

State of California  
AIR RESOURCES BOARD

**Characterizing the Climate Impacts of Brown Carbon**

RESEARCH CONTRACT AUGMENTATION

Resolution 17-39

**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, the Research Division staff have reviewed Contract No. 13-330, titled "Characterizing the Climate Impacts of Brown Carbon" and recommended a contract augmentation for approval to the University of California, San Diego, for a total amount not to exceed \$50,000;

WHEREAS, the Research Division finds that in accordance with Health and Safety Code section 39701, the results of the research study augmentation will help CARB to determine the climate benefit of the ongoing mitigation of brown carbon emission sources in California; and

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

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 augmentation.

BE IT FURTHER RESOLVED, that the Executive Officer is hereby authorized to initiate administrative procedures and execute all necessary documents and contracts for the augmentation proposed herein, and as described in Attachment A, in an amount not to exceed \$50,000.

I hereby certify that the above is a true and correct copy of Resolution 17-39 as adopted by the California Air Resources Board.

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Rana McReynolds, Clerk of the Board

October 26, 2017

**Identification of Attachments to Board Resolution 17-39**

**Attachment A:** “Characterizing the Climate Impacts of Brown Carbon” Summary and Budget Summary

## **ATTACHMENT A**

### **Characterizing the Climate Impacts of Brown Carbon**

#### **Background**

A contract augmentation is requested to enhance assessment of the net contribution of brown carbon (BrC) in California and supplement the evaluation of its global impacts. BrC refers to organic compounds contained in airborne particles that absorb incoming shortwave solar radiation leading to heating of the atmosphere. Measurements and model calculations indicate that BrC has the potential to be a strong global warming component and to have negative consequences for public health through its contributions to fine particulates matter (PM<sub>2.5</sub>). The current project has been successful to reduce the uncertainty associated with the global warming potential of BrC by measuring the optical properties in-situ under both summer and winter conditions in California. While remaining uncertainty stems primarily from differences in model emissions and scales, the expanded scope of work in this proposal addresses both of these sources of remaining uncertainty, improving the model and observation comparisons. The supplemental funding would ensure that all of these new inputs can be used to the maximum extent.

#### **Objective**

The primary objectives of the original project were to identify and characterize the contribution of BrC to climate forcing in California by: 1) providing PM<sub>2.5</sub> measurements that constrain the chemical concentrations and optical properties of burning activities; 2) quantifying the BrC organic components and the multi-wavelength absorption from burning emissions and from atmospheric formation of secondary components at two California locations; and 3) examining the globally and regionally averaged climate response of BrC.

#### **Methods**

Three methods for assessing the BrC climate forcing have been proposed to constrain both the regional and global BrC impacts. Both long-term and short-term global/regional model simulations will be enhanced to examine in greater detail the spatial distribution, optical properties, radiative properties, and human exposure effects of BrC. Additional global sensitivity analyses will be run to compare the relative impacts of BrC aerosol with the impacts of all fossil-fuel and biofuel soot aerosols and with the impacts of all fossil-fuel and biofuel and biomass burning soot aerosol. Furthermore, the characterization of the effects of mitigation of BrC as a greenhouse gas (equivalent) emission reduction strategy will be made to be more directly policy-relevant by explicit overarching analysis of consistencies between the model and measurement results. In addition, the new task will add evaluation of the results in the context of recent literature.

#### **Expected Results**

This research study will help to identify sources of BrC and quantify its relative contribution to the absorption of solar radiation by PM. This will allow for improved assessment of the potential climate benefit of reducing specific PM sources with high organic carbon emissions that are determined to be large contributors to BrC.

**Significance to the Board**

This project will improve the CARB's understanding of the fundamental processes that dominate brown carbon formation and its evolution in the atmosphere, and help to determine the potential climate benefit of mitigating sources of brown carbon emissions in California. This research will also provide useful new measurements and analysis of immediate value for developing air quality attainment strategies in California and the development of the State Implementation Plan, and for understanding the pathways leading to secondary organic aerosols.

**Contractor:**

University of California, San Diego

**Contract Period:**

60 months

**Principal Investigator (PI):**

Lynn Russell, Ph.D.

**Original Contract Amount:**

\$452,500

**Total Contracts Amount:**

\$502,500

**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:**

Professor Lynn Russell will serve as the principal investigator coordinating and synthesizing the effort for the overall project. Her 15 plus years of experience in aerosol science and strong publication record make her ideal to fulfill this role. Professor Russell has successfully completed several projects for CARB and showed exceptional effort to produce valuable reports.

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

Year	2016	2015	2014
Funding	\$ 0	\$ 0	\$ 452,500

## B U D G E T   S U M M A R Y

Contractor: University of California, San Diego

“Characterizing the Climate Impacts of Brown Carbon”

<b><u>DIRECT COSTS AND BENEFITS</u></b>	<b>Original Budget</b>	<b>Augmented Budget</b>
1. Labor and Employee Fringe Benefits	\$ 152,097	\$ 127,097
2. Subcontractors	\$ 252,500	\$ 302,500 <sup>1</sup>
3. Equipment	\$ 0	\$ 0
4. Travel and Subsistence	\$ 6,720	\$ 17,528
5. Electronic Data Processing	\$ 0	\$ 0
6. Reproduction/Publication	\$ 0	\$ 0
7. Mail and Phone	\$ 1,250	\$ 1,250
8. Supplies	\$ 9,331	\$ 18,831
9. Analyses	\$ 3,500	\$ 3,500
10. Miscellaneous	<u>\$ 11,625</u>	<u>\$ 16,317</u>
Total Direct Costs	\$ 437,023	\$ 487,023
 <b><u>INDIRECT COSTS</u></b>		
1. Indirect (F&A) Costs <sup>2</sup>	<u>\$ 15,477</u>	<u>\$ 15,477</u>
Total Indirect Costs	<u>\$ 15,477</u>	<u>\$ 15,477</u>
 <b><u>TOTAL PROJECT COSTS</u></b>	 <b><u>\$ 452,500</u></b>	 <b><u>\$ 502,500</u></b>

NOTES:

1. The subcontractors will play critical roles in this project by performing measurements and analyzing and interpreting the results. The subcontractors will also conduct comprehensive data analysis and employ sophisticated regional and global climate models that are uniquely suited to the objectives of this project.
2. Facilities & Administrative costs.

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

University of California, Davis (UCD):

UCD investigators will apply advanced instrumentation that will provide unprecedented chemical and optical characterization of brown carbon sources and investigate its formation pathways. They will also apply source-oriented model, weather research and forecasting model coupled with chemistry, which provides unique capabilities in linking climate impacts with specific aerosol sources.

**DIRECT COSTS AND BENEFITS**

1.	Labor and Employee Fringe Benefits	\$	176,746
2.	Subcontractors	\$	0
3.	Equipment	\$	0
4.	Travel and Subsistence	\$	8,991
5.	Electronic Data Processing	\$	8,525
6.	Reproduction/Publication	\$	5,488
7.	Mail and Phone	\$	0
8.	Supplies	\$	2,068
9.	Analyses	\$	0
10.	Miscellaneous	\$	<u>70,000<sup>1</sup></u>
	Total Direct Costs		\$ 271,818

**INDIRECT COSTS**

1.	Overhead	\$	<u>30,682</u>
	Total Indirect Costs		<u>\$ 30,682</u>

**TOTAL PROJECT COSTS****\$ 302,500**

## Note:

1. Dr. Mark Z. Jacobson, independent consultant (Scientific Collaborator at Stanford), will run and analyze two types of 3-D computer simulations: 1) global simulations to simulate the climate response of brown carbon, and 2) nested global-regional simulations focusing on California. As part of supplemental tasks, both long-term and short-term global/regional model simulations will be enhanced to examine in greater detail the spatial distribution, optical properties, radiative properties, and human exposure effects of brown carbon. Additional global sensitivity analyses will be run to compare the relative impacts of brown carbon aerosol with the impacts of all fossil-fuel and biofuel soot aerosols and with the impacts of all fossil-fuel and biofuel and biomass burning soot aerosol.