State of California
AIR RESOURCES BOARD

Resolution 01-37

September 20, 2001

Agenda Item No.: 01-7-3

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 2491-219, entitled “Determination of the Contributions of Light-Duty and Heavy-Duty Vehicle Emissions to Ambient Particles in California," was awarded to the University of California, Riverside under Resolution number 01-15 on April 26, 2001;

WHEREAS, Dr. Kimberely Prather, who is the principal investigator for research proposal number 2491-219, is changed employment within the University of California system;

WHEREAS, the same project will now be undertaken by Dr. Prather at the University of California, San Diego;

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 change in University campuses and approves the following:

> Proposal Number 2491-219 entitled “Determination of the Contributions of Light-Duty and Heavy-Duty Vehicle Emissions to Ambient Particles in California," awarded to the University of California, San Diego, for a total amount not to exceed $333,790.

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 $333,790.

I hereby certify that the above is a true and correct copy of Resolution 01-37, as adopted by the Air Resources Board.

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Marie Kavan, Clerk of the Board

Attachment A

"Determination of the Contributions of Light-Duty and Heavy-Duty Vehicle Emissions to Ambient Particles in California"

Background

Source apportionment experiments indicate that motor vehicle exhaust is a major component of PM10, especially in urban areas. To date, source apportionment within the motor vehicle fleet has relied on inferred fractionation based on "broad brush" approaches such as elemental carbon (EC) ratios or modeling from dynamometer test data. Since they are based on generalized and/or assumed fleet emission characteristics, these approaches are inappropriate for several types of analyses, especially examining "hot spots" and comparing in-use emissions with inventory estimates and modeled air quality ("top down" validation). Resolving these issues depends on developing methods to directly detect diesel and gasoline vehicles' emissions in ambient air, a capability that appears beyond the reach of conventional sampling and analytical techniques.

Although many particle sources produce distinct "diagnostic" particles, the bulk collection of particles on filters or impaction plates masks individual particles, and precludes their recognition in ambient samples. Bulk sampling methods generally cannot gather samples over the short time periods needed for direct observation of the formation and transformation of secondary aerosols. Finally, bulk methods cannot distinguish between aerosols composed of identical particles with complex composition and those composed of mixtures of different kinds of particles. Without these kinds of data, source apportionment for primary aerosols relies on statistical inferences that often lack sound observational and theoretical bases, and interpretation of secondary particles relies on assumed gas-aerosol interactions not verified by observations in ambient air. The aerosol time-of-flight mass spectrometry (ATOFMS) technology, combines single-particle analyses, real-time data stream, and continuous operation. Therefore, it can potentially answer many questions about aerosols that cannot be practically addressed by other means, and can provide detailed information necessary to refine and extend the interpretation of data gathered by conventional bulk sampling and analysis methods. Previous work with ATOFMS indicates that this technology can distinguish gasoline and diesel emissions as well as sample aerosols with temporal resolution down to a few seconds. These are the exact capabilities needed to resolve the diesel-gasoline emission problem.

Objective

The objective of this project is to demonstrate source-specific (diesel versus gasoline) detection of ambient particles emitted by motor vehicles. The approach involves limited new source sampling to better characterize "fresh" diesel exhaust particles, reanalysis of existing ambient monitoring data, and new field sampling along roadways, in a tunnel, and in a complex urban setting.

Expected Results
The expected results are techniques to perform time-resolved (possibly real-time) source apportionment for motor vehicle particulate emissions. This project consists of multiple components. It will develop an ATOFMS data management system and sample diesel exhaust to identify "marker" compounds and particles. It will also characterize aerosol signatures of unburned fuel and lubricants as well as compare diesel and gasoline vehicle exhaust in a traffic segregated tunnel by assessing particle transformation by upwind-downwind sampling of roadway emissions. Finally, it will demonstrate the detection schemes in a complex urban setting.

Significance to the Board
Motor vehicles are major contributors to ambient concentrations of particulate matter (PM10 & PM2.5). Diesel exhaust particles, a significant fraction of total motor vehicle PM emissions, are classified as a Toxic Air Contaminant. Developing plans to reduce human exposure to these air pollutants requires data on the origins of ambient aerosols, both to identify source-specific concentrations of primary particles and to understand the processes that form secondary particles in the air. Real-time single particle analysis using ATOFMS is capable of discriminating among sources based on characteristic particles and particle populations that are irretrievably mixed in conventional filter and impactor samples. This study builds on the ATOFMS instrumentation and expertise developed at UCR with ARB support, with the goal of detecting motor vehicle aerosols in ambient air and discriminating their diesel and gasoline vehicle components in quasi-real time.

Contractor:
University of California, San Diego

Contract Period:
36 months

Principal Investigator (PI):
Dr. Kimberly Prather

Contract Amount:
$333,790

Co-funding:
No co-funding is provided. However, project has cost savings through a cooperative effort with ongoing major diesel studies (ARB testing at MTA, ARCO EC-Diesel, CRC Project E55/59).

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:
Staff has extensive experience with Dr. Prather. Her program is in the forefront of particle analysis and her work is well-published.

Prior Research Division Funding to the University of California, San Diego:

Year	2000	1999	1998
Funding	$0	$0	$0

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

University of California, San Diego

"Determination of the Contributions of Light-Duty and Heavy-Duty Vehicle Emissions to Ambient Particles in California"

DIRECT COSTS AND BENEFITS				
1.	Labor and Employee Fringe Benefits	$	189,900	
2.	Subcontractors	$	0	
3.	Equipment	$	0	
4.	Travel and Subsistence	$	41,000	
5.	Electronic Data Processing	$	0	
6.	Reproduction/Publication	$	0	
7.	Mail and Phone	$	0	
8.	Supplies	$	50,000	
9.	Analyses	$	0	
10.	Miscellaneous	$	24,800[1]	
	Total Direct Costs			$305,700
INDIRECT COSTS				
1.	Overhead	$	28,090	
2.	General and Administrative Expenses	$	0	
3.	Other Indirect Costs	$	0	
4.	Fee or Profit	$	0	
	Total Indirect Costs			$28,090
TOTAL PROJECT COSTS				**$333,790**

[1] Components to maintain operation of 3 ATOFMSs