PROPOSED

State of California
AIR RESOURCES BOARD

Measurement of In-Use Emissions and Fuel Consumption from Vocational Heavy-Duty Vehicles with Conventional and Alternative Engine and Fuel Technologies in Southern California

RESEARCH PROPOSAL

Resolution 16-16

October 20, 2016

Agenda Item No.: 16-9-1

WHEREAS, the Air Resources Board (ARB or 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 2800-285, titled, "Measurement of In-Use Emissions and Fuel Consumption from Vocational Heavy-Duty Vehicles with Conventional and Alternative Engine and Fuel Technologies in Southern California," has been submitted by the South Coast Air Quality Management District;

WHEREAS, ARB will fund this proposal for a total amount of $150,000; the South Coast Air Quality Management District for $600,000; the California Energy Commission for $2,000,000; and the Southern California Gas Company for $500,000; for total funding of $3,250,000;

WHEREAS, the Research Division staff has reviewed Proposal Number 2800-285 and finds that in accordance with Health and Safety Code section 39701, the results of this study will provide critical information to help ARB expand its understanding of vocational use of heavy-duty vehicles and develop effective strategies for achieving federal ambient air quality standards and state greenhouse gas reduction goals; and

WHEREAS, in accordance with Health and Safety Code section 39705, the Research Screening Committee has reviewed and recommends funding the Research Proposal.

NOW, THEREFORE BE IT RESOLVED, that ARB, pursuant to the authority granted by Health and Safety Code section 39700 through 39705, hereby accepts the recommendations of the Research Screening Committee and staff and approves the Research Proposal.

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 Proposal as further described in Attachment A, in an amount not to exceed $150,000.

Resolution 16-16

October 20, 2016

Identification of Attachments to Board Resolution 16-16

Attachment A: "Measurement of In-Use Emissions and Fuel Consumption from Vocational Heavy-Duty Vehicles with Conventional and Alternative Engine and Fuel Technologies in Southern California" Summary and Budget Summary.

ATTACHMENT A

"Measurement of In-Use Emissions and Fuel Consumption from Vocational Heavy-Duty Vehicles with Conventional and Alternative Engine and Fuel Technologies in Southern California"

Background

Current heavy-duty engine emission standards have reduced both oxides of nitrogen (NO_X) and particulate matter (PM) emissions significantly in the South Coast Air Basin (SoCAB). However, it is projected that heavy-duty vehicles (HDV) will continue to be a dominant source of those emissions in the SoCAB and there is a need for additional reductions in NO_X emissions to meet National Ambient Air Quality Standards (NAAQS) for PM2.5 and ozone. Understanding the impact of conventional and alternative engine and fuel technologies on in-use emissions and fuel use is critical for developing State Implementation Plans (SIP) as well as for understanding the effectiveness of potential rules to further lower emission standards for HDVs.

Objective

The objectives of this research are to characterize the impact of conventional and alternative heavy-duty engine and fuel technologies on in-use emissions and fuel use from HDVs in various vocation types and to explore optimum HDV engine and fuel technologies to match with each vocation type for maximizing the reduction of NO_X, PM, and greenhouse gas (GHG) emissions in the region.

Methods

The investigator will recruit up to 200 HDVs with gross vehicle weight rating (GVWR) greater than 14,000 pounds in transit, school bus, refuse, delivery, and goods movement applications powered by diesel, bio-diesel, natural gas (NG), renewable NG, NG-electric hybrid, and electric engines. The investigators will instrument those vehicles with portable emissions measurement systems (PEMS), portable vehicle activity measurement systems (PAMS), and other instruments to monitor daily vehicle activity, fuel usage, and instantaneous emissions. They will then use the measurements to characterize the impact of heavy-duty engine and fuel technologies on in-use engine emissions and fuel use, and to explore the comparative benefits of reducing NO_X and PM using conventional versus alternative engines and fuel technologies in various vocational uses.

Expected Results

This project will provide detailed emission, activity, and fuel use data from 200 on-road HDVs in various vocation types (transit bus, school bus, refuse, delivery, and goods movement) and with conventional and alternative fuel types (diesel, bio-diesel, NG, renewable NG, NG-electric hybrid, and electric). The data will be used to:

- Characterize vehicle activity, emission, and fuel use profiles in various vocation types;
- Develop new emission test cycles or improve existing cycles for each vocation;
- Estimate emission deterioration rates associated with engine, fuel, and aftertreatment technologies;
- Identify the impact of current and near-future technology options on engine performance, emissions, and fuel usage, and to explore optimum engine and fuel

technologies to match with individual vocation types to maximize the benefits of reducing NO_X, PM, GHG emissions; and
- Develop in-use vehicle activity and emission profiles that could be used for emission inventory updates.

Significance to the Board
Our current research investigations characterizing HDV activity profiles by vocation and quantifying the potential GHG benefits of aerodynamic features on HDV use only onboard diagnostic data and do not include measurements of in-use emissions and fuel use due in part to limited resources. This project will provide critical information to help ARB expand our understanding of vocational use of HDVs and develop effective strategies for achieving the federal ambient air quality standards and the state greenhouse gas reduction goals.

Contractor:
South Coast Air Quality Management District

Contract Period:
24 months

Principal Investigator (PI):
Adewale Oshinuga

Contract Amount:
$150,000

This project will be highly leveraged with $3,100,000 in co-funding from the South Coast Air Quality Management District ($600,000), the California Energy Commission ($2,000,000), and the Southern California Gas Company ($500,000), for a total funding amount of $3,250,000.

Basis for Indirect Cost Rate:
ARB's contribution to this project does not include overhead charges.

Past Experience with this Principal Investigator:
Adewale Oshinuga has had very positive previous research collaborations with all organizations involved in this project.

Prior Research Division Funding to South Coast Air Quality Management District:

Year	2015	2014	2013
Funding	$ 0	$ 0	$ 0

B U D G E T S U M M A R Y

Contractor: South Coast Air Quality Management District

"Measurement of In-Use Emissions and Fuel Consumption from Vocational Heavy-Duty Vehicles with Conventional and Alternative Engine and Fuel Technologies in Southern California"

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

NOTE:

[1] The project investigators from University of California, Riverside and West Virginia University will conduct all tasks proposed for this project. ARB funds will contribute to their work in part, but not in full. Funds from co-funding organizations will contribute to their remaining work. The project investigators will collect the data, conduct data quality assurance, and prepare interim and final project reports.

SUBCONTRACTORS' BUDGET SUMMARY

Subcontractor: University of California, Riverside

Description of subcontractor's responsibility: The project investigators from University of California, Riverside will conduct all tasks to deliver the outcomes described in the **Expected Results** section.

DIRECT COSTS AND BENEFITS			
1.	Labor and Employee Fringe Benefits	$ 74,152	
2.	Subcontractors	$ 0	
3.	Equipment	$ 0	
4.	Travel and Subsistence	$ 0	
5.	Electronic Data Processing	$ 0	
6.	Reproduction/Publication	$ 0	
7.	Mail and Phone	$ 0	
8.	Supplies	$ 0	
9.	Analyses	$ 0	
10.	Miscellaneous	$ 0	
	Total Direct Costs		$ 74,152
INDIRECT COSTS			
1.	Overhead	$ 0	
2.	General and Administrative Expenses	$ 0	
3.	Other Indirect Costs	$ 0	
4.	Fee or Profit	$ 0	
	Total Indirect Costs		$ 0
TOTAL PROJECT COSTS			**$ 74,152**

SUBCONTRACTORS' BUDGET SUMMARY

Subcontractor: West Virginia University

Description of subcontractor's responsibility: The project investigators from West Virginia University will conduct all tasks to deliver the outcomes described in the **Expected Results** section.

DIRECT COSTS AND BENEFITS			
11.	Labor and Employee Fringe Benefits	$ 75,848	
12.	Subcontractors	$ 0	
13.	Equipment	$ 0	
14.	Travel and Subsistence	$ 0	
15.	Electronic Data Processing	$ 0	
16.	Reproduction/Publication	$ 0	
17.	Mail and Phone	$ 0	
18.	Supplies	$ 0	
19.	Analyses	$ 0	
20.	Miscellaneous	$ 0	
	Total Direct Costs		$ 75,848
INDIRECT COSTS			
1.	Overhead	$ 0	
2.	General and Administrative Expenses	$ 0	
3.	Other Indirect Costs	$ 0	
4.	Fee or Profit	$ 0	
	Total Indirect Costs		$ 0
TOTAL PROJECT COSTS			**$ 75,848**