and will be performed seasonally (i.e., winter, spring, summer, and fall) for a period of two years. The results from this part of the study will provide useful information on the spatial distribution of VOCs and other air toxics in EJ communities and their potential health impact on nearby residents.

To complement this mobile data and provide long-term information on residential air toxic concentrations, 30 "low-cost" VOC sensors will be deployed, operated, and maintained for one year in one or more EJ communities of the Carson-Wilmington area (to be identified). In each community SCAQMD staff will recruit individuals that are interested in air quality issues, in learning more about the use and applications of sensor technologies, and in collecting air monitoring data using sensors. All recruited individuals will receive a monitoring sensor to collect air quality data during this study. Sensors will also be deployed at the nearest fixed-site stations that are part of the SCAQMD air monitoring network to gather comparable VOC measurements (i.e., continuous total non-methane hydrocarbon and canister-based measurements) for data verification and inter-comparison purposes. Based on an estimated average sensor cost of about $1,000 (typically, "low-cost" sensors range in price from $100 to $2500) (16, 17) we anticipate the procurement of approximately 50 air quality sensors (i.e., 30 units for community deployment; 5 units deployed at one or more SCAQMD fixed site(s); 15 units kept as spare in case of malfunction of the main sensors).

Prior to sensor deployment (i.e., during the first six months of this project) a variety of commercially available "low-cost" VOC sensors will be tested within SCAQMD's newly funded Air Quality Sensor Performance Evaluation Center (AQ-SPEC), the nation's first comprehensive sensor evaluation program. Using a substantial amount of SCAQMD resources (over $850,000 for the first year of operation), AQ-SPEC will perform a thorough performance characterization of currently available "low-cost" VOC sensors using both field and laboratory based testing. Candidate VOC sensors include ToxiRAE, CairclipVOC, SensoTran, Alphasense and others.

Data Analysis

Data collected by the mobile ORS laboratory during transects around refineries and other industrial complexes will be combined with meteorological information to calculate HAP emissions from these facilities. At the same time, spectra collected by the two MAX-DOAS instruments placed upwind and downwind of industrial complexes will be analyzed producing slant column densities (SCD) of NO_2 and HCHO. These SCDs will then be combined with wind data and boundary layer height data obtained from the LiDAR to calculate facility-wide emissions. Flux calculations will be automated using MATLAB. Multi-year data collected by the ORS methods will capture seasonal and inter-annual variability of emissions. Calculated annual emissions will be compared with those reported in annual emission inventories. Analysis of these data will contribute to Objective 1 of this proposal.

Data collected by the mobile ORS laboratory within and around communities will be combined with information on its geographical location to produce maps/plots of pollutant concentrations along the path travelled. Similarly, VOC sensor data will be analyzed to characterize spatial and diurnal trends in the selected communities, identify potential gradients due to proximity to the refineries, and assess other factors that may contribute to increasing the ambient levels of the measured pollutants (e.g., meteorology). This information will provide invaluable insights on neighborhood VOC exposure and its diurnal, seasonal, and inter-annual variability. This analysis will contribute to Objective 2.

All ORS equipment will undergo periodic spectral fitting quality check. This quality check will be performed by inspection of selected measured spectra to assure that spectral fitting results in a clear spectral signature of the trace gas in question. Periodically, the upward-looking DOAS instrument onboard of the mobile ORS laboratory will be used to measure HCHO and NO_2 flux in the area covered by the dual MAX-DOASs. If area fluxes calculated from the two systems differ greatly, the cause of the discrepancy will be investigated. Such intercomparisons of ORS methods satisfy Objective 1. We anticipate that other quality assurance metrics for ORS methods will be identified during the project. Based on this experience, SCAQMD staff will develop quality assurance guidelines for optical remote sensing measurements for future use by the EPA and other air pollution control agencies.

VOC sensor measurements will be periodically validated through a rigorous QA/QC process to evaluate sensor performance and reliability. A collocated field comparison between sensor and SCAQMD network data will show how pollutants are distributed spatially around a central-site monitor, and how they relate to fixed-site monitor measurements. SCAQMD staff will also perform intercomparisons between the "low-cost" VOC sensor data, the ORS data collected concurrently in the same geographical area, and the data obtained by the traditional methods (e.g. VOC canister samples). Such analysis will evaluate how well "low-cost" sensor devices and ORS equipment can detect spatial and diurnal VOC variations and their overall performance.

Environmental Justice Impacts

Communities in the Carson-Wilmington area are mostly low-income underprivileged (EJ) communities. Their close proximity to large refineries and other industrial facilities suggests they are likely to be impacted by increased ambient levels of VOCs and other air toxics (4). The work proposed within this document will provide unprecedented monitoring information on HAP emissions from refineries and other industrial sources, and will allow to map ambient level HAP concentrations in surrounding neighborhoods. The proposed work will allow to identify and address specific concerns related to air toxic exposure in the Carson-Wilmington area. Additionally, it will serve as a template for developing monitoring strategies/studies to provide information on mitigation efforts and their future implementation.

Community Collaboration/Outreach

SCAQMD has a long-standing relationship with refineries and environmental community groups in Carson, Wilmington, and surrounding areas. SCAQMD staff will work with industry and the community to identify multiple refineries for this study, recruit study participants for monitoring VOCs using "los cost" sensors, and secure locations for instruments' placement. During the proposed project, SCAQMD is committed to work in partnership with various community organizations, schools, and members of the public to accomplish the objectives of this proposal. SCAQMD staff will be readily available to answer any questions community members, individuals, and students may have on the proposed measurement technology or results of the measurements. Results from this study will be shared with all participants in terms understandable to those without technical training. Community members and study participants will be periodically updated on the progress of this project via website and community meetings.

Environmental Results: Outcomes, Outputs, Performance Measures

<u>Outputs of this project will include:</u>

- Long-term HAP emission data from refineries and other industrial sources (to be compared with available emission inventories).
- Detailed mapping of ambient VOC concentrations in Carson-Wilmington communities.
- Measurement of data quality, cost-effectiveness, and applicability of emerging "low-cost" sensors and ORS equipment.
- Development of a quality assurance guidelines document for ORS methods and "low cost" VOC sensors. This document will be shared with other regulatory agencies in California and throughout the US, and could provide a reference for monitoring HAPs using NGAM instruments.
- Public meetings to share results and get feedback from participating communities and study participants.
- Dissemination of results and outreach activities (e.g., website, workshops, public meetings)
- Quarterly progress reports (to be submitted to EPA).
- Interim final report and final report, which will include analysis of progress towards short- and mid-term outcomes and prognosis for achieving long-term outcomes of the project.

<u>Short-term outcomes:</u>

- Detailed HAP monitoring/mapping in EJ communities adjacent to refineries and major industrial facilities in the Carson-Wilmington area.
- Detailed technical and cost assessment of the feasibility of using ORS techniques and "low-cost" VOC sensors for measuring industrial emissions and ambient level concentrations of HAPs.

<u>Mid-term outcomes:</u>

- Improved HAP emission inventories.

- Development of quality assurance protocols and standard operating procedures for using ORS techniques and "low-cost" sensors.

Long-term outcomes:

- Reduction of HAPs emissions from refineries, improved input data for air quality modeling, and reduced ambient levels of HAPs.
- Use of the collected datasets for future exposure assessment studies.
- The procedures developed in this work could be used for similar HAP monitoring by other agencies in California and throughout the country.

Timeline

TASKS	Year 01	Year 02	Year 03
Evaluation and testing of ORS equipment. VOC sensor testing and selection for deployment. Identification of measurement sites (06/01/2015 to 11/30/2015)	↔		
ORS fenceline measurements at refineries, other industrial facilities, and surrounding communities (12/01/2015 to 11/30/2017)	↔	↔	↔
VOC sensor measurements in communities surrounding the selected refineries (Sensor deployment: 12/01/2015 to 05/31/2016; Sensor measurements: 06/01/16 to 05/31/2017)	↔	↔	
Data reduction, QA/QC, analysis, and interpretation (06/01/2017 to 11/30/2017)		↔	↔
Dissemination of results, and outreach activities (e.g., website, workshops, public meetings) (12/01/2017 to 05/31/2018)			↔

Programmatic Capability and Past Performance

SCAQMD is one of the largest local air pollution control agencies in the United States. Its jurisdictional boundaries include a population of over 16 million people. SCAQMD has made significant progress in improving air quality through a long history of innovative regulations and control measures. It also has demonstrated technical excellence and innovation in air quality monitoring and analysis technology. SCAQMD has engaged in numerous large and small scale air toxics monitoring campaigns to assess air toxics levels and risks within the basin. Results from these studies are widely disseminated and used by other agencies to formulate risk reduction strategies and improve public health.

Key personnel:

Dr. Laki Tisopulos (PI) is the Assistant Deputy Executive Officer for Science & Technology Advancement at the SCAQMD. In this role, he leads the groups responsible for conducting ambient monitoring, laboratory analysis, quality assurance, and the AQ-SPEC program. Dr. Tisopulos was previously the Assistant Deputy Executive Officer of Planning, Rule Development & Area Sources where he directed the development of regulations and programs to reduce emissions from chemical process plants, refineries and other stationary and area sources.

Dr. Andrea Polidori is the Quality Assurance Manager for Science & Technology Advancement at the SCAQMD and is responsible for the development and implementation of quality assurance control methods, plans, procedures, and programs. He is also involved in the analysis of data collected from numerous field activities and air monitoring projects, and is currently leading the design, development and implementation of AQ-SPEC.
Dr. Jason Low is the Atmospheric Measurements Manager at SCAQMD in the Science and Technology Advancement Division. He manages its network of over 35 ambient air monitoring stations and coordinates field activities of special air monitoring projects focusing on air toxics and the local impacts of air pollution. Also, he is a co-coordinator for the SCAQMD monitoring response to incidents that may affect ambient air quality such as industrial events and regional wildfires.
Dr. Olga Pikelnaya has extensive experience in field data collection and data analysis. During the past three years, Dr. Pikelnaya was one of leading investigators of the SCAQMD-funded optical remote sensing technology demonstration projects. She designed and built two MAX-DOAS instruments. She has extensive knowledge of the Carson-Wilmington area and established good working relationship with the industry representatives in the area.

Past Performance:

1. Enhanced Air Toxics Exposure Study for the South Coast Air Basin, funded by U.S. EPA, 2004 – Present: The project was completed, although with some delay due to switching of lead personnel and permissions at a site not being obtained. A final report was submitted and is currently under U.S. EPA review. All other requirements of the grant were met.
2. Photochemical Assessment Monitoring Stations (PAMS) and PM2.5 Monitoring Programs, funded by U.S. EPA, 1993 – Present: These on-going programs have met all requirements and objectives through complete integration into the ambient monitoring activities of SCAQMD. All reporting requirements have been met through the annual network review and Section 103 grant renewal applications.
3. National Air Toxics Trends Stations (NATTS) Monitoring Program, funded by U.S. EPA, 2007 – Present: This on-going program has met all requirements and objectives through complete integration into the ambient monitoring activities of SCAQMD. All reporting requirements have been met through the annual network review and Section 103 grant renewal applications.
4. National Core Network (NCore) Monitoring Program, funded by U.S. EPA, 2010 – Present: This on-going program for multi pollutant network measurement system for particles, pollutant gases and meteorology has met all requirements and objectives through complete integration into the ambient monitoring activities of SCAQMD. All reporting requirements have been met through the annual network review and Section 105 grant renewal applications.
5. Near-Road Monitoring Program, funded by U.S. EPA, 2014 – Present: This on-going program to deploy monitors to conduct NO_2, CO, and PM2.5 measurements near road is anticipated to meet all requirements and objectives by 2015 through complete integration into the ambient monitoring activities of SCAQMD. Workshops have been conducted to involve and gather input from community and other stakeholders. All reporting requirements will be met through the annual network review and Section 103 grant renewal applications.

Budget

Description	Total EPA*	Voluntary Cost Share	Total Project Cost
Personnel: Title-Name (Annual Salary):			
QA Manager-Andrea Polidori ($121,382)	$7,283 (2%)	$72,829 (20%)	$80,112
AM Manager-Jason Low ($133,543)	$8,013 (2%)	$80,126 (20%)	$88,139
AQ Specialist-TBD ($95,347)	$228,833 (80%)	$57,208 (20%)	$286,041
AQ Specialist-Olga Pikelnaya ($95,347)	$28,604 (10%)	$85,812 (30%)	$114,416
Sr. AQ Instrument Specialist-TBD ($83,565)	$25,070 (10%)	$75,209 (30%)	$100,279
Total Personnel	**$297,803**	**$371,184**	**$668,987**
Fringe Benefits (51% of Personnel)	**$151,879**	**$189,304**	**$341,183**
Equipment:			
AQ-SPEC Field and Laboratory Equipment	$0	$403,000	$403,000
Sensor Purchase (50 @ $1,000 per sensor)	$50,000	$0	$50,000
Two Multi-Axis DOAS Instruments	$0	$60,000	$60,000
Total Equipment	**$50,000**	**$463,000**	**$513,000**
Supplies:			
Consumables, tools, hardware, etc.	**$15,000**	**$0**	**$15,000**
Travel:			
In-Basin Travel Within Measurement Area (2 weeks every 3 months for 3 years x 200 miles/day x $0.55/mile)	**$0**	$**18,480**	**$18,480**
Other:			
Cellular communication and services for wireless data telemetry	$25,000	$0	$25,000
MATLAB software license	$5,000	$0	$5,000
AQ-SPEC Activities and Website	$10,000	$235,000	$245,000
Outreach Activities – Workshops / Meetings	$15,000	$0	$15,000
Total Other	**$55,000**	**$235,000**	**$290,000**
TOTAL BUDGET	***$569,682***	***$1,276,968***	***$1,846,650***

*Values in parenthesis represent % of time assigned to project for “Total EPA” and “Cost Share” costs

Substantial in-kind contribution will be provided by SCAQMD in the form of voluntary cost share. Indirect costs will not be charged on this project. Fringe benefits include retirement and insurance benefits, Medicare, and State Disability Insurance. SCAQMD calculates the fringe benefits rate by applying a 51% rate to the base salary (Personnel) amount.

Leveraging

Substantial resources will be leveraged from the AQ-SPEC program including field and laboratory equipment ($463,000 value) to evaluate sensor performance during the first six months of the study. SCAQMD financed the construction and initial testing of two MAX-DOAS instruments proposed to be used for long-term facility-wide emissions measurements. This proposal includes $1,276,968 in voluntary cost share with the EPA funding request representing 31% of the total project cost. SCAQMD is also leveraging the ORS mobile laboratory as a “other leveraged resource”. SCAQMD secured funds for acquiring this equipment and we anticipate delivery of the system in late-2015.