State of California
AIR RESOURCES BOARD

RESEARCH PROPOSAL

Resolution 12-13

March 22, 2012

Agenda Item No.: 12-2-1

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 2735-273, entitled "Benefits of High Efficiency Filtration to Children with Asthma," 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 2735-273 entitled "Benefits of High Efficiency Filtration to Children with Asthma," submitted by the University of California, Davis, for a total amount not to exceed $3,350,000.

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 2735-273 entitled "Benefits of High Efficiency Filtration to Children with Asthma," submitted by the University of California, Davis, for a total amount not to exceed $3,350,000.

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 $3,350,000.

I hereby certify that the above is a true and correct copy of Resolution 12-13, as adopted by the Air Resources Board.

Mary Alice Morency, Clerk of the Board

ATTACHMENT A

"Benefits of High Efficiency Filtration to Children with Asthma"

Background

Numerous studies have found particulate matter (PM) and ozone levels to be elevated in California's urban areas, and fine and ultrafine PM (UFP) to be elevated near busy roadways. This is a significant health issue, because elevated ambient PM and ozone have been associated with numerous adverse effects, including exacerbation of asthma symptoms in children. Recent State policies for sustainable communities encourage urban infill development and will place future residential communities and transportation hubs into closer proximity with one another, thus increasing the potential for greater indoor exposures to outdoor PM and UFP.

Approximately 8.5 percent of children in the United States suffer from asthma. Some counties in California have considerably higher levels. For example, in Fresno County 20.2 percent of 5-17 year olds have been diagnosed with asthma at some time in their lives, and 12.6 percent currently have asthma. Asthma puts a considerable burden on the California health care system. In fact, in 2007 total charges for asthma hospitalizations alone in California were $770 million.

The overall objective of the proposed study is to quantify the exposure and asthma reduction benefits of high efficiency filtration. Some recent small-scale studies have shown that high efficiency filtration can be effective in reducing indoor pollutant levels and asthma symptoms, but others did not show a reduction. The proposed study will address the weaknesses of previous studies by having a larger sample size and testing the filtration in real world conditions – in the homes of 200 children with asthma. Additionally, the intervention (filtration) period will run for a full 12 months, as recommended by the American Academy of Allergy, Asthma & Immunology Indoor Allergen Committee to obtain meaningful results.

Objective

The specific objectives of the study are to:

1. Determine the extent to which the use of high efficiency in-duct filtration and high efficiency portable air cleaners in homes of children with moderate to severe asthma reduce their indoor exposures to ambient and indoor PM, UFP, and ozone.
2. Determine the extent to which the use of high efficiency in-duct filtration and high efficiency portable air cleaners in their homes reduces the children's asthma symptoms, emergency room visits, hospitalizations, use of rescue inhalers, missed school days due to asthma, and other measures of asthma reduction.
3. In the course of obtaining data to meet the above objectives, measure the current indoor, outdoor and personal exposures of children with asthma to PM, UFP and ozone.

Methods
Two hundred moderate to severely asthmatic children 6-12 years of age will be enrolled to study the effectiveness of high efficiency filtration of indoor air to reduce indoor exposures in Fresno and Riverside, both regions with high outdoor air pollution. One intervention group will have high efficiency filters or filtration systems installed in their central heating and air conditioning systems. The second intervention group will have high efficiency portable air cleaners placed in the child's bedroom and in the main living area. Filters with a Minimum Efficiency Rating Value (MERV) of 15 or higher will be used. Improvements in asthma symptoms will be evaluated in a randomized cross-over design, with each participant receiving high efficiency air filtration for a year and no filtration for a year, allowing the investigators to isolate the improvements related to the air filtration. During the control periods, "sham" filters with little or no particle removal capability will be used. As a sub-study, half of the homes with portable air cleaners will also have filters that remove ozone and volatile organic chemicals.

The investigators will use low-flow samplers to collect two-week integrated samples of PM10, PM2.5 and PM0.2 (as a near-UFP measure) inside and outside the homes prior to the study and twice during each of the intervention and sham periods. Indoor and outdoor measurements of ozone will be made using passive samplers during the six high ozone months of the year. Nitrogen dioxide will be collected indoors using passive badges during the six colder months of the year. Reflectance measurements of some of the PM samples will be used to provide an estimate of black carbon as an indicator of traffic emissions. In addition, personal exposure samples for PM2.5 will also be obtained with 25-30 of the older children carrying personal monitors in small backpacks.

Key asthma health endpoints will also be examined, including unplanned utilization of the healthcare system for asthma-related illness, short-term medication use, symptom diaries, peak exhaled flow, spirometry, and exhaled nitric oxide (eNO). These measures will be made at the beginning of the study and, for most, quarterly during both the true filtration and sham periods.

Expected Results
It is anticipated that this study will show that utilization of high efficiency filtration in both central and portable air filtration systems will result in significant reductions to indoor particle levels and ozone. It is also anticipated that asthma symptoms will be reduced, enabling ARB to determine if these interventions would be cost effective at reducing health costs associated with asthma care.

Significance to the Board
The proposed research should enable ARB to provide guidance regarding the reduction of indoor pollutant levels and exposures, particularly for those individuals living in areas most impacted by exposure to high outdoor pollutant levels such as near major roadways, transportation hubs, or areas of high ambient pollution. This information will be particularly beneficial for those who suffer from respiratory conditions, such as asthma.

Contractor:
University of California, Davis

Contract Period:
48 Months

Principal Investigator (PI):
Deborah H. Bennett, Ph.D.

Co-funding:
Dr. Bennett has received $136,605 from UC Davis in co-funding for this project. Also, her co-investigator, Dr. Nicholas Kenyon, plans to apply for NIH funding that would be used in part to include asthmatic parents of the children enrolled in the study, to add a small cohort of participants from the Sacramento region, and to add other measures to the study.

Contract Amount:
$ 3,350,000

Basis for Indirect Cost Rate:
The State and the UC system have agreed to a ten percent indirect cost rate.

Past Experience with the Principal Investigators:
In 2011, Dr. Deborah Bennett completed a large, successful field study of ventilation, indoor air quality and energy use in small and medium commercial buildings for ARB. She has already published one paper from that study, and has another in press and a third submitted for publication. The team of investigators assembled for the proposed study cover all areas of expertise needed to conduct a high quality, successful study, including knowledge of asthma management and assessment, exposure monitoring and modeling, filtration, indoor air quality, epidemiology and statistics. Dr. Bennett has expertise in indoor-outdoor pollutant relationships, monitoring, exposure measurement and modeling, and environmental epidemiology. In addition to the small and medium commercial building study, she also has completed a study of children's exposures to a number of environmental contaminants. Drs. Nicholas Kenyon and Marc Schenker from UC Davis bring expertise in asthma and epidemiology to the project, and Bill Fisk from Lawrence Berkeley National Laboratory is an internationally respected expert in indoor air quality and filtration. Other members of the team add strength in statistics, asthma and the health effects of air pollution.

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

Year	2011	2010	2009
Funding	$1,394,560	$508,267	$1,588,387

BUDGET SUMMARY

Contractor: University of California, Davis

Benefits of High Efficiency Filtration to Children with Asthma

DIRECT COSTS AND BENEFITS			
1.	Labor and Employee Fringe Benefits	$ 1,723,747	
2.	Subcontractors	$ 154,577	
3.	Equipment	$ 0	
4.	Travel and Subsistence	$ 284,150[1]	
5.	Electronic Data Processing	$ 0	
6.	Reproduction/Publication	$ 2,100	
7.	Mail and Phone	$ 21,020	
8.	Supplies	$ 315,873	
9.	Analyses	$ 134,136	
10.	Miscellaneous	$ 426,464[2]	
	Total Direct Costs		$3,062,067
INDIRECT COSTS			
1.	Overhead	$ 287,933	
2.	General and Administrative Expenses	$ 0	
3,	Other Indirect Costs	$ 0	
4.	Fee or Profit	$ 0	
	Total Indirect Costs		$ 287,933
TOTAL PROJECT COSTS			**$3,350,000**

[1]Item 4: The travel costs cover ground travel at the two study locations (Fresno and Riverside) and travel, lodging, and per diem costs for field staff to stay at the study locations 4-5 days per week for much of the two-year field study period.

[2]Item 10: The majority of the expense in this category ($270,609) is the estimated labor and installation costs associated with central system inspections and upgrades, so that the existing heating and air units can accommodate high efficiency filters, and the purchase of the portable air cleaners and sham and real filters for all of the homes.

Attachment 1

SUBCONTRACTORS' BUDGET SUMMARY

Subcontractor: Lawrence Berkeley National Laboratory

Description of subcontractor's responsibility: William Fisk, Indoor air quality and ventilation engineering advisor. Mr. Fisk is a Staff Scientist and mechanical engineer, and head of the Indoor Environment Department. He will work with Dr. Bennett in the development of the air filtration plan. He will assist in the selection of filtration devices used and help communicate with providers to ensure the most appropriate product is used. He will provide his expertise in the analysis of the air quality data and in preparation of the draft-final and final reports.

DIRECT COSTS AND BENEFITS				
1.	Labor and Employee Fringe Benefits	$	37,986	
2.	Subcontractors	$	0	
3.	Equipment	$	0	
4.	Travel and Subsistence	$	0	
5.	Electronic Data Processing	$	0	
6.	Reproduction/Publication	$	0	
7.	Mail and Phone	$	0	
8.	Supplies	$	0	
9.	Analyses	$	0	
10.	Miscellaneous	$	8,546[1]	
	Total Direct Costs			$46,532
INDIRECT COSTS				
1.	Overhead	$	23,732	
2.	General and Administrative Expenses	$	0[2]	
3.	Other Indirect Costs	$	3,635	
4.	Fee or Profit	$	0	
	Total Indirect Costs			$27,367
TOTAL PROJECT COSTS				**$73,899**

[1] Miscellaneous includes charges to cover phone, fax, photocopying, administrative support, and related costs, charged as percentages of direct cost.

[2] LBNL has waived the usual federal administrative fee, for a savings of $2217.

Attachment 2

SUBCONTRACTORS' BUDGET SUMMARY

Subcontractor: University of California, San Francisco (at Fresno)

Description of subcontractor's responsibility: Mr. Timothy Tyner is the Associate Director of the Center for Clinical and Translational Research at UCSF Fresno, and an adjunct Associate Professor of Biology at California State University, Fresno. He serves as a collaborator and co-investigator on several projects related to air pollution and asthma. Mr. Tyner will work with the Fresno area school districts and health care providers to facilitate recruitment of 130 children with asthma and their families for this study. He will develop the recruitment protocol, obtain approval of the recruitment plan, and assist the study team with recruitment.

DIRECT COSTS AND BENEFITS				
11.	Labor and Employee Fringe Benefits	$	68,810	
12.	Subcontractors	$	0	
13.	Equipment	$	0	
14.	Travel and Subsistence	$	4,000[1]	
15.	Electronic Data Processing	$	0	
16.	Reproduction/Publication	$	0	
17.	Mail and Phone	$	0	
18.	Supplies	$	0	
19.	Analyses	$	0	
20.	Miscellaneous	$	533	
	Total Direct Costs			$73,343
INDIRECT COSTS				
5.	Overhead	$	7,334	
6.	General and Administrative Expenses	$		
7.	Other Indirect Costs	$		
8.	Fee or Profit	$		
	Total Indirect Costs			$7,334
TOTAL PROJECT COSTS				**$80,667**

[1] Travel charges are for local travel in Fresno to and from schools, health care providers' offices, and participants' homes, and to UC Davis for study team meetings.