STATE OF CALIFORNIA
AIR RESOURCES BOARD

MEETING OF THE
RESEARCH SCREENING COMMITTEE

January 18, 2024
10:00 a.m.

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 18, 2024
10:00 A.M

Agenda

California Air Resources Board

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

November 17, 2023
10:00 A.M

Minutes

Research Screening Committee Members in Attendance via Teleconference

Francesca
Aly
Sam
Bryan
Roya

I. Approval of Minutes of Previous Meeting

September 6, 2023

II. Discussion of Research Proposals

2. "Using Integrated Observations and Modeling to Better Understand Current and Future Air Quality Impacts of Wildfires and Prescribed Burns," University of California, Davis, $805,000

One committee member recognized that the proposal was well developed, organized, and comprehensive enough to address the objectives of the study. Research hypotheses that introduce a research question and propose an expected result were clearly and concisely written.

The committee member provided the following key comments:

- The research team should have a plan for dynamic evaluation of sampling locations given high variability in year-to-year fires—would not be desirable for them to decide not to sample at a fire because they are waiting for a better match to their criteria.
- Provide more clarity on the prescribed burn scenarios — why not use the actual prescribed burn and then model a counterfactual fire scenario without the prescribed fire as well as a wildfire with the actual prescribed fire.

- The proposal will need to make some assumptions about the relationship between prescribed fires and the risks of wildfires in the same geography — including probability of ignition and severity/extent of the fire.
- Proposal should clarify what data will be used to inform the relationship between acres of prescribed fires and acres/intensity of wildfires. For example, is this just going to be based on expert judgement?

Staff briefly responded to the comments and agreed to address these concerns in a revised version of the proposal.

Motion: Move to recommend that California Air Resources Board (CARB) accept the proposal, subject to the inclusion of revisions based on committee comments.

The committee approved the motion.

3. "Impacts of Multiple Climate Change Stressors on Health in California," University of California, Los Angeles, $500,000

The committee requested clarification as follows:

- Please provide hypotheses or proposed mechanisms for the research topics addressed (i.e., make the research goals framed as testable questions).
- Please provide hypotheses or proposed mechanisms for the research topics addressed (i.e., make the research goals framed as testable questions).

Staff agreed to make the requested changes.

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

The committee approved the motion.

4. "Unlocking the Health Benefits for Californians through Active Land Management Strategies," University of California, Merced, $549,316

The committee was supportive of the proposal and acknowledged that it was an important study. The committee expressed concerns on using wildfire specific fine particulate matter (PM2.5) functions in place of health functions based on general PM2.5 for the health analysis given the limited literature to support those functions. The committee recommended that general PM2.5 health functions and wildfire specific PM2.5 functions be used for sensitivity analyses. The committee also commented that the researchers should consider using annual mean PM2.5 concentrations as opposed to daily concentrations in the health analysis and to investigate the impacts of treatment scenarios on wildfires occurring in both the wildland urban interface (WUI) and non-WUI areas.

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

The committee approved the motion.

III. Discussion of Proposed Contract Augmentations

2. "Impact of Air Pollution Exposure on Metabolic Outcomes for California Residents," University of California, Berkeley, $50,000, Contract No. 22RD010

   One committee provided the following comments:
   The team is well qualified to carry out this research, and it has high importance to CARB. Early results of this project are presented here, but it is not clear how the data products will be shared with the public. The project mentions that data will be transmitted to CARB, but there is not mention of making the data available to the public.

   Staff responded as follows:
   Although certain datasets, such as emissions and air quality data, can be shared with the public upon request, patient health information cannot be provided due to Institutional Review Board confidentiality guidelines. However, the research team will provide the public with a one-page summary of the study's findings in plain language. And, if feasible, CARB will explore ways to incorporate study results into regulatory health analysis.

   Motion: Move to recommend that CARB accept the contract augmentation, subject to inclusion of revisions based on comments from staff and the committee.

   The committee approved the motion.

3. "Total Exposures to Air Pollutants and Noise in Disadvantaged Communities," University of California, Berkeley, $75,000, Contract No. 20RD012

   The committee recommended moving forward with the report as-is.

   Motion: Move to recommend that CARB accept the contract augmentation.

   The committee approved the motion.

4. "Understanding and Characterizing Emission Factors from Burning Structures in California Due to Wildfires," University of California, Berkeley, $300,000, Contract No. 22RD004

   One committee member expressed that the approach appeared sound and would improve the strength of the original contract. The proposal clearly explains the purpose of laboratory experiments, which involve burning an array of samples under various ventilation, oxygen, and heating conditions. The results will be useful for direct

comparison to large-scale burns to better isolate the effect of materials and conditions on overall emissions of large-scale fires.

Motion: Move to recommend that CARB accept the contract augmentation.

The committee approved the motion.

IV. Discussion of Draft Final Reports (DFR)

4. "A Scenario Tool for Assessing the Health Benefits of Conserving, Restoring and Managing Natural and Working Lands in California," University of California, Los Angeles, $536,124, Contract No. 19RD015

   The committee acknowledged the extensive work that was presented in the DFR. The committee recommended that more discussion of the uncertainties and limitations of the wildfire specific PM2.5 health functions used in the study, and discussion of the large body of literature on the health impacts of general PM2.5, especially on cardiovascular outcomes, be included in the report. The committee also recommended to not include the statement comparing the prescribed fire smoke impacts to total wildfire impacts due to the speculative nature of the statement.

   Staff updated the committee on the additional reviews of the report by the California Department of Public Health, the Office of Environmental Health Hazard Assessment, and CARB staff in the Industrial Strategies Division. The main comments from these reviewers were to include more discussion of the uncertainties and limitations of the air quality modeling and the health scenario tool.

   Motion: Move to recommend that CARB accept the report, subject to the inclusion of revisions based on comments from staff and the committee.

   The committee approved the motion.

5. "Understanding and Mitigating Wildfire Risk in California," University of California, Berkeley, $900,000, Contract No. 19RD008

   One committee member expressed that the report has detailed very well the motivation, measurement approaches, and results from this project. The committee member provided the following key comments:

   - Mixing and dilution will affect the mixing ratios, particularly over longer timescales.
   - Since the drone sampled the plumes closer to the source and the ground sampling was farther, could reactivity of some of these volatile organic compounds (VOC) explain the observed differences?
   - Black carbon (BC) and PM2.5 are not conserved during transport. The loss of BC and formation of secondary PM2.5 would further impact the BC/PM2.5 ratio as compared with fresh emissions.

- The report presents a lack of a pronounced Modified Combustion Efficiency dependence of emission factors of VOCs, Organic Carbon, and PM2.5. Is there some inherent bias or high uncertainty in the measurements that do not capture the possible variability with burning condition?

Staff agreed to address these concerns in the report's revised version.

Motion: Move to recommend that CARB accept the report, subject to the inclusion of revisions based on committee comments.

The committee approved the motion.

6. "A Data Science Framework to Measure VMT by Mode and Purpose," University of California, Berkeley, $550,000, Contract No. 20RD005

   The committee provided a summary of the report, complemented findings from this report, and applauded CARB for selecting this project for funding. The committee also suggested changes for the contractor to improve the report. Some suggestions pertain to adding details of specific models used in the report rather than referencing publications that are not public. Other suggestions include incorporating further explanation and details to figures, adding additional data and sources to corroborate the report's conclusions, and providing details on the validation tests used in the report. Staff updated the committee about the concurrent review of the DFR from CARB staff and other agencies and acknowledged the alignment of the recommendations provided by the committee member and other staff. Staff agreed to request that the contractor address all comments.

   Motion: Move to recommend that CARB accept the report, subject to the inclusion of revisions based on comments from staff and the committee.

   The committee approved the motion.

7. "Measuring, Analyzing and Identifying Small-Area Vehicle Miles Traveled Reduction," University of California, Davis, $199,500, Contract No. 20RD006

   The committee provided a summary of report, complemented the comprehensive focus for the three selected areas, acknowledged the challenging feat of this study, and the findings not being in line with the premise. The committee also suggested changes for the contractor to improve the report. Some suggestions pertain to adding the equations used to compute the values that are reported on the figures. Other suggestions include incorporating confidence intervals, not just point measures as plotted on the figures; revisiting the overall conclusions on changes to vehicle miles traveled from the built environment to be deemed "inconclusive;" and suggesting recommendations for future work, such as adding quantitative data in the models and working with researchers residing in the study areas. Staff commented that the current DFR is a second draft and

similar comments about the study sample size were raised by other staff. Staff agreed to request that the contractor address the committee and additional staff comments.

Motion: Move to recommend that CARB revise the report and bring it to a future Research Screening Committee meeting.

The committee approved the motion.

Item No.: II.1
Date: January 18, 2024
Proposal No.: 2878-310

Staff Evaluation of a New Research Project

Title:	Ozone Exposure and Respiratory Effects – School Absenteeism, Asthma-related Symptoms, and Asthma-related Emergency Department visits and Hospitalizations
Prime Contractor:	University of California, Los Angeles
Subcontractor:	University of California, Davis
Principal Investigators:	Ying-Ying Meng, Ph.D. Ninez Ponce, Ph.D. Michael Jerrett, Ph.D.
Budget:	$500,000
Contract Term:	36 Months

For further information, please contact Dr. Hye-Youn Park at (279) 208-7575.

I. Summary

The California Air Resources Board (CARB) routinely quantifies adverse health endpoints associated with particulate matter exposure. Research has shown that numerous adverse health effects are associated with exposure to a variety of criteria pollutants and toxic air contaminants. In April 2020, CARB adopted Board Resolution 20-13 directing staff to expand their methodologies to include additional air pollutants and health endpoints associated with pollution exposure.

This proposed project will develop models that estimate statewide concentration-response (C-R) functions between respiratory health effects and ozone (O3) exposure. Additionally, this project will identify C-R functions not only for the average statewide population but also for subgroups such as by race/ethnicity, gender, and income. The United States Environmental Protection Agency currently relies on a 2001 study to estimate the health impact of O3 exposure on school absenteeism, which can now be updated with more recent data to better inform health analysis. The information gained through this

project will support CARB's ability to evaluate the effects of its policies and programs, including a wide range of public health benefits.

II. Technical Summary

Objective

The main objective of this study is to increase understanding of the respiratory health effects associated with exposure to O3 throughout California. The study's specific aim is to develop California-specific C-R functions between O3 exposure and respiratory health effects on both children and adults, and also for different subgroups based on race/ethnicity, gender, and income. These effects include asthma-related symptoms, school absenteeism, hospitalizations, asthma-related emergency department (ED) visits, and work loss days.

Background

Despite significant improvements in air quality control, O3 remains a major public health concern in the United States, particularly in California. While there is evidence that short-term and long-term O3 exposures can have adverse health impacts, very few studies have investigated the effects of O3 exposure on school absenteeism. Additionally, the short-term effects of O3 exposure have not been thoroughly studied due to the challenges of modeling O3 exposure and limited data on health outcomes. Moreover, there are no statewide population-based studies on the respiratory health effects of ambient O3 exposure on children and adults. The proposed research aims to address these gaps. The proposed study will identify associations between modeled daily O3 concentrations and respiratory health effects from the California Health Interview Survey (CHIS). This project will provide important health analysis information for CARB to support its regulations, strategies, and programs.

Proposal Summary

The proposed study aims to develop California-specific C-R functions between exposure to O3 and respiratory health effects, including school absenteeism, asthma-related symptoms, work loss days, and asthma-related ED visits and hospitalizations.

The investigators will conduct a systematic literature review on the impacts of short-term and long-term O3 exposures on a range of adverse health outcomes, including school absences, asthma-related

symptoms, asthma-related ED visits and hospitalizations, work loss due to sickness, work loss days due to asthma, and other respiratory disease-related health endpoints. Additionally, they will conduct a literature review of the effects of O3 on subgroups such as race/ethnicity, gender, and income group.

The investigators will utilize O3 concentration data from 2011-2019, which takes into account seasonal variations and complex O3 chemistry, with a fine spatial resolution of 4 km obtained from the chemical transport model developed by Dr. Michael Kleeman, University of California, Davis. They will use existing CHIS data from 2011-2019, which is based on the respondents' geo-coded residential addresses and interview dates. The investigators will link the modeled statewide O3 pollutants surface data to the CHIS data using geocoded addresses or zip codes. They will employ a refined air pollution exposure modeling approach to identify the effects of both short- and long-term O3 exposure on respiratory health statewide as well as on subgroups where possible (such as by race/ethnicity, gender, and income). These respiratory health effects include school absenteeism, asthma-related symptoms, work loss days, asthma-related ED visits and hospitalizations.

The investigators will develop statewide C-R functions that establish the correlation between ambient O3 and these health effects in both children and adults, as well as stratified by population subgroups to determine differential exposure and health impacts. Furthermore, they will assess how socioeconomic factors interact with exposures to increase the impact.

III. Staff Comments

Dr. Ying-Ying Meng submitted the proposal titled "O3 Exposure and Respiratory Effects-School Absenteeism, Asthma-related Symptoms, and Asthma-related ED Visits and Hospitalizations." The full proposal was reviewed by CARB staff in the Research Division and the Transportation and Toxics Division, and staff from the Office of Environmental Health Hazard Assessment.

The reviewers expressed support for the project and had no major concerns about the proposal. Most comments they made were for clarification, particularly regarding technical information and approaches. The investigators have addressed these comments in the current proposal. In addition, the

investigators have added a “Statement of Significance” section and descriptions about transferring data, analyses, and analytical tools to CARB.

The reviewers also recognized the high degree of expertise in exposure assessment, epidemiology, air pollution (including O3), and policy-relevant research on health equity represented by Drs. Meng, Ninez Ponce, Michael Jerrett, and Kleeman. Drs. Meng, Jerrett, and Kleeman have previously participated in CARB contracts. The reviewers expressed confidence that these researchers could conduct the project as presented in the proposal.

Staff believes that the investigators’ expertise and work on ambient O3 and respiratory health effects research make them the best persons qualified for this research project.

IV. Staff Recommendation

Staff recommends the Research Screening Committee recommend that CARB accept this proposal for a total amount not to exceed $500,000, subject to inclusion of appropriate additions and revisions specified by the Committee.

Item No.: III.1
Date: January 18, 2024
Contract No.: 21RD003

Staff Evaluation of a Proposed Contract Augmentation

Title:	Examining the Health Impacts of Short-Term Repeated Exposure to Wildfire Smoke
Contractor:	University of California, Irvine
Principal Investigator:	Jun Wu, Ph.D.
Contract Type:	Interagency Agreement
Additional Budget:	$25,000
Contract Term:	48 Months

For further information, please contact Dr. Barbara L. Weller at (916) 324-4816.

I. Summary

During the August 20, 2021 meeting, the Research Screening Committee (RSC) reviewed a contract to examine the health impacts of short-term repeated exposure to wildfire smoke in California, and the Contractor is now requesting an augmentation to that contract and a contract extension. This contract aims to provide timely information on the health impact estimates of wildfire smoke exposure that is expected to increase due to the impacts of climate change and the hotter and drier weather in California. In the contract, the University of California, Irvine investigators use advanced techniques to model statewide smoke exposure, link this exposure to multiple health outcomes, and apply statistical models to estimate the health effects for short-term wildfire exposure. The investigators also work with community partners to understand the community's concerns about the health effects of wildfire smoke. In the proposed contract augmentation, CARB will provide $25,000 in additional funding which will enable the investigators to perform additional analysis of the information collected from the community outreach activities, including surveys and focus groups in Task 5 of the initial approved contract. The new analysis results will provide an in-depth understanding of the community's concerns, and this information will better inform future community engagement workshops in this project. The main objective and tasks of the approved contract remain unchanged. The results of this contract and the augmentation will help

CARB better understand the concerns and communicate health impacts from smoke exposure in vulnerable communities and will inform CARB's programs and policies to reduce climate change impacts.

II. Technical Summary

Objective

The original contract's main goal and tasks remain unchanged with the contract augmentation, but the additional time and funding will ensure more robust results. The overarching goal of this contract is to advance the state-of-science regarding the short-term health effects of repeated exposure to wildfire-specific air pollution and to better communicate these health impact findings to vulnerable communities. By providing an additional $25,000, the investigators will be able to analyze the data gathered from the community engagement activities in Task 5, which include surveys and focus groups. Moreover, investigators need additional time to develop the machine learning model for Task 2 and ensure its quality and applicability. Thus, a 12-month extension is requested to complete the exposure modeling and additional analysis of the community outreach data.

Contract Background

On August 20, 2021, the RSC approved the contract to advance CARB's research on the health impacts of wildfire smoke in California due to more frequent and intense wildfires in recent decades. While air pollution from conventional sources have been linked to multiple health outcomes, the health impacts of exposure to wildfire-specific pollutants are not as well studied. This contract will provide wildfire-specific health estimates to assist CARB's analysis of the health burdens from wildfires, and thus will better inform CARB's wildfire mitigation programs and climate change policies. This contract will also provide information to improve messaging and outreach efforts designed to inform the public about the harmful effects of wildfire smoke, specifically in communities that are vulnerable to climate change impacts.

Summary of Proposal for Augmentation and Extension

The proposed augmentation will not change the original tasks of the contract, including

Task 1: Conduct a literature review on health impacts of wildfire-specific exposure; Task 2: Model statewide wildfire air pollution at a high spatiotemporal resolution across multiple years; Task 3: Obtain

health data; Task 4: Conduct an epidemiological analysis on the health effects of wildfire-specific exposure; Task 5: Conduct a collaborative and informative community outreach.

This augmentation will allow the investigators to perform additional analysis on the information collected from the community outreach activities in Task 5. The investigators plan to gather data from at least 100 participants through surveys and focus groups. The collected data will be translated from Spanish to English. After quality checks, the investigators will conduct a quantitative analysis of the survey data using the SAS program and a qualitative data analysis using NVivo software, which organizes, analyzes, and visualizes qualitative data to identify patterns. The outcomes of these new analyses will provide an in-depth understanding of the community's concerns on wildfire and smoke risk. The information will help the investigators better plan the future community engagement workshops that will disseminate the preliminary findings from this project and will contribute to CARB's understanding of the concerns of wildfire impacts in vulnerable communities.

III. Staff Comments

The principal investigator, Dr. Jun Wu, and the research team have been responsive and worked diligently to maintain progress toward developing the exposure models and more informative community outreach. Building upon the original approved $500,000 in this three-year contract, the $25,000 augmentation will assist investigators in better utilizing community input to provide in-depth analysis and effectively communicate with community partners and residents.

IV. Staff Recommendation

Staff recommends the RSC recommend that CARB accept this contract augmentation for $25,000, subject to inclusion of appropriate additions and revisions specified by the Committee.

Item No.: IV.1
Date: January 18, 2024
Contract No.: 20RD002

Staff Evaluation of a Draft Research Final Report

Title:	Measurements of Volatile Organic Compounds in the South Coast Air Basin: Chemical Characterization and Impacts of Potential Ozone and PM Formation
Contractor:	National Oceanic and Atmospheric Administration
Principal Investigator:	Jessica Gilman, Ph.D.
Contract Type:	Interagency Agreement
Budget:	$294,284
Contract Term:	36 Months

For further information, please contact Dr. Toshihiro Kuwayama at (279) 842-9873.

I. Summary

Air quality in the South Coast Air Basin (SoCAB) has significantly improved over the past five decades. However, the region falls short of meeting the National Ambient Air Quality Standards (NAAQS) for ozone (O3) and fine particulate matter (PM2.5), and the decreasing trends of these criteria pollutants have slowed. This emphasizes the need to understand present-day sources and chemistry influencing O3 and PM formation. In this project, the National Oceanic and Atmospheric Administration (NOAA) researchers conducted detailed chemical measurements of volatile organic compounds (VOC), the precursors of O3 and secondary particulate matter (PM), at the Caltech campus between August and September 2021. The study yielded the following key findings: 1) Ethanol and methanol persist as the most abundant VOCs in Pasadena 2021, highlighting substantial primary emission sources in the Los Angeles region; 2) tracers for VOC emission source sectors were identified, including D5-siloxane for personal care products, para-chlorobenzotrifluride for solvent-based coatings, Texanol for water-based coatings, and octanal and nonanal for cooking emissions. Using their correlations with carbon monoxide (CO), emission rates were calculated as 5.6 and 3.2 tons per day for octanal and nonanal, respectively, in the Los Angeles basin; 3) the ethane/CO emission ratio doubled compared to the CalNex 2010 campaign measured at the same site, consistent with increased ethane emissions from natural gas

usage. Coinciding mobile lab measurements during this study and subsequent airborne measurements in 2023 (both of which are not part of this contract) revealed prevalent ethane and propane throughout the basin, with prominent ethane sources near the Port of Long Beach; 4) isoprene was the single largest contributor to the VOC-hydroxyl radical reactivity, followed by formaldehyde, ethanol, and acetaldehyde. Aromatics were the dominant aerosol precursors; 5) the VOC/CO and VOC/ethyne emission ratios for 70 chemical species were generally lower than values during the 2010 CalNex campaign and consistent with those from the 2020 measurements.

This comprehensive dataset establishes a new foundation for evaluating emission inventories and chemical models, crucial for understanding and predicting O3 and secondary organic aerosol formation in the Los Angeles Basin. Ultimately, it can contribute to informing the development of effective regulatory policies for future State Implementation Plans (SIP) and O3 and PM reduction strategies.

II. Technical Summary

Objective

The primary goal of this project is to quantify and characterize speciated VOCs, and use this data set to examine the emission sources and chemistry in the SoCAB. The focus is particularly on providing insights into O3 and secondary organic aerosol formation.

Background

Under the Federal Clean Air Act, CARB is tasked with developing SIPs to attain health-based air quality standards. Despite substantial reductions in ambient O3 and PM in California over recent decades, the SoCAB continues to surpass the NAAQS for O3 and PM2.5. The recent stabilization of the average ambient O3 and PM2.5 levels in California presents added challenges in achieving lower design values and enhancing air quality. This stabilization may result from a combination of shifting precursor sources and changes in chemistry related to O3 and secondary PM formation. Consequently, understanding the current levels, sources, and chemistry of precursor VOCs is crucial for formulating future SIPs. This project aims to contribute scientific insights to guide SIP development by conducting comprehensive measurements of speciated VOCs in the SoCAB and characterizing their properties.

Project Summary

The draft final report (DFR) summarizes the results for the following major tasks.

Task 1: VOC Measurements

NOAA successfully conducted in-situ, speciated, sub-hourly VOC measurements (4-minute samples every 20 minutes) using a novel, custom-built Gas Chromatography-Mass Spectrometer on the Caltech campus between August and September 2021.

Task 2: Field Data and Final Data

NOAA has carefully calibrated and post-processed the field data. The measurements have been finalized and are now publicly available. (RECAP-CA/SUNVEx Data Download). The data source also includes information about data-sharing protocols.

Task 3: Data Analysis

NOAA has conducted a comprehensive analysis, including the examination of concentration levels, diurnal variations, tracer identification, emission quantification, and a comparison of the measurements with the data from the previous CalNex 2010 campaign.

III. Staff Comments

The Contractor requested a two-month delay in submitting the DFR due to the Atmospheric Emission and Reactions Observed from Megacities to Marine Areas field campaign in the summer of 2023. This request was approved.

The DFR provides an accurate account of the completed work. The DFR has been sent to staff from CARB's Research Division and CARB's Air Quality Planning and Science Division for internal review. A revised version incorporating CARB's comments has been provided to the Research Screening Committee (RSC) for review.

The project has successfully met its stated objectives, resulting in the acquisition of a robust VOC dataset and the completion of comprehensive data analysis. The insights derived from this dataset are highly valuable as they enhance our comprehension of emission sources and their respective roles in the formation of O3 and secondary organic aerosols. The depth of understanding achieved through careful data analysis positions this dataset as a pivotal resource in informing strategies for improving air quality.

The significance of the new VOC dataset and its associated analyses extends to the development of SIPs aimed at reducing O3 and PM levels in the SoCAB. For instance, this study reaffirmed CARB's understanding of the importance of biogenic isoprene (natural) and ethanol (anthropogenic) for O3 formation in the SoCAB, and provided a necessary contrast between ambient VOC levels in 2010 and 2021. By providing nuanced insights into the intricacies of emission sources and chemistry, the dataset provides CARB with the necessary information to formulate targeted and effective measures for mitigating future O3 and PM air pollution. As efforts to combat air pollution in the SoCAB continue, the outcomes of this project stand as a valuable resource, fostering a more informed and strategic approach to sustainable air quality improvement.

IV. Staff Recommendation

Staff recommends the RSC recommend that CARB accept this DFR, subject to inclusion of appropriate additions and revisions specified by the Committee.

Item No.: IV.2
Date: January 18, 2024
Contract No.: 20RD006

Staff Evaluation of a Draft Research Final Report

Title:	Measuring, Analyzing and Identifying Small-Area Vehicle Miles Traveled Reduction
Contractor:	University of California, Davis
Principal Investigator:	Susan Handy, Ph.D.
Contract Type:	Interagency Agreement
Budget:	$199,500
Contract Term:	36 Months

For further information, please contact Dr. Sarah Pittiglio at (279) 842-9114.

I. Summary

Metropolitan Planning Organizations (MPO) are required to adopt Sustainable Communities Strategies (SCS) that lay out the strategies by which the region will achieve its greenhouse gas (GHG) reduction targets, including strategies to reduce vehicle miles travel (VMT). Strategies to reduce VMT include changes to the built environment, to both land development patterns and the transportation system, that reduce the need for driving. As one way to test the effectiveness of these strategies, this project used available data to qualitatively examine changes in travel patterns associated with changes in land-use patterns and the transportation system in three case study areas: the downtown areas of Sacramento, Fresno, and Santa Monica. Overall, the report findings underscore the importance for the State to facilitate a more robust evaluation process to accurately assess the impacts of built environment changes on VMT in specific areas that captures data on travel patterns before and after the changes occur. The findings from this report should contribute to developing best practices, including establishing robust evaluation processes, for more SCSs that help meet air quality, climate, and VMT reduction goals, as mandated by Senate Bill (SB) 375.

II. Technical Summary

Objective

This contract aimed to document on-the-ground changes in the built environment, explore the contribution of local and or regional policy change and public and private investments, and assess whether changes in VMT occurred over the same period in the selected downtown case study areas of Sacramento, Santa Monica, and Fresno.

Background

SB 375, signed into law in 2008, directed CARB to collaborate with the State's MPOs to set regional targets for reductions in GHG emissions from passenger vehicles. The MPOs are required to adopt SCSs that lay out the strategies by which the region will achieve its GHG reduction targets, including strategies to reduce VMT. Strategies to reduce VMT include changes to the built environment, to both land development patterns and the transportation system, that reduce the need for driving. As one way to test the effectiveness of these strategies, this project used available data to qualitatively examine changes in travel patterns associated with changes in land-use patterns and the transportation system in the three selected case study areas.

Project Summary

This project documented on-the-ground changes in the built environment in three (3) selected downtown case study areas (i.e., Sacramento, Santa Monica, and Fresno) that experienced notable changes in their transportation systems and land development patterns between 2000 and 2019. The project assessed whether changes in VMT occurred over the same period and explored the contribution of local and/or regional policy change and public investments such as transit, bike, and pedestrian infrastructure as well as private development investments to the observed on-the-ground changes. The first part of the case-study analysis focused on identifying changes to the built environment in the area and the factors contributing to those changes, including broadly defined public policies and market forces. The second part of the case-study analysis examined changes in travel patterns in the area between 2000 and 2019 using available data sources. Estimates of reductions in VMT were promising, as were estimates of increases in the shares of trips by active modes, though the small sample sizes on which estimates were based makes them highly uncertain. In these case studies, changes to the built

environment were associated with changes in travel behavior consistent with the goal of reducing VMT. The study determined that to robustly evaluate the impact of built environment changes on VMT in specific areas, data on travel patterns must be collected before and after the changes occur.

III. Staff Comments

The previous version of the draft final report (DFR) for this project was tabled by the Research Screening Committee (RSC) at the November 2023 meeting. The committee suggested changes for the Contractor to improve the report. Their suggestions pertain to adding the equations used to compute the values that are reported on the figures. Other suggestions include incorporating confidence intervals, not just point measures as plotted on the figures; revisiting the overall conclusions on changes to VMT from the built environment to be deemed "inconclusive;" and suggesting recommendations for future work, such as adding quantitative data in the models and working with researchers residing in the study areas.

The current DFR was revised in accordance with the above comments by the RSC. In revising the report, the principal investigator provided a satisfactory response to the comments raised and made changes accordingly. The revisions include language to say the results are inconclusive, an explanation in the methodology section about the weighting for the used datasets, in addition to added margin of errors to figures; where appropriate.

IV. Staff Recommendations

Staff recommends the RSC recommend that CARB accept this DFR, subject to inclusion of appropriate additions and revisions specified by the Committee.

Item No.: IV.3
Date: January 18, 2024
Contract No.: 19RD026

Staff Evaluation of a Draft Research Final Report

Title:	Low Carbon Transportation Incentive Strategies Using Performance Evaluation Tools for Heavy-Duty Trucks and Off-Road Equipment
Contractor:	University of California, Irvine
Principal Investigators:	Stephen Ritchie, Ph.D.
Contract Type:	Interagency Agreement
Budget:	$1,000,000
Contract Term:	42 Months

For further information, please contact Dr. Sarah Pittiglio at (279) 841-9114.

I. Summary

In order to identify barriers to uptake of low-carbon technology (LCT), the research team conducted an analysis of existing market survey and real-world operation data of heavy-duty fleets and off-road equipment (ORE) participating in incentive programs. The project examined incentive programs as a whole and quantified socioeconomic, environmental, and health impacts as a function of incentive dollars spent on clean technology adoption. Using the market data, as well as inputs from other research projects, this project delivered a tool that forecasts LCT market penetration between 2020 and 2050 that considers incremental cost, projected availability of low-carbon fuel sources, estimated reduction of criteria pollutants, and greenhouse gas (GHG) emissions. Finally, this project estimated the year in which LCT solutions reach cost parity or market acceptance relative to conventional technologies without incentive program supports.

II. Technical Summary

Objective

The objectives of this research project are to identify potential policy and incentive strategies that promote greater adoption of LCT technologies (zero and near-zero carbon and pollutant emissions) in the heavy-duty and off-road sectors.

Background

The transportation sector is California's largest emitter of oxides of nitrogen (NOx) and GHGs and ORE has become the largest source of NOx emissions statewide. To meet federal health-based air quality standards and California climate change goals, including carbon neutrality by 2045, medium and heavy-duty trucks and ORE operating in California must transition to low-NOx emission technologies coupled with advanced renewable fuels and to zero-emission vehicles where possible. CARB has various policies aimed at reducing GHG emissions as well as toxic air pollutant emissions, including regulatory programs aimed at reducing GHG emissions as well as toxic air pollutant emissions of both on-road heavy-duty trucks and ORE. CARB also has incentive programs to promote clean technology uptake and nudge markets toward full-scale technology transformation by bringing capital costs and the total cost of ownership for clean technologies into line with equivalent costs for conventional technologies. Investment in incentives can significantly impact market behavior, environmental and health outcomes, and the broader economy. The aim of this project is to better understand the impact that incentives have on market behavior and to create a tool that CARB staff can use to design more effective incentive programs that will facilitate the transition to LCT in heavy-duty vehicles (HDV) and ORE.

Project Summary

The research team explored six (6) different research methods to fulfill the project objectives.

1. Incentive Program Synthesis

The research team synthesized current incentive program data and explored their effect on LCT uptake among HDVs and ORE.

2. Market Analysis

The research team identified existing and developing LCT and its applicability to heavy-duty on-road and ORE applications, selecting the most important sectors to evaluate in more depth based upon their potential to reduce emissions and forecasting technology and fuel costs out to 2050 for conservative, moderate, and aggressive market scenarios. They improved and expanded their Transportation Rollout Affective Cost and Emissions model to project total cost of ownership (TCO) for use in this research project.

3. Transition to LCT

The research team explored the technical and behavioral factors governing the transition to LCT through an analysis of existing literature and results from structured interviews conducted with heavy-duty and ORE fleets in California.

4. Performance Evaluation Tool (PET)

The research team developed an incentive program PET that employs a TCO-driven technology choice model to the evolution of fuel technologies in the fleet over time to quantify the emissions reductions, and ancillary benefits and cost-effectiveness of LCT incentive program designs targeting specific drayage, linehaul, and construction fleets of different sizes. For ORE it was projected that incentive program supports would be needed for the foreseeable future in order to maintain price parity with conventional technology. For on-road linehaul, drayage, and construction vocations with a range of incentive designs focused on duration of supports and caps tied to conventional technology costs show that cost parity can be reached by 2035.

5. Incentive Program Forecasts and Recommendations

Using this tool, the research team made recommendations on incentive strategies by vehicle and vocation types for the sectors in which shifting to LCT will have the most impact toward meeting the State's emissions goals, forecasting LCTs' attainment of cost parity or market acceptance relative to conventional technologies. To achieve the cost parity for HDVs by 2035, the results recommend an incentive design for CARB's incentive programs that gradually tapers from current (2023) levels down to zero by 2035. Unlike the current CARB incentives, the research team's recommended design institutes caps on incentives to keep them under the incremental cost difference between zero emission vehicles

and their conventional counterparts. The costs of the selected design range from $4.2B to $5.3B for incentives through 2035, with the mid-market estimate at $4.6B. To improve the likelihood of more favorable market conditions, the research team recommends that policymakers should particularly focus on fuel costs as sensitivity results show that they have the most impact on the TCO driving the transition. Bringing down the cost of electric vehicle supply equipment (EVSE) also shows a notable impact on TCO, particularly if optimized charging is used to increase the ratio of trucks to EVSE.

III. Staff Comments

This project has been steered and overseen by CARB staff from the Research Division, Industrial Strategies Division (ISD), Air Quality Planning and Science Division (AQPSD) and from the Mobile Sources Control Division (MSCD). Staff from these four divisions helped steer the project objectives and methods and shared a significant amount of incentive program data with the team. In particular, AQPSD provided significant direction on how to implement data from CARB's emission factor model (EMFAC). MSCD staff also recommended what types of input the PET tool should include to make it as usable as possible for CARB staff. Finally, ISD staff provided a lot of input on current programs, such as the Low-Carbon Fuel Standard program, which has a significant impact on total cost of ownership and therefore impacts the model outputs. The research team provided an initial draft final report (DFR) to CARB in October of 2023. CARB comments overall requested that the team correct language and facts around current CARB programs and provide clarity on model assumptions.

IV. Staff Recommendations

Staff recommends the Research Screening Committee recommend that CARB accept this DFR, subject to inclusion of appropriate additions and revisions specified by the Committee.