State of California
AIR RESOURCES BOARD

RESEARCH PROPOSAL

Resolution 11-5

February 24, 2011

Agenda Item No.: 11-1-1

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 2708-269, entitled "Understanding Primary Organic Aerosol Volatility at Atmospherically Realistic Concentrations for SIP Analysis," has been submitted by the University of California, Davis.

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 2708-269, entitled "Understanding Primary Organic Aerosol Volatility at Atmospherically Realistic Concentrations for SIP Analysis," has been submitted by the University of California, Davis, for a total amount not to exceed $309,769.

NOW, THEREFORE, BE IT RESOLVED that ARB, 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 2708-269, entitled "Understanding Primary Organic Aerosol Volatility at Atmospherically Realistic Concentrations for SIP Analysis," has been submitted by the University of California, Davis, for a total amount not to exceed $309,769.

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 $309,769.

I hereby certify that the above is a true and correct copy of Resolution 11-5, as adopted by the Air Resources Board.

Mary Alice Morency, Clerk of the Board

ATTACHMENT A

"Understanding Primary Organic Aerosol Volatility at Atmospherically Realistic Concentrations for SIP Analysis"

Background

Organic aerosols (OA) account for a significant fraction of fine particulate mass in the atmosphere. However, there are large uncertainties in evaluating the impacts of OA on atmospheric chemistry, climate, and human health, due to many unknowns regarding their sources, composition, properties, and transformation mechanisms. OA can be emitted directly from combustion sources (primary organic aerosol, POA) or it can be formed from gas species in the atmosphere (secondary organic aerosol, SOA). POA has been traditionally assumed to be non-volatile and non-reactive and thus distinctly separate from SOA although certain POA compounds have long been recognized as semi-volatile. Recently, the distinction between POA and SOA has become less clear because experiments have suggested that a significant fraction of POA can evaporate to the gas phase and then form SOA via atmospheric processing. Understanding of the gas-particle partitioning behavior of POA emissions from motor vehicles would be greatly improved by additional data describing concurrent gas- and particle-phase concentrations of individual POA species. In addition, the concurrent measurements of these POA species will also enable a direct evaluation of theoretical versus observed gas-particle partitioning for these species.

Objective

The objective of the proposed research is to identify the dominant partitioning mechanism for POA emitted from diesel- and gasoline-powered vehicles at atmospherically realistic concentrations in the range from 5 to 30 $\mu g/m^3$.

Methods

POA emissions from diesel- and gasoline-powered motor vehicles will be diluted to concentrations ranging from 5 to 50 $\mu g/m^3$. The influence of changing temperature on the aerosol will be investigated using a thermal denuder system. Simultaneous measurements of gas-phase compounds will be made and related directly to the aerosol composition measurements. The organic aerosol concentrations produced during a series of gasoline and diesel vehicle tests will be measured as a function of dilution amount and thermo denuder temperature using a high-resolution Aerosol Mass Spectrometer (AMS) capable of providing information about the size-resolved chemical composition of the particles and the elemental composition of the POA. In addition to measurements, absorption models will be applied to identify the dominant gas-particle partitioning mechanism at atmospherically realistic conditions.

Expected Results

A suite of state-of-science instruments will be used to study the composition and properties of POA emissions. Such data are sparse in the literature yet are critical for determining which mechanisms (e.g., absorption and adsorption) govern the gas-particle partitioning at low concentrations. The innovation of the proposed study lies in the development of an experimental and model protocol designed to check the validity of the hypotheses for POA concentrations at atmospherically relevant levels. At the conclusion

of the project, a draft final report and text files of all relevant data used in this study and suitable for data archiving will be submitted to ARB. All members of the project team will contribute to the publication of the results and the writing of reports.

Significance to the Board
This research project will have broad application within regional air quality models used to predict the efficiency of emissions control programs during State Implementation Plan (SIP) analysis. The results will strengthen the scientific basis for the emissions controls within the SIP.

Contractor:
University of California, Davis

Contract Period:
24 months

Principal Investigator (PI):
Michael Kleeman, Ph.D.

Contract Amount:
$309,769

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:
Professor Kleeman is a highly regarded scientist and has extensive experience in the characterization and modeling of emission sources. The PI has impressive experience in the evaluation of Eulerian air quality models for complex aerosol systems. Professor Kleeman has successfully completed several projects for ARB and consistently demonstrates exceptional effort to produce very valuable reports.

Prior Research Division Funding to the University of California, Davis

Year	2009	2008	2007
Funding	$1,588,387	$1,419,135	$ 773,346

BUDGET SUMMARY

Contractor: University of California, Davis

"Understanding Primary Organic Aerosol Volatility at Atmospherically Realistic Concentrations for SIP Analysis"

DIRECT COSTS AND BENEFITS				
1.	Labor and Employee Fringe Benefits	$	131,096	
2.	Subcontractors	$	53,948	
3.	Equipment	$	0	
4.	Travel and Subsistence	$	17,578	
5.	Electronic Data Processing	$	0	
6.	Reproduction/Publication	$	0	
7.	Mail and Phone	$	0	
8.	Supplies	$	30,458[1]	
9.	Analyses	$	0	
10.	Miscellaneous	$	58,776[2]	
	Total Direct Costs			$291,856
INDIRECT COSTS				
1.	Overhead	$	17,913	
2.	General and Administrative Expenses	$	0	
3.	Other Indirect Costs	$	0	
4.	Fee or Profit	$	0	
	Total Indirect Costs			$17,913
TOTAL PROJECT COSTS				**$309,769**

Notes:

1. Several supplies are included to support consumables in the instrument and the materials needed to connect the instruments the dilution sampling system. It is also estimated that two MCPs, and ionizer (ToF-CIMS) and a turbo-pump (AMS) will need to be replaced over the duration of the project. Dilution /RH supplies include humidity probes, pumps, and spray nozzles.
2. In-State Student Fees are included for 7 quarters and 3 GSRs. All fees are exempt from the indirect cost calculation.

Attachment 1

SUBCONTRACTOR'S BUDGET SUMMARY

Subcontractor: University of California, San Diego

Description of subcontractor's responsibility: The subcontractor will be responsible for proper operation of instrumentation during the emissions sampling experiments and for timely processing of collected real-time data; subcontractor will also contribute to the publication of the results and the writing of reports.

DIRECT COSTS AND BENEFITS				
1.	Labor and Employee Fringe Benefits	$	26,575	
2.	Subcontractors	$	0	
3.	Equipment	$	0	
4.	Travel and Subsistence	$	5,000[1]	
5.	Electronic Data Processing	$	0	
6.	Reproduction/Publication	$	0	
7.	Mail and Phone	$	0	
8.	Supplies	$	3,786[2]	
9.	Analyses	$	0	
10.	Miscellaneous	$	15,051[3]	
	Total Direct Costs			$50,412
INDIRECT COSTS				
1.	Overhead	$	3,536	
2.	General and Administrative Expenses	$	0	
3.	Other Indirect Costs	$	0	
4.	Fee or Profit	$	0	
	Total Indirect Costs			$3,536
TOTAL PROJECT COSTS				**$53,948**

Notes:

1. The requested travel funds are for truck rental and fuel costs to transport the UCSD instrument to the CARB facility for measurements. Lodging is requested for the duration of the experiment and estimated at $2,500 (double occupancy).

2. Consumable gases required to operate CI-ToFMS during the experiment phase (total $650). Funds are also requested to replace the multichannel plates on our detector and ionizer following the first years experiment.

3. Tuition remission is requested for the graduate student researcher for years 1 and 2 of the project at $7,167 and $7,884 for years one and two, respectively.