PROPOSED

State of California
AIR RESOURCES BOARD

RESEARCH PROPOSAL

Resolution 12-2

January 26, 2012

Agenda Item No.: 12-1-1

WHEREAS, the Air Resources Board (ARB) 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 2730-272, entitled "Reducing Air Pollution Exposure in Passenger Vehicles and School Buses," 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 2730-272 entitled "Reducing Air Pollution Exposure in Passenger Vehicles and School Buses," submitted by the University of California, Los Angeles, for a total amount not to exceed $150,000.

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 2730-272 entitled "Reducing Air Pollution Exposure in Passenger Vehicles and School Buses," submitted by the University of California, Los Angeles, for a total amount not to exceed $150,000.

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 $150,000.

ATTACHMENT A

"Reducing Air Pollution Exposure in Passenger Vehicles and School Buses"

Background

Exposure to roadway-related particulate matter (PM) has been linked to respiratory and cardiovascular diseases. Commuters are at greater risk of exposure due to their proximity to the source of this pollution while traveling in their vehicles. Few studies, however, have investigated methods to reduce PM exposure inside the passenger cabin. High efficiency (HEPA) filters have been shown to filter more than 99 percent of fine particles, and, if used in cabin filters, may dramatically reduce occupants' exposures to fine and ultrafine particles. Previous studies using HEPA filters in automobiles have demonstrated reductions in in-cabin concentrations when windows and vents were closed and the cabin air was re-circulated. These studies, however, did not test filtration of outside air entering the cabin. Since recent studies have measured a potentially harmful build-up of carbon dioxide (CO_2) when vents and windows are kept closed, investigations into ventilation with filtered outside air are needed. Preliminary studies have also indicated that HEPA filtration may be useful in reducing on-road PM exposures of children in school buses.

Objective

The objective of this study is to test the ability of HEPA filters to reduce in-cabin fine and ultrafine particles in cars and buses when ventilation with outside air is allowed. Additionally, the proposed study will identify the important factors affecting the performance of HEPA filters in passenger vehicles and school buses.

Methods

The investigators will replace low efficiency, factory-installed passenger cabin filters with HEPA filters in 12 different models of automobiles. To assess the effect of the HEPA filter, real-time cabin particle numbers and size distributions will be monitored using two water-based condensation particle counters and a photometer with a PM2.5 inlet impactor. Other measurements taken while driving will include CO and CO_2, meteorological parameters and traffic activity. In all experiments, particle levels in outside air will be measured to generate a ratio of inside to outside particles. Vehicles will be tested with no filter, with the factory-installed filter, and with a HEPA filter to determine the benefit of high efficiency filtration. Automobile ventilation settings in these experiments will be set to direct outside air through the cabin ventilation systems where it can be filtered (typically a "vents open" setting). The cars will be driven on freeways and city streets to test filter performance under different road conditions, and at two different speeds since air exchange rates in vehicles are dependent on vehicle speed. Additionally, the investigators will examine the potential for HEPA filtration to reduce exposure of children to fine particulate matter in school buses. The investigators will install HEPA filters in the air conditioning systems of six school buses, and particle numbers and sizes will be measured as described above with the addition of two Scanning Mobility Particle Sizers to further measure fine and ultrafine particle size distribution. Additionally, the investigators will test two buses with a portable

HEPA-based air purifier in the cabin and measure the ability of the air purifier to reduce passenger cabin PM levels.

Expected Results
This study is expected to demonstrate that fine and ultrafine particle exposure of commuters can be reduced by the use of HEPA filters in cars and buses when vents are open.

Significance to the Board
While tremendous progress has been made in reducing vehicular emissions by tightening emission standards in cars and retrofitting trucks and buses, evidence of the dangers of roadway pollutant exposure to commuters in California is growing. This study will test an additional, complementary means to further reduce in-cabin exposures. It may provide information ARB can use in guidance for commuters and vehicle manufacturers to further protect public health.

Contractor:
University of California, Los Angeles

Contract Period:
30 months

Principal Investigator (PI):
Yifang Zhu, Ph.D.

Contract Amount:
$150,000

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. Zhu has considerable experience studying vehicle filtration and measuring particles and other pollutants inside vehicles and along roadways. She has published a number of articles on these topics. This is the first project in which ARB will work with this investigator, but staff is confident in Dr. Zhu's ability to meet or exceed the expectations of this study in a timely manner.

Prior Research Division Funding to University of California, Los Angeles

Year	2011	2010	2009
Funding	$630,264	$290,000	$539,284

BUDGET SUMMARY

Contractor: University of California, Los Angeles

"Reducing Air Pollution Exposure in Passenger Vehicles and School Buses"

DIRECT COSTS AND BENEFITS				
1.	Labor and Employee Fringe Benefits	$	124,587	
2.	Subcontractors	$	0	
3.	Equipment	$	0	
4.	Travel and Subsistence	$	5,000	
5.	Electronic Data Processing	$	0	
6.	Reproduction/Publication	$	0	
7.	Mail and Phone	$	1,081	
8.	Supplies	$	5,696	
9.	Analyses	$	0	
10.	Miscellaneous	$	0	
	Total Direct Costs			$136,364
INDIRECT COSTS				
1.	Overhead	$	13,636	
2.	General and Administrative Expenses	$	0	
3.	Other Indirect Costs	$	0	
4.	Fee or Profit	$	0	
	Total Indirect Costs			$ 13,636
TOTAL PROJECT COSTS				**$150,000**