

State of California  
AIR RESOURCES BOARD

RESEARCH PROPOSAL

Resolution 07-24

**June 21, 2007**

Agenda Item No.: 07-7-2

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 2628-256, an augmentation of contract 04-324 entitled "Cardiovascular Health Effects of Fine and Ultrafine Particles during Freeway Travel," has been submitted by the University of California, Los Angeles;

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

WHEREAS, the Air Resources Board will fund this proposal for a total amount \$60,469; and

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

Proposal Number 2628-256, an augmentation of contract 04-324 entitled "Cardiovascular Health Effects of Fine and Ultrafine Particles during Freeway Travel," submitted by the University of California, Los Angeles, for a total amount not to exceed \$60,469.

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 2628-256, an augmentation of contract 04-324 entitled "Cardiovascular Health Effects of Fine and Ultrafine Particles during Freeway Travel," submitted by the University of California, Los Angeles, for a total amount not to exceed \$60,469.

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 \$60,469.

I hereby certify that the above is a true and correct copy of Resolution 07-24, as adopted by the Air Resources Board.

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Lori Andreoni, Clerk of the Board

## ATTACHMENT A

### “Cardiovascular Health Effects of Fine and Ultrafine Particles During Freeway Travel”

#### **Background**

The Air Resources Board (ARB) is currently funding the University of California, Los Angeles to conduct research into the cardiovascular health effects of fine and ultrafine particles during freeway travel. Particulate matter (PM) appears to be the most significant contributor to the adverse health effects of air pollution due to its links to excess mortality and cardiovascular and respiratory illness. There is growing concern that particle number, usually dominated by the particles in the ultrafine size range (<0.1 µm), may play an important role in the adverse health effects associated with PM exposure, although particle numbers typically show poor correlation with PM mass measures. Ultrafine particles (UFP) may also be of greater relative toxicity because of their ability to directly penetrate cell membranes, their relatively high absorption of organic components, and their relatively high deposition efficiency in the lung. Some of the highest measured UFP concentrations have been found on freeways, with concentrations up to two orders of magnitude higher than urban background concentrations. Only one previous study has investigated the effect of UFP exposures on heart rate variability endpoints and found statistically significant decreases in heart rate variability in both young/healthy and old/impaired subjects (Chan et al., 2004).

Good exposure contrasts between filtered and unfiltered particulate measurements have been obtained to date in the study. Environmental, physiologic, cardiovascular, and blood marker monitoring are conducted without major technical problems. Larger subject samples will give greater statistical power and increase the likelihood of significant findings. The addition of three subjects is expected to give a 9 percent increase in the power of the statistical analyses to detect significance.

#### **Objective**

The objective of this project is to determine if exposure to ambient air during travel on freeways changes heart rate variability (HRV) and other noninvasive measures of cardiovascular and respiratory health and to determine if such changes increase with increasing levels of exposure to ultrafine particles. Investigators will also provide data that can be used by ARB to estimate in-vehicle exposure to ultrafine particles during freeway travel.

#### **Methods**

In this study, human subjects are exposed to fine and ultrafine particles in a van instrumented with particle and gaseous air pollutant measurement instruments, along with a filtration system capable of removing most particles when activated. In this augmentation, three additional (sixteen originally proposed) healthy, elderly subjects will be subjected to vehicle emissions on either gasoline-dominated or diesel-dominated freeways, with and without particles. Noninvasive measures of cardiovascular function such as HRV will be monitored to see if exposures have immediate and/or short-term effects, and blood cytokines will be measured. Other studies have found effects for

vehicle-related PM2.5 exposures, but vehicle-related ultrafine particle exposures have not been studied.

**Expected Results**

This project will potentially provide two kinds of important data to ARB—data on the effects of UFP on cardiac function and blood markers of cardiovascular disease and more information about freeway pollutant exposures. The effects of different vehicle-related pollutants on these health endpoints will also be better understood, along with the possible synergistic effect differences between diesel-dominated and gasoline-dominated freeways.

**Significance to the Board**

The results will aid ARB in evaluating the importance of UFP and motor-vehicle-related UFP. It will also contribute to the evidence needed to evaluate whether mass-based PM standards alone are adequate to protect public health, or if particle numbers also need to be regulated. Furthermore, this work will add to ARB’s ability to evaluate the contribution of freeway driving to overall air pollution exposures.

**Contractor:**

University of California, Los Angeles

**Contract Period:**

The contract end date is January 2009. No additional time is requested for this augmentation.

**Principal Investigator (PI):**

William C. Hinds, Ph.D.

**Contract Amount:**

\$60,469

**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:**

William Hinds has conducted previous satisfactory work for ARB.

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

Year	2006	2005	2004
Funding	\$0	\$176,963	\$1,493,392

Chan, C.C., Chung, K.J., Shiao, G.M., and Lin, L.Y. (2004). “Personal Exposure to Submicrometer Particles and Heart Rate Variability in Human Subjects.” *Environ Health Perspect*, 112(10), 1063-7.

## BUDGET SUMMARY

Contractor: University of California, Los Angeles

“Cardiovascular Health Effects of Fine and Ultrafine Particles During Freeway Travel”

### **DIRECT COSTS AND BENEFITS**

1.	Labor and Employee Fringe Benefits	\$	3,391
2.	Subcontractors	\$	52,617 <sup>1</sup>
3.	Equipment	\$	0
4.	Travel and Subsistence	\$	0
5.	Electronic Data Processing	\$	0
6.	Reproduction/Publication	\$	0
7.	Mail and Phone	\$	0
8.	Supplies	\$	875
9.	Analyses	\$	0
10.	Miscellaneous	\$	<u>2,872</u>

Total Direct Costs \$59,755

### **INDIRECT COSTS**

1.	Overhead	\$	714
2.	General and Administrative Expenses	\$	0
3.	Other Indirect Costs	\$	0
4.	Fee or Profit	\$	<u>0</u>

Total Indirect Costs \$714

**TOTAL PROJECT COSTS** **\$60,469**

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<sup>1</sup> Subcontractors:

Los Amigos Research and Education Institute (LARIE; \$27,944) will be conducting all of the cardiovascular, physiological, and other health effects monitoring for the project.

East Carolina University (\$24,673) will perform the screening, analysis, and interpretation of cardiac measurements and conduct the blood chemistry analysis and its interpretation.

## Attachment 1

# SUBCONTRACTORS' BUDGET SUMMARY

Subcontractor: Los Amigos Research and Education Institute (LAREI)

Description of subcontractor's responsibility: LAREI will be conducting all of the cardiovascular, physiological, and other health effects monitoring for the project.

### **DIRECT COSTS AND BENEFITS**

1.	Labor and Employee Fringe Benefits	\$17,287	
2.	Subcontractors	\$0	
3.	Equipment	\$0	
4.	Travel and Subsistence	\$0	
5.	Electronic Data Processing	\$0	
6.	Reproduction/Publication	\$0	
7.	Mail and Phone	\$480	
8.	Supplies	\$633	
9.	Analyses	\$2,052	
10.	Miscellaneous	<u>\$4,190</u>	
	Total Direct Costs		\$24,642

### **INDIRECT COSTS**

1.	Overhead	\$3,302	
2.	General and Administrative Expenses	\$	
3.	Other Indirect Costs	\$	
4.	Fee or Profit	\$	
	Total Indirect Costs		<u>\$3,302</u>

**TOTAL PROJECT COSTS** \$27,944

Attachment 1

**SUBCONTRACTORS' BUDGET SUMMARY**

Subcontractor: East Carolina University

Description of subcontractor's responsibility: East Carolina University will perform the screening, analysis, and interpretation of cardiac measurements and conduct the blood chemistry analysis and its interpretation.

**DIRECT COSTS AND BENEFITS**

1.	Labor and Employee Fringe Benefits	\$16,905	
2.	Subcontractors	\$0	
3.	Equipment	\$0	
4.	Travel and Subsistence	\$0	
5.	Electronic Data Processing	\$0	
6.	Reproduction/Publication	\$0	
7.	Mail and Phone	\$400	
8.	Supplies	\$850	
9.	Analyses	\$4,275	
10.	Miscellaneous	<u>\$0</u>	
	Total Direct Costs		\$22,430

**INDIRECT COSTS**

1.	Overhead	\$2,243	
2.	General and Administrative Expenses	\$	
3.	Other Indirect Costs	\$	
4.	Fee or Profit	<u>\$</u>	
	Total Indirect Costs		<u>\$2,243</u>

**TOTAL PROJECT COSTS** **\$24,673**