

**PROPOSED**

State of California  
AIR RESOURCES BOARD

**A Tool to Prioritize Sources for Reducing High PM2.5 Exposures  
in Environmental Justice Communities in California**

RESEARCH PROPOSAL

Resolution 17-29

**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 2805-287, titled "A Tool to Prioritize Sources for Reducing High PM2.5 Exposures in Environmental Justice Communities in California," has been submitted by the University of Texas at Austin for a total amount not to exceed \$180,000;

WHEREAS, the Research Division staff have reviewed Proposal Number 2805-287 and finds that in accordance with Health and Safety Code section 39701, the results of this study will provide a screening tool for evaluating the relative importance of emission sources by their exposure impacts, and identify sources that contribute to higher levels of PM2.5 in environmental justice communities in California. Results from this project will help inform decision-makers about emission sources that need further control to reduce higher levels of PM2.5 in environmental justice communities and minimize exposure disparities in California; 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 \$180,000.

**Resolution 17-29**

October 26, 2017

**Identification of Attachments to Board Resolution 17-29**

**Attachment A:** “A Tool to Prioritize Sources for Reducing High PM2.5 Exposures in Environmental Justice Communities in California” Summary and Budget Summary

## ATTACHMENT A

### **“A Tool to Prioritize Sources for Reducing High PM2.5 Exposures in Environmental Justice Communities in California”**

#### **Background**

California ambient PM2.5 concentrations have decreased by up to 30 percent overall in the past two decades; however, environmental justice (EJ) communities are still exposed to higher levels of PM2.5 than non-EJ communities. Identification of PM2.5 sources that contribute to higher exposures in EJ communities is critically needed to achieve CARB’s goal to provide clean air to all Californians. Intake fraction (iF), the fraction of a pollutant from a specific source that is inhaled by the impacted population, can be used to compare the relative importance of sources in terms of their exposure impacts, and has been successfully used to inform CARB programs and facilitate source control prioritizations. For example, a much higher individual iF for school bus self-pollution was found compared to the emissions from other vehicles, indicating higher impacts on school children’s exposure from school bus self-pollution than other vehicles. These study results have been used to support CARB’s school bus retrofit programs. However, currently, iF datasets are mainly available for primary PM2.5 from a few source categories and/or a few regions. Secondary PM2.5, particles formed by photochemical reactions, accounts for about half of the ambient PM2.5, but iF data for secondary PM2.5 from different sources in California are largely missing. There is a need to expand current iF datasets to include both primary and secondary PM2.5 for both ground-level and above-ground-level emission sources in all major air basins. These will be useful as CARB and the local air districts implement Assembly Bill 617.

#### **Objective**

The overall objective of this project is to generate a screening tool for evaluating the relative importance of emission sources by their exposure impacts, and identify sources that contribute to higher levels of PM2.5 (including secondary PM2.5) in EJ communities in California. The specific objectives are to:

1. Develop a comprehensive database containing location-specific values for four types of measures: iF; total PM2.5 intake; a set of measures indicating exposure disparity for different disadvantaged population groups and vulnerable populations; and iF and total PM2.5 intake within EJ communities in California;
2. Evaluate the relative importance of emission sources in terms of their impacts on exposures and exposure disparities by source location and source category;
3. Assemble a list of sources for which emission reductions would lead to higher-than-average improvements in exposures and exposure disparities; and
4. Train CARB staff on the use of a unique air quality simulation model to generate iF for future analysis and decision-making.

**Methods**

The investigators will use the Intervention Model of Air Pollution (InMAP), a computationally efficient model that can estimate iF for both primary and secondary PM<sub>2.5</sub> at a high spatial resolution, to estimate annual average changes in ambient primary and secondary PM<sub>2.5</sub> concentrations attributable to annual changes in emissions of five pollutants. These five pollutants are primary PM<sub>2.5</sub> and four PM<sub>2.5</sub> precursors, including nitrogen oxides, oxides of sulfur, ammonia, and volatile organic chemicals. Each pollutant will be simulated independently at three effective plume heights and 21,180 emission locations (a resolution of 1 km<sup>2</sup> in most urbanized areas) within the State of California and surrounding areas. Using the modeling results, the investigators will calculate location-specific values for iF, total PM<sub>2.5</sub> intake, measures for exposure disparity, and measures for impacts on EJ communities. These measures will be used to evaluate the impacts of emission sources on exposures and exposure disparities by source location. In addition, the investigators will combine these measures with spatially explicit emissions inventory data for specific source categories, and evaluate the impacts of emission sources on exposures and exposure disparities by source category. The investigators will assemble a list of source locations and source categories that have higher than average impacts on exposures and exposure disparities and thus should be prioritized for emission reduction.

**Expected Results**

This project will provide a comprehensive database that will be used to predict how changes in emissions – from a specific location or source category – would result in changes in primary and secondary PM<sub>2.5</sub> concentrations, exposures, and exposure disparities in California. The database will be presented quantitatively as spreadsheets and visually as GIS maps. A list of source locations and source categories that have higher-than-average impacts on exposures and exposure disparities in California will be provided. In addition, CARB staff will be trained on the use of InMAP to generate iF and the use of the database created through this project for future analysis and decision making.

**Significance to the Board**

Despite decreases in ambient PM<sub>2.5</sub> concentrations in California in the past two decades, EJ communities in California are still exposed to higher levels of PM<sub>2.5</sub>. Pursuant to AB 617, CARB is required to develop a statewide strategy to reduce air pollutant exposures in EJ communities. Actions to reduce PM<sub>2.5</sub> exposure in EJ communities could be more effective if they target emissions from sources with disproportionately high impacts in these communities. The results of this project will help inform strategies to prioritize emission sources for control to reduce the levels of PM<sub>2.5</sub> in EJ communities and minimize exposure disparities in California.

**Contractor:**

The University of Texas at Austin

**Contract Period:**

18 months

**Principal Investigator (PI):**

Joshua Apte, Ph.D.

**Contract Amount:**

\$180,000

**Basis for Indirect Cost Rate:**

The State and The University of Texas at Austin have agreed to a 25 percent indirect cost rate.

**Past Experience with this Principal Investigator:**

CARB has not contracted with the principal investigator in the past. However, the principal investigator has extensive experience in air pollution modeling for exposure assessment and analysis of air quality disparities in low-income communities and communities of color. The investigator worked with the subcontractors (noted on the next two pages) in this field for several years, and have developed and verified InMAP, the model that can efficiently estimate iF for primary and secondary PM2.5, that will be used in this project. No other researchers were found to have experience using this model. In addition, the three lead researchers in this project have published over 100 journal articles on air pollution modeling, exposure estimation, and the use of iF to characterize exposures to air pollutants and related health burden. They have fully demonstrated their in-depth knowledge on this topic and capability for meeting CARB's needs with high quality products.

**Prior Research Division Funding to the University of Texas at Austin:**

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

## B U D G E T   S U M M A R Y

Contractor: The University of Texas at Austin

“A Tool to Prioritize Sources for Reducing High PM2.5 Exposures in Environmental Justice Communities in California”

### **DIRECT COSTS AND BENEFITS**

|                    |                                    |    |                           |
|--------------------|------------------------------------|----|---------------------------|
| 1.                 | Labor and Employee Fringe Benefits | \$ | 71,040                    |
| 2.                 | Subcontractors                     | \$ | 39,000                    |
| 3.                 | Equipment                          | \$ | 0                         |
| 4.                 | Travel and Subsistence             | \$ | 8,460                     |
| 5.                 | Electronic Data Processing         | \$ | 10,000                    |
| 6.                 | Reproduction/Publication           | \$ | 400                       |
| 7.                 | Mail and Phone                     | \$ | 100                       |
| 8.                 | Supplies                           | \$ | 0                         |
| 9.                 | Analyses                           | \$ | 0                         |
| 10.                | Miscellaneous                      | \$ | <u>18,750<sup>1</sup></u> |
| Total Direct Costs |                                    | \$ | <u>147,750</u>            |

### **INDIRECT COSTS**

|                      |                                     |    |               |
|----------------------|-------------------------------------|----|---------------|
| 1.                   | Overhead                            | \$ | 32,250        |
| 2.                   | General and Administrative Expenses | \$ | 0             |
| 3.                   | Other Indirect Costs                | \$ | 0             |
| 4.                   | Fee or Profit                       | \$ | <u>0</u>      |
| Total Indirect Costs |                                     | \$ | <u>32,250</u> |

**TOTAL PROJECT COSTS** **\$ 180,000**

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<sup>1</sup> This is the tuition for a graduate research assistant who will be responsible for the day-to-day execution of the project. As of October 1, 2001, The University of Texas at Austin requires that all sponsored projects include funds for tuition and fees for graduate students that will be employed on the project. The tuition charges are not subject to an overhead charge and are thus not included in the calculation of indirect costs.

**ATTACHMENT 1****SUBCONTRACTORS' BUDGET SUMMARY**

Subcontractor: Dr. Julian Marshall

Description of subcontractor's responsibility: Dr. Julian Marshall will contribute to interpreting the InMAP modeling outputs, developing environmental justice analysis methods, analyzing data, and reviewing the draft final report.

**DIRECT COSTS AND BENEFITS**

|     |                                    |    |          |
|-----|------------------------------------|----|----------|
| 1.  | Labor and Employee Fringe Benefits | \$ | 22,000   |
| 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                           | \$ | 0        |
| 10. | Miscellaneous                      | \$ | <u>0</u> |
|     | Total Direct Costs                 | \$ | 22,000   |

**INDIRECT COSTS**

|    |                                     |    |          |
|----|-------------------------------------|----|----------|
| 1. | Overhead                            | \$ | 0        |
| 2. | General and Administrative Expenses | \$ | 0        |
| 3. | Other Indirect Costs                | \$ | 0        |
| 4. | Fee or Profit                       | \$ | <u>0</u> |
|    | Total Indirect Costs                | \$ | <u>0</u> |

**TOTAL PROJECT COSTS****\$ 22,000**

**ATTACHMENT 2****SUBCONTRACTORS' BUDGET SUMMARY**

Subcontractor: Dr. Christopher Tessum

Description of subcontractor's responsibility: Dr. Christopher Tessum will lead the development of the InMAP Source-Receptor matrix, provide technical direction of elements of the work pertaining to InMAP, and will contribute to data analysis and report writing.

**DIRECT COSTS AND BENEFITS**

|     |                                    |    |          |
|-----|------------------------------------|----|----------|
| 1.  | Labor and Employee Fringe Benefits | \$ | 17,000   |
| 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                           | \$ | 0        |
| 10. | Miscellaneous                      | \$ | <u>0</u> |
|     | Total Direct Costs                 | \$ | 17,000   |

**INDIRECT COSTS**

|    |                                     |    |          |
|----|-------------------------------------|----|----------|
| 1. | Overhead                            | \$ | 0        |
| 2. | General and Administrative Expenses | \$ | 0        |
| 3. | Other Indirect Costs                | \$ | 0        |
| 4. | Fee or Profit                       | \$ | <u>0</u> |
|    | Total Indirect Costs                | \$ | <u>0</u> |

**TOTAL PROJECT COSTS****\$ 17,000**