State of California
AIR RESOURCES BOARD

RESEARCH PROPOSAL

Resolution 05-72

December 8, 2005

Agenda Item No.: 05-12-2

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 2597-250, entitled "Ultrafine Particle Concentrations in Schoolrooms and Homes", 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 2597-250 entitled "Ultrafine Particle Concentrations in Schoolrooms and Homes", submitted by the University of California, Berkeley, for a total amount not to exceed $300,000.

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 2597-250 entitled "Ultrafine Particle Concentrations in Schoolrooms and Homes", submitted by the University of California, Berkeley, for a total amount not to exceed $300,000.

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 $300,000.

I hereby certify that the above is a true
and correct copy of Resolution 05-72, as
adopted by the Air Resources Board.

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Lori Andreoni, Clerk of the Board

ATTACHMENT A

"Ultrafine Particle Concentrations in Schoolrooms and Homes"

Background

Many studies have shown an association between airborne particulate matter and adverse cardiovascular health effects. It has been hypothesized that these effects may be due to ultrafine particles (UFP, particles smaller than 100 nm) rather than larger particles (PM2.5 to PM10). Characterizing UFP concentrations in indoor environments and the factors that influence them is critical for accurately estimating people's exposures to UFP, because people spend most of their time indoors. Sources of indoor UFP include infiltration from outdoors, particularly for homes near busy roadways; cooking with gas stoves and ovens; other combustion sources such as fireplaces and other gas appliances; and burning candles and incense. The reaction of ozone with terpenes in cleaning products and air fresheners has also been shown to generate UFP indoors.

A limited number of studies have measured UFP levels in residences, including a study of 17 homes in the Los Angeles area which was co-funded by ARB and U.S. EPA. In this study, investigators found that indoor UFP concentrations in the 20 – 100 nm fraction varied by three orders of magnitude throughout the day. In another ARB-sponsored study, investigators measured UFP emissions during cooking experiments in a test home and determined that ultrafine particles ranged from approximately 2,000 to more than 200,000 particles/cm^3. However, the information provided by these studies is very limited, and UFP concentrations have not been studied in California schools.

Objective

The main objective of this research is to increase the knowledge base of UFP concentrations in California schoolrooms and residences. A second objective is to advance our understanding of the factors that influence UFP levels in these environments, including the presence and use of indoor sources, infiltration of UFP generated by outdoor sources, building ventilation, particle deposition rates, and other factors.

Methods

Investigators would continuously measure UFP, ozone, carbon monoxide, carbon dioxide, and nitric oxide indoors and outdoors at six homes and six classrooms in the San Francisco Bay Area. A pilot study would be conducted in two homes to test protocol design and the performance of the monitors in residential environments.

In the main field study, homes and classrooms will be monitored on a 24-hour basis for a total of six days at each location. Homes will be selected to provide a range of potential UFP sources. For example, at least two homes will be close to major transportation emissions. One home will be selected as "urban background", meaning it is in the urban environment but not close to major roadways. Homes will also be selected based on the presence and use of gas-cooking appliances, other combustion appliances, use of cleaning products or air fresheners that contain terpenes, and use of

candles or incense. At least one school will be near a major roadway, and the other schools and classrooms will be selected to gain information on other sources or conditions that might influence indoor UFP concentrations.

Expected Results
This study will increase our knowledge of UFP concentrations in homes and schools. It will measure the infiltration of UFP from the outdoors, particularly in locations near heavily traveled roadways. The study will also document the generation of UFP from known indoor sources and measure their impact on the indoor environment, as well as identify deposition rates for UFP generated indoors and outdoors.

Significance to the Board
UFP concentrations resulting from motor vehicle emissions have been studied in the ambient environment. However, the extent that these particles infiltrate to indoor environments and the contribution from indoor sources are relatively unknown. The level of infiltration from outdoors and the peak and duration of indoor emissions have important implications for exposure assessment and mitigation.

Contractor:
University of California, Berkeley

Contract Period:
33 months

Principal Investigator (PI):
William Nazaroff, Ph.D.

Contract Amount:
$300,000

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:
Dr. Nazaroff is currently completing another ARB-funded project on emissions from cleaning products and their indoor reaction with ozone to produce toxic air contaminants. Air Resources Board staff have been very pleased with the quality of his work on this project. He has previously completed several other successful projects for ARB as well.

Prior Research Division Funding to UCB:

Year	2005	2004	2003
Funding	$543,997	$1,021,876*	$715,194

* Approximately $780,000 was funded by the California Energy Commission.

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

University of California, Berkeley

"Ultrafine Particle Concentrations in Schoolrooms and Homes"

DIRECT COSTS AND BENEFITS			
1.	Labor and Employee Fringe Benefits	$ 157,070	
2.	Subcontractors	$ 75,000	
3.	Equipment	$ 12,000	
4.	Travel and Subsistence	$ 2,208	
5.	Electronic Data Processing	$ 1,500	
6.	Reproduction/Publication	$ 300	
7.	Mail and Phone	$ 566	
8.	Supplies	$ 26,000	
9.	Analyses	$ 0	
10.	Miscellaneous	$ 6,000	
	Total Direct Costs		$280,644
INDIRECT COSTS			
1.	Overhead	$ 19,356	
2.	General and Administrative Expenses	$ 0	
3.	Other Indirect Costs	$ 0	
4.	Fee or Profit	$ 0	
	Total Indirect Costs		$19,356
TOTAL PROJECT COSTS			**$300,000**

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

Subcontractor: Aerosol Dynamics Inc.

Description of subcontractor's responsibility: Aerosol Dynamics will play a key scientific role in the assembly of the instrumentation package, in the acquisition of all experimental data and in the interpretation of the ultrafine particle concentration data.

DIRECT COSTS AND BENEFITS				
1.	Labor and Employee Fringe Benefits	$	41,636	
2.	Subcontractors	$	2,250	
3.	Equipment	$	0	
4.	Travel and Subsistence	$	0	
5.	Electronic Data Processing	$	0	
6.	Reproduction/Publication	$	0	
7.	Mail and Phone	$	0	
8.	Supplies	$	1,969	
9.	Analyses	$	0	
10.	Miscellaneous	$	0	
	Total Direct Costs			$45,855
INDIRECT COSTS				
1.	Overhead	$	29,145	
2.	General and Administrative Expenses	$	0	
3.	Other Indirect Costs	$	0	
4.	Fee or Profit	$	0	
	Total Indirect Costs			$29,145
TOTAL PROJECT COSTS				**$75,000**