

State of California
AIR RESOURCES BOARD

RESEARCH PROPOSAL

Resolution 05-2

January 20, 2005

Agenda Item No.: 05-1-2

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 2574-246, 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 Research Screening Committee has reviewed and recommends for funding:

Proposal Number 2574-246 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 \$580,205.

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 2574-246 entitled "Cardiovascular Health Effects of Fine and Ultrafine Particles during Freeway Travel", submitted by University of California, Los Angeles for a total amount not to exceed \$580,205.

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 \$580,205.

I hereby certify that the above is a true and correct copy of Resolution 05-2, as adopted by the Air Resources Board.

Lori Andreoni, Clerk of the Board

ATTACHMENT A

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

Background

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 ($<0.1 \mu\text{m}$), 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).

Objective

The overall objective of this study is to determine if exposure to UFP and/or related co-pollutants during travel on freeways changes heart rate variability and blood measures of inflammation or coagulation. These effects will be measured and contrasted on both diesel-dominated and gasoline-dominated freeways.

Methods

This clinical, environmental study will continuously monitor measures of cardiovascular health, in-vehicle measures of fine and ultrafine particles, and gas phase pollutants, before during and after a 2-hour exposure on a freeway. Sixteen adult subjects will each undergo four freeway exposures – one on Interstate 405 (or 110), a gasoline dominated freeway, and one on Interstate 710, a diesel dominated freeway, and one each on the same freeways, but with filtered air.

During the exposure periods, concentration and size distribution of fine and ultrafine particles and the concentration of CO, elemental carbon, particle bound PAHs, PM_{2.5} mass, selected transition metal in PM_{2.5}, and NO_x will be monitored in the subject's personal environment.

Expected Results

This project will potentially provide two kinds of important data to the 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 the ARB in evaluating the importance of UFP and motor-vehicle-related UFP acting in concert with co-pollutants. 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 number also needs to be regulated. This work will also add to the ARB's ability to evaluate the contribution of freeway driving to overall air pollution exposures.

Contractor:

University of California, Los Angeles

Contract Period:

26 Months

Principal Investigator (PI):

William Hinds, Sc.D.

Contract Amount:

\$580,205

Basis for Indirect Cost Rate:

The State and 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 the ARB.

Prior Research Division Funding to UCLA:

Year	2004	2003	2002
Funding	\$109,975	\$0	\$0

BUDGET SUMMARY

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	\$102,415
2.	Subcontractors	\$310,137 ¹
3.	Equipment	\$ 92,532 ²
4.	Travel and Subsistence	\$ 7,704
5.	Electronic Data Processing	\$ 0
6.	Reproduction/Publication	\$ 400
7.	Mail and Phone	\$ 330
8.	Supplies	\$ 28,102
9.	Analyses	\$ 9,100
10.	Miscellaneous	\$ 8,800
	Total Direct Costs	\$ 559,520

INDIRECT COSTS

1.	Overhead	\$ 20,685
2.	General and Administrative Expenses	\$ 0
3.	Other Indirect Costs	\$ 0
4.	Fee or Profit	\$ 0
	Total Indirect Costs	\$ 20,685

TOTAL PROJECT COSTS \$ 580,205

¹ Los Amigos Research and Education Institute	\$175,463
East Carolina University	134,674

² Equipment:	
TSI, Inc. water-based condensation particle counter	\$ 29,150
(2) TSI, Inc. Dusttraks (PM2.5) and (PM-10)	\$ 8,250
Ecochem PAS 2000 (PAHs)	\$ 16,808
Magee Scientific Aethalometer (black carbon)	\$ 20,350
Dell laptop computer	\$ 2,000
Inverter	\$ 1,034
Teledyne NOx analyzer	\$ 14,300
Xantrex battery charger	\$ 640
Total Equipment	\$ 92,532

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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	\$ 97,744
2. Subcontractors	\$ 0
3. Equipment	\$ 0
4. Travel and Subsistence	\$ 1,235
5. Electronic Data Processing	\$ 192
6. Reproduction/Publication	\$ 1,540
7. Mail and Phone	\$ 3,619
8. Supplies	\$ 20,529 ¹
9. Analyses	\$ 10,944 ²
10. Miscellaneous	<u>\$ 23,709³</u>
Total Direct Costs	\$ 159,512

INDIRECT COSTS

1. Overhead	\$ 15,951
2. General and Administrative Expenses	\$ 0
3. Other Indirect Costs	\$ 0
4. Fee or Profit	<u>\$ 0</u>
Total Indirect Costs	\$ 15,951

TOTAL PROJECT COSTS

\$ 175,463

¹ Supplies:

Consumable clinical supplies	\$ 3,380
Consumable computer supplies	\$ 330
Mortara Hoelter recorders	\$ 8,353
Space Labs mobile blood pressure monitors	\$ 8,216
Prorated maintenance for refrigerated centrifuge	<u>\$ 250</u>
Total Supplies	\$ 20,529

² Miscellaneous

Main chamber maintenance, 60 hours	\$ 6,809
Subject recruitment	\$ 2,600
Subject remuneration	<u>\$ 14,300</u>
Total Miscellaneous	\$ 23,709

³ Analyses

Uric acid (192 X \$37)	\$ 7,104
hematocrit, MCV, MCH, MCHC, neutrophils, lymphocytes, and lymphocyte counts (192 X \$20)	<u>\$ 3,840</u>
Total Analyses	\$ 10,944

SUBCONTRACTORS' BUDGET SUMMARY

Subcontractor: East Carolina University

Description of subcontractor's responsibility: Dr. Wayne Cascio of 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	\$ 78,479
2. Subcontractors	\$ 0
3. Equipment	\$ 0
4. Travel and Subsistence	\$ 4,080
5. Electronic Data Processing	\$ 0
6. Reproduction/Publication	\$ 0
7. Mail and Phone	\$ 102
8. Supplies	\$ 39,770 ¹
9. Analyses	\$ 0
10. Miscellaneous	\$ 0
Total Direct Costs	\$ 122,431

INDIRECT COSTS

1. Overhead	\$ 12,243
2. General and Administrative Expenses	\$ 0
3. Other Indirect Costs	\$ 0
4. Fee or Profit	\$ 0
Total Indirect Costs	\$ 12,243

TOTAL PROJECT COSTS **\$ 134,674**

¹ Supplies

Human Cytokine Assay	\$6,120
High sensitivity C-reactive protein	\$4,000
Plasminogen	\$3,500
von Willebrand factor	\$4,550
Angiotensin converting enzyme	\$4,600
Atrial naturetic protein	\$4,500
Endothelin-1	\$4,000
Angiotensin II	\$4,000
Plasminogen activator inhibitor	\$4,500
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	\$39,770