

**STATE OF CALIFORNIA
AIR RESOURCES BOARD**

**MEETING OF THE
RESEARCH SCREENING COMMITTEE**

**January 27, 2025
10:00 a.m.**

California Air Resources Board
Research Division
Cal/EPA Building
1001 I Street
Sacramento, CA 95814
(916) 445-0753

California Air Resources Board

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

January 27, 2025
10:00 A.M

Agenda

- I. Approval of Minutes of Previous Meeting
November 15, 2024 *i-iii*
- II. Discussion of Research Proposal
 - a. "Quantifying Greenspace Impacts on Human Health in California," University of California, Davis", \$697,489, Proposal No. 2889-315 1
- III. Discussion of Draft Final Report
 1. "Improved Assessment and Tracking of Health Impacts for California Communities Most Burdened by Pollution" University of California, Los Angeles, \$499,971, Contract No. 21RD005 11
- IV. Other Business
 1. Update on Research Planning

California Air Resources Board

Research Screening Committee Meeting
November 15, 2024
10:00 A.M

Minutes

Research Screening Committee Meeting Members in Attendance via Teleconference:

Dr. Sam Silva
Dr. Bryan Hubbell
Dr. Mary Johnson
Dr. Francesca Hopkins
Dr. Roya Bahreini
Dr. Michael Schmeltz
Dr. Aly Tawfik

I. Approval of Minutes of Previous Meeting

September 23, 2024

II. Discussion of Research Proposals

1. "Dust on the Horizon: Assessing Current and Projecting Future Health Risks from the Shrinking Salton Sea," University of California, San Diego, \$930,000

The Research Screening Committee (RSC or Committee) agreed that the scientific questions considered in the proposal are "interesting and worthwhile and will be valuable to community members." One RSC member asked how exposure to co-pollutants in Salton Sea dust, which could be a significant co-founder, would be factored into the health analyses. The contract manager explained that the health analyses would not include a cumulative exposure assessment but would be conducted using PM2.5 and PM10 measurements of Salton Sea dust and modeling. It was also explained that the presence of chemical constituents in the dust that could also induce health effects would be discussed in the health analysis and discussion sections of the final report. However, their estimated contribution to health effects, as specific causative factors, is outside the scope of this study. The PIs are requested additional clarifying language to the proposal to make this more apparent, including an assessment of the need for future epidemiological research once the chemical composition of Salton Sea dust is determined in this study.

Motion: Move to recommend that CARB accept the proposal, subject to the inclusion of revisions based on comments from the Committee.

The Committee approved the motion.

2. "Reducing Exposure with Air Cleaners and Technology (REACT) in At-Risk Communities," University of California, Berkeley, \$850,000

The RSC felt that there were many strengths in the proposal but did ask that sections of the proposal be revised or expanded on to address their questions and concerns. The revised proposal will then be reviewed by a subcommittee of RSC members, who would then make a decision on final approval.

1. There should be a better explanation about the literature review and how it will differ from what is already known.
2. The RSC would like to see more detail about the messages or educational interventions that will be made at the end of the study. Also, what recommendations are triggered if the air cleaners are not used?
3. The committee asked that a baseline level of participants' air cleaner knowledge be assessed, since the study population may be fairly well versed in the subject and to provide details on how this would impact inclusion of participants in the study.
4. If the surveys are based on households, not per individual, would that introduce a conflict by associating a household with two or more people with different behaviors? This could be difficult to disentangle. The RSC requested clarification about this aspect of the study design.
5. The RSC asked how the PurpleAir results would be associated with household cleaners and participants, since they are anonymized. The RSC asked that clarifying language be added to explain how the PA and air cleaner data are to be associated with the household, including or not including the participant.
6. There was some confusion over the use of an interrupted time series method. The RSC asked that the objectives of the study design be clarified and why there is not a sham air cleaner control group. Also, there are other factors besides technical issues that drive use of cleaners, such as noise. This is not a technical assistance issue, but a design issue. Should not assume why people are not using air cleaners. The proposal needs to better explain how barriers to air cleaner use will be determined.

Motion: Move to recommend that CARB accept the proposal, subject to subcommittee re-review and inclusion of revisions based on comments from the Committee.

The Committee approved the motion.

3. "HEAT–Health Equity and Adaptation to Extreme Temperature," University of California, Merced, \$600,000

The RSC agreed that the study's topic is highly worthwhile given the growing threat of extreme heat to public health and the need for more information on how to best mitigate this risk. They agreed that the reasoning for the study and the selection of Kern County as the case study location were justified and appropriate. Several key concerns were raised by the RSC:

- Better define the goals of the project
- Provide more background on the types of heat interventions to be considered and refine the criteria for intervention selection
- Address how to control for co-pollutants or investigate co-benefits (e.g., interaction effects) in the statistical models.

Motion: Move to recommend that CARB accept the proposal, subject to the inclusion of revisions based on comments from the Committee.

The Committee approved the motion.

4. "Assessing Health Impacts of Brake and Tire Wear Emissions in Overburdened Communities of the San Joaquin Valley," University of California, Berkeley, \$850,000

In addition to a brief overview of the study, staff provided information on the use of traffic data in the proposal for sample site selection. The RSC requested that additional information be added to the proposal on field measurements, sources of analysis, health metrics and their use in the model. Staff agreed to make this revision.

The following are major comments from the committee:

- Further information is needed on the use of exposure data from the PM1 instrument AS-PMS and the limitations in using this data to inform the development of the profiles for brake and tire wear.

- The use of highly detailed comprehensive data related to transportation and vehicle activity such as type of car, weight, age of car, speed, and road roughness needed to be clarified in the proposal. The process of site selection needs to be fully explained. Other uses of this detailed dataset and the limitation of its use in the final models need to be clarified.
- More Information on the limitations of the sampling and modeling techniques needed to be added to the proposal including the limitations of developing the brake and tire wear profiles and any limitations of the datasets used or developed through the field sampling study.
- Information needed to be added on how co-exposures (such as to heat and other pollutants) would be handled in the study.
- In Task 6, where people would be serving as their own control, more detail should be added on how subjects would be chosen, and how the control periods would be chosen for health outcomes.

Motion: Move to recommend that CARB accept the proposal, subject to the inclusion of revisions based on comments from the Committee.

The Committee approved the motion.

III. Discussion of Draft Final Reports

1. "Understanding Travel Demand and Built Environment Factors to Optimize Increased ZEV Access in Underserved Communities," University of California, San Davis, \$599,978, Contract No. 22STC017

The RSC provided the following feedback on the draft final report:

- The project aimed to understand the mobility needs and barriers to electric vehicle adoption in underserved communities, including disadvantaged, low-income, and tribal communities.
- The project conducted extensive listening sessions and a statewide survey to gather this information.
- The draft final report provided valuable data and insights ,however, the RSC expressed concern that the survey sample may not fully represent the state population. Staff explained that while the invited sample was representative, response bias was observed, with a higher proportion of older individuals participating—a common challenge in survey research.

- The RSC asked that staff look into the wording on page XV of the report regarding whether underserved communities would benefit from warranties. The current wording states they would benefit, but it seems the intent was to say they would not benefit.
- RSC members suggested that authors consider adding visuals to the report about the geographic distribution of the survey responses. The RSC noted that some findings were specific to certain regions, and it would be helpful to see how the sample was distributed geographically.
- The RSC asked that staff work with UC Davis to make the data from the report publicly accessible, while protecting private information, so that other researchers can benefit from this valuable dataset.

Motion: Move to recommend that CARB accept the draft final report, subject to the inclusion of revisions based on comments from the Committee.

The Committee approved the motion.

2. "Plume Capture Measurement of Vehicle Emissions at the Caldecott Tunnel for Heavy-Duty Emission Program Development and Verification," University of California, Berkeley, \$449,571, Contract No. 20RD004

The RSC commended the study as excellent and noted that the draft final report was very well-written, concise, and effectively presented the data and findings. They highlighted the comprehensive nature of the measurements and analysis, emphasizing that the data would be valuable not only for California but also for other regions with similar truck usage. The RSC also praised the report as an outstanding documentation of policy-driven changes in emissions from heavy-duty vehicles over the past decade.

Motion: Move to recommend that CARB accept draft final report, subject to the inclusion of revisions based on comments from the Committee.

The Committee approved the motion.

3. "Alignment of Planned Transportation Investments with Climate and Equity Goals," University of California, Los Angeles, \$199,950, Contract No. 21RD008

Staff provided a summary of the draft final report, covering the motivation for this contract. The summary highlighted the results and how they foresee these helping CARB advance Senate Bill 375 climate efforts.

RSC members found the report comprehensive. Chapter 2 was highlighted as a valuable foundation for understanding Metropolitan Planning Organizations' (MPO) role and function. RSC members noted that the report's recommendations to multiple stakeholders were encouraging to help improve collaboration among government agencies and MPOs. They specifically agreed on the recommendation for the state to provide additional resources and guidance to enable MPOs to accomplish their work effectively. Furthermore, the RSC mentioned that regional planning is complex and that MPO regions have varying needs and realities across urban, suburban, and rural areas, which call for unique approaches to specific regions. The RSC suggested that the research team modify the language of the recommendations to encourage state agencies, like CARB, to find individual solutions collectively through iterative processes with MPOs rather than compelling all MPOs to adopt an approach that may not be best suited for their region. Staff responded that researchers are bound to offer policy recommendations for government authorities to consider, and the authorities hold discretion over how they proceed and what level of collaboration and engagement they will pursue. Staff further added that CARB already provides guidelines to MPOs when adopting sustainable community strategies and that updates and guidelines setting have been done in a collaborative effort with MPOs.

Motion: Move to recommend that CARB accept the draft final report, subject to the inclusion of revisions based on comments from the Committee.

The Committee approved the motion.

Item No.: II.1
Date: January 27, 2025
Proposal No.: 2889-315

Staff Evaluation of a New Research Project

Title: Quantifying Greenspace Impacts on Human Health in California
Contractor: University of California, Davis
Principal Investigator: Peter James. ScD
Budget: \$697,489
Contract Term: 24 Months

For further information, please contact Dr. Barbara L. Weller at (279) 324-4816 or Barbara.Weller@arb.ca.gov

I. Summary

Urban greening is a key action included in CARB’s Scoping Plan to achieve net-zero greenhouse gas (GHG) emissions, and increasing urban forests is one strategy to achieve this goal. In addition to their role in reducing GHG emissions, urban green spaces provide a variety of health benefits to the communities of California. However, urban greenness is not distributed equally, and vulnerable communities and communities of color have less access to greenspace, as demonstrated in the qualitative analysis in the Scoping Plan. Preliminary research funded by CARB examined the health benefits of urban greenness and found substantial health improvements. This current proposal will use open access databases to develop a tool to quantify the human health benefits of greenspaces and their economic impacts including the differential impacts in vulnerable communities. This project will develop models and provide a current map of the quality and accessibility of greenness at the finest spatial scale possible, including different types of greenness such as trees compared to shrubs and grasslands. The maps will also describe how greenspace vary by racial/ethnic composition, and vulnerability. The researchers will develop methods to calculate the health benefits of greenness and their economic impacts at the state, regional, and local levels. The tool developed by this contract will be able to analyze the health impact of current levels of

urban greening and future projections of urban greening. The final methodology will be updateable and will be able to analyze a large number of scenarios quickly. This study will support CARB's Nature-Based Solution programs to increase greenspace in California communities, such as through street, neighborhood, and schoolyard greening efforts, including those related to AB 1757 which is designed to increase nature-based solutions. This project will be developed in close collaboration with the staff of CARB and will also be informed by engagement with a Community Advisory Group (CAG).

II. Technical Summary

Objective

The objectives of this proposal are to create a repeatable and transferable process using remotely sensed data that will: 1) develop estimates of different types of greenness and accessibility at the finest possible resolution; 2) quantify the health benefits of greenspaces, including economic impacts; and 3) estimate how the benefits of greenspace impact vulnerable communities. The study will develop methodologies that can be applied to both current levels of urban greenness and future projections of urban greening under climate change to assess the health benefits at the state, regional, and local level. The project will result in a spatially defined tool that CARB staff can update and continue using for future assessments of health impacts and their respective economic impacts under multiple different greening scenarios.

Background

Research increasingly indicates that greenspaces may benefit health by reducing exposures to air pollution, noise, and extreme heat and mitigating the impacts of these exposures on health. Additionally, greenspaces promote physical activity, encourage social interaction, reduce stress, and restore cognition. Collectively, these health benefits may have substantial economic impacts on the state. However, there are still large knowledge gaps in quantifying how changing greenspaces are related to changes in human health and the potential economic benefits of these changes. Moreover, greenspace is not equally distributed, and

underserved and overburdened communities may obtain greater benefits from greenspaces. Prior research from CARB has estimated that increasing greenspace statewide could lead to large benefits for health; however, these analyses were limited to using non-specific satellite vegetation indices. More work is required to quantify urban greenspaces based on numbers of trees, shrubs, grassland, access, location, and tree canopy cover metrics. These future analyses are fundamental to meet CARB's urban greenspace modeling needs. Furthermore, linking these novel greenspace metrics to underserved communities will aid CARB in estimating health equity concerns related to greenspace.

In response, this proposal will develop methodologies to fill these gaps in quantifying the human health benefits of greenspaces and to support CARB's Nature-Based Solution programs to equitably increase greenspace in California communities. These methodologies will be able to be applied to both current levels of urban greenness and future projections of urban greening under climate change to assess the health benefits at the state, regional, and local level.

Proposal Summary

Task 1. Development of an Overall Work Plan for the study

The research team will work with both CARB and the CAG in the development of this work plan. This work plan will include all aspects of the project including overall analysis of the project, data sets for health and greenness, methods for quantifying health benefits and economic quantification of such benefits. The datasets to be used and the methods need to be transferable and open access for staff to be able to continue to use this tool in the future.

Key Deliverables: A complete work plan for the study will be developed in consultation with CARB staff and with input from the CAG to include the study design and all aspects of this study. The work plan will include a list of health outcomes to be considered. This is an early deliverable and will be delivered three months into the project. Work will proceed with the contract after the approval of the work plan.

Task 2. Literature Review of the Health Impacts of Greenness and the Methods used to Quantify Health Benefits

The research team will conduct a systematic search of greenspace and health literature. Researchers will summarize study findings, including but not limited to those from CARB-funded projects, and will annotate the methodologies applied across studies. Close attention will be paid to exposure assessment, to ensure that the most accurate and specific metrics of greenspace exposure have been identified. Findings will be summarized for important vulnerable subgroups, including age groups, race/ethnicity, neighborhood socioeconomic status (SES), linguistic isolation, and urbanicity/population density.

Key Deliverables: Comprehensive reviews of the literature on the health impacts of greenness and the methodology and tools currently used to quantify the health benefits of greenness. This will include a table summarizing major findings, methodological approaches, and potential biases and limitations in literature. The literature review will be delivered six months into the project.

Task 3. Data Collection for Exposure and Health Impact Analysis

The researchers have collected large scale spatial exposure data including high resolution remote sensing data on landcover classification and statewide individual tree monitoring maps. A clear methodology for the development of exposure assessment using open-source data will be completed. Data used will be collected in collaboration with CARB staff and using a current CARB project with CNRA and NASA. Detailed information on remote sensing data and how this data will be incorporated into this project and what spatial deliverables will result directly from incorporating this remote sensing data will be provided. In addition, the researchers will use datasets on shrubs and grasslands to estimate other greenspace exposure.

The researchers have access to a large amount of open source health data, which may include mortality data, hospitalization (including heat-related illness) and birth outcomes data as well as datasets on potential confounding factors. The Contractor will work to identify health and

greenspace datasets that are routinely collected and are publicly available, in order to monitor how changes in greenspace exposures impact health outcomes. The project will provide a clear comprehensive plan of how all the variables/attributes will be synthesized and fit together to conduct the health analysis.

Key Deliverables: An easy-to-use dataset of all relevant data needed to perform all aspects of the exposure and health benefits analysis. In coordination with CARB, the Contractor will provide a catalog of greenspace and health datasets that are updated regularly, are open-source or made open-source, and can be linked to conduct epidemiologic analyses. The Contractor will also provide CARB with estimates for secondary datasets, including area-level SES and climate data, that can be used in analyses going forward.

Task 4. Development of Methodology to Quantify Health Benefits of Current and Future Urban Green Space Levels in California

The greenness layers for current levels of tree canopy will be mapped at a high resolution using a variety of datasets, including remote sensing data. Then, the project will develop dose response functions for health outcomes using current health data and the mapped greenness layers. These dose response relationships can then be used to calculate the impacts of future projections of greenness. The models developed will be able to produce maps of California showing the levels, access, and types of greenspace across the state. The maps will also describe how greenspace vary by area-level age, SES, racial/ethnic composition, and population density. The methodology will include an analysis of the health impacts of greenness at the finest spatial scale possible (zip code or census tract level) that can provide information on the distribution of impacts in vulnerable communities to identify areas that can most benefit from increased greenness. The health points to be studied will be decided in collaboration with CARB staff and will include mortality (all cause), hospitalization (cardiovascular and heat-related illness) and birth outcomes (birthweight and pre-term birth), and confounding factors will be accounted for in the analysis. The economic valuation of the health outcomes will be conducted for the project such as cost of illness and loss of

productivity. The team will build on previous work to estimate the changes in health outcomes from different urban greenspace scenarios in California. To estimate future greenspace scenarios, the Contractor will consult with CARB on the number of scenarios to be analyzed. The models developed will be replicable so that CARB staff can modify and run future scenarios after the contract ends.

Key Deliverables: Models of current greenness for the state of California will be developed at the finest spatial scale possible to produce maps on the quality and accessibility of greenness using open access datasets such as for trees compared to shrubs and grasslands. The maps will also be able to describe how greenspace differ in vulnerable communities. The Contractor will work closely with CARB staff on the methodology used and the linking of the datasets. Maps of greenness will be built such that they can be periodically updated into the future. This deliverable will be due before the contract proceeds to develop the health outcomes relationships in Task 4. The Contractor will then provide a model methodology to estimate impacts of current and future greenspace scenarios on health, as well as the economic benefits. The Contractor will examine at least four health outcomes. Methods and results for mortality, birth outcomes, and heat-related outcomes will be delivered by month 16 of the project.

Task 5: Quantification of Health Benefits for Current and Future Projected Levels of Greenness in California

Using the methods developed in Task 4, the investigators will calculate the health and economic benefits of both current and future projected levels of greenness in California. The benefits will be calculated both statewide and for regional and local areas of the state. The specific years to be analyzed and the scenarios for greenness used will be determined through collaboration with CARB staff. The project will provide details regarding how the future projection modeling will work, including model inputs and outputs, processing required, what drivers of change are included, and other details that will show the modeling satisfies CARB's needs. The researchers will also incorporate changes in estimates for the

potential confounders such as area-level age, SES and racial/ethnic composition, in addition to population averages into the models to quantify how the interaction between these factors might impact current and projected health benefits of greenspace.

Key Deliverables: The Contractor will provide quantitative estimates of the health benefits, and economic benefits, of greenspace under current and future green space scenarios. Estimates will be provided at the state, regional, and local level, and will account for current and projected changes in other spatial factors, including underserved populations and climate changes. The number of future greenness scenarios to be analyzed for quantified health outcomes will be determined by CARB and will include scenarios for 25 years and approximately 4 scenarios for each year, but will be up to 400 in total so the method to quantify health outcomes will be designed to quickly analyze these scenarios

Task 6: Community Focused Advisory Group

A CAG will be recruited and facilitated in collaboration with the UC Davis Center Towards Health, Resilience and Environmental Equity (THREE) Community Engagement Core to supplement and expand the expertise of the research team, in particular in the areas of equity-oriented research methodologies, ground truthing of health modeling, modeling for equitable benefits distribution, and research-to-policy and translation of research into community action. The Contractor anticipates the CAG will be made up of the following: 4-6 representatives from AB617 communities with urban greening strategies in their Community Emission Reduction Plans, and 2-4 representatives from community-based organizations with a focus on urban greening at either a local or statewide level.

Key Deliverables: The advisors will provide comments on the methodology and the workplan and on the results of the study to be included in the final report.

Task 7: Meeting, Reporting, Methods Transfer, and Preparation of Draft and Final Report

The research team will work closely with CARB staff on all tasks, meeting regularly and providing appropriate deliverables before moving onto the next task. The team will share all

code, documentation, and analyses with CARB staff and will ensure successful execution of the methods developed during this contract on CARB IT systems. Additionally, all data and code necessary to update the methods will be provided to CARB staff in clean, understandable, and well documented formats with the appropriate tutorials and meta-data.

Key Deliverables: The Contractor will provide CARB with code, documentation, and the final models. The Contractor will provide a draft final report nine months before the project ends, as well as a final report with a complex technical version and a version for lay audiences.

III. Staff Comments

A research concept to quantifying greenspace impacts on human health and ecosystem services in California was proposed and subsequently developed into a detailed scope of work for the CARB Fiscal Year 2024-2025 Research Project Solicitation, directed to the Universities of California or California State Universities. This team of investigators was selected to move from preproposal to full proposal development because the preproposal was well aligned with CARB's suggested scope of work. CARB collaborated closely with other agencies, including the California Department of Public Health and the California Office of Environmental Health Hazard Assessment, to review the research concept, preproposals, and the full proposal. Reviewers' feedback primarily focused on the gaps in information needed, particularly on the future modelling, remote sensing data, access to greenspace, types of greenness, and health outcome analysis. CARB staff worked closely with the investigators to develop the draft proposal. Staff received a revised version of the proposal that has addressed all of the comments from the reviewers.

Investigator Qualifications

Peter James (PI) has substantial expertise in greenspace epidemiology, including developing spatial metrics of greenspace and linking these data to large prospective cohorts to study associations with health outcomes. He has led multidisciplinary research teams developing novel metrics of greenspace and has modeled how these exposures are associated with health outcomes.

Alessandro Ossola (Co-I) is the lead of the Urban Science Lab at UC Davis with experience in research aimed at quantifying the fine-scale distribution and change of urban greenspaces and tree canopy cover.

Michael Springborn (Co-I) co-leads the Natural Resource Economics (NatuRE) and Policy Lab at UC Davis conducting research at the intersection of public health, economics and ecosystems.

Irva Hertz-Picciotto (Co-I) is Director of the UCD Environmental Health Sciences Center (EHSC) THREE, which develops collaborative research to advance understanding of environmental contributors to health, and translation of results into policies or practices to improve public health.

Jonathan K. London (Co-I) co-directs the Community Engagement Core of the UCD EHSC THREE and is a nationally recognized expert in Community-Based Participatory Action Research in environmental health and justice.

Shosha Capps (Co-I) has experience on action-oriented, policy relevant research addressing health, access, and exposure disparities experienced by low-income communities and communities of color in California's Central Valley.

Noli Brazil (Co-I) is an Associate Professor and Vice Chair in the Department of Human Ecology at UC Davis has extensive expertise on applying spatial data to solve problems in human health and ecology.

Staff believes that the PI and co-PI's expertise in environmental epidemiology, plant science, economics and community engagement, along with their established collaborations with community partners UCD EHSC THREE, make them well-qualified to lead this research project. However, staff are asking that the team include additional experience with remote sensing.

IV. Staff Recommendation

Staff recommends the RSC recommend that CARB approve this proposal for a total amount not to exceed \$697,489 subject to inclusion of any changes and additions specified by the Committee and by CARB staff and management.

Item No.: III.1
Date: January 27, 2025
Contract No.: 21RD005

Staff Evaluation of a Draft Final Report

Title: Improved Assessment and Tracking of Health Impacts for California Communities Most Burdened by Pollution

Contractor: University of California, Los Angeles

Principal Investigator: Michael Jerrett, Ph.D.

Budget: \$499,971

Contract Term: 36 Months

For further information, please contact Dr. Patrick Wong at (279) 208-7295 or Pat.Wong@arb.ca.gov

I. Summary

The project aimed to advance the ability to track, assess, and communicate community-level public health impacts that are often associated with air pollutant exposures. This is aligned with CARB’s goals of targeting air quality improvements in AB 617 and other heavily impacted communities by providing community level health metrics to complement other strategies such as community-based air monitoring and community-specific air pollution emission reduction programs.

Problem Statement

Assembly Bill (AB) 617 directs CARB to take measures to protect communities disproportionately impacted by air pollution, via localized air quality monitoring and improvements. An important aspect of this mandate, and the state’s broader air quality efforts, is the need to track and understand potential improvements to community health resulting from such programs in these and other heavily impacted communities. At present, no such systematic tracking system of health outcomes associated with air quality with readily accessible and cleanly summarized health data over time, at neighborhood scales, is in place. This need has been especially felt, and expressed by, communities most burdened by air

pollution. Additionally, a generalizable statistical framework that would enable evaluation and quantification of the community-level health impacts of environmental interventions is needed. Such a causal framework is necessary because many other factors beyond air pollution can affect observed health trends.

Objectives/Methods

In consultation with communities, the Contractor aimed to develop a prototype of an online health tracking system, using routinely collected administrative health data at the zip code geographic scale, that is scientifically valid, responsive to community concerns, and easily accessible as a web-based tool. This tool tracks health outcomes most likely to indicate near-term benefits from air quality interventions, such as emergency room visits for asthma. The system also utilizes metrics and data visualizations, developed in consultation with communities, to facilitate assessment and communication of community-level health data. In addition, the Contractor aimed to develop and apply advanced quasi-experimental causal statistical models to measure the impacts on a health outcome from an emission reduction policy in a heavily polluted community. This project's prototype online health tracking system, combined with the project's example of estimating causal effects, together provide an improved ability to track, assess, and communicate health benefits from environmental interventions.

Results for Final Report

Below are the key results from this project:

- 1) Developed from administrative data, a set of health outcomes useful for tracking community (i.e., at zip code geographic scale) health known to be associated with air pollution, in consultation with community stakeholders.
- 2) Developed summary health metrics and data visualizations for assessing and communicating the health status and changes over time at the community level, in consultation with community stakeholders.

- 3) Created a proof-of-concept online tool called CalHealthScore, in consultation with community stakeholders, incorporating results 1 and 2 above: CalHealthScore is a prototype of a user-friendly, web-based tool to track, visualize, and assess community-level health outcomes related to air pollution.
- 4) Assessed and quantified causal health benefits of the Emission Reduction Plan for Ports and Goods Movement, using advanced statistical methods to compare pre- and post-intervention birth outcomes across treatment and control groups.

Regulatory/Policy Implications

The development of CalHealthScore as a pilot tool represents a significant step toward democratizing health data for communities most burdened by pollution. By providing localized health metrics in a user-friendly format, the dashboard will empower communities to better advocate for evidence-based policy changes and more equitable resource allocation. Moreover, CalHealthScore and this project's example of the application of statistical modeling for the estimation of causal effects will aid CARB in future work by providing tangible and quantifiable metrics for assessing air pollution associated health disparities in communities throughout the state.

II. Technical Summary

Objectives

This project aimed to utilize routinely collected individual morbidity and mortality data from small geographic areas (i.e., at zip code level) to: 1) develop and create a user-friendly health tracking online system called CalHealthScore, and 2) develop a causal statistical framework, and an example of its application, for the evaluation of health impacts from an emission reduction policy.

Background

The purpose of this project was to develop a health tracking system in response to AB 617, which aims to protect communities disproportionately impacted by air pollution. This

initiative, directed by CARB and local air districts, provides funds for community-based air monitoring and the creation of Community-Specific Emission Reduction Plans. While these plans aim to address pollution sources and improve environmental conditions, a critical gap emerged: the absence of a systematic way to track potential health improvements resulting from these emission reduction and other policy efforts in these and other communities. Without such tracking, it would be challenging to evaluate the effectiveness of these programs to ensure they meet community health needs.

Project Summary

To meet the objectives, this project completed the following tasks:

Task 1: In collaboration with communities, developed a set of priority health outcomes and metrics from existing and routinely collected administrative data that are influenced by air pollution and so could reflect the impact of emission reduction efforts in communities.

The chosen health outcomes are sensitive to changes in air quality, responsive on short time scales, available statewide, at zip code scale, and timely. Specifically, the chosen morbidity data are from Healthcare Access and Information (HCAI) on emergency room (ER) visits, with conditions identified by ICD-10 codes for all-cause cardiovascular, all-cause cerebrovascular, all-cause respiratory, asthma, COPD, diabetes, diseases of the circulatory system and diabetes (DCS diabetes), dysrhythmias, ischemic heart disease, and total ER visits. All-cause mortality data are from the California Comprehensive Death File (CCDF).

In response to community stakeholder requests, health metrics were developed to compare a community's health status to that of another population, either to the state overall, or to California's healthiest communities. To define California's healthiest communities the contractors utilized the California Health Places Index (HPI), using the top 25% of communities having the best characteristics for access to healthcare, housing, education, clean air and water, and social support. HPI is a metric developed by the Public Health Alliance of Southern California (PHASC) to measure the healthiness of neighborhoods by combining over twenty

different measures of the social determinants of health. Also in response to community-based input, two different comparative summary metrics were calculated for each health outcome, in every California zip code, for each year (2015 thru 2018), adjusted for age (0-19, 20-44, 45-64, 65+ years) and sex (male, female, unknown): 1) Standardized Incidence Ratios (SIRs), which are the empirical number of observed cases divided by the number of cases that would have been expected if the community had the same health burden as the statewide population; 2) Relative Risks (RRs), which are the chance of a health outcome in a community, as compared to the average chance in the state. Note that the calculations of relative risks involve a Poisson-based count modeled value, as opposed to an empirical point estimate, which helpfully enables estimations of uncertainty such as 95% confidence lower and upper limits. Bayesian spatial smoothing was also utilized, in which data from nearby regions inform an area's estimates, which helps obtain more reliable results when data are sparse, such as in small zip code areas. Lastly, to provide a single summarized health indicator for each health outcome (as was requested by community stakeholders), the "excess number of cases" were calculated for each zip code and year, as compared to what would have been expected if the health burden had been the same everywhere in California.

Task 2: Developed and implemented a causal modeling framework using quasi-experimental methods, such as the difference-in-difference, to evaluate the impact of an air quality intervention over time. Specifically, the project assessed the health benefits (birth outcomes) of the 2007 Goods Movement Corridors policy (an AB 617 intervention), which targeted emissions reductions from transportation and freight activities in heavily polluted areas.

Task 3: In collaboration with communities, created a web-based tool to visualize and communicate the health data and metrics identified in Task 1, called CalHealthScore, currently hosted on UCLA's C-Solutions website. This tool offers customizable data visualizations by zip code, health outcome, and year, with educational resources plus data summaries and downloads also available. Developed using iterative engagement with communities, the number of excess cases is the key metric in the CalHealthScore tool that is

visualized. This key metric indicates how much more or less frequent a health outcome is in an area and year, compared to what would have been expected if the community's health burden had been the same as the state average. The CalHealthScore tool also computes the number of excess cases as compared to California's healthiest communities. The underlying data processing requirements were designed such that, given additional resources, CalHealthScore could be updated annually to reflect the ongoing health status of California's communities.

Community engagement and collaboration for Tasks 1 and 2 included monthly planning meetings with AB 617 stakeholders in the Bay Area, Central Valley, and Los Angeles regions, quarterly conference calls with Allies in Reducing Emissions (AIRE) Collaborative members, virtual workshops, and online surveys.

III. Staff Comments

The investigators provided CARB with a draft final report, and a link to the CalHealthScore prototype online tool in early December 2024. Staff from both the Office of Environmental Health Hazard Assessment and California Department of Public Health reviewed and provided comments on CalHealthScore and the draft final report. Research Division staff reviewed the draft final report and provided comments. Comments have focused on:

- 1) What might be the best name for the web-based tool?
- 2) Requests for additional documentation in both the web-based tool and the final report regarding:
 - a. Context on how the tool differs from existing online resources that provide health information
 - b. A video tutorial
 - c. Contact information
 - d. Separate lay and technical explanations for the following:
 - i. What the metrics (i.e., RRs, SIRs, excess counts) are, why they were chosen, how they are calculated (including information on small area

estimation techniques used), and how they are (and are not) to be interpreted

- ii. Why each health outcome was chosen, with supporting citations (especially review papers) on associations with air pollution
- iii. The advantages and limitations to the datasets utilized.

3) Requests for the final report to:

- a. Be re-organized such that each of the three major tasks is described cohesively (i.e., with intro, methods, and results together by task)
- b. Provide additional narrative on the reasons for the causal analyses and its different methods, choice of health outcomes, and interpretations of the results
- c. Include descriptions of possible next steps for the expansion of CalHealthScore to include additional years, continued improvements, and a mechanism for annual update
- d. Include a description of the desire expressed by community stakeholders for a large public health campaign centered around CalHealthScore, including workshops with other agencies and policymakers.

The project has met its objectives and deliverables, with the following exceptions:

- 1) Responses to the above comments
- 2) A public launch of the online tool
- 3) Copies of all software computer code and its documentation, to support dashboard expansion and maintenance.

IV. Staff Recommendation

Staff recommends the RSC recommend that CARB approve this report for \$499,971 subject to inclusion of any changes and additions specified by the Committee.