**PROPOSED**

State of California
AIR RESOURCES BOARD

**Characterization of Air Toxics and GHG Emission Sources and Their Impacts on Community-Scale Air Quality Levels in Disadvantaged Communities**

RESEARCH PROPOSAL

Resolution 17-31

**October 26, 2017**

Agenda Item No.: 17-10-3

WHEREAS, the California Air Resources Board (CARB or Board) has been directed to carry out an effective research program in conjunction with its efforts to combat air pollution, pursuant to Health and Safety Code sections 39700 through 39705;

WHEREAS, a research proposal, number 2807-287, titled “Characterization of Air Toxics and Greenhouse Gas Emission Sources and Their Impacts on Community-Scale Air Quality Levels in Disadvantaged Communities” has been submitted by FluxSense, Inc. for a total amount not to exceed $224,650;

WHEREAS, the Research Division staff have reviewed Proposal Number 2807-287 and finds that in accordance with Health and Safety Code section 39701, the results of this study will: quantify and characterize the emission rates of greenhouse gases and air toxics from a variety of sources; help CARB understand local community-scale air quality issues (especially in disadvantaged communities); identify sources and implement mitigation and control efforts or enact enforcement actions; and use the information to inform our programs; and

WHEREAS, in accordance with Health and Safety Code section 39705, the Research Screening Committee has reviewed and recommends funding the Research Proposal.

NOW, THEREFORE BE IT RESOLVED, that CARB, pursuant to the authority granted by Health and Safety Code sections 39700 through 39705, hereby accepts the recommendations of the Research Screening Committee, and staff and approves the Research Proposal.

BE IT FURTHER RESOLVED, that the Executive Officer is hereby authorized to initiate administrative procedures and execute all necessary documents and contracts for the Research Proposal as further described in Attachment A, in an amount not to exceed $224,650.

**Resolution 17-31**

October 26, 2017

**Identification of Attachments to Board Resolution 17-31**

**Attachment A:** "Characterization of Air Toxics and Greenhouse Gas (GHG) Emission Sources and Their Impacts on Community-Scale Air Quality Levels in Disadvantaged Communities" Summary and Budget Summary

# ATTACHMENT A

## Characterization of Air Toxics and GHG Emission Sources and Their Impacts on Community-Scale Air Quality Levels in Disadvantaged Communities

### Background

Methane is an important short-lived climate pollutant, and contributes roughly nine percent to the statewide GHG emissions. California has passed several recent climate bills, including Senate Bill 1383 (Lara, 2016) and Assembly Bill (AB) 1496 (Thurmond, 2015), which require CARB to use the best available scientific and technical methods to monitor and measure high-emission methane hotspots within the State, to use the information to update relevant programs and policies, and to implement a climate mitigation program to reduce statewide methane emissions by 40 percent below the 2013 levels. Additionally, several scientific studies have suggested that national and statewide GHG emissions inventories for methane sources are underestimated, but there is limited updated source-specific emission rate data in California that can be used to update the statewide inventories. In order to meet the requirements under AB 1496, CARB and the California Energy Commission (CEC) have recently funded a first-of-its-kind Statewide Methane Survey conducted by the NASA Jet Propulsion Laboratory (JPL) to detect and identify methane super emitters in California. Although the project has identified a number of potential super-emitters, additional analysis is needed to quantify the emission fluxes. Moreover, due to the statewide scope of the study and primary focus on point sources, the survey could do limited characterization of the emission behaviors. Therefore, additional complementary measurements are needed to quantify the emission rates from the sources, provide independent validation to prioritize these sources for emission inventory updates, and enforcement and mitigation actions.

Furthermore, certain industrial emissions sources, such as oil and gas facilities, are known to co-emit air toxic emissions that have adverse health effects, and their impacts may be more pronounced in neighboring communities when compared to regional air quality monitoring stations. Therefore, it is important to understand these emissions and conduct enhanced community-scale monitoring for air toxics in near-source communities, many of which may be disadvantaged.

The recently approved AB 617 (Garcia, 2017) requires CARB to develop a plan to identify disadvantaged communities for community monitoring, and a statewide strategy to reduce emissions of toxic air contaminants and criteria air pollutants in communities affected by a high cumulative exposure burden. The community-scale monitoring component of this project will support and inform these requirements, in addition to providing complementary efforts for community air monitoring near oil and gas operations required by CARB's Oil and Gas Regulations.

### Objective

This project was developed to characterize and quantify air toxics and GHG emission behavior from complex air pollution sources, as well as to study their impacts on

community-scale air quality levels in disadvantaged communities. The project will undertake two main objectives:

1. Characterize the emissions of several known methane super-emitters and other high emitting sources in California to identify the operational and fugitive emissions from the various sources. The study will aim to quantify the real-time emission fluxes of important GHGs (methane and nitrous oxide), BTEX (benzene, toluene, ethylbenzene and xylene), and volatile organic compounds or VOCs (alkanes and alkenes) from various sources in the energy and industrial sectors, agricultural sector, and waste management sector.

2. Characterize community-scale air quality in disadvantaged communities located near high-emitting priority sources. The study will survey the air quality levels in surrounding communities through ground-based concentration measurements of air toxics and other important pollutants, provide data to identify potential sources, and analyze community-scale air pollution exposures and health impacts.

**Methods**

The project will utilize a state-of-the-art research grade mobile monitoring laboratory equipped with advanced monitoring instruments to characterize and quantify the air toxics and GHG emission behavior from complex air pollution sources, as well as their impacts on community-scale air quality. The novel platform includes a combination of mobile optical remote sensing measurements, including SOF method (Solar Occultation Flux), MWDOAS (Mobile White Cell DOAS), and MeFTIR (Mobile extractive FTIR), which will collectively provide a unique ability to measure ground-level concentrations as well as vertical plume measurements for emission flux estimation. These instruments will be used to quantify emission fluxes of methane, nitrous oxide, BTEX, and VOCs, as well as ammonia, formaldehyde, and oxides of nitrogen and sulfur from a variety of complex emission sources. The investigators will also characterize the community-scale air quality level in disadvantaged communities near priority high-emitting sources through ground-level measurements.

The project will cover source facilities and neighboring communities located in four geographical areas, including the South Coast, San Joaquin Valley, Sacramento Valley, and San Francisco Air Basins. The targeted facilities will be selected in consultation with CARB staff, including sources from the energy and industrial sectors, agricultural sector, and waste management sector, and will include a majority of methane super-emitters identified by the NASA/JPL Statewide Methane Survey.

Once the emissions from facilities (or facility clusters) have been characterized and the emission patterns have been identified, the investigators will conduct community-scale concentration measurements downwind from the facilities in selected communities based on Environmental Justice Screening Method (EJSM) scores, CalEnviroScreen 3.0 scores, and population census data. The ground level concentration of methane, nitrous oxide, ammonia, and BTEX in the communities will be mapped in real-time using the MeFTIR and MWDOAS instruments. The investigator will drive on public roadways

in a “grid pattern” depending on the layout of the specific community and continue these measurements with increasing distance to the facility until no significant ground-level concentrations are detected. The community mapping will investigate the local air pollution hotspots, and the temporal variation of community exposure due to the emission patterns of the nearby sources and the local micrometeorology.

**Expected Results**
The project will provide quantified emission fluxes of methane, nitrous oxide, BTEX, and VOCs, as well as ammonia, formaldehyde, and oxides of nitrogen and sulfur from a variety of complex emission sources in the energy and industrial sector, agricultural sector, and waste management sector. The project will also provide community-scale air quality level of air toxics in disadvantaged communities to understand the impact by different sources, and identify potential sources.

**Significance to the Board**
CARB staff believe that this is a very novel and important project, which will use innovative measurement resources to conduct emission measurements from complex GHG and air toxic emission sources, as well as study their impacts on community-scale air quality in the neighboring communities. This work has important implications for CARB’s GHG emissions research, and will be closely coordinated by CARB staff to complement other statewide efforts. For instance, the recently completed Statewide Methane Survey by NASA-JPL was able to identify over 300 potential super-emitters sources with high methane concentrations signatures, and this project will be implemented to quantify and characterize the emission rates for a majority of those sources. In addition, this method is expected to offer a cost-effective alternative to estimating emissions from large-footprint sources (like landfills, dairies, and oil and gas source clusters) and study multiple facilities in a short time, while also allowing us the ability to measure emission rates of air toxics from complex sources.

Secondly, this project also allows CARB to conduct community-scale air toxics measurements in real-time, conduct quick response measurement surveys to identify local air pollution hotspots, and identify sources that have a significant impact on local air quality. This study element has important implications for CARB, as it allows us to understand local community-scale air quality issues (especially in disadvantaged communities), identify sources and implement mitigation and control efforts or enact enforcement actions, and use the information to inform our programs. The community-scale component of this project will also support CARB’s program requirements regarding community air monitoring near oil and gas operations, and provide information to develop and inform the community-scale air monitoring program under AB 617.

**Contractor:**
FluxSense Inc.

**Contract Period:**
11/1/2017 – 10/30/2019

**Principal Investigator (PI):**
Johan Mellqvist, Ph.D.

**Contract Amount:**
$224,650

**Basis for Indirect Cost Rate:**
FluxSense Inc. has listed a fully loaded rate.

**Past Experience with this Principal Investigator:**
The research team is a renowned entity in mobile measurements, with proven expertise in emission quantification of GHGs, BTEX, and VOCs, as well as characterization of community-scale air quality level with mobile monitoring capabilities. The investigators have been active in the field of optical remote sensing for more than 10 years, and have carried out over a 100 industrial site surveillances of refineries, petrochemical facilities, and landfills in Europe and the United States, including a recent series of projects in the South Coast Air Basin funded by the South Coast Air Quality Management District. This work has demonstrated the efficacy of their technology for emission characterization of small sources (oil depots, treatment facilities, oil wells, gas stations, fuel islands, etc.) and found that these “small sources” can have a much larger emission and air quality impact.

**Prior Research Division Funding to FluxSense Inc.:**

| Year | 2016 | 2015 | 2014 |
|---|---|---|---|
| Funding | $ 0 | $ 0 | $ 0 |

# B U D G E T  S U M M A R Y

Contractor: FluxSense, Inc.

"Characterization of Air Toxics and GHG Emission Sources and Their Impacts on Community-Scale Air Quality Levels in Disadvantaged Communities"

| | | | | |
|---|---|---|---|---|
| **DIRECT COSTS AND BENEFITS** | | | | |
| 1. | Labor and Employee Fringe Benefits | $ | 0 | |
| 2. | Subcontractors | $ | 0 | |
| 3. | Equipment | $ | 0 | |
| 4. | Travel and Subsistence | $ | 0 | |
| 5. | Electronic Data Processing | $ | 0 | |
| 6. | Reproduction/Publication | $ | 0 | |
| 7. | Mail and Phone | $ | 0 | |
| 8. | Supplies | $ | 0 | |
| 9. | Analyses | $ | 66,000 | |
| 10. | Miscellaneous | $ | 158,650 | |
| | Total Direct Costs | | | $ 224,650 |
| **INDIRECT COSTS** | | | | |
| 1. | Overhead | $ | 0 | |
| 2. | General and Administrative Expenses | $ | 0 | |
| 3. | Other Indirect Costs | $ | 0 | |
| 4. | Fee or Profit | $ | 0 | |
| | Total Indirect Costs | | | $ 0 |
| **TOTAL PROJECT COSTS** | | | | **$ 224,650** |

NOTE:

- The Analyses Cost with a total of $66,000 includes 600 hours of meteorological analysis, facility emission rate quantification and community-level air pollution analysis, with an hourly rate of $110/hour.
- The direct miscellaneous cost is composed of three parts:
  - The cost of $110,000 for a total of 400-hour field measurement, with an aggregated hourly rate of $275/hour, including labor, instrumentation, mobile lab operation and travel expense;
  - The cost of $25,000 for 400-hour rental of wind LIDAR system and pick-up truck to collect wind profile data which is necessary for the flux estimation;
  - The cost of $23,650 for 215-hour preliminary and final reporting;
  - FluxSense Inc. has listed a fully loaded rate.