State of California
AIR RESOURCES BOARD

RESEARCH PROPOSAL

Resolution 06-5

January 26, 2006

Agenda Item No.: 06-1-1

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 2595-250 entitled "Evaluation of the Proposed New European Methodology for Determination of Particle Number Emissions and its Potential in California for In-use Screening", has been submitted by the 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 2595-250 entitled "Evaluation of the Proposed New European Methodology for Determination of Particle Number Emissions and its Potential in California for In-use Screening", submitted by the University of California, Riverside, for a total amount not to exceed $250,000.

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 2595-250 entitled "Evaluation of the Proposed New European Methodology for Determination of Particle Number Emissions and its Potential in California for In-use Screening", submitted by the University of California, Riverside, for a total amount not to exceed $250,000.

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 $250,000.

I hereby certify that the above is a true and correct copy of Resolution 06-5, as adopted by the Air Resources Board.

Lori Andreoni, Clerk of the Board

ATTACHMENT A

"Evaluation of the Proposed New European Methodology for Determination of Particle Number Emissions and its Potential in California for In-use Screening"

Background

Diesel particulate matter (PM) has been determined to be harmful to human health and was designated as a Toxic Air Contaminant (TAC) by the State of California in 1998. Currently, PM emission standards for heavy-duty diesel engines (HDDEs) are based on limiting the mass of PM emitted. The current standard is 0.1 grams of PM per brake horsepower-hour (g/bhp-hr). New regulations will take effect in 2007 and will require new heavy-duty diesel engines to be certified to a PM emission standard of 0.01 g/bhp-hr. These very low masses of PM have proven very difficult to measure using the current gravimetric methodology. ARB and U.S. EPA are now working closely with industry to modify the measurement protocol and improve the resolution of the gravimetric method for certification of 2007-compliant engines. However, in spite of improvements, it is apparent that the future utility of the filter-based method is limited. Preliminary measurements of emissions of 2007 compliant HDDEs suggest that PM emissions can be as low as 0.005 g/bhp-hr, or less than half of the standard. Accurate measurements at such low emission rates have proven elusive using the current gravimetric method and are still very challenging with the improvements under the new U.S. EPA Code of Federal Regulations Part 1065 method.

A promising complement to the gravimetric method is a solid particle number measurement as proposed in Europe. Not only is the detection limit for solid particle number significantly lower than for mass, but recent studies also suggest that particle number measurements can be done with higher accuracy and precision. In addition, particle number may be a better metric for adverse health effects than particle mass. The Particle Measurement Program (PMP) has worked for several years under the auspices of the United Nations Economic Commission for Europe (UNECE) to determine if such a standard is viable and what new instrumentation and protocols are needed. The work of the PMP has been successful. Their findings are the basis of a proposed new regulation by the Swiss Agency for the Environment, Forests, and Landscape to limit the number of particles emitted by diesel-powered vehicles. Similar regulations are proposed to be part of the new EURO 5 standards.

Objective

The goal of this project is to enable ARB staff to conduct a critical evaluation of the proposed PMP method for determining particle emissions from heavy-duty diesels and its potential in California for PM emission measurement and in-use screening. The primary objective is to determine the precision of the PMP measurement in comparison to the precision of the standard gravimetric method. Secondary objectives are to investigate the correlation of PMP results to gravimetric results and to investigate the importance of certain limitations of the PMP method as it is currently specified.

Methods
The contractor will assemble the instruments and follow the protocols of the proposed method in strict accordance with the PMP recommendations. Simultaneous samples will be collected from the Concurrent Versions System (CVS) tunnel by the currently used gravimetric method and by the PMP method. Sampling will be repeated multiple times and as needed to develop a sufficiently robust and statistically significant database of results to ascertain accuracy, precision, and repeatability of both methods and the inter-method correlation. The primary test platform will be a Diesel Particulate Filter-equipped engine, but samples from an engine without a trap will be collected for comparison. Both over-the-road (with CE-CERT's Mobile Emissions Laboratory) and laboratory (in ARB's emissions laboratory) samples will be collected.

Expected Results
The study will provide data on the robustness of results using the current PMP protocol. Also, the project will provide insights into the attributes of the method to on-road sampling. Finally, the project will provide data on some of the limitations of the protocol.

Significance to the Board
As the emission rates of newer diesel engines continue to decrease the utility of the gravimetric method to measure exhaust PM and as a marker for health effects are challenged. The current study will enable ARB to make an informed decision on the applicability of a number based particle standard.

Contractor:
University of California, Riverside

Contract Period:
15 months

Co-Principal Investigators (PIs):
Thomas Durbin, Ph.D. and David Cocker, Ph.D.

Contract Amount:
$250,000

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:
ARB staff have extensive prior experience with this investigator. This experience has been positive.

Prior Research Division Funding to UCR:

Year	2005	2004	2003
Funding	$249,827	$1,717,466	$1,036,130

BUDGET SUMMARY

University of California, Riverside

"Evaluation of the Proposed New European Methodology for Determination of Particle Number Emissions and its Potential in California for In-use Screening"

DIRECT COSTS AND BENEFITS			
1.	Labor and Employee Fringe Benefits	$ 73,514	
2.	Subcontractors	$ 49,999[1]	
3.	Equipment	$ 16,786	
4.	Travel and Subsistence	$ 2,110	
5.	Electronic Data Processing	$ 0	
6.	Reproduction/Publication	$ 0	
7.	Mail and Phone	$ 0	
8.	Supplies	$ 24,000[2]	
9.	Analyses	$ 34,440[3]	
10.	Miscellaneous	$ 33,244[4]	
	Total Direct Costs		$ 234,093
INDIRECT COSTS			
1.	Overhead	$ 15,907	
2.	General and Administrative Expenses	$ 0	
3.	Other Indirect Costs	$ 0	
4.	Fee or Profit	$ 0	
	Total Indirect Costs		$ 15,907
TOTAL PROJECT COSTS			**$ 250,000**

[1] Three researchers from Europe will be incorporated as consultants on this project as well as an expert from the University of Minnesota. The rates for these experts are $150/hour x $273.33 hours = $40,999. There will also be three trips from Europe at $3,000/trip for a total of $9,000.

[2] Not all sampling equipment required for the PMP is currently owned by CARB. This item covers the purchase of the remaining instruments to sample in accordance with the PMP.

[3] This item includes the cost of renting the Mobile Emissions Laboratory for 10 days and for statistical analysis of the data-set.

[4] Because CE-CERT is a permanent off-campus facility, federal regulations requires the accounting for facilities rental as a direct cost. Facilities rental is charged based on 20.9% of Modified Total Direct Costs (MTDC).