PROPOSED

State of California
AIR RESOURCES BOARD

Investigative Modeling of PM2.5 Episodes in the San Joaquin Valley Air Basin During Recent Years

RESEARCH PROPOSAL

Resolution 15-17

May 21, 2015

Agenda Item No.: 15-4-1

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 2788-282, titled "Investigative Modeling of PM2.5 Episodes in the San Joaquin Valley Air Basin During Recent Years," has been submitted by the University of California, Davis, for a total amount not to exceed $199,234;

WHEREAS, the Research Division staff has reviewed Proposal Number 2788-282 and finds that in accordance with Health and Safety Code section 39701, research is needed to provide sound scientific tools for improved modeling of extreme pollution events, which will translate into a much better ability to carry out SIP development in future years; 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 the Air Resources Board, 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 $199,234.

ATTACHMENT A

"Investigative Modeling of PM2.5 Episodes in the San Joaquin Valley Air Basin During Recent Years"

Background

California's regulatory program has resulted in a significant decrease in the severity of wintertime PM2.5 pollution events in the San Joaquin Valley (SJV) over the past decades. However, the recent and unexpected extreme wintertime PM2.5 pollution episodes in 2013 and 2014 in the SJV require a reevaluation of the conceptual model for PM2.5 during such episodes. An important component of the reevaluation of the conceptual model is an evaluation of the modeling system (emissions, meteorology, chemistry, aerosol processes) to ensure that the model is able to capture these extreme events as completely as possible.

Objective

The objective of the project is to evaluate and update the conceptual model for PM2.5 to reflect any changes needed based on recent extreme wintertime episodes in the SJV. The project will identify and correct any necessary changes to the modeling system, such as emissions inputs, meteorological fields, and basic chemistry/aerosol processes that are required for the model to more accurately reflect the updated conceptual model.

Methods

The Principal Investigator (PI) will identify and correct potential updates in emissions inputs, meteorological fields, and basic nitrate chemistry/aerosol processes that are needed. Two phases of the project are planned: an initial phase that will investigate if and how the conceptual model for PM2.5 events has changed based on recent exteme events, with a focus on precursor emissons of reactive nitrogen species and the formation mechanisms that convert these reactive nitrogen emissions to particulate nitrate; and a second phase, in which the specific tasks from a set of four hypotheses will be chosen by the PI and ARB staff based on evaluation of results from the first phase of the project. Based on this work, the investigators will refine the modeling of the historical and contemporary PM2.5 episodes in the SJV.

Expected Results

Results from this work will include verified model inputs for the California Regional Particulate Air Quality Study, CALNEX, and DISCOVER-AQ periods, a revised conceptual model for PM2.5 formation, and an updated modeling system (potential updates to emissions, meteorology, and/or the chemical/aerosol processes that lead to PM2.5 formation). Any updates will be easily transferable to regulatory models such as Community Multi-Scale Air Quality Model, which will improve ARB's modeling basis for State Implementation Plan development.

Significance to the Board
The PM2.5 modeling enhancements for the San Joaquin Valley will provide sound scientific tools for improved modeling of extreme pollution events across a wide range of years to the present, which will translate into a much better ability to carry out SIP development in future years.

Contractor:
The University of California, Davis

Contract Period:
30 months

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

Contract Amount:
$199,234

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 has worked with the ARB on many different source apportionment and modeling studies and has a very good record for both producing useful results and keeping projects on schedule and within budget. He has extensive experience in investigating and characterizing the physical and chemical properties of aerosols; his work ranges from laboratory and field observations to model studies of aerosol formation and transformation. As well as bringing extensive knowledge of air quality in California and a deep set of skills in air quality modeling to this project, he brings a powerful and flexible computing environment, consisting of a cluster of 400 nodes forming a distributed memory parallel computer (one of the largest in the UC system that is operated by a single research group). Commercial costs alone for the processing power needed for this work would run over $400,000.

Prior Research Division Funding to the University of California, Davis:

Year	2013	2012	2011
Funding	$ 2,249,136	$ 1,131,715	$ 4,949,363

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

The University of California, Davis

Investigative Modeling of PM2.5 Episodes in the San Joaquin Valley Air Basin During Recent Years

DIRECT COSTS AND BENEFITS				
1.	Labor and Employee Fringe Benefits	$	155,572	
2.	Subcontractors	$	0	
3.	Equipment	$	0	
4.	Travel and Subsistence	$	0	
5.	Electronic Data Processing	$	20,000[1]	
6.	Reproduction/Publication	$	0	
7.	Mail and Phone	$	0	
8.	Supplies	$	5,550	
9.	Analyses	$	0	
10.	Miscellaneous	$	0	
	Total Direct Costs			$ 181,122
INDIRECT COSTS				
1.	Overhead	$	18,112	
2.	General and Administrative Expenses	$	0	
3.	Other Indirect Costs	$	0	
4.	Fee or Profit	$	0	
	Total Indirect Costs			$ 18,112
TOTAL PROJECT COSTS				**$ 199,234**

[1] Funding in the amount of $20,000 is requested for electronic data processing (EDP) fees for simulations that test the capabilities of the models over multiple air pollution episodes. Individual simulations will be conducted for each of the three month-long episodes using an appropriate spin-up time of ~5 days. It is anticipated that the model development process will require that these episodes each be simulated ~50 times during the debugging process. Each of these jobs will consume 840 hrs (2-3 weeks) using 100 cores of power in the UCD cluster maintained by PI Kleeman. (The commercial cost of purchasing this processing power from the Amazon cloud would be $0.1/core/hr * 840hrs * 100 cores * 50 repetitions = $420,000.)