

State of California  
AIR RESOURCES BOARD

RESEARCH PROPOSAL

Resolution 12-6

January 26, 2012

Agenda Item No.: 12-1-1

WHEREAS, the Air Resources Board (ARB) 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 2732-272, entitled "Source Speciation of Central Valley GHG Emissions using In-Situ Measurements of Volatile Organic Compounds," has been submitted by the University of California, Berkeley;

WHEREAS, the Research Division staff has reviewed and recommended this proposal for approval; and

WHEREAS, the Research Screening Committee has reviewed and recommends for funding:

Proposal Number 2732-272 entitled "Source Speciation of Central Valley GHG Emissions using In-Situ Measurements of Volatile Organic Compounds," submitted by the University of California, Berkeley, for a total amount not to exceed \$360,000.

NOW, THEREFORE, BE IT RESOLVED that the Air Resources Board, pursuant to the authority granted by Health and Safety Code section 39703, hereby accepts the recommendation of the Research Screening Committee and approves the following:

Proposal Number 2732-272 entitled "Source Speciation of Central Valley GHG Emissions using In-Situ Measurements of Volatile Organic Compounds," submitted by the University of California, Berkeley, for a total amount not to exceed \$360,000.

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 effort proposed herein, and as described in Attachment A, in an amount not to exceed \$360,000.

I hereby certify that the above is a true and correct copy of Resolution 12-6, as adopted by the Air Resources Board.

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Mary Alice Morency, Clerk of the Board

## ATTACHMENT A

### “Source Speciation of Central Valley GHG Emissions using In-Situ Measurements of Volatile Organic Compounds”

#### Background

The Global Warming Solutions Act of 2006 (AB 32) requires reduction of California's greenhouse gas (GHG) emissions. Building and testing GHG inventories has been the subject of significant effort even before AB 32 through research at the California Energy Commission, the California Air Resources Board, and academia. Prior research by this study's co-Principal Investigator (PI) has predicted variations in atmospheric GHG concentration due to fossil fuel emissions and terrestrial ecosystem exchange. One method to apportion different sources requires measurement of multiple species that can serve as source tracers and an extensive set of aloft measurements. However, such data are not common. Aside from Walnut Grove Tower, Mount Wilson, Sutro Tower, and a few other sites currently being developed, California has few continuous multiple GHGs measurement sites.

Using inverse emission estimates, prior research by the co-PI to estimate source contributions to non-CO<sub>2</sub> GHG emissions has used observations made from a tall tower located at Walnut Grove. The tower provides samples at multiple heights representing different geographic extents for continuous CO<sub>2</sub>, CH<sub>4</sub>, CO, and <sup>222</sup>Rn and daily flask sampling (analyzed daily for CO<sub>2</sub>, CO, CH<sub>4</sub>, N<sub>2</sub>O, SF<sub>6</sub>, and periodically for broad suite of halo carbons and isotopes of CO<sub>2</sub>, and CH<sub>4</sub>). Continuous N<sub>2</sub>O measurements may also be added. Inverse emission estimates rely on accurately measured GHG mixing ratios to determine local-to-regional enhancements above background levels; these estimates require a clear understanding of local and regional meteorology combined with detailed meteorological modeling including long-distance and multi-height trajectory analysis.

#### Objective

This project is intended to evaluate and demonstrate the use of volatile organic compounds (VOCs) as source tracers for non-CO<sub>2</sub> GHGs; thus providing a new tool to potentially validate GHG emission inventories in California. Specific project objectives are to deploy a proton transfer reaction mass spectrometer (PTR-MS) at five elevations from close to the ground to roughly 500 meters above to measure speciated VOCs strongly related to emission sources that also emit methane and nitrous oxides. Using these relationships, the project would provide estimation of methane and N<sub>2</sub>O emissions from these sources and, given the right meteorological conditions, the project would support inverse modeling of these emission inventories.

#### Methods

The PI will use a state-of-the-science proton transfer reaction mass spectrometer for measuring speciated volatile organic compounds at five elevations. With prior experience with this instrument on board airplanes and after operating a major site in the southern San Joaquin Valley during the CalNex 2010 study also equipped with these types of instruments, the PI will use these data in state-of-the-art inverse modeling and data analysis.

**Expected Results**

Using a proton transfer reaction mass spectrometer (PTR MS), this study would add speciated VOC measurements to the measurement program at an existing tall tower in Walnut Grove. Using speciated VOCs, this study would develop detailed GHG source profiles and test their use in more robust inverse estimation and modeling for GHG emission inventory evaluation and validation. Significant improvements to GHG emission inventories are expected.

**Significance to the Board**

Accurate and precise GHG emission inventories for all source categories are essential to fairly determine their mitigation potential and to apportion the required GHG emission reductions.

**Contractor:**

University of California, Berkeley

**Contract Period:**

36 months

**Principal Investigators (PIs):**

Professor Allen H. Goldstein (UC Berkeley)  
Dr. Marc Fischer (Lawrence Berkeley National Laboratory)

**Contract Amount:**

\$360,000

**Basis for Indirect Cost Rate:**

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

**Past Experience with the Principal Investigators:**

Over the last fifteen years, Professor Goldstein has been the key PI for work on biogenic emission inventories in California, for the CalNex field study, for work on new aerosol and development of speciated VOC instruments. In the last seven years, Dr. Fischer has been the key PI for an inverse modeling study using data collected at the Walnut Grove tower, Sutro tower, and Mount Wilson site to validate ARB’s greenhouse gas emission inventories.

**Prior Research Division Funding to University of California, Berkeley:**

Year	2011	2010	2009
Funding	\$754,264	\$801,587	\$1,507,702

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

Contractor: University of California, Berkeley

“Source Speciation of Central Valley GHG Emissions using In-Situ Measurements of  
Volatile Organic Compounds”

### **DIRECT COSTS AND BENEFITS**

1.	Labor and Employee Fringe Benefits	\$ 233,069
2.	Subcontractors	\$ 70,000
3.	Equipment	\$ 0
4.	Travel and Subsistence	\$ 1,920
5.	Electronic Data Processing	\$ 0
6.	Reproduction/Publication	\$ 4,000
7.	Mail and Phone	\$ 2,000
8.	Supplies	\$ 10,417
9.	Analyses	\$ 0
10.	Miscellaneous	<u>\$ 11,531</u>

Total Direct Costs \$332,937

### **INDIRECT COSTS**

1.	Overhead	\$ 27,063
2.	General and Administrative Expenses	\$ 0
3.	Other Indirect Costs	\$ 0
4.	Fee or Profit	<u>\$ 0</u>

Total Indirect Costs \$ 27,063

### **TOTAL PROJECT COSTS**

**\$360,000**

## Attachment 1

# SUBCONTRACTORS' BUDGET SUMMARY

Subcontractor: Lawrence Berkeley National Laboratory

Description of subcontractor's responsibility: Managing the tower measurements and assisting with data analysis and inverse modeling

### **DIRECT COSTS AND BENEFITS**

1.	Labor and Employee Fringe Benefits	\$	31,545
2.	Subcontractors	\$	0
3.	Equipment	\$	0
4.	Travel and Subsistence	\$	2,280
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		\$33,825

### **INDIRECT COSTS**

1.	Overhead	\$	36,175
2.	General and Administrative Expenses	\$	0
3.	Other Indirect Costs	\$	0
4.	Fee or Profit	\$	<u>0</u>
	Total Indirect Costs		<u>\$36,175</u> <sup>1</sup>

**TOTAL PROJECT COSTS** \$70,000

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### Notes

<sup>1</sup> Department of General Services and ASD have agreed to the Lab's indirect costs