

**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**

**October 18, 2013
9:00 a.m.**

ADVANCE AGENDA

I. Approval of Minutes of Previous Meeting:

May 17, 2013 meeting

II. Discussion of Draft Final Reports:

- 1) "Persistent Immune Effects of Wildfire Particulate Matter Exposure during Childhood Development," University of California, Davis, \$268,029, Contract No. 10-303

Little is known about whether air pollution exposure during early life has life-long impacts. Some have speculated that air pollution exposure during the early childhood lung development period could alter lung and immune system development in ways that increase susceptibility to lung-related disease later in life. This project investigated the impact of early childhood exposure to ozone and particulate matter on lung function development, and development of immune system parameters that modulate responses to infectious disease and contribute to lung function decline with aging. The study involved a cohort of rhesus monkeys that were born during the three-month period prior to the wildfires that impacted the Sacramento Valley during June and July 2008. Half of the cohort lived outdoors from birth, and was exposed to the elevated air pollution concentrations that occurred during the fires, while the other half of the cohort was born during the same months of 2009, and was also raised outdoors. The results suggest that early life exposure to combined ozone and wildfire PM_{2.5} can result in immune and lung function decrements that persist with maturity.

- 2) "In-Duct Cleaning Devices: Ozone Emissions Rates and Test Methodology," University of Missouri Science & Technology, \$325,000, Contract No. 09-342

This study examined the ozone emission rates and the increase in indoor ozone concentrations from the use of electrically connected in-duct air cleaners through a combination of laboratory experiments, test method development, field studies and modeling analyses. A complete laboratory test apparatus and standard test method (STM) were developed simultaneously during this study. Emission rates from the models tested in the laboratory ranged from below the detection limit, to greater than 100 mg per hour. In

addition to laboratory tests, field tests of in-duct devices were completed in seven residential buildings and one classroom. The incremental increase in the ozone concentration due to the operation of these devices ranged from not detectable to as high as 134 parts per billion (ppb). Two models increased the ozone concentration in field residences by greater than 50 ppb. Finally, a standard “mass-balance” model of indoor air concentrations of ozone demonstrated that use of ozone-emitting, electrically connected in-duct air cleaners can raise ozone concentrations substantially in buildings typical of residences in California. For a typical house, the model predicted that an emission rate of approximately 150 mg per hour would raise the indoor concentration by about 50 ppb. For an “at risk” house, or one that has characteristics that enhance indoor ozone concentrations, 50 ppb could be achieved with emission rates as low as 27 mg per hour. The modeling results and the measured ozone concentrations in the field in this study showed reasonable agreement for most devices. Based on model analysis, laboratory testing and field studies, the project team concluded that the use of electrically connected in-duct air cleaners of the types studied in this research can increase residential indoor concentrations of ozone above the current California limit set for portable ozone generating devices.

- 3) “Quantifying the Effect of Local Government Actions on Vehicle Miles Traveled,” University of California, Davis, \$125,000, Contract No. 09-343

On-road vehicles generate more than one-third of California’s greenhouse gas (GHG) emissions annually. While the state is moving forward with vehicle emission standards and low-carbon fuel standards to reduce transportation emissions to meet the goals of Assembly Bill (AB) 32, an overall reduction in vehicle miles traveled (VMT) is also critical to achieve the 2020 climate target. In 2008, Senate Bill (SB) 375 was adopted requiring California regions to prepare a Sustainable Community Strategy that identifies how the region will achieve GHG reduction targets through integrated land use, housing and transportation planning. Regional planners and local government officials have limited information on which strategies will be most effective to reduce VMT in their area. Past research studies provide basic information on whether certain policies may have a positive or negative affect on reducing VMT. Little evidence was available that provided local estimates of how changes in land use and transportation variables, such as access to public transit and land use mix, might lead to local changes in VMT. Local estimates were needed because a strategy likely does not have the same impact across all neighborhood types. For instance, increasing public transit capacity in an urban area that already has a robust system may lead to a greater change in VMT than introducing public transit to a rural area with little ridership potential. Research was needed to provide information to local governments to assist them in evaluating which policies would be most effective to reduce VMT within each of their existing neighborhood types, also referred to as “local context.” The results of this study are expected to provide local and regional assistance to meet statewide targets to reduce GHG emissions and overall VMT.

- 4) “Residential Energy Use and Greenhouse Gas Emissions’ Impacts of Compact Land Use Types,” University of California, Berkeley, \$100,000, Contract No. 10-323

Nearly 15 percent of statewide greenhouse gas (GHG) emissions are related to heating and cooling residential buildings, which are partly a function of house size and orientation, and are therefore strongly tied to land use planning decisions. A few academic studies examined national data sets of residential energy use as a function of urban form, which

indicated that residents living in high-density urban centers emit 20 to 50 percent fewer GHG emissions than residents of low-density suburbs. The objective of this research was to 1) investigate the relationship between land use planning factors and residential energy use in California's various climate zones; and 2) develop a spreadsheet modeling tool that analyzes residential energy use as a function of land use planning factors. The research results will be useful to local planners for comparing various development scenarios when preparing general plans or climate action plans. Until now, there have been no easy-to-use calculators for local land use planners to estimate the GHG emissions of residential energy use from various land use planning designations. This tool is intended to fill that gap and assist local planners in meeting the State's GHG reduction targets under AB 32 and Executive Order S-3-05.

- 5) "Inverse Modeling to Verify California's Greenhouse Gas Emission Inventory," California State University, East Bay, \$150,000, Contract No. 09-348

The California Global Warming Solutions Act of 2006 (AB 32) requires ARB to develop a statewide greenhouse gas (GHG) emissions inventory. This GHG emissions inventory is based on the International Panel on Climate Change (IPCC) recommended methodologies which use a "bottom-up" approach and calculate GHG emissions based on emission factors (e.g., grams of methane per gallon of gasoline combustion) multiplied by activity data (e.g., gallons of gasoline combusted). An accurate inventory is important for tracking progress towards meeting the AB 32 goals. As such, it is critical to evaluate the accuracy of the existing GHG emissions inventory, while continuing efforts to better understand and quantify GHG emissions in California.

This study uses ambient methane (CH₄) measurements and inverse modeling to estimate emissions and provide a comparison to the ARB-developed inventory. The inverse model relies on maps of CH₄ source locations and emission estimates to accurately estimate emissions. This study uses two different maps, one based on California-specific data and the other that uses a generalized approach (EDGAR 4.2). Utilizing these different maps as a priori emissions, along with ambient measurements, the analyses yield annually averaged posterior CH₄ emissions that are 1.30 - 1.74 times larger than the ARB estimated CH₄ emissions. However, as can be seen from the large range of emission estimates, the modeling approach has large uncertainties derived from the different emission maps. The other part of the uncertainties lie in the inability of the model to accurately resolve the Southern California area and additional tower measurements in the South Coast air basin are recommended. Additional work is also needed to identify and reduce the remaining model uncertainties.

- 6) "Assessment of Nitrous Oxide Emissions in California's Dairy Systems," University of California, Davis, \$82,000, Contract No. 09-325

Nitrous oxide (N₂O) is known to be a major greenhouse gas (GHG) emitted from agricultural systems. There is, however, substantial uncertainty in its emission estimate due to the variable nature of its emission fluxes from agricultural soils, which can be affected by many environmental and management parameters. Quantifying the N₂O emissions from California agricultural soils is important to improve California's GHG emission inventory. This project, focusing on N₂O emissions from organic nitrogen sources, was conducted as a supplemental study to a previous investigation determining baseline N₂O emissions from nitrogen (N) fertilizer uses in California's cropping systems. The project provided N₂O

emission data from three dairy farms with different cropping systems receiving both chemical and dairy manure as fertilizers in California. The results indicated that the annual emission rate of N₂O from the dairy forage fields ranged widely from 4.8 to 17 N₂O-N kg ha⁻¹, with an emission factor of 0.9 -1.7 percent. The N application rate, soil water content, and soil texture are the main factors controlling N₂O emissions. The project improved our understanding of N₂O emissions from California agricultural land and confirmed that California dairy farms with irrigated forage cropland receiving extraordinarily high N inputs are hot spots of N₂O emissions.

- 7) "Assessment of NO_x Emissions from Soil in California Cropping Systems," University of California, Davis, \$83,500, Contract No. 09-329

Nitrogen oxides (NO_x) are air pollutants that can react with volatile organic compounds (VOCs) under sunlight to produce ozone (O₃). Due to the detrimental effects of ozone to human health and the environment, control of NO_x emissions is critical to improve air quality in California. Agricultural land is a known source of NO_x emissions, but its contribution to California's NO_x inventory is uncertain. On the global scale, it is estimated roughly 16 percent of the total NO_x emissions was produced from soils through processes known as nitrification-denitrification driven by soil microorganisms. Application of nitrogen (N) fertilizers in agricultural land provides N substrate to the nitrification-denitrification process, and therefore enhances NO_x emissions from soils. This project measured soil NO_x emission fluxes from five major California's cropping systems under various environmental conditions and management practices. Significant NO_x emissions were detected in all crop fields, with an average flux ranged from 0.04 g NO_x-N ha⁻¹ h⁻¹ in wheat to 2.79 g NO_x-N ha⁻¹ h⁻¹ in tomato at the highest N application rate. The results of the study are expected to be useful in ozone modeling, providing an estimate of NO_x contribution from agricultural land which is currently missing from California's NO_x inventory.

III. Discussion of Responses to A Request for Proposals:

- 1) "Technical Analysis of Vehicle Load-Reduction Potential for Advanced Clean Cars," RFP No. 13-313

IV. Other Business

- 1) Update on Annual Research Plan