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

June 9, 2011
9:00 a.m.

ADVANCE AGENDA

1. Approval of Minutes of Previous Meeting
   April 28, 2011

2. Review of Final Draft Report:
   "Collaborative Lubricating Oil Study on Emissions," South Coast Air Quality Management District, $100,000, Contract No. 06-324

   Engine lubricating oil has been implicated as a significant parent material in the formation of mobile source particulate matter (mostly PM2.5) emissions, including ultrafine PM emissions. As fuels become cleaner (especially with lower sulfur content) and emission control systems become more effective and durable, the contribution of PM emissions from the lubricant becomes increasingly significant. However, to date, much of the understanding regarding the impact of lubricating oil on PM emissions has been anecdotal and not the subject of a focused and carefully conducted research study. The Coordinating Research Council, National Renewable Energy Laboratory (NREL), the South Coast Air Quality Management District, the American Chemistry Council Product Approval Protocol Task Group, the California Energy Commission, and ARB funded a concerted effort to characterize the potential for reformulated lubricants to reduce PM emissions from mobile sources, both from new vehicles and from the much larger in-use vehicle fleet. This study helped ARB explore some currently unclear, but highly relevant issues regarding PM and OC emissions from lubricating oil. Determining the relative fractions of PM from fuel and lubricating oil proved to be very difficult. However, fresh oil results in more PM than aged oil in otherwise clean cars (i.e., non-oil burners), suggesting that lubricating oil formulation could influence oil-derived PM, but that does not appear to be the case for high-emitters that account for the majority of PM emissions.

3. Review of Final Draft Report:
   "Characterization of Toxicity as a Function of Volatility of Ultrafine PM Emissions from Compressed Natural Gas Vehicles," West Virginia University, $349,996, Contract No. 07-340

   Heavy-duty (HD) compressed natural gas (CNG) vehicles have been advanced as a means to meet stringent PM mass standards, but reductions in health impacts may not be commensurate with reductions in PM mass. Many studies have been conducted to determine the characteristics and toxicity of emissions from CNG engines for comparison with the same characteristics for conventional-fueled diesel engines and other alternative-fueled engines. In 2002, ARB initiated a pilot study to investigate emissions from CNG buses in comparison with heavy-duty diesel vehicles with diesel particle traps. The results demonstrated the benefit of CNG and diesel particle traps in significantly reducing PM emissions and other toxic pollutants. However, CNG buses exhibited relative high emissions of aldehydes and volatile organic compounds (VOCs), and posed a potential toxic risk based on mutagenicity testing. As a conclusion of this pilot CNG study, oxidation catalysts were suggested as an emissions control for CNG buses and have now been implemented statewide. As a follow-up, the current study characterized the physical, chemical, and toxicological properties of emissions from CNG buses equipped with three-way catalysts. The CNG vehicles augment the vehicle test matrix of ongoing heavy-duty diesel vehicle (HDDV) and light-duty vehicle (LDV) studies. The three-way catalyst equipped, 2010 emissions compliant stoichiometric heavy-duty natural gas engines have proven to be a viable alternative in comparison to selective catalytic reduction (SCR) equipped heavy duty diesel engines to meet stringent PM and NOX standards. The work plan involved the chassis dynamometer testing of two heavy-duty CNG transit buses that are compliant with the U.S. Environmental Protection Agency (EPA) 2010 emission requirements. This study provided a comprehensive dataset of particle size distribution, criteria pollutants (CO, NOX, total hydrocarbons [THC], PM, and CO2), non-criteria pollutants (e.g., polycyclic aromatic hydrocarbons [PAHs], speciated gas phase non-methane hydrocarbon [NMHC], carbonyls; metals, elemental and organic carbon (EC/OC); water soluble ions and toxicity [e.g. oxidative stress, inflammation, mutagenicity]). The relative contribution of volatile and non-volatile particle toxicity was also assessed.

4. Review of Final Draft Report:
   "Flux Measurements of Biogenic Precursors to Ozone and Particulate Matter in the Central Valley," University of California, Berkeley, $400,003, Contract No. 06-329

   Biogenic volatile organic carbon (BVOC) emissions inventories are critical elements in federally required state implementation plans for ozone and particulate matter (PM). ARB's computer model for estimating BVOC emissions requires plant species composition and dominance, canopy area, leaf area index, leaf mass density, and taxonomic emission factors to produce BVOC emission inventories. This study focused on improving current emission factors for agricultural crops as these are a potentially significant source of emissions in the San Joaquin Valley (Valley) during the ozone season. Specifically, the project collected biogenic emissions data for

previously unmeasured chemical species emitted by the most common crops in the Valley using a combination of enclosure and canopy eddy covariance flux measurements. In addition to validating and extending our current assumptions about agricultural biogenic emissions, this study was unique in that it included a full year of measurements in an orange orchard. This longitudinal study captured a number of different activities such as fertilizing, harvesting, and pruning which result in increased biogenic emissions. Results of this project will be incorporated into ARB's current biogenic emissions inventory model that will be used in future State Implementation Plans.

5. Review of Final Draft Report:
   "Spatiotemporal Analysis of Air Pollution and Mortality in California Based on the American Cancer Society Cohort," University of California, Berkeley, $749,974, Contract No. 06-332

   The portion of the nationwide American Cancer Society (ACS) cohort living in California (76,000 individuals with over 20,000 deaths for an 18-year follow-up ending in 2000) was used to investigate the statewide health risk associated with exposure to particulate matter (PM) and gaseous air pollution on all-cause and cause-specific deaths. The investigators used twenty individual-level variables to control for confounding of the air pollution-death association from lifestyle, dietary, demographic, occupational, and educational influences, and variables to control for neighborhood-level confounding (e.g., poverty, unemployment). Using multiple statewide models for PM less than or equal to 2.5 µm (PM2.5), the investigators found significantly elevated risks for death due to cardiovascular disease (CVD), with the largest risk for death due to ischemic heart disease (IHD). PM2.5 was also associated with all-cause deaths statewide, but only when using the land use regression (LUR) model for exposure and controlling for residence in the largest urban areas. The other pollutants investigated – nitrogen dioxide (NO2), PM less than or equal to 10 µm (PM10), PM10 sulfates, and ozone – all showed consistent associations with CVD and IHD that are similar in size to those observed for PM2.5, although the exposure estimates for these pollutants are correlated with each other and with PM2.5.