

State of California  
AIR RESOURCES BOARD

RESEARCH PROPOSAL

Resolution 09-13

February 26, 2009

Agenda Item No.: 09-2-2

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 2677-263, entitled "Characterization of the Atmospheric Chemistry in the Southern San Joaquin Valley and Initial Comparison with Atmospheric Chemistry in the South Coast Air Basin," 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 2677-263 entitled "Characterization of the Atmospheric Chemistry in the Southern San Joaquin Valley and Initial Comparison with Atmospheric Chemistry in the South Coast Air Basin," submitted by the University of California, Berkeley, for a total amount not to exceed \$1,050,000.

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 2677-263 entitled "Characterization of the Atmospheric Chemistry in the Southern San Joaquin Valley and Initial Comparison with Atmospheric Chemistry in the South Coast Air Basin," submitted by the University of California, Berkeley, for a total amount not to exceed \$1,050,000.

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 \$1,050,000.

I hereby certify that the above is a true and correct copy of Resolution 09-13, as adopted by the Air Resources Board.

/s/

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Monica Vejar, Clerk of the Board

**ATTACHMENT A****“Characterization of the Atmospheric Chemistry in the Southern San Joaquin Valley and Initial Comparison with Atmospheric Chemistry in the South Coast Air Basin”****Background**

A wide suite of volatile organic compounds (VOC) react in the atmosphere with nitrogen oxides and sunlight to form ozone ( $O_3$ ) and secondary aerosols. In the South Coast Air Basin, control of anthropogenic VOC from automobiles and industrial processes has proven effective at reducing ozone exceedances over the past three decades, indicating that VOC was the limiting factor in ozone production in this region. In central California, differences between weekday and weekend ozone concentrations indicate that ozone production in urban cores tend to be  $NO_x$ -saturated (VOC-limited) while downwind areas and the Sierra Nevada are more  $NO_x$ -sensitive.

A comprehensive set of VOC and radical measurements, including both directly emitted and secondarily produced oxygenated VOCs (especially formaldehyde and other aldehydes) are required to investigate the relative roles of various atmospheric chemistry pathways. The ratios of certain “indicator species ratios” (e.g.  $O_3/NO_y$  and  $H_2O_2/HNO_3$ ) are useful for analyzing ozone production chemistry in the atmosphere. In defining these indicators, measurements of  $HNO_3$  and organic nitrates can be particularly useful as can be ratios of PAN analogues to their associated aldehydes.

ARB and the National Oceanic and Atmospheric Administration (NOAA) have proposed a joint field study of atmospheric processes over California and the eastern Pacific coastal region in CalNex 2010. The goal of CalNex is to study the important issues at the nexus of air quality and climate change problems, and to provide scientific information regarding the potential trade-offs or dis-benefits faced by decision-makers when addressing these two inter-related issues. During this field study, the UCB ground site will provide a detailed study of  $O_3$ ,  $PM_{2.5}$ , their precursors, and associated indicator species to study the chemical production and loss of  $PM_{2.5}$  and  $O_3$ . The data collected will provide insights into whether a different air quality control strategy may be needed in the San Joaquin Valley Air Basin (SJVAB) in order to expeditiously reduce the concentrations of secondary pollutants.

**Objective**

The primary objective of this project is to provide the critical components of a ground-based measurement site as one of the ARB contributions to the CalNex 2010 study. These measurements will be used to describe the  $O_3$  and  $PM_{2.5}$  chemistry in the southern portion of the SJVAB. The investigators will contrast their results (measurements and analysis) with historical and CalNex measurements describing the atmospheric chemistry in Central California and the South Coast Air Basin. Measurements that UCB proposes to make include  $O_3$ , CO, NO,  $NO_2$ , total peroxy nitrates, total alkyl and multifunctional nitrates,  $HNO_3$ , and a wide range of

VOCs—most notably C<sub>3</sub>-C<sub>10</sub> alkanes and alkenes, benzene, toluene, xylenes, isoprene, terpenes, C<sub>2</sub>-C<sub>6</sub> aldehydes, alcohols, and ketones. The investigators will organize a team of researchers to augment the UCB core measurements with measurements of radicals, peroxides, formaldehyde, glyoxal, and aerosol properties. Analysis of these measurements will test the current understanding of atmospheric chemistry and the performance of models simulating O<sub>3</sub> and PM<sub>2.5</sub> production in the San Joaquin Valley.

### **Methods**

The Principal Investigators, their sub-contractors, and other CalNex 2010 participants will collect specialized air quality measurements in the San Joaquin Valley and the South Coast Air Basin to address joint air quality and climate change issues. The investigators will share results and analyze the data to better characterize the atmospheric chemistry at work in determining ambient air quality in the San Joaquin Valley and near downtown Los Angeles. With the use of indicator ratios, modeling, and other data analysis techniques, the investigators will better characterize the atmospheric chemistry in the southern San Joaquin Valley.

### **Expected Results**

This project will improve our understanding of the atmospheric chemistry in the southern San Joaquin Valley and how it controls the formation of secondarily-formed pollutants (e.g., O<sub>3</sub> and PM<sub>2.5</sub>).

### **Significance to the Board**

The measurements and data analyses from this project and the larger CalNex 2010 study will support the development of appropriate and cost-effective control strategies for reducing secondarily-formed pollutants like O<sub>3</sub> and PM<sub>2.5</sub> in the San Joaquin Valley and the South Coast Air Basin. The CalNex study will provide the data needed to better characterize the potential impacts of climate change on ambient air quality in California.

### **Contractor:**

University of California, Berkeley (UCB)

### **Contract Period:**

36 months

### **Principal Investigators (PIs):**

Professors Ronald Cohen and Allen Goldstein

### **Contract Amount:**

\$1,050,000

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

The State and the UC system have agreed to a ten percent indirect cost rate. Some of the sub-contractors have also agreed to indirect cost rates less than they normally charge. All indirect cost rates in this proposal are less than federally approved rates.

### **Past Experience with these Principal Investigators:**

Professors Cohen and Goldstein are well-respected researchers in the atmospheric measurements and chemistry community. They have worked with other high-level, national research groups (e.g., the National Aeronautics and Space Administration) in the past. At least four staff members of the Research Division have worked with these PIs on at least 7 projects (e.g., biogenics, organic aerosols, Lake Tahoe Atmospheric Deposition Study, night-time chemistry, satellite measurements) in the past. Staff has been very satisfied with their research.

**Prior Research Division Funding to UCB:**

Year	2008	2007	2006
Funding	\$483,986	\$1,377,484	\$1,607,398

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

Contractor: The University of California, Berkeley

Characterization of Atmospheric Chemistry in the Southern San Joaquin Valley  
and Initial Comparison with Atmospheric Chemistry in the South Coast Air Basin

### DIRECT COSTS AND BENEFITS

1.	Labor and Employee Fringe Benefits	\$	307,947
2.	Subcontractors	\$	500,000 <sup>1</sup>
3.	Equipment	\$	0
4.	Travel and Subsistence	\$	42,192
5.	Electronic Data Processing	\$	0
6.	Reproduction/Publication	\$	1,000
7.	Mail and Phone	\$	1,000
8.	Supplies	\$	73,665
9.	Analyses	\$	0
10.	Miscellaneous	\$	<u>70,816</u>
Total Direct Costs			\$996,620

### INDIRECT COSTS

1.	Overhead	\$	53,380
2.	General and Administrative Expenses	\$	0
3.	Other Indirect Costs	\$	0
4.	Fee or Profit	\$	<u>0</u>
Total Indirect Costs			<u>\$53,380</u>

### TOTAL PROJECT COSTS

\$1,050,000

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<sup>1</sup> Four sub-contractors have been recruited to provide critical supplementary air quality measurements to constrain the interpretation of photochemistry and reaction pathways. . . . . Their direct costs are primarily associated with deploying staff (2 each) to the southern San Joaquin Valley for 6 full weeks of detailed measurements of many critical common and trace air pollutants and also each student's tuition during their involvement in the project. . . . .

## Attachment 1

**SUBCONTRACTORS' BUDGET SUMMARY**

Subcontractor: California Institute of Technology

Description of subcontractor's responsibility: The California Institute of Technology (CalTech, Professor Paul Wennberg) will measure nitric acid (HNO<sub>3</sub>), peroxyntic acid (HO<sub>2</sub>NO<sub>2</sub>), hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>), hydrogen cyanide (HCN), formic acid {HC(O)OH}, acetic acid {CH<sub>3</sub>C(O)OH}, peroxyacetic acid {CH<sub>3</sub>C(O)OOH} for a 6-week period in the southern San Joaquin Valley. CalTech will also attempt to make measurements of nitrous acid (HONO), glycolaldehyde, hydroxyacetone, and isoprene hydroxyhydroperoxide.

**DIRECT COSTS AND BENEFITS**

1.	Labor and Employee Fringe Benefits	\$	49,000
2.	Subcontractors	\$	0
3.	Equipment	\$	0
4.	Travel and Subsistence	\$	14,182
5.	Electronic Data Processing	\$	0
6.	Reproduction/Publication	\$	0
7.	Mail and Phone	\$	0
8.	Supplies	\$	9,408
9.	Analyses	\$	0
10.	Miscellaneous	\$	<u>8,493<sup>1</sup></u>
	Total Direct Costs		\$81,083

**INDIRECT COSTS**

1.	Overhead	\$	43,917
2.	General and Administrative Expenses	\$	0
3.	Other Indirect Costs	\$	0
4.	Fee or Profit	\$	<u>0</u>
	Total Indirect Costs		<u>\$43,917</u>

**TOTAL PROJECT COSTS****\$125,000**

<sup>1</sup> CalTech requested \$8,493 in graduate student tuition support. . . . . Both the PIs and staff of the Research Division have unsuccessfully attempted to get CalTech to reduce their indirect cost rate (60.5%) for this project. . . . .

**Attachment 2****SUBCONTRACTORS' BUDGET SUMMARY**

Subcontractor: Pennsylvania State University

Description of subcontractor's responsibility: The Pennsylvania State University (PSU, Professor William Brune) will measure hydroxyl (OH) and hydroperoxyl (HO<sub>2</sub>) radicals for a 6-week period in the southern San Joaquin Valley, and thus enabling direct tests of the chemistry that is at the core of ozone and aerosol production. PSU will also use their Potential Aerosol Mass instrument to provide an upper-limit constraint on secondary aerosol formation potential and its production in photochemical models.

**DIRECT COSTS AND BENEFITS**

1.	Labor and Employee Fringe Benefits	\$	47,235
2.	Subcontractors	\$	0
3.	Equipment	\$	0
4.	Travel and Subsistence	\$	62,400
5.	Electronic Data Processing	\$	0
6.	Reproduction/Publication	\$	4,000
7.	Mail and Phone	\$	0
8.	Supplies	\$	0
9.	Analyses	\$	0
10.	Miscellaneous	\$	<u>0</u>
	Total Direct Costs		\$113,635

**INDIRECT COSTS**

1.	Overhead	\$	11,365 <sup>1</sup>
2.	General and Administrative Expenses	\$	0
3.	Other Indirect Costs	\$	0
4.	Fee or Profit	\$	<u>0</u>
	Total Indirect Costs		<u>\$11,365</u>

**TOTAL PROJECT COSTS****\$125,000**


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<sup>1</sup> PSU has agreed to only charge the University of California's 10% indirect cost rate for this project.

**Attachment 3****SUBCONTRACTORS' BUDGET SUMMARY**

Subcontractor: The University of Washington

Description of subcontractor's responsibility: The University of Washington (U of WA, Professor Joel Thornton) will measure a suite of acyl peroxy nitrates (APNs), such as PAN, PPN, and MPAN, at high time resolution and low detection limits (~ 5 ppt in 1 second for PAN) for a 6-week period in the southern San Joaquin Valley.

**DIRECT COSTS AND BENEFITS**

1.	Labor and Employee Fringe Benefits	\$	64,680
2.	Subcontractors	\$	0
3.	Equipment	\$	0
4.	Travel and Subsistence	\$	10,608
5.	Electronic Data Processing	\$	0
6.	Reproduction/Publication	\$	0
7.	Mail and Phone	\$	0
8.	Supplies	\$	9,757
9.	Analyses	\$	0
10.	Miscellaneous	\$	<u>17,610<sup>1</sup></u>
	Total Direct Costs		\$102,655

**INDIRECT COSTS**

1.	Overhead	\$	22,345 <sup>2</sup>
2.	General and Administrative Expenses	\$	0
3.	Other Indirect Costs	\$	0
4.	Fee or Profit	\$	<u>0</u>
	Total Indirect Costs		<u>\$22,345</u>

**TOTAL PROJECT COSTS****\$125,000**

<sup>1</sup> Costs for connecting the department computers to the server that are not covered by indirect costs (\$896). Tuition for two full academic years for one graduate student (\$16,714). Indirect costs are not paid on graduate student tuition.

<sup>2</sup> The University of Washington provided a 26% indirect cost rate.



**Attachment 4****SUBCONTRACTORS' BUDGET SUMMARY**

Subcontractor: The University of Wisconsin

Description of subcontractor's responsibility: The University of Wisconsin, Madison (U of WI, Professor Frank Keutsch) will measure formaldehyde (for a six-week period in the southern San Joaquin Valley) with high sensitivity (sub-ppb) and time resolution (10 Hz) to enable analyses of HO<sub>x</sub> radical budgets.

**DIRECT COSTS AND BENEFITS**

1.	Labor and Employee Fringe Benefits	\$	56,422
2.	Subcontractors	\$	0
3.	Equipment	\$	0
4.	Travel and Subsistence	\$	20,894
5.	Electronic Data Processing	\$	0
6.	Reproduction/Publication	\$	0
7.	Mail and Phone	\$	0
8.	Supplies	\$	6,366
9.	Analyses	\$	0
10.	Miscellaneous	\$	<u>18,000<sup>1</sup></u>
	Total Direct Costs		\$101,682

**INDIRECT COSTS**

1.	Overhead	\$	23,318 <sup>2</sup>
2.	General and Administrative Expenses	\$	0
3.	Other Indirect Costs	\$	0
4.	Fee or Profit	\$	<u>0</u>
	Total Indirect Costs		<u>\$23,318</u>

**TOTAL PROJECT COSTS****\$125,000**

<sup>1</sup> Miscellaneous costs include \$12,000 for student tuition support, and \$6,000 in shipping costs for the LIF and LIP instruments and supporting equipment from Madison to Bakersfield or equivalent location based on recent deployments.

<sup>2</sup> The University of Wisconsin has provided a reduced indirect cost rate of 26.0% for this project.