

**State of California  
AIR RESOURCES BOARD**

Resolution 01-14  
April 26, 2001

Agenda Item No.: 01-3-4

**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 2481-218, entitled "Characterizing the Range of Children's Pollutant Exposure During School Bus Commutes," has been submitted by University of California, Riverside.

**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:

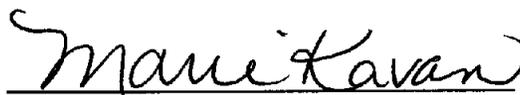
Proposal Number 2481-218 entitled "Characterizing the Range of Children's Pollutant Exposure During School Bus Commutes," submitted by University of California, Riverside for a total amount not to exceed \$449,503.

**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 2481-218 entitled "Characterizing the Range of Children's Pollutant Exposure During School Bus Commutes," submitted by University of California, Riverside for a total amount not to exceed \$449,503.

**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 \$449,503.

I hereby certify that the above is a true and correct copy of Resolution 01-14, as adopted by the Air Resources Board.

  
Marie Kavan, Clerk of the Board

## **Attachment A**

### **“Characterizing the Range of Children’s Pollutant Exposure During School Bus Commutes”**

#### **Background**

A 1997 study of in-vehicle pollutant concentrations sponsored by the Air Resources Board indicated that proximity to diesel-fueled vehicles causes high concentrations of in-vehicle fine particles and black carbon, an indicator of diesel exhaust particulate. Because most California school buses are diesel-powered, significant numbers of school children are potentially exposed to high concentrations of diesel particles and other pollutants during their commutes by bus and during their time spent in proximity to idling buses. Children are especially susceptible to air pollution because of their high inhalation rates relative to body mass, their high activity levels, narrower lung airways, immature immune systems, and rapid growth. Exposure to pollutants as children travel to and from school has not been studied to date, even though roadways, sidewalks, and the space inside vehicles have repeatedly been shown to have some of the highest pollutant concentrations of all locations.

#### **Objective**

The objective of this study is to provide the pollutant concentration measurements needed to characterize school bus commute exposures experienced by children while riding on buses, waiting at bus stops, and waiting near idling buses during loading. This study would obtain data needed to characterize the range of children’s exposures experienced during school bus commutes by obtaining measurements across a range of commute scenarios, sampling locations (such as bus stops and loading areas), and bus fuel types. A full range of both gaseous and particulate vehicle exhaust pollutants would be measured. Many of these measurements would be made in real-time to determine which factors and events result in the highest concentrations and to measure the duration of peak concentrations.

#### **Expected Results**

A large database of pollutant concentrations will be created and linked to various activities and locations in and around operating school buses. Real-time measurements will include particle mass, particle counts, black carbon, particle-bound polycyclic aromatic hydrocarbons, carbon monoxide, and nitrogen dioxide. Integrated measurements will include total particle mass, metals, and volatile organic compounds. Comparing concentrations to background levels will demonstrate whether school bus commutes contribute significantly to children’s exposures. Statistical analysis of factors associated with the highest concentrations will determine which activities, bus conditions, and driving conditions may be contributing the most to these exposures.

#### **Significance to the Board**

The results of this study will be used by ARB staff to better estimate children’s exposure to diesel exhaust particles and other bus-related pollutants, and to determine the fraction of children’s total exposure attributable to school bus-related activity. By identifying the factors that lead to higher exposures, the results of this study may

provide guidance for minimizing children's exposures. The results may also facilitate evaluations of the direct health benefits of alternative fuel types and improved bus control technologies.

**Contractor:**  
University of California, Riverside,  
College of Engineering—Center for  
Environmental Research and Technology

**Contract Period:**  
25 Months

**Principal Investigator (PI):**  
Dennis Fitz

**Contract Amount:**  
\$449,503

**Cofunding:**  
The South Coast Air Quality Management District has agreed to provide \$59,000 through a direct contract with UCR for the inclusion of diesel buses retrofitted with particle traps and enhanced ambient VOC monitoring.

**Basis for Indirect Cost Rate:**  
The indirect cost rate of 10 percent is a negotiated rate agreed to by the State and the University of California campuses.

**Past Experience with this Principal Investigator:**  
Dennis Fitz has conducted previous satisfactory work for the ARB.

**Prior Research Division Funding to University of California, Riverside:**

Year	2000	1999	1998
Funding	\$0	\$479,943	\$278,579

# BUDGET SUMMARY

University of California, Riverside

"Characterizing the Range of Children's Pollutant Exposure During School Bus Commutes"

## DIRECT COSTS AND BENEFITS

1.	Labor and Employee Fringe Benefits	\$ 99,079	
2.	Subcontractors	\$178,515 <sup>1</sup>	
3.	Equipment	\$ 0	
4.	Travel and Subsistence	\$ 2,849	
5.	Electronic Data Processing	\$ 0	
6.	Reproduction/Publication	\$ 1,100	
7.	Mail and Phone	\$ 1,200	
8.	Supplies	\$ 97,998 <sup>2</sup>	
9.	Analyses	\$ 25,500 <sup>3</sup>	
10.	Miscellaneous	\$ 17,990	
	Total Direct Costs		\$424,231

## INDIRECT COSTS

1.	Overhead	\$ 25,272	
2.	General and Administrative Expenses	\$ 0	
3.	Other Indirect Costs	\$ 0	
4.	Fee or Profit	\$ 0	
	Total Indirect Costs		\$ 25,272

\$449,503

## TOTAL PROJECT COSTS

<sup>1</sup>University of California, Los Angeles (\$178,515)

<sup>2</sup>Supply Details:

Equipment Rentals:	
Aethalometer	\$ 26,000
EcoChem PAH Monitor	\$ 20,000
Portable Gas Chromatograph	\$ 15,000
Bus Rental	\$ 16,680
Plumbing	\$ 6,000
Electrical	\$ 6,000
Hardware	\$ 6,000
Fuel	\$ 1,450
Calibration Gases	\$ 1,000
Total Supplies	\$ 97,998

<sup>3</sup>Analysis Details:

Aldehydes and ketones	\$ 18,000
Elemental analysis	\$ 7,500
Total Analysis	\$ 25,500

Attachment 1

**SUBCONTRACTORS' BUDGET SUMMARY**

University of California, Los Angeles (UCLA)

Description of subcontractor's responsibility: UCLA will be responsible for design of the sampling protocol and scenario construction, design of questionnaires, design of data analysis and presentation, and will help with conducting the field study measurements.

**DIRECT COSTS AND BENEFITS**

1.	Labor and Employee Fringe Benefits	\$ 136,062	
2.	Subcontractors	\$ 0	
3.	Equipment	\$ 2,291 <sup>1</sup>	
4.	Travel and Subsistence	\$ 7,000	
5.	Electronic Data Processing	\$ 0	
6.	Reproduction/Publication	\$ 1,200	
7.	Mail and Phone	\$ 1,600	
8.	Supplies	\$ 14,200 <sup>2</sup>	
9.	Analyses	\$ 0	
10.	Miscellaneous	\$ 1,000	
	Total Direct Costs		\$ 163,353

**INDIRECT COSTS**

1.	Overhead	\$ 15,162	
2.	General and Administrative Expenses	\$ 0	
3.	Other Indirect Costs	\$ 0	
4.	Fee or Profit	\$ 0	
	Total Indirect Costs		\$ 15,162

**TOTAL PROJECT COSTS**

**\$ 178,515**

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(1) Equipment Details:		
Pentium III computer	\$ 2,291	
(2) Supply Details:		
Software	\$ 3,000	
Electrical and Mechanical		
Shops	\$ 4,500	
Shop Supplies	\$ 2,000	
Reconditioned CO		
Monitors (4)	\$ 2,000	
Misc. Supplies for Field	\$ 2,700	
Total Supplies:	\$ 14,200	