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

July 8, 2015
9:00 a.m.

ADVANCE AGENDA

I. Approval of Minutes of Previous Meeting:

March 27, 2015 meeting

II. Discussion of a Request for Proposals (RFP):

1) "Evaluating Engine and Aftertreatment Performance and Deterioration for Heavy-Duty Engines," $400,000, RFP No. 15RD006

III. Discussion of a Proposed Contract Augmentation:

1) "Advanced Plug-In Electric Vehicle Travel and Charging Behavior," University of California, Davis, $442,356, Contract No. 12-319

This project was originally approved by the RSC in 2012 to advance the Air Resources Board's (ARB) research related to advanced technology vehicles. A contract augmentation is requested to allow ARB to accept $442,356 of co-funding from the California Energy Commission to significantly expand this study. This project's objective is to collect and analyze in-use vehicle data from a variety of plug in electric vehicle (PEV) types in a household context to improve estimates of emission profiles and consumer benefits, in order to provide insight into the real-world emission benefits of plug-in vehicles. PEVs constitute a growing share of new light-duty vehicle sales; however, their environmental benefits will vary depending on consumer usage and charging behavior. The additional funds will be used to add newer vehicle technologies, additional households, a project manager, and interviews with PEV-owning households, which will improve the robustness and richness of the results.

IV. Discussion of New Research Projects:

1) "Heavy-Duty On-Road Vehicle Inspection and Maintenance Program," Foundation for California Community Colleges, $499,560, Proposal No. 2789-283

Despite substantial reductions in oxides of nitrogen and diesel particulate matter emissions from heavy-duty vehicles (HDV), these vehicles are still significant contributors to statewide and regional emissions of these pollutants. Because of their long service lives, it is important that HDVs remain in emissions compliance throughout their entire lifetimes, and a HDV inspection and maintenance (I/M) program is one means of trying to ensure this compliance. The objectives of this project are to evaluate various approaches to HD I/M, select one or more promising alternatives, develop and demonstrate a prototype HDV I/M program, and conduct an economic cost analysis for this prototype program. Results from this project will be used to inform the design of an improved HDV I/M program for consideration by ARB.

2) "Designing Vehicle Retirement and Replacement Incentives for Low-Income Households," University of California, Los Angeles, $483,133, Proposal No. 2790-283

In order to meet air quality and climate change goals in California, a transformation of the light-duty vehicle fleet will be necessary. Incentives play an important role by accelerating the retirement and replacement of older, high-polluting vehicles and to increase adoption of advanced clean vehicles. This project will provide insight into vehicle retirement and replacement motivations and patterns of low and moderate income households, and will assess the effectiveness and cost-effectiveness of different policies and financial incentive program structures for optimizing adoption of advanced technology vehicles or other travel options (such as transit or car- or ride-sharing), particularly among low and moderate income households. The results of the research will be used to evaluate the light-duty vehicle market and inform ARB decision makers about the potential options for modifying ARB's incentive programs to ensure they make the best use of limited State resources, as well as provide benefits to underserved populations and disadvantaged communities.

3) "Identifying, Evaluating and Selecting Indicators, Indices and Data for Future Monitoring System of the Implementation of Sustainable Communities Strategies," University of California, Los Angeles, $149,908, Proposal No. 2791-283

In 2008, the Sustainable Communities and Climate Protection Act (Senate Bill 375 (SB 375)) requires Metropolitan Planning Organizations (MPOs) to do more integrated land use, transportation, and housing planning, through development of Sustainable Communities Strategies (SCS). These regional planning elements show that, if implemented, the major regions of California can reduce transportation-related greenhouse gas (GHG) emissions compared to 2005 levels. In the 2014 Scoping Plan Update, one of the recommended actions to achieve the State's post-2020 climate goals is to "ensure GHG emission reductions from approved SCSs are achieved or exceeded through coordinated planning." In order to track and monitor the progress in achieving the goals of SB 375, a framework must be established that identifies the key indicators of progress, such as vehicle miles traveled (VMT) and fuel usage data, as well as tracking the effectiveness of land use policies. In particular, there is a need to

understand the extent to which shifts in regional and local planning are resulting in actual changes in land use and transit-oriented development patterns, and resulting in reduced VMT across the State through time. This project will develop a framework and baseline to enable future tracking and evaluation of land use, development, and other indicators that reflect progress toward the goals of SB 375 over time.

4) "Assessing the Travel Demand and Co-Benefit Impacts of Affordable TODs," University of California, Berkeley, $300,000, Proposal No. 2792-283

Senate Bill 375 (SB 375) requires Metropolitan Planning Organizations (MPOs) in California to develop a Sustainable Communities Strategy (SCS) as part of their federally mandated Regional Transportation Plan (RTP), to demonstrate how, largely through reduced travel demand and vehicle miles traveled; they will meet regional passenger vehicle greenhouse gas reduction (GHG) targets set by ARB. Affordable housing in transit-oriented developments has been recognized as a potential travel demand reduction strategy. However, to date very limited empirical, peer-reviewed research has evaluated the impact of preserving or building affordable housing on travel behavior and associated GHG emissions. The objectives of the research project are to evaluate the impact that preserving and building affordable housing in transit-oriented areas has on travel demand and vehicle miles traveled (VMT), and to assess the economic, health, and well-being impacts on the associated residents.

5) "Zero-Carbon Buildings in California: A Feasibility Study," University of California, Berkeley, $430,574, Proposal No. 2793-283

California is on track to achieving the 2020 greenhouse gas (GHG) target, however much more must be done long-term to ratchet down emissions to a level needed for climate stabilization. The First Update to the Scoping Plan identified future actions and policies that can help California achieve our post-2020 climate goals, including advancing Zero Net Energy (ZNE) buildings to be Zero Carbon Buildings. A zero or near-zero carbon building is a Zero Net Energy building that would generate nearly no GHG emissions from the energy, water, waste, and transportation use associated with the building. Zero carbon buildings will utilize high performance design solutions, generate renewable energy on-site, and employ other techniques to eliminate or offset these GHG emissions. To date, almost no research has been conducted on Zero Carbon Buildings, and additional research is needed to explore the technical feasibility of zero or near-zero carbon building for both residential and commercial buildings.

6) "Characterize Physical and Chemical Properties of Manure in California Dairy Systems to Improve Greenhouse Gas (GHG) Emission Estimates," University of California, Davis, $151,423, Proposal No. 2794-283

When manure is stored anaerobically (i.e. without oxygen, in facilities such as lagoons and deep pits), bacteria break down manure volatile solids (VS) and generate methane. California's greenhouse gas (GHG) inventory cites United States Environmental Protection Agency (U.S. EPA) modeling to quantify the methane emitted from manure storage, though CA lacks real world data to substantiate the modeling assumptions such as the amount of VS stored in lagoons. The majority of manure from California's 1.8 million milking cows is assumed to be stored anaerobically, with lagoons being the largest manure methane emitter (nearly 9 million

metric tons of CO_2 equivalent emitted in 2012). Real world surveying of manure management pathways (including VS at each stage of management) is necessary to substantiate or refute modeling assumptions. Other factors such as nitrogen (N) will also be tracked and measured with the intent to better inform the N_2O inventory. Dairy farms will be selected to represent the various types of manure management systems, including scraping, flushing, solids separation, lagoon storage, covered lagoon digestion, and solids digestion, etc. Representative samples of manure will be taken from each manure pathway to determine the nutrient flow at each stage of management. Results will be compared to U.S. EPA assumptions about VS in manure management systems modeled according to farm-size, temperature, and other modeled factors related to methane production. If current assumptions used by ARB for GHG inventory purposes do not reflect industry practices or the physical/chemical environment in which the manure is residing, alternative values or ranges of values will be suggested. If manure methane is shown to be larger or smaller than the existing U.S. EPA modeling, then ARB will be better able to prioritize dairy manure methane mitigation concepts as well as better calculate the costs and benefits of methane capture or abatement.

7) "Characterize California-specific Cattle Feed Rations and Improve Modeling of Enteric Fermentation for California's Greenhouse Gas (GHG) Inventory," University of California, Davis, $99,964, Proposal No. 2795-283

   Enteric emissions comprise the largest known source (30 percent) of methane (CH_4) in California. Enteric fermentation is a microbial fermentation process that occurs in the digestive tract that produces CH_4 as a byproduct and mostly eructated by ruminant animals such as cattle. The amount of CH_4 produced from enteric fermentation depends primarily on feed intake and diet composition, which can vary widely across the state depending on feed availability and cost. Although emissions from a small number of animals under controlled conditions can be measured, it is not practical to sample large numbers of ruminant animals. Therefore, enteric CH_4 emission estimates for greenhouse gas inventories must rely on mathematical models. The U.S. EPA uses Cattle Enteric Fermentation Model (CEFM), which is a spreadsheet-based mathematical model and the basis of California's inventory, to estimate enteric methane emissions from cattle. However, some values that the model assigns are single values applied nationwide and thus do not represent the variability by state or region for estimating the enteric CH_4 emissions. This study is intended to develop a set of empirical mathematical models for estimating enteric CH_4 emissions from California's cattle using California-specific inputs. Moreover, the improved CH_4 emissions estimate will better reflect on-farm realities, allow better tracking of other feed-related issues such as nitrogen, and better inform policy decisions for focusing sectorial GHG goals and development of short-lived climate pollutant reduction strategies.

8) "Policy and Scenario Analysis for Managing and Mitigating California's F-gas Emissions," University of California, Berkeley, $318,382, Proposal No. 2796-283

   A majority of future high global warming potential (high-GWP) emissions in California will be comprised of fluorinated gases (F-gases), which are used primarily in refrigeration, air conditioning, insulation and pesticide applications. This project specifies a recommended policy or combination of policies needed to achieve

targeted 2030 and 2050 reductions of F-gas emissions in California. To ensure that future F-gas control programs achieve reductions in the most reliable and cost-effective manner, relevant regulatory experience will be reviewed and its lessons applied to a systematic comparative analysis of potential F-gas emission reduction strategies. The design of a recommended F-gas fee program will be specified, and emission reduction strategies other than fees will also be evaluated and compared across multiple criteria including cost-effectiveness, feasibility, economic impacts, and interaction with other emission control programs. Project results will inform the design of ARB's medium and long-term F-gas emission control programs.

9) "Improved Understanding of the Magnitude of Trans-Pacific Long Range Transported Ozone Aloft at California's Coast," San Josè State University, $281,699, Proposal No. 2797-283

   Despite very dramatic improvements in air quality in the State, California must continue to achieve significant new reductions in ozone precursor emissions. For non-attainment areas, the SIP must demonstrate how new controls will reduce ground-level ambient ozone to levels below the health-based standards. While recent health research has led to the United States Environmental Protection Agency (U.S. EPA) to propose a new, lower ozone standard, increasing industrialization in Asia have led to increased baseline ozone concentrations entering the State from the west. Short term field studies have documented instances of elevated ozone concentrations aloft that could potentially be relevant to ground level exceedances. While these measurements have provided infrequent information about ozone aloft, these isolated efforts do not provide sufficient information to fully understand the spatial and temporal variations in baseline ozone concentrations entering California. The proposed research will launch ozonesondes from a California coastal site on a near daily basis and collect ozone vertical profiles from the late spring to summer in 2016. The upper air ozone data collected from this project will help us to better quantify the magnitude and temporal variations in baseline ozone concentrations entering California, particularly on high ozone days in the San Joaquin Valley (SJV). The data are also critically important for evaluating and improving the boundary conditions generated from the global transport models used in our ozone SIP modeling.

10) "LIDAR Profiling of Ozone in the San Joaquin Valley," National Oceanic and Atmospheric Administration, $107,639, Proposal No. 2798-283

    Because health effects research has consistently led to lower ambient air quality standards for ozone, ARB needs to continue to reduce ozone precursor emissions in California. While state/local control strategies have resulted in significant decreases in locally produced ozone in California, baseline ozone concentrations in the air entering the State have been increasing. Increasing out-of-state contributions are making attainment of the more stringent ozone standards increasingly difficult. Intermittent field studies have documented instances of elevated ozone concentrations aloft (associated with global, regional, and local sources) that could potentially be relevant to ground level exceedances. Modeling exercises focused on the contributions of long-range transport and the stratosphere to ozone in the western United States (including California) have also suggested that baseline ozone aloft may contribute to surface ozone exceedances in California, especially at the high elevation sites. However, at present, there remains a great deal of uncertainty about the contributions

of stratospheric and transported ozone to surface concentrations in the San Joaquin Valley (SJV). Intermittent measurements by ozonesondes or aircraft do not provide the temporal coverage needed to evaluate how well models (such as WRF-Chem) can estimate the contribution of background ozone to surface concentrations in the SJV during these transport regimes. This project will use a surface based ozone LIDAR to provide quasi-continuous ozone profiles up to 2 – 3 kilometre (km) above ground level in the SJV for 6 weeks during the spring and summer (ozone season) of 2016. The data will help us to better characterize the ozone vertical profile and its temporal variation in the SJV, and understand the vertical mixing of ozone aloft down to the surface. It will provide key data to begin to look into any contribution of baseline ozone aloft to surface ozone exceedances in the SJV.

V. Discussion of a Draft Final Report:

1) "Environmental Fate of Low Vapor Pressure - Volatile Organic Compounds from Consumer Products: A Modeling Approach," University of California, Davis, $200,000, Contract No. 13-304

Low vapor pressure-volatile organic compounds (LVP-VOCs) are exempt from the VOC content limits for consumer products and are defined in the California Code of Regulations. To evaluate the availability of LVP-VOCs that may contribute to ozone formation from the use of consumer products, modeling tools were evaluated and developed for two modes of releases during the use of consumer products (i.e., direct release to the outdoor air and disposal down the drain). For the fate of LVP-VOCs found in some consumer products used in down-the-drain applications (e.g., laundry detergents, fabric softeners, dishwashing detergents, and other laundry products), a wastewater treatment plant (WWTP) fate model was applied to predict the fraction of LVP-VOCs that may volatilize at WWTPs. For the portion of the LVP-VOCs volatilized to air during product use, a multi-compartment mass-balance model was used to track the fate of LVP-VOCs in a multimedia urban environment. Based on the modeling results for the selected LVP-VOCs, loss by volatilization in a WWTP is negligible for most compounds, suggesting that most of the LVP-VOCs will not be available for ozone formation reactions once they are disposed down the drain. In contrast, for the LVP-VOCs in a consumer product that is volatilized from the surface to which it has been applied, greater than 90 percent will remain in the air and may participate in photochemical reactions either at the source location or in the downwind areas. Comparing results from these two modes of releases emphasizes the importance of determining the fraction of LVP-VOCs volatilized versus the fraction disposed down the drain when a product is used by consumers. The results from this study can provide important information and modeling tools to evaluate the impact of LVP-VOCs on air quality.