

State of California  
AIR RESOURCES BOARD

RESEARCH PROPOSAL

Resolution 06-32

November 16, 2006

Agenda Item No.: 06-10-2

WHEREAS, the Air Resources 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 2612-253, entitled "Flux Measurements of Biogenic Precursors to Ozone and Particulate Matter in the Central Valley," has been submitted by the University of California, Berkeley;

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

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

Proposal Number 2612-253, entitled "Flux Measurements of Biogenic Precursors to Ozone and Particulate Matter in the Central Valley," submitted by the University of California, Berkeley, for a total amount not to exceed \$400,003.

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 2612-253, entitled "Flux Measurements of Biogenic Precursors to Ozone and Particulate Matter in the Central Valley," submitted by the University of California Berkeley, for a total amount not to exceed \$400,003.

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 \$400,003.

I hereby certify that the above is a true and correct copy of Resolution 06-32, as adopted by the Air Resources Board.

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Lori Andreoni, Clerk of the Board

## **ATTACHMENT A**

### **“Flux Measurements of Biogenic Precursors to Ozone and Particulate Matter in the Central Valley”**

#### **Background**

California has nearly 6,000 native plant species; countless “exotic” plants have been imported into our state. In a span of less than 70 kilometers, California ecosystems change from coastal chaparral to Alpine conifers. Speed of urbanization and changes to established land use in California’s modern history have also been significant. Cognizant of these particularities, ARB staff, with help from the California and national academia, has developed Biogenic Emissions Inventory through Geographic Information Systems (BEIGIS) simulation platform to project isoprene, terpene, and methyl butenol emission inventories specific to California.

The source of emission factor input data for BEIGIS is the Winer and Benjamin taxonomic method which is based on important investigations in southern California, and more recent work at the Blodgett Forest Research (BFR) station. The taxonomic method extended our limited emission factor data to cover all existing plant species based on genus, family, or other generalization. Our developing understanding of ozone and aerosol chemistry impacted by biogenic emissions has also been largely confined to southern California and BFR. In the last several years, BFR work by Professor Goldstein and his coworkers have demonstrated the role of sesqui terpene emissions within the canopy that react with ozone and isoprene reaction products to form nucleation aerosols. This research team has expanded data on oxygenated biogenic emissions important in the atmospheric free radical balance. These observations have been validated through environmental chamber tests at Professor Seinfeld’s laboratory at the California Institute of Technology.

California’s agricultural communities, the San Joaquin Valley in particular, are the location for a very large leaf biomass whose emission profiles have not previously been the target of inquiry. New leaf area index inputs to BEIGIS, including MODIS, emphasize the importance of proper assignment of emission factors for agricultural plant species. Changes in agricultural practice to high return on investment orchard, wine, and apiary agriculture may also have significant emission ramifications we need to understand.

#### **Objective**

The objective of this proposal is to significantly improve our understanding of agricultural contributions to biogenic volatile organic compounds (BVOC) emissions and to significantly improve our biogenic inventory simulations performance.

#### **Methods**

During the screening phase, the principal investigators will select target crops in the eight southern counties during the screening phase using the taxonomic relationships, known emissions behavior of plants, the acreage of their plantings within the San

Joaquin valley, and an additional literature search. The measurement platform will be a dynamic branch enclosure of the type that has provided a significant fraction of existing emission factors in California. The dynamic flow through enclosures would completely house potted crop plants. Using standard branch enclosure measurement methodology supplemented by GC-MS/FID and PTR-MS, principal investigators will measure mono and sesqui terpenes, methanol, acetone, acetaldehyde, isoprene, isoprene-ozone oxidation products, methyl butenol, and many other intermediate compounds of terpene ozone oxidation. The University of California Cooperative Extension in Bakersfield California is the proposed site of the screening phase.

Using information from the screening phase, in Phase II the principal investigators will collect, through two measurement programs of at least three weeks each, above canopy eddy covariance flux measurement data on BVOC emissions, leaf mass, leaf area index, and micro meteorological data relevant to BEIGIS simulations at two sites. The suite of measurements and the details of emission factor development mirror the screening phase and consist of: ozone, CO<sub>2</sub>, and water vapor, photosynthetic light radiation (PAR), and other micro meteorological parameters (wind speed, direction, vertical wind speed, temperature, relative humidity, pressure, etc).

### **Expected Results**

The proposed work would provide input data to the BVOC simulation platform from selected Central Valley agricultural operations. The proposed work could lead to new understanding of ozone and aerosol chemistry likely requiring new modules and important modifications to elements of the existing BVOC simulation platform. The project will improve ARB's BVOC emissions inventory.

### **Significance to the Board**

The proposed work would help define ozone and aerosol design values as specified in the ozone and particulate matter state implementation planning documents. The proposed work is also a key part of the developing state greenhouse gas emission inventory platforms.

### **Contractor:**

University of California, Berkeley

### **Contract Period:**

24 months

### **Principal Investigator (PI):**

Professor Allen Goldstein

### **Contract Amount:**

\$400,003

### **Basis for Indirect Cost Rate:**

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

**Past Experience with this Principal Investigator:**

Professor Goldstein has completed three previous contracts with us in the area of biogenic emissions inventories and ambient data. Each contract was handled to ARB's satisfaction and has produced significant beneficial results for the Board.

**Prior Research Division Funding to UCB:**

Year	2005	2004	2003
Funding	\$1,829,446*	\$920,205	\$715,194*

\* The California Energy Commission contributed a total of \$1,003,850 to projects during these fiscal years.

# BUDGET SUMMARY

University of California, Berkeley

Flux Measurements of Biogenic Precursors to Ozone and Particulate Matter in the Central Valley

## **DIRECT COSTS AND BENEFITS**

1.	Labor and Employee Fringe Benefits	\$242,119
2.	Subcontractors	\$ 0
3.	Equipment	\$ 22,200
4.	Travel and Subsistence	\$ 44,000 <sup>1</sup>
5.	Electronic Data Processing	\$ 0
6.	Reproduction/Publication	\$ 1,200
7.	Mail and Phone	\$ 1,000
8.	Supplies	\$ 57,000 <sup>2</sup>
9.	Analyses	\$ 0
10.	Miscellaneous	<u>\$ 0</u>
	Total Direct Costs	\$367,519

## **INDIRECT COSTS**

1.	Overhead	\$ 32,484
2.	General and Administrative Expenses	\$ 0
3.	Other Indirect Costs	\$ 0
4.	Fee or Profit	<u>\$ 0</u>
	Total Indirect Costs	<u>\$ 32,484</u>

## **TOTAL PROJECT COSTS**

**\$400,003**

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<sup>1</sup> Travel funds are requested for transporting instrumentation and personnel between UC Berkeley and the field measurement sites for the proposed measurements of plant BVOC emissions using chambers in year 1 and at the crop scale in year 2, and for travel by John Karlik to UC Berkeley in order to collaborate in the research planning and execution. Per diem (including housing costs) is included for three people during the field measurements in both year 1 and year 2, and \$2000 per year is included for travel to meetings associated with the proposed research.

<sup>2</sup> Cost includes materials and supplies for building to plant enclosures conduct plant scale flux measurement.