State of California
AIR RESOURCES BOARD

RESEARCH PROPOSAL

Resolution 08-16

February 28, 2008

Agenda Item No.: 08-2-2

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 2653-259, entitled "Characterization of Toxicity as a Function of Volatility of Ultrafine PM Emissions from Compressed Natural Gas Vehicles," has been submitted by West Virginia University.

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

WHEREAS, the California Energy Commission has agreed to cosponsor this proposal for the total amount of $349,996; and

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

> Proposal Number 2653-259 entitled "Characterization of Toxicity as a Function of Volatility of Ultrafine PM Emissions from Compressed Natural Gas Vehicles," submitted by West Virginia University, for a total amount not to exceed $349,996.

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 2653-259 entitled "Characterization of Toxicity as a Function of Volatility of Ultrafine PM Emissions from Compressed Natural Gas Vehicles," submitted by West Virginia University, for a total amount not to exceed $349,996.

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 $349,996.

I hereby certify that the above is a true and correct copy of Resolution 08-16, as adopted by the Air Resources Board.

Lori Andreoni

Lori Andreoni, Clerk of the Board

ATTACHMENT A

Characterization of Toxicity as a Function of Volatility of Ultrafine PM Emissions from Compressed Natural Gas Vehicles

Background

Exhaust emissions from vehicles include both semi-volatile and non-volatile particles. Some emission control technologies effectively remove the non-volatile fraction of particles, but can increase the number of semi-volatile particles. Semi-volatile particles dominate a commuter's exposure to particle number while commuting. The Air Resources Board (ARB) is currently sponsoring a study to investigate the characteristics of particulate matter (PM) fractions, and their implications for exposure and health impacts: "*Physicochemical and toxicological assessment of the semi-volatile and non-volatile fractions of PM from heavy and light-duty vehicles operating with and without emissions control technologies.*"

Objective

The objective of this project is to determine the physicochemical and toxicological properties of the semi-volatile and non-volatile fractions of PM from heavy-duty compressed natural gas (CNG) engines operating with state-of-the-art after treatment technology. The CNG vehicles augment the vehicle test matrix of the ongoing heavy duty diesel (HDD) and light duty gasoline vehicle study.

Methods

The contract will acquire and test two CNG buses: one, a recent model with oxidation catalyst; and one, a vehicle fully compliant with the 2007 PM standard and the 2010 NO_X standard.

They will conduct chassis dynamometer experiments to collect samples from heavy-duty (HD) CNG vehicles with emission control technologies under different driving cycles: Urban Driving dynamometer Schedule, steady state 60 percent of rated power at 50 miles per hour, and idle. Conduct multiple replicate cycles to allow accumulation of sufficient sample onto sampling media for subsequent PM and toxicity analyses.

They will also obtain real-time data on particle size and concentration using Scanning Mobility Particle Sizer, Engine Exhaust Particle Sizer, and Differential Mobility Spectrometer instruments. And analyze total particle and non-volatile particle samples for toxicity using assays for reactive organic species, electrophillic chemistry, diothiothreitol assay for oxidative potential, and analysis for vanadium pentoxide.

Expected Results

A report will be developed that describes test methods, results of bulk sample analyses, results of particle sizing samples, toxicity of bulk samples, conclusions and recommendations, references, and appendices including tables of test results and results of equipment calibration and quality control.

Significance to the Board
HD CNG vehicles have been advanced as a means to meet stringent PM mass standards, but reductions in health impacts may not be commensurate with reductions in PM mass. This project will provide data to characterize the physical and toxicological properties of emissions from HD CNG vehicles fitted with advanced after-treatment controls. These data will contribute to the assessment of the health impacts of technologies used to meet the latest HD emission standards and will contribute to the evaluation of potential new emission regulations based on characteristics other than PM mass.

Contractor:
West Virginia University (WVU)

Contract Period:
18 months

Principal Investigator (PI):
Mridul Gautam (PI), Mohan Krishnamurthy (Joint-PI)

Contract Amount:
$349,996

Cofunding:
The California Energy Commission funding is the total amount of this study.

Basis for Indirect Cost Rate:
The indirect costs do not include any overhead charges. The indirect costs include 26 percent General and Administrative (G&A) costs. These G&A costs are listed as Facilities and Administrative (F&A) costs by WVU and are calculated at the federally audited rate for WVU F&A.

Past Experience with this Principal Investigator:
WVU and Dr. Mridul Gautam are well respected in the field of HDD emission studies. Dr. Gautam has been PI on projects that were co-sponsored by ARB, and his performance on those projects has been excellent. Staff have collaborated with Dr. Gautam on conference presentations.

Prior Research Division Funding to West Virginia University:

Year	2007	2006	2005
Funding	$0	$0	$0

BUDGET SUMMARY

Contractor: West Virginia University

Characterization of Toxicity as a Function of Volatility of Ultrafine PM Emissions from Compressed Natural Gas Vehicles

DIRECT COSTS AND BENEFITS			
1.	Labor and Employee Fringe Benefits	$ 124,516	
2.	Subcontractors	$ 19,560	
3.	Equipment	$ 40,500[1]	
4.	Travel and Subsistence	$ 68,000[2]	
5.	Electronic Data Processing	$ 0	
6.	Reproduction/Publication	$ 0	
7.	Mail and Phone	$ 440	
8.	Supplies	$ 10,500	
9.	Analyses	$ 13,250	
10.	Miscellaneous	$ 9,366	
	Total Direct Costs		$286,132
INDIRECT COSTS			
1.	Overhead	$ 0	
2.	General and Administrative Expenses	$ 63,864	
3.	Other Indirect Costs	$ 0	
4.	Fee or Profit	$ 0	
	Total Indirect Costs		$63,864
TOTAL PROJECT COSTS			**$349,996**

[1] Includes purchase of three thermal denuders, which will be owned by ARB and delivered to ARB at the conclusion of the project

[2] Emission sample collection will be performed at CE-CERT, University of California, Riverside, CA

Attachment 1

SUBCONTRACTORS' BUDGET SUMMARY

Subcontractor: University of Southern California (USC)

Description of subcontractor's responsibility: USC will be responsible for the collection of non-volatile and volatile fraction of PM emissions from the test fleet. USC will also be responsible for the analysis of chemical and toxicological properties of those PM components.

DIRECT COSTS AND BENEFITS				
11.	Labor and Employee Fringe Benefits	$	9,924	
12.	Subcontractors	$	0	
13.	Equipment	$	0	
14.	Travel and Subsistence	$	1,122	
15.	Electronic Data Processing	$	0	
16.	Reproduction/Publication	$	0	
17.	Mail and Phone	$	0	
18.	Supplies	$	0	
19.	Analyses	$	4,000	
20.	Miscellaneous	$	0	
	Total Direct Costs			$15,046
INDIRECT COSTS				
5.	Overhead	$	4,514	
6.	General and Administrative Expenses	$	0	
7.	Other Indirect Costs	$	0	
8.	Fee or Profit	$	0	
	Total Indirect Costs			$4,514
TOTAL PROJECT COSTS				**$19,560**