

March 7, 2019

**RE: RELEASE OF FISCAL YEAR 2019-20 PROPOSED RESEARCH PROJECTS**

Dear Public Stakeholders:

The California Air Resources Board (CARB or Board) has identified its fiscal year 2019-20 priority research projects. A research budget of approximately \$3.2 million is anticipated to fund four new projects and three white papers. The selection of these projects was guided by the research initiatives outlined in *The Triennial Strategic Research Plan for Fiscal Years 2018-2021* (Plan), along with extensive coordination with other agencies, research institutions, stakeholders, and experts in these fields of research.

The enclosed list provides greater detail on the projects, which are designed to support existing programs, and advance the state of the science in the areas of health and exposure, environmental justice, air quality, and climate. The scope of this year's projects has broadened and the projects are designed to comprehensively approach anticipated challenges associated with changing mobility options and building technologies, the increasing threat of wildfire, and evolving sources of on-road emissions that impact health. These projects will provide essential data, strategies, metrics, and tools to inform future policies that will ensure that California meets its long-term air quality and climate goals and protects public health, the economy, and vulnerable populations.

These projects will be proposed to the Board on March 21, 2019. If the Board approves these projects, staff will proceed to work with researchers to develop the research projects into complete proposals. The proposals will be reviewed by interested stakeholders and CARB's Research Screening Committee before it is fully executed. Results are anticipated in three to five years after a project commences.

For additional information on the research program, please visit our website (<https://ww2.arb.ca.gov/our-work/topics/research>). For more information on the Fiscal Year 2019-20 Proposed Research Projects, please contact Dr. Sarah Pittiglio at (916) 324-0627 or [sarah.pittiglio@arb.ca.gov](mailto:sarah.pittiglio@arb.ca.gov).

Sincerely,

Elizabeth Scheehle  
Chief, Research Division

Enclosure

cc: See next page

cc: Jorn Herner, Research Division

Sarah Pittiglio, Research Division

Annalisa Schilla, Research Division

# FISCAL YEAR 2019-20 PROPOSED RESEARCH PROJECTS

Project	Cost
1 - Quantifying the health impacts of air pollution exposure in vulnerable populations	\$900,000
2 - Improving indoor air quality, energy efficiency, and greenhouse gas reductions through multifamily unit compartmentalization	\$400,000
3 - The health and air quality impacts of wildfire	\$1,100,000
4 - Incentivizing zero emission, high occupancy new mobility options	\$700,000
<b>White Paper</b>	
5 - Methodology for the collection and analysis of Per- and Poly- fluoroalkyl substances (PFAS)	\$25,000
6 - Anti-displacement policy effectiveness	\$25,000
7 - A review of emerging technologies and methods for carbon sequestration	\$25,000
<b>Total Budget</b>	<b>\$3,175,000</b>

## PROJECT DESCRIPTIONS

### 1) Quantifying the health impacts of air pollution exposure in vulnerable populations

The objective of this work is to improve the methodology by which CARB characterizes health effects related to its programs and regulations, including those related to climate change. The first project will examine asthma symptoms associated with exposure to air pollution by tracking subjects' use of GPS-enabled rescue medication. The results will help quantify the relationship between asthma symptoms and exposure to on-road emissions, a particular concern for AB 617 communities. The second project will develop a tool to assess health co-benefits (mortality and morbidity) associated with changes in conservation and management practices on natural and working lands. Quantified health benefits could include those associated with reductions in wildfires and heat stress, and with increased physical activity from utilization of parklands. The results of this project will be one tool in a larger portfolio of tools and models needed to help quantify the health benefits of Scoping Plan measures.

### 2) Improving indoor air quality, energy efficiency, and greenhouse gas reductions through multifamily unit compartmentalization

Multifamily housing represents more than 50% of new residential housing in California annually. Therefore, understanding factors which can affect energy use and indoor air quality in these dwellings represent an important concern for the state of California. In addition, these units are important from an environmental justice stance since they often house a disproportionate percentage of disadvantaged families. Most California multi-family units are not compartmentalized to seal air infiltration from the exterior and from other interior units. Pollutant transfer in multi-family housing is a critical health and exposure concern, particularly in mid- and high-rise multi-family buildings, because of leakage and extensive use of common conduits for plumbing and electrical service. To meet recent ventilation code requirements, most builders use an exhaust-only ventilation approach in new construction, which can increase pollutant transfer between multi-family units. The objective of this research is to investigate indoor air quality, energy benefits, and greenhouse gas (GHG)

reductions of enhanced compartmentalization of multi-family units. A controlled field experiment will be conducted to measure infiltration of air pollutants from the exterior to the interior and between and among multi-family units and to assess the effectiveness of various construction and air sealing technologies in reducing infiltration. Results of this study will be used to quantify multi-family residents' potential exposure to pollutants and inform updates to improve building standards (such as for conduit construction and air sealing) in California's Title 24 Building Energy Efficiency Standards.

### **3) The health and air quality impacts of wildfire**

According to the Fourth National Climate Assessment, California and the West have already witnessed an expansion of catastrophic wildfires, and the frequency and severity are projected to increase. It is essential that we develop a greater understanding of the impacts of wildfire emissions on human health and air quality at local to regional scales. The objective of this project is to improve CARB's ability to model the impacts of fire on air quality and to provide a timeline of lifetime health effects from exposure to emissions during infancy. While most pollutants of anthropogenic origin are subject to increasingly strict legislation, wildfires emit significant amounts of particles and chemically reactive gases, which has important consequences for air quality management. To address the air quality impacts of wildfires, this project will leverage ongoing laboratory, field, and satellite sampling of emissions from biomass burning in varying conditions, including from prescribed and naturally occurring fires in managed and fire-suppressed forests. To address the health impacts, this project will extend an existing study that has followed monkeys that were naturally exposed to ambient wildfire emissions in infancy, to examine their health impacts in adulthood. This project has been developed with input from multiple State agencies, stakeholders, and academic researchers in this field of study in order to leverage other research efforts in the State and avoid duplication of effort. The results of this study will be useful in informing the selection of forest management practices that will minimize impacts on health, climate, and air quality. They may also be helpful in the development of biomarkers of wildfire exposure.

### **4) Incentivizing zero emission, high occupancy new mobility options**

New mobility options, including ride-hailing, ride-sharing, automated vehicles, first/last mile strategies, and alternatives to vehicles, are poised to become much more prevalent in the coming years. At the same time, California needs to reduce criteria pollutants, greenhouse gas emissions, and vehicle miles travelled in order to meet its air quality and climate goals and reduce congestion. This will require incentivizing zero-emission, high-occupancy new mobility options. CARB is currently examining the influence of automated vehicles on travel demand, acquiring activity data from ride-hailing vehicles, and helping MPOs develop successful new mobility strategies, while the Strategic Growth Council's "Climate Smart Communities Consortium" is supporting several case studies in California examining similar issues. The objective of this project is to identify and evaluate novel new mobility strategies and/or incentives (not currently being investigated by CARB or other state entities). This project will involve both a review of the academic literature and a critical analysis of new mobility/land use strategies around the world (e.g., in London, Toronto, Stockholm, and Singapore). It will then rank these strategies by how well-suited they are for California's projected land use and population, based on a quantitative (e.g., travel demand modelling) analysis. The project will also identify and evaluate novel methods for incentivizing new mobility (electric vehicles, ride sharing, active transport, etc.) based on their cost-effectiveness. This evaluation should be based in part on information collected from the general population, including potential ride-hailing/sharing drivers and passengers in disadvantaged communities. This information can be gathered via focus groups, surveys, smartphone location tracking, and/or odometer records, and will help determine what types of incentives best encourage use of zero-emission vehicles and

increase occupancy. Finally, this project will investigate the potential impact of autonomous vehicles, focusing specifically on how the cost and sharing of self-driving vehicles influences their use.

#### **5) White paper: Assessment of methods to collect and analyze Perfluoroalkyl and Polyfluoroalkyl substances (PFAS)**

Perfluoroalkyl and polyfluoroalkyl substances (PFASs) are a class of over 3,000 chemicals that are commonly used in household products and by industries such as chrome plating. Common household products that contain PFAS include stain- and water- repellent textiles, carpets, nonstick products such as cooking pans, polishes, waxes, paints, food packaging, and cleaning products. Exposure to PFAS from these products can readily occur because these chemicals persist in the environment and can become airborne and settle in to dust and soil, which can then be inhaled or consumed if they are suspended in water. PFAS have been found in over 99% of blood samples collected for a study on Californians. Perfluorooctanoic acid (PFOA) and Perfluorooctanesulfonic acid (PFOS) are the most studied PFAS chemicals and their toxicological properties are well-characterized. They are no longer manufactured in the United States, and are banned for use by industries, but they are still produced internationally and can be found in imported consumer goods. The International Agency for Research on Cancer (PFOA) and the US EPA (PFOA and PFOS) has classified these PFAS as possibly carcinogenic to humans, and OEHHA has listed PFOS as a Proposition 65 developmental toxicant. Due to these health risks, it is important for CARB to develop approaches for the collection and analysis of ambient air PFAS samples to determine the fate and transport of PFAS in ambient and indoor air, Californians' exposures to them, and their impact on public health. The objective of this white paper is to review the scientific literature to identify the best methods to measure ambient and indoor PFAS levels, including sample collection, extraction, and laboratory analysis and assess whether further method development is needed. The white paper will also provide a roadmap for characterizing the ambient and indoor concentrations of these compounds in order to determine exposures to them in California.

#### **6) White paper: Anti-displacement policy effectiveness**

Regions across California are pursuing more compact, transit-oriented development as a key strategy to achieve greenhouse gas reductions through their sustainable communities strategy per Senate Bill 375. There is concern that this type of development, especially around transit stations and stops, may result in increased property values and the displacement of low income households, which can also lead to an increase in vehicle miles traveled. The objective of this research is to analyze anti-displacement policies, both inside and outside of California, that seem to be most effective at mitigating displacement risk. This work will leverage existing literature reviews and expand them to include studies published outside of California. The project will analyze existing anti-displacement policies to determine a level of effectiveness as well as conduct interviews of local government and academics with experience in displacement and gentrification. The study will also identify research gaps and make recommendations for further analysis. The results of this study will help identify the most effective anti-displacement strategies and help guide future research and policy development.

#### **7) White Paper: A review of emerging technologies and methods for carbon sequestration**

The recent Intergovernmental Panel on Climate Change, Global Warming of 1.5°, and Executive Order B-55-18, both call for carbon neutrality by mid-century. Additionally, Board Resolution 17-46 directs the California Air Resources Board staff to continue to evaluate and explore opportunities to achieve significant cuts in greenhouse gases (GHG) from all sources. California's Greenhouse Gas Inventory shows that California's GHG emissions fell below 1990 levels in 2016, 4 years earlier than mandated by AB 32. The 2017 Scoping Plan Update details an achievable and cost-effective path to achieve the 2030 SB 32 target. However, in order to

achieve carbon neutrality mid-century, California will need to identify and recommend measures to remove GHG emissions from the atmosphere and oceans. The objective of this project is to review the literature to identify innovative technologies and remaining research gaps that need to be addressed to remove GHG emissions from the atmosphere and oceans. Nascent and shovel-ready technologies will be assessed for viability, particularly those that fall under the categories of direct air capture, biomass energy carbon capture and sequestration, carbon dioxide sequestration in commercial materials, and geologic sequestration in offshore or non-traditional reservoirs, such as basalts. These technologies will be assessed for scale, viability, cost-effectiveness, societal benefits, and potential risks to health, the environment, or disproportionate impacts on low-income communities. The review will also identify any existing local, state or national government programs that have attempted to mandate or incentivize the use of these technologies at scale in order to examine their achievements and barriers to success. Results from this review will provide recommendations for potential strategies that warrant future State research funding.