

**PROPOSED**

State of California  
AIR RESOURCES BOARD

**Combined Exposure to UFPM and Ozone: Characterization of Particulate  
Deposition, Pulmonary Oxidant Stress and Myocardial Injury**

RESEARCH PROPOSAL

Resolution 17-30

**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 2806-287, titled "Combined Exposure to UFPM and Ozone: Characterization of Particulate Deposition, Pulmonary Oxidant Stress and Myocardial Injury," has been submitted by the University of California, Davis for a total amount not to exceed \$196,806;

WHEREAS, the Research Division staff have reviewed Proposal Number 2806-287 and finds that in accordance with Health and Safety Code section 39701, the results of this study will improve understanding of the mechanism and potential interactions between ozone and ultrafine particulate matter (UFPM) induced effects on the cardiovascular system and can inform setting health protective ambient air quality standards; 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 \$196,806.

## **Resolution 17-30**

October 26, 2017

### **Identification of Attachments to Board Resolution 17-30**

**Attachment A:** “Combined exposure to UFPM and Ozone: Characterization of Particulate Deposition, Pulmonary Oxidant Stress and Myocardial Injury” Summary and Budget Summary

## ATTACHMENT A

### **“Combined exposure to UFPM and Ozone: Characterization of Particulate Deposition, Pulmonary Oxidant Stress and Myocardial Injury”**

#### **Background**

Findings obtained from a previously CARB-funded investigation demonstrated that a combination of ultrafine particulate matter (UFPM) and ozone (O<sub>3</sub>) exposures increased the potency compared to single pollutant exposures. Importantly, these responses were shown to be exacerbated in a mature adult rat model of cardiovascular disease (CVD). This was the first study to provide evidence of acute air pollution exposure-induced heart tissue damage in an animal model. Due to the magnitude of these findings and their potential impact on public health, further investigation to determine the pathophysiology behind these results were proposed for this study.

#### **Objective**

The objectives of this study are directly relevant to the mission of the CARB. The proposed work will improve scientific understanding of the relationship between UFPM, O<sub>3</sub>, and CVD-related susceptibility to cardiac events.

#### **Methods**

In a previous CARB funded investigation, normal and hypertensive rats were exposed to O<sub>3</sub>, UFPM, O<sub>3</sub>+UFPM, or filtered air for six hours. Lung and heart tissue were collected eight hours after exposures. This study will perform additional analysis on the collected heart and lung tissue.

#### **Expected Results**

The immunohistochemical analysis of the lung tissue is expected to determine the ability of UFPM+O<sub>3</sub> exposure to alter the expression of antioxidant defense genes as a result of reactive oxygen species overwhelming cellular antioxidant defenses. Together with the UFPM hyperspectral mapping, it can be determined if these alterations are more prevalent in an area with UFPM deposits. Immunohistopathological analysis of both lung and heart vasculature will be performed to determine the effect of UFPM+O<sub>3</sub> on neutrophil extracellular traps and microthrombi formation which increases the risks for cardiovascular events. Immunostaining of heart tissue will be used to characterize acute and chronic changes in the myocardium and confirm whether myocardial necrosis is caused by ischemia.

#### **Significance to the Board**

CARB has a legislative mandate to set ambient air quality standards and perform research to guide regulations that protect the health of the public, including sensitive subpopulations (Health and Safety Code §39003; §39606). It is critical that we understand how particulate matter and ozone air pollution causes adverse health effects to ensure that the State ambient air quality regulations are adequate to protect the

public health. The multi-pollutant approach in this project more closely models real-world human exposure than those in previous single pollutant studies, which will help CARB better address public health policy decisions.

**Contractor:**

University of California, Davis

**Contract Period:**

24 months

**Principal Investigator (PI):**

Edward Schelegle, Ph.D.

**Contract Amount:**

\$196,806

**Basis for Indirect Cost Rate:**

The State and the UC system have agreed to a 25 percent indirect cost rate.

**Past Experience with this Principal Investigator:**

Dr. Edward Schelegle is well qualified for this project given his track record in air pollution toxicology publications (>107) and pulmonary and cardiovascular immunohistopathological evaluations. In addition, he was the co-investigator in the previous CARB funded study from which this current study builds upon and his assembled research team has the logistical advantage of already obtaining the necessary isolated tissues samples from their previous investigation.

**Prior Research Division Funding to the University of California, Davis:**

Year	2016	2015	2014
Funding	\$ 650,000	\$1,468,460	\$2,249,136

## B U D G E T   S U M M A R Y

Contractor: University of California, Davis:

“Combined exposure to UFPM and Ozone: Characterization of Particulate Deposition,  
Pulmonary Oxidant Stress and Myocardial Injury”

### **DIRECT COSTS AND BENEFITS**

1.	Labor and Employee Fringe Benefits	\$	128,524
2.	Subcontractors	\$	0
3.	Equipment	\$	0
4.	Travel and Subsistence	\$	1,525
5.	Electronic Data Processing	\$	0
6.	Reproduction/Publication	\$	0
7.	Mail and Phone	\$	0
8.	Supplies	\$	27,396
9.	Analyses	\$	0
10.	Miscellaneous	\$	<u>0</u>
Total Direct Costs		\$	157,455

### **INDIRECT COSTS**

1.	Indirect (F&A) Costs <sup>1</sup>	\$	<u>39,361</u>
Total Indirect Costs		\$	<u>39,361</u>

<b><u>TOTAL PROJECT COSTS</u></b>	<b><u>\$</u></b>	<b><u>196,806</u></b>
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Note:

<sup>1</sup> Facilities & Administrative costs.