State of California
AIR RESOURCES BOARD

RESEARCH PROPOSAL

Resolution 11-10

February 24, 2011

Agenda Item No.: 11-1-1

WHEREAS, the Air Resources Board (ARB 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 2711-269, entitled "Probing the Intrinsic Ability of Particles to Generate Reactive Oxygen Species and the Effect of Physiologically Relevant Solutes," has been submitted by the University of California, Los Angeles;

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

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

> Proposal Number 2711-269 entitled "Probing the Intrinsic Ability of Particles to Generate Reactive Oxygen Species and the Effect of Physiologically Relevant Solutes," submitted by the University of California, Los Angeles, for a total amount not to exceed $301,039.

NOW, THEREFORE, BE IT RESOLVED that ARB, 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 2711-269 entitled "Probing the Intrinsic Ability of Particles to Generate Reactive Oxygen Species and the Effect of Physiologically Relevant Solutes," submitted by the University of California, Los Angeles, for a total amount not to exceed $301,039.

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 $301,039.

I hereby certify that the above is a true and correct copy of Resolution 11-10, as adopted by the Air Resources Board.

/s/

Mary Alice Morency, Clerk of the Board

ATTACHMENT A

"Probing the Intrinsic Ability of Particles to Generate Reactive Oxygen Species and the Effect of Physiologically Relevant Solutes"

Background

Particulate matter (PM) has been associated with significant adverse health outcomes, but it is difficult to devise cost-effective control strategies without a better understanding of the cause of PM toxicity. Recent studies implicate reactive oxygen species (ROS) as responsible for much of this toxicity, and important ROS in PM include hydrogen peroxide (H_2O_2) and hydroxyl (OH) radical. Those studies indicate that PM can catalytically generate ROS within the lung, and that the most likely catalysts responsible are transition metals and quinones. This study will attempt to understand formation of ROS by PM, by monitoring H_2O_2 and OH radical generation as well as transition metals and quinones, in ambient aerosol samples and in laboratory-generated test aerosols.

Objectives

1) Conduct field studies in Los Angeles and Fresno to simultaneously measure quinones and metals, and H_2O_2 and OH radical generation by PM.
2) Quantify the generation of H_2O_2 and OH radical by particle components in surrogate lung fluid.
3) Probe the sources of quinones in ambient PM.

Methods

Using both ambient aerosols collected in the field, and laboratory-generated test aerosols, the researchers will monitor for H_2O_2 and OH radical generation as well as transition metals and quinones, and perform analyses in the presence of physiologically relevant levels of four reductants found in the lung: ascorbate, glutathione, uric acid, and citrate. Measurements of aerosols in the field will be complemented by laboratory studies of H_2O_2 and OH radical generation by transition metals and quinones (active PM components) and by test aerosols. In order to compare ROS generated by the particles themselves and ROS generation as a biological response to PM, some samples will be extracted in the presence of dithiothreitol, which has been correlated with markers for biological ROS production.

Expected Results

The project will provide a detailed analysis of organics and metals from ambient samples collected in the Central Valley and the South Coast Air Basin, and their correlation with ROS activity. These field sample analyses will allow the researchers to attribute many of the active PM components to their sources.

Significance to the Board

This study will contribute substantially to the understanding of PM toxicity. Successful completion of this study should help ARB to devise control strategies for PM that target the sources that are most responsible for the adverse health impacts associated with PM exposure.

Contractor:
University of California, Los Angeles

Contract Period:
36 months

Principal Investigator (PI):
Suzanne E. Paulson, Ph.D.

Contract Amount:
$301,039

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 Suzanne E. Paulson has successfully completed three research projects for ARB as a principal investigator. These were titled "Particle Phase Peroxides: Concentrations, Sources, and Behavior," "Total Non-Methane Organic Carbon: Development and Validation of a New Instrument and Measurements of Total Non-Methane Organic Carbon and C_2-C_{10} Hydrocarbons in the South Coast Air Basin," and "An Investigation of the Relationship between Total Non-Methane Organic Carbon and the Sum of the Speciated Hydrocarbons and Carbonyls."

Prior Research Division Funding to the University of California, Los Angeles:

Year	2009	2008	2007
Funding	$ 539,284	$ 388,521	$ 306,544

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

University of California, Los Angeles (UCLA)

"Probing the Intrinsic Ability of Particles to Generate Reactive Oxygen Species and the Effect of Physiologically Relevant Solutes"

DIRECT COSTS AND BENEFITS

1.	Labor and Employee Fringe Benefits	$ 141,014	
2.	Subcontractors	$ 87,405	
3.	Equipment	$ 24,200	
4.	Travel and Subsistence	$ 6,530	
5.	Electronic Data Processing	$ 0	
6.	Reproduction/Publication	$ 1,458	
7.	Mail and Phone	$ 480	
8.	Supplies	$ 17,132	
9.	Analyses	$ 0	
10.	Miscellaneous	$ 1,054[1]	
	Total Direct Costs		$279,273

INDIRECT COSTS

1.	Overhead	$ 21,766	
2.	General and Administrative Expenses	$ 0	
3.	Other Indirect Costs	$ 0	
4.	Fee or Profit	$ 0	
	Total Indirect Costs		$ 21,766

TOTAL PROJECT COSTS **$301,039**

Notes:

1. Miscellaneous: Technology Infrastructure Fee, $1,054

ATTACHMENT 1

S U B C O N T R A C T O R ’S B U D G E T S U M M A R Y

California State University, Fresno (CSUF)

CSUF will conduct the field sampling with UCLA, and will perform analyses for the organics, including quinones and source tracers.

DIRECT COSTS AND BENEFITS				
1.	Labor and Employee Fringe Benefits	$	30,874	
2.	Subcontractors	$	0	
3.	Equipment	$	0	
4.	Travel and Subsistence	$	6,550	
5.	Electronic Data Processing	$	0	
6.	Reproduction/Publication	$	0	
7.	Mail and Phone	$	0	
8.	Supplies	$	7,000	
9.	Analyses	$	0	
10.	Miscellaneous	$	0	
	Total Direct Costs			$44,424
INDIRECT COSTS				
1.	Overhead	$	4,442	
2.	General and Administrative Expenses	$	0	
3.	Other Indirect Costs	$	0	
4.	Fee or Profit	$	0	
	Total Indirect Costs			$ 4,442
TOTAL PROJECT COSTS				**$48,866**

ATTACHMENT 2

S U B C O N T R A C T O R ' S B U D G E T S U M M A R Y

University of California, Davis (UCD)

UCD will investigate the effect of reductants and related species present in lung fluids on the production of reactive oxygen species (ROS) by transition metals and quinones in ambient particles.

DIRECT COSTS AND BENEFITS				
1.	Labor and Employee Fringe Benefits	$	26,635	
2.	Subcontractors	$	0	
3.	Equipment	$	0	
4.	Travel and Subsistence	$	0	
5.	Electronic Data Processing	$	0	
6.	Reproduction/Publication	$	0	
7.	Mail and Phone	$	0	
8.	Supplies	$	8,400	
9.	Analyses	$	0	
10.	Miscellaneous	$	0	
	Total Direct Costs			$35,035
INDIRECT COSTS				
1.	Overhead	$	3,504	
2.	General and Administrative Expenses	$	0	
3.	Other Indirect Costs	$	0	
4.	Fee or Profit	$	0	
	Total Indirect Costs			$ 3,504
TOTAL PROJECT COSTS				**$38,539**