State of California
AIR RESOURCES BOARD

Air Quality Impacts of Low Vapor Pressure-Volatile Organic Compounds

RESEARCH PROPOSAL

Resolution 13-22

June 27, 2013

Agenda Item No.: 13-6-1

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 2757-276, entitled "Air Quality Impacts of Low Vapor Pressure-Volatile Organic Compounds," has been submitted by University of California, Riverside; and

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

> Proposal Number 2757-276 entitled "Air Quality Impacts of Low Vapor Pressure-Volatile Organic Compounds," submitted by the University of California, Riverside, for a total amount not to exceed $405,338.

WHEREAS, the Research division staff has reviewed Proposal Number 2757-276 and finds that in accordance with Health and Safety Code section 39701, the results will improve estimates of the emission rates of low vapor pressure volatile organic compounds (LVP-VOCs) and their impacts on air quality, which can be used to improve air quality models and will inform ARB's assessment of the air quality impacts of the exemption for LVP- VOCs in the Consumer Products regulations.

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 recommendations of the Research Screening Committee and Research Division staff and approves the following:

> Proposal Number 2757-276 entitled "Air Quality Impacts of Low Vapor Pressure-Volatile Organic Compounds," submitted by the University of California, Riverside not to exceed $405,338.

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 $405,338.

I hereby certify that the above is a true and correct copy of Resolution 13-22, as adopted by the Air Resources Board.

Tracy Jensen

Tracy Jensen, Clerk of the Board

ATTACHMENT A

"Air Quality Impacts of Low Vapor Pressure-Volatile Organic Compounds"

Background
Low vapor pressure volatile organic compounds (LVP-VOCs) are ingredients used in some consumer product formulations, and are exempt by ARB from compliance with VOC limits for consumer products based on their low vapor pressure/high boiling point. The LVP-VOC exemption was initially developed to exclude compounds that do not readily participate in ozone formation and typically represented a small fraction of the overall composition of a formulated product. Some recent laboratory testing indicates that certain LVP-VOCs may contribute to the formation of ozone, but the rates of volatilization of LVP-VOCs in different formulations of consumer products are not well characterized. Research efforts, including emission tests and chamber studies, are needed to further understand the role of LVP-VOCs on ozone and secondary organic aerosol (SOA) formation and to improve air quality modeling for State Implementation Plans (SIPs).

Objective
The objective of this project is to investigate the emissions of low vapor pressure-volatile organic compounds from consumer products and their impacts on air quality. It is designed to evaluate the evaporation flux, and therefore atmospheric availability, of specific LVP-VOCs both as pure compounds and in consumer products sold in California. The project will also evaluate the ozone and secondary particle formation of these compounds once they enter the atmosphere using a state-of-the-science environmental chamber.

Methods
The research team will conduct laboratory and environmental chamber experiments to develop key parameters for the evaluation of the ozone and SOA formation potential of consumer products containing LVP-VOCs. The ambient evaporation rates of LVP-VOCs both as pure compounds and in consumer products sold in California will be experimentally determined using three separate analytical approaches. A state-of-the-science environmental chamber will be used to investigate ozone and SOA formation from LVP-VOCs, including: (1) new method development for injection of LVP-VOCs and consumer products into the environmental chamber while minimizing thermal degradation of the compounds studied; (2) development of a chamber model to account for partitioning of LVP-VOCs to surfaces within the chamber (walls or particles); and (3) development of chemical mechanisms necessary to more accurately estimate ozone and particulate matter (PM) formation from the LVP-VOCs.

Expected Results
The volatility of the LVP-VOC species will be used to evaluate the availability of LVP-VOCs for ozone and PM formation. Environmental chamber studies of ozone and secondary organic aerosol impacts of LVP-VOCs will assess the atmospheric impacts

of LVP-VOCs and provide the baseline data necessary to improve ozone and PM2.5 modeling.

Significance to the Board
The results will improve estimates of the emission rates of LVP-VOCs and their impacts on air quality, which can be used to improve air quality models and will inform ARB's assessment of the air quality impacts of the exemption for LVP- VOCs in the Consumer Products regulations.

Contractor:
University of California, Riverside

Contract Period:
36 months

Principal Investigator:
David R. Cocker III, Ph.D.

Contract Amount:
$405,338

Basis for Indirect Cost Rate:
The State and the University of California, Riverside have agreed to a 10 percent indirect cost rate.

Past Experience with the Principal Investigator:
ARB staff has worked with Dr. David Cocker on several projects including measurement of the emissions of VOCs, environmental chamber studies, and development of chemical mechanism for ozone and particulate matter modeling.

Prior Research Division Funding to the University of California, Riverside

Year	2012	2011	2010
Funding	$ 0	$390,004	$ 0

BUDGET SUMMARY

University of California, Riverside

"Air Quality Impacts of Low Vapor Pressure-Volatile Organic Compounds"

DIRECT COSTS AND BENEFITS			
1.	Labor and Employee Fringe Benefits	$ 208,570	
2.	Subcontractors	$ 0	
3.	Equipment	$ 0	
4.	Travel and Subsistence	$ 750	
5.	Electronic Data Processing	$ 0	
6.	Reproduction/Publication	$ 0	
7.	Mail and Phone	$ 0	
8.	Supplies	$ 48,690[1]	
9.	Analyses	$ 0	
10.	Miscellaneous	$ 121,527[2]	
	Total Direct Costs		$ 379,537
INDIRECT COSTS			
1.	Overhead	$ 25,801	
2.	General and Administrative Expenses	$ 0	
3.	Other Indirect Costs	$ 0	
4.	Fee or Profit	$ 0	
	Total Indirect Costs		$ 25,801
TOTAL PROJECT COSTS			**$ 405,338**

[1] This project will utilize the environmental chamber facility and advanced gas-phase and particle-phase instrumentation for measurements of LVP-VOC evaporation rates and ozone/SOA forming potential. The "supplies" budget item includes supplies necessary for the operation of the chamber facility and the repair/maintenance of the instruments. Reporting costs and publication costs for peer-reviewed journal submissions are also included.

[2] The "miscellaneous" budget item includes a facility rental charge because the majority of the research will be performed at The Center for Environmental Research and Technology (CERT), which is an off-campus facility. The university policy also requires inclusion of partial fees and tuition remission and Graduate Student Health Insurance (GSHIP) for Graduate Student Researchers employed during each academic year with an appointment of 25 percent time or more.