CALIFORNIA AIR RESOURCES BOARD

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

February 25, 2022
9:00 a.m.

ADVANCE AGENDA

I. Approval of Minutes of Previous Meeting

November 5, 2021

- Approved

II. Discussion of a Request for Proposal (RFP)

1. "Characterization of Tire-Wear and Brake-Wear PM Emissions under On-Road Driving Conditions," $650,000

The objectives of this research are to measure and analyze real-world brake and tire-wear PM emissions, to understand the emission impact of moving to electric vehicles (EV), and to inform relevant health impact studies and programs. California representative light-duty vehicles (LDV) and heavy-duty vehicles (HDV) with different power sources (gasoline, diesel, and electricity) will be tested in this research. This research will require developing innovative methods to measure real-world brake- and tire-wear PM as well as particulate number (PN) count and size distributions. Measurement uncertainties reported from the laboratory tests (CARB Contract #17RD016 and Caltrans Project #65A0703) will be investigated by comparing the test results to real-world brake wear PM and PN that will be measured from this study.

III. Discussion of Research Proposals

1. "Equitable Electrification of Existing Buildings: A Pathway to Decarbonization," University of California, Los Angeles, $599,157, Proposal No. 2859-300

Building electrification is one of the most viable strategies for reducing GHG and criteria pollutant emissions from the building sector. While several studies have demonstrated the theoretical cost-effectiveness of building electrification in new and existing buildings, the equity implications and actual costs of electrification for priority populations living in existing buildings are not well-understood. This study will collect and synthesize existing data to model the extent to which current policy supports leave critical gaps in Californians' ability to electrify end uses in accordance with the State's climate and air quality goals. The project will also collect and analyze primary data related to electric service panel upgrade requirements and costs, and household level electrification drivers and barriers. Results from this project will inform ongoing CARB

and other public agency efforts to develop an aligned set of standards, incentives, and regulations across policy scales and domains to support rapid and equitable building decarbonization.

IV. Discussion of a Proposed Contract Augmentation

1. "A Scenario Tool for Assessing the Health Benefits of Conserving, Restoring and Managing Natural and Working Lands in California" University of California, Berkeley, $140,124,Contract No. 19RD015

A contract augmentation is requested to cover a change in scope and direction for the contract. The contract was approved to develop a Natural Working Lands Scenario Tool and this work will continue. However, CARB is currently updating the climate change scoping plan. This contract amendment will assess the health and associated economic impacts for fire emissions resulting from changes due to various climate and land management scenarios evaluated in the draft scoping plan. The augmentation will allow the contractor to quantify monthly statewide PM2.5, isolate and assess the wildfire PM2.5 impacts on several important health outcomes, and assess the economic impact associated with the health outcomes using validated methods from the U.S. EPA's Benefits Mapping and Analysis Programs (BenMAP) utilizing the emissions data produced by CARB staff. The result of this augmentation will be used to provide quantitation of the different wildfire scenarios used in the update to the climate change scoping plan on the health of Californians.

V. Discussion of Draft Final Reports

1. "Examining Entitlement in California to Inform Policy and Process: Advancing Social Equity in Housing Development Patterns," University of California, Berkeley, $399,701, Contract No. 19STC005

In order to meet California's climate goals, land use law and environmental regulations governing housing development must facilitate access to quality transit and employment opportunities. However, there is limited data to shed light on how land use laws and environmental regulations impact infill and greenfield development. This project filled this data gap by leveraging an existing project—the Comprehensive Assessment of Land Use Entitlements Study (CALES)—and expanding upon it. CALES extracts project-level entitlement data for residential development in cities and counties across California from 2014 2017. This CARB-funded project expanded the CALES dataset, adding four jurisdictions (to the 16 jurisdictions from which data was already being compiled) that represent exurban areas of the state. This enabled the researchers to conduct a comparative analysis of entitlement in infill and exurban areas. Through social science and legal research methods, the researchers concluded that the most significant barrier to increasing the development of dense, infill housing and affordable housing is local land use authority and regulation. Results show that though community opposition to housing through litigation varies across cities, less than 3 percent of all approvals in the 20-jurisdiction CALES dataset faced litigation—with no noticeable difference between litigation rates for housing in infill or exurban contexts. Both dense infill and exurban subdivision development used similar expedited environmental review pathways intended to promote infill development, including exurban development sited in high fire hazard areas. This robust and comprehensive study will inform CARB's implementation of Senate Bill (SB) 375, the development of the 2022 Scoping Plan Update, and other various policy-related activities currently

underway at CARB. The California Department of Housing and Community Development (HCD) has also expressed its intention to use this data for a variety of its programs, projects, and policies.

2. "Design and Development of an Instrument for Toxic-metal Aerosol Real Time Analysis," University of California, Davis, $399,999, Contract No. 17RD022

Technologies to screen for toxic compounds, such as benzene, toluene and many criteria pollutants are commercially available from a multitude of manufacturers. However, instruments that can measure near real time particle based toxic metals easily and at low cost are not yet available. Examples of the need for such a device include the identification of chromium in the Paramount area of Los Angeles and the airborne lead emissions from the now closed Exide battery recycling facility in Vernon California. Deploying portable devices that can monitor for toxic metals in real time will help CARB and communities determine the source of these metals and develop strategies to reduce their emissions. Real time community-based measurements of metals would be enabled by low-cost monitors and will allow those communities, the local air districts, to quickly identify and respond to emission events, and thereby minimize the impacts of heath hazardous incidents.

3. "Real-World Tire and Brake-Wear Emissions," University of California, Riverside, $400,000, Contract No. 18RD017

Non-exhaust emissions, including brake and tire-wear particles, have become more significant contributors to traffic-related PM emissions as exhaust emissions have steadily decreased. Thus, it is important to understand their contribution to local and regional air quality and impact on roadside exposure and health effects. This research has measured PM samples at upwind and downwind locations near two major highways: one for truck and car mixed fleet on I-710 (Long Beach Location) and one for car dominant fleet on I-5 (Anaheim Location) in Southern California and evaluated chemical and physical characteristics of the samples such as elements/organic matter and particle size, respectively, which were used for source apportion analysis. Source apportionment analysis showed that the contribution from non-exhaust sources to the roadside PM2.5 was 1 -1.5 that of primary exhaust PM2.5 (i.e., without including secondary PM2.5 formed downwind of the near roadway locations). The relative magnitude of the non-exhaust and direct exhaust PM emissions measured is in good agreement with emission inventory (EMFAC2021) estimation, in which brake and tire-wear PM2.5 emissions are 1.3 times greater than the exhaust emission in 2020. In the study, non-exhaust PM10 emissions were 2-3 times direct exhaust PM10 emissions. It is worth noting that a large amount of the coarse PM was identified as road dust including pavement materials, soil dust, etc. In addition to exhaust and non-exhaust PM, road dust should be considered in future investigation of health effects on the near-road communities.

4. "Effects of Brake and Tire Wear on Particulate Matter Composition, Reactive Oxygen Species, Placental Development and Birth Outcomes in Los Angeles," University of California,Los Angeles, $458,813, Contract No. 17RD012

Although a large body of evidence links exposure to fine (PM2.5) and coarse particulate matter (PM2.5-10¬) to adverse health effects, little is known about what specific

components in the heterogeneous mixture of particles contribute to the health effects. Non-combustion sources such as brake and tire wear are an important source of PM-metals in urban areas and PM2.5 metal components are thought to play an important role in determining overall PM2.5 health effects. Metals are known to induce oxidative stress by generating reactive oxygen species (ROS), which is one of the most significant physiological mechanisms of PM toxicity. The investigators in this study collected PM2.5 and PM2.5-10 samples in two (warm and cool) seasons across the Los Angeles Metropolitan Area to determine the metal content and ROS generation by the particles. The samples were used to develop predictive exposure models for metals and ROS associated with brake and tire wear using land use regression (LUR) and co kriging and to estimate associations between metals or ROS and health impacts. Health effects studies included placental abnormalities and function and birth outcomes in an ongoing National Institutes of Health-funded (NIH) study of 161 pregnant women in Los Angeles and pre-term births (PTB) and low birth weight (LBW) in 285,614 live births in Los Angeles County from 2017-2019. Results found that non combustion sources such as brake and tire wear are an important source of PM-metals and can be associated with adverse health outcomes. There were associations of PTB and Term (LBW) with metals from brake wear (barium) and tire wear (zinc). Hispanic and African American mothers had higher odds of preterm delivery. Suggestive effects were found from metals and oxidative stress potential on placental abnormalities. Positive correlations were found between measures of social disadvantage and oxidative stress potential of particles. The results of the study will help CARB to understand the health impacts of non combustion sources of emissions from brake and tire wear and help target regulations to reduce associated health impacts.

5. "Sources of On-Road Vehicle Emissions and their Impacts on Respiratory Disease Symptoms in California," University of California, Berkeley, $500,000, Contract No. 19RD004

Regulations and technological upgrades have resulted in a steady decline in vehicle tailpipe emissions in California. However, some communities continue to be disproportionately exposed due to their proximity to heavily trafficked freeways and vehicular congestion, as well as their proximity to area-based traffic related exposure such as shopping centers, parking lots and distribution centers. These sources have serious impacts on respiratory health. Another possible vehicle pollution source is non-exhaust emissions from tire and brake wear (metals). In this project, UCB used a rescue medication use dataset that could be related to the time and location of the medication use to identify the impacts of both vehicle tailpipe emissions and non-tailpipe trace metals emissions on sub-acute respiratory disease symptoms. The medication use data collected by ResMed and its sub-division Propeller Health uses digital sensors for 3,386 patients across California from January 1, 2012 to December 31, 2019. In health outcome analysis, both traditional and advanced random forest modeling techniques successfully predicted positive and significant impacts of daily air pollution on daily rescue medication use (number of puffs) after comprehensive control for confounding. All the three criteria pollutants (nitrogen dioxide (NO2), PM2.5 and O3) were statistically significantly associated with rescue inhaler use. In the linear mixed model with all the three criteria pollutants integrated in a single model, an effect of NO2 on 1 ppb increase, PM2.5 on 1 ug m-3 increase, and O3 on 1 ppb increase, was respectively a 0.25 percent, 0.88 percent and 0.53 percent increase in daily rescue puffs use.

6. "Impact of Air Pollution on COVID-19 Case and Death Risk in California,"

University of California, San Francisco, $105,493, Contract No. 19RD029

Previous studies have reported associations between air pollution and COVID-19 morbidity and mortality, but most have limited their exposure assessment to a large area, have not used individual-level variables, nor looked at infections. This study examined 3.1 million COVID-19 infections and 49,691 COVID-19 deaths in California from February 2020 to February 2021 to evaluate risks associated with long-term neighborhood levels of PM2.5. The study found that those living in neighborhoods with the highest long-term PM2.5 exposure had risks of COVID-19 infections which were 20 percent higher and risks of COVID-19 mortality which were 51 percent higher, than those living in neighborhoods with the lowest long term PM2.5 exposure. Populations living in neighborhoods with the highest long-term PM2.5 exposure were more likely to be Hispanic and more socioeconomically vulnerable. Moreover, the risk estimates suggest that, if all areas of California had PM2.5 levels below the current U.S. air quality standard of 12.0 µg/m3, approximately 4,250 deaths from COVID-19 (8.5 percent of all deaths) could have been prevented during the duration of this study. These findings are consistent with a growing body of literature from studies worldwide, and further highlights the importance of reducing levels of air pollution to protect public health.

7. "Ambient Air Pollution and COVID-19 Disease Severity or Death among Confirmed Cases in Southern California,"University of California, Los Angeles, $607,967, Contract No. 19RD030

A growing body of evidence links ambient air pollution to COVID-19 outcomes, suggesting a biological plausibility that air pollution increases susceptibility to contracting COVID-19. Given the high risk of death and serious debilitating complications that may result from COVID-19, it is critical to determine whether air pollution exposure not only increases the risk of contracting COVID-19 but also worsens the prognosis for patients infected with COVID-19. This study assessed the impacts of multiple air pollution exposures on worse COVID-19 outcomes in confirmed cases among patients who were members of the KPSC healthcare system (N = 316,224 positive tests). Outcomes within subgroups based on socioeconomic status, race, age, preexisting conditions, and ethnicity were also investigated. Advanced exposure techniques were performed to estimate ambient concentrations of several air pollutants, including O3, NO2, and PM2.5, as well as chemical speciation and sources of fine and ultra-fine particles (PM0.1). After linking air pollution levels to the primary residential addresses of COVID-19 cases, statistical models were conducted to assess associations between air pollution exposures and death from COVID-19. This study found significant associations between COVID-19 death and several air pollution exposures; for PM2.5 mass, PM0.1 mass, and several of the particle species or source tracers, including PM2.5 nitrates, PM2.5 elemental carbon, PM2.5 on-road diesel, and PM2.5 on-road gasoline. The increased risks of COVID-19 deaths linked to PM 2.5 mass and PM 2.5 nitrate were highest (ranging from 12 percent per interquartile (the difference between the 75th and 25th percentiles), while the other species and source markers had increased risks of about 6-7 percent. The increased risk for COVID-19 deaths associated with a 1 µg/m3 increase in the PM2.5 mass was 3 percent. The mean PM2.5 mass concentrations linked to COVID-19 risks were similar among racial/ethnic groups, while White population had slightly lower concentrations than other groups. When stratifying by race, the study found higher effect of PM2.5 mass on the risk of death from COVID-19 in the Asian-Pacific Islanders (6 percent increased risk with a

1 μg/m3 increase) than in other groups (2-4 percent). This study concludes that there is a high likelihood that prevalent air pollution exposures contribute to a higher risk of death from COVID-19.

VI. Other Business

1. Update on Research Planning