

**State of California
AIR RESOURCES BOARD**

**Research Screening Committee Meeting
Cal/EPA Headquarters Building
1001 I Street
Conference Room 510
Sacramento, California 95814
(916) 445-0753**

**May 6, 2010
9:00 a.m.**

ADVANCE AGENDA

Draft Final Reports

1. "Effects of Inhaled Fine Particles on Lung Growth and Lung Disease," University of California, Irvine, \$450,447, Contract No. 05-342

One of the most provocative and potentially important findings from the Children's Health Study (CHS) was the significant association between reduced lung function growth and exposure to nitrogen dioxide (NO₂), acid vapor, fine ambient particles and elemental carbon. Because the pollutants in ambient air that were associated with the development of lung function deficits were highly correlated, it was not possible to definitively attribute the health effects to one or more specific pollutants. These findings from the CHS raised several questions. Among them, does air pollution exposure during childhood and adolescence alter lung development, and if so, how and are the observed deficits permanent? This study tested the hypothesis that ambient fine particle (PM_{2.5}) exposure would induce oxidative stress that would lead to pulmonary function deficits in rodents exposed from birth to adulthood, and that observed deficits would persist with subsequent filtered air exposure. The investigators examined molecular mechanisms for PM_{2.5}-induced developmental effects on the lung, as well as the roles of PM_{2.5} concentration and speciation on lung development in mice exposed using a Versatile Aerosol Concentration Enrichment System (VACES) particle concentrator. The results suggest that long-term exposure to relatively high concentrations of PM_{2.5} during the period of lung development can lead to developmental changes in the lung, and that effects persist for at least one week after PM_{2.5} exposures end.

2. "Role of Inhaled Particles in the Pathophysiology of Cardiovascular Disease," University of California, Irvine, \$446,358, Contract No. 04-320

Many epidemiological studies have found an association between exposure to ambient fine particles (PM_{2.5}) and cardiovascular disease. The mechanisms by which particulate matter (PM) exposure disrupts cardiac function and worsens cardiovascular disease (CVD) are not well understood. There is a growing body of knowledge that

suggests that PM exposure can induce inflammatory changes in blood vessels, which can lead to the development of atherosclerotic plaques and lesions. The researchers hypothesized that PM exposure would abnormally activate endothelial cells and induce vascular inflammation that will lead to the accelerated formation of arterial plaques which are a hallmark of atherosclerosis. The study was performed using mice that were genetically susceptible to the development of atherosclerosis; the mice were exposed to concentrated ambient particulate matter. The development of atherosclerosis was monitored over the course of exposures using an ultrasound microscope technique, implanted cardiographic transponders, and biomarkers associated with oxidative stress. The results of this study show that PM_{2.5} exposure accelerated the development of atherosclerotic plaque in genetically susceptible mice approximately 1.6-fold compared to plaque development in mice exposed to purified air. The conclusion drawn from this study is that exposure to concentrated PM_{2.5} in California can accelerate atherosclerosis development in the mouse model studied.

3. "Assessment of Health Impacts of PM from Indoor Air Sources Phase I: Development of In Vitro Methodology," University of California, Davis, \$399,997, Contract No. 05-302

Exposure to ambient particulate matter (PM) in California contributes to thousands of premature deaths and serious adverse health impacts such as respiratory and cardiovascular diseases. Indoor-specific sources can produce elevated concentrations of PM indoors, and several toxic components have been detected in PM from these sources. Consequently, PM of indoor origin may have a significant health impact. This study examined the potential impact of PM of indoor origin on human health, using chemical and biological assays. Using a human macrophage and a human lung cell line, PM from different indoor combustion sources (cooking, wood burning, candles, and incense) was found to elicit inflammatory responses, with incense samples evoking the strongest responses. Chemical analyses were also performed on samples from the different sources. Incense and woodsmoke were both found to contain polycyclic aromatic hydrocarbons (PAHs); other compounds were detected that were specific to the different source types. Results of this study will help enable ARB to understand the relative health risks associated with major indoor PM sources. It also provides insight into the types of chemicals responsible for their toxicity.

4. "Improved Geospatial Scenarios for Commercial Marine Vessels," University of Delaware, \$47,954, Contract No. 07-320

Ship emissions affect air quality in coastal areas. Since 2004, ARB has worked with the United States Environmental Protection Agency (EPA) and other agencies to develop emission inventories of Commercial Marine Vessels (CMV) in North American waters. A CMV project completed in 2006 provided monthly ship emission inventories in a base year (2002) and projected inventories in future years (2010 and 2020). This new study complemented the previous study by refining those projected inventories through the use of individually estimated growth rates for various vessel types (e.g., containerships, bulk carriers) for six pollutants. Projected inventories were developed under two scenarios: the previous growth rates (pre-recession) and lower growth rates (recession). In both scenarios, containerized shipping activity was estimated to increase, accounting

for nearly 60 percent of total emissions under the high scenario and 40 percent under the low scenario by 2020, followed by bulk carriers and tankers. This study provides greater detail and improved geospatial emission inventories of CMV for North American coastal waters that support state, federal, and international efforts to quantify and evaluate air quality and climate impacts from shipping.

5. "Lifecycle Analysis of Climate-Change Mitigation Strategies of the California Air Resources Board," University of California, Davis, \$199,561, Contract No. 06-323

ARB proposed and adopted many strategies to reduce greenhouse gases (GHG); however, the full lifecycle emissions for most of these strategies have yet to be analyzed. The Institute of Transportation Studies at University of California, Davis, (UCD), developed a user-friendly calculator tool to quantify the lifecycle emissions of selected Early Action items in the Scoping Plan to reduce California's GHG emissions. The Climate Change Mitigation Strategy Impact Calculator estimates reductions in carbon dioxide-equivalent (CO₂E) emissions of GHGs in a user-specified target year and over a user-specified period of years, for the following strategies: Cargo-Handling Equipment Anti-Idling, Low-Global Warming Potential (GWP) Refrigerants for Mobile Vehicle Air Conditioning Systems, Transportation Refrigeration Unit (TRU) Cold Storage Limits, Cool Automobile Paints, Low-friction Engine Oil, High GWP Reduction from Stationary Sources, Alternative Suppressants in Fire Protection systems, and Foam Recovery and Destruction Program. This tool will allow ARB program staff to estimate lifecycle emissions to ensure that these measures will yield *net* emission reductions. Additionally, this tool will highlight the variables and assumptions to which lifecycle emissions are most sensitive.

6. "Evaluation of Efficiency Activities in the Industrial Sector Undertaken in Response to Greenhouse Gas Emission Reduction Targets," University of California, Berkeley, \$100,000, Contract No. 07-321

The California Global Warming Solutions Act of 2006 (AB 32) calls for reducing greenhouse gas (GHG) emissions to 1990 levels by 2020. This aggressive goal requires emission reductions in all sectors, including the industrial sector. Many countries have national-level GHG reduction or energy-efficiency targets that have led to significant improvements in energy efficiency within the industrial sectors. This project identified programs and policies that have effectively targeted the industrial sector with detailed review provided for programs in Ireland, France, the Netherlands, Denmark, and the United Kingdom. This review indicates that structured programs that engage industry, require members to monitor and report potential efficiency measures, and provide incentives and support in achieving the goals, can be quite effective. Companies in all programs exceeded their targets for energy efficiency and GHG emission reductions. Based on international experiences, a carefully designed California program with clear guidelines, and strong support programs to assist manufacturers would compliment the goals of AB 32 and increase the energy-efficiency and competitiveness of California's industries.

7. "A Pilot Study: Improvements in Health Outcomes From Incremental Improvements in Air Quality," University of California, Berkeley, \$471,261, Contract No. 01-346

ARB sets ambient air quality standards at levels which are protective of human health. The air pollution reduction efforts by ARB and the air districts have contributed to significant reductions in ambient air pollution and the potential adverse health effects associated with air pollution exposure in southern California since 1980. This project was designed to investigate trends in the occurrence of specific health endpoints in the South Coast Air Basin (SoCAB) over the period 1980 through 2000 and assess whether or not these trends could be related to the improvements in air quality, based on newly developed techniques that account for changes in a large number of socioeconomic, behavioral, and medical factors associated with cardiovascular and respiratory health. The investigator concluded that reductions in warm season ambient ozone concentrations, which resulted from regulatory programs to reduce these concentrations, are associated with health benefits for asthma hospitalizations and cardiac mortality, with benefits for the latter likely reaching a plateau in the late 1990s. This latter conclusion should be interpreted with caution since the newly developed models are based on many underlying assumptions. No result on particular matter was presented. In summary, the investigator performed two of the required eight ozone analyses listed in their proposal. None of the particulate matter (PM) analyses were completed due to insufficient time to address exposure assessment errors and also due to preliminary results that indicated a lack of association between particulate matter less than 10 microns in diameter (PM10) and cardiac mortality. In addition, the investigators stated that the time period for which fine particulate matter (PM2.5) exposure data is available was too short to perform the analyses proposed in the study. The draft final report was submitted past the ending date of the contract, although two publications were produced from the contract.

Other Business

8. Concept Review for 2010-2011 Planned Air Pollution Research

Staff will solicit input from RSC members regarding research concepts submitted in response to public solicitation as candidates for ARB's FY 2010-2011 Research Plan. This year, more than 150 concepts were submitted in response to our solicitation.

Based on technical review by ARB staff as well as representatives from other State agencies, federal institutions, and funding organizations, 25 concepts (totaling \$6M) have emerged as top-tier candidates for funding and 12 concepts (totaling \$3.4M) have been identified as strong candidates to consider, pending resource availability.

Staff seeks the committee's comments regarding the portfolio of top-ranking research concepts. In particular, ARB hopes to:

- identify opportunities to leverage on-going or completed studies;
- avoid duplication of efforts undertaken elsewhere;
- address niche areas of particular importance to the Board that may not be funded elsewhere;
- ensure a cost-effective research portfolio comprising projects with strong prospects for delivering results that will help the Board fulfill its mission.