STATE OF CALIFORNIA
AIR RESOURCES BOARD

MEETING OF THE RESEARCH SCREENING COMMITTEE

May 5, 2026
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

May 5, 2026
10:00 A.M

Agenda

I. Approval of Minutes of Previous Meeting
   February 13, 2026 *i-v*

II. Discussion of Draft Final Reports

1. "Long-Term Chemical Characterization and Source Apportionment of PM2.5 in the San Joaquin Valley," University of California, Davis, $950,000, Contract No. 22RD038 1

2. "State of Zero Emission Vehicle Secondary Market and Accessibility Impacts in California's Underserved Communities," University of California, Davis, $500,000, Contract No. 22STC016 6

III. Other Business

1. Update on Research Planning

California Air Resources Board

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

February 13, 2026
10:00 A.M

Minutes

Research Screening Committee Members in Attendance via Teleconference
Dr. Danae Hernandez-Cortez
Dr. Thomas Bradley
Dr. Michael Schmeltz
Dr. Bryan Hubbell
Dr. Sam Silva
Dr. Aly Tawfik

I. Approval of Minutes of Previous Meeting

December 1, 2025

II. Discussion of Draft Final Reports

1. "State of Zero Emission Vehicle Secondary Market and Accessibility Impacts in California's Underserved Communities," University of California, Davis, $500,000, Contract No. 22STC016

   Staff provided Research Screening Committee (RSC or Committee) members with an overview of this project. The goal was to identify differences between new and used PEV drivers and internal combustion engine drivers and identify barriers to market growth. The research team also examined whether used PEVs remain, or are transferred out of California, and identified destination patterns in cases where the vehicles left the state. The research team found that there are differences between new and used PEV drivers, and any secondary market policies and programs developed need to address used PEV drivers should address affordability and practicality concerns. RSC members submitted written and oral comments about the project. The Committee found the project to be timely and informative. However, committee members voiced concerns about potential sampling bias and the usage of ChatGPT. The research team received the oral and written comments and is integrating the comments into the final report.

Motion: Move to recommend that California Air Resources Board (CARB) revise the draft final report and bring it to a future RSC meeting.

The Committee approved the motion.

2. "Equitable Electrification of Existing Buildings: A Pathway to Decarbonization," University of California, Los Angeles, $1,049,073, Contract No. 21STC023

   Committee members agreed that the report's findings were important, emphasizing that inequities in building electrification impacts across demographic groups must be thoroughly examined as California decarbonizes. They noted that the draft final report (DFR) was extensive and provided detailed analyses of electrification trends, capacity constraints, stakeholder decision making, and prioritization frameworks, along with focused emission estimates. Overall, members found the study comprehensive, methodologically robust, and well supported by a mix of quantitative analysis, interviews, and surveys. Remaining concerns were minor, including requests for clarification of certain statistical comparisons, potential use of California specific emission factors, and refinements to the equity discussion, but they agreed the work met the expected standard for approval, and recommended to approve it after these detailed comments addressed.

   Motion: Move to recommend that CARB accept the draft final report, subject to the 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, $874,980, Contract No. 20RD012

   The Committee reviewed the "Air Pollution and Noise Exposures to Residents in San Joaquin Valley" study (SPHERE), which assessed indoor and outdoor air quality and noise exposures in disadvantaged communities in Fresno and Stockton. Committee members both commented that the study was robust and well written, and noted the challenges faced during the study such as COVID-related delays, recruitment shortfalls (especially in Stockton), and data loss from monitoring devices.

   One Committee member asked for clarification about the sample sizes, enrollment rates, and verification that all participant households had adult-child pairs. Another RSC reviewer pointed out the investigators seemed to stress specific results that were favorable to the messaging, even when the results were not significant. They also requested more neutral language in statistical interpretations, clearer explanation of regression model selection,

and stronger discussion on why indoor concentrations were higher indoors than outdoors. Lastly, The RSC member wanted to see practical recommendations about what people could to reduce their pollutant exposures.

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

The Committee approved the motion.

4. "Impacts of Air Pollution on Life Expectancy Across Multiple Generations: Race, Ethnicity and Vulnerability Perspectives," University of California, Berkeley, $500,000, Contract No. 22RD011

   Staff provided a brief overview of the study to RSC members. Both RSC and staff agreed that this was a well-designed project and an informative report. It provided a very comprehensive reporting of results, especially for the age and race stratified estimates of life expectancy impacts. However, the RSC had several questions on the interpretation of results, as well as on the few gaps in the information provided regarding the inputs to the risk models.

   Committee members provided the following comments:

   - More information is requested on the modeling of PM2.5 at scales of 100-meter resolution.
   - Additional information is needed in the methods section of the report to show the characteristics of the air quality data being used for risk estimates.
   - Add a justification that the study of Life Expectancy is needed because it is a more relevant public health metric.
   - Adding the proportional change in Life Expectancy will help to clarify the relative magnitude of the impacts.
   - The PI could consider moving some of the age specific results to an appendix.
   - A number of papers from life expectancy studies seem to be missing from the literature review and these were provided to the investigators.

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

   The Committee approved the motion.

5. "Impact of Air Pollutant Exposure on Metabolic Outcomes for California Residents," University of California, Berkeley, $525,000, Contract No. 22RD010

   RSC members had several requests for clarification regarding data timelines, methodology, and policy framing. Key points included a potential inconsistency in data years (2010–2019 vs. 2014–2021) that needs resolution, and a request to clarify the meaning of the total at the end of Table 1 on page 32. Methodologically, questions were raised about how the 20% subsample on page 60 was selected, and why additional confounders like ambient temperature were not included in the analysis, especially given the vulnerability of Type 2 diabetes patients to heat. Reviewers also asked whether length of stay (LOS) was examined in relation to insurance status. Finally, while the economic benefits section is described as policy-relevant, it relies on reductions per interquartile range (IQR) for each pollutant. One RSC member noted would be helpful to translate IQR into concrete units (e.g., ?g/m? or ppb) and tie it to realistic policy scenarios, such as attainment standards or expected reductions under specific CARB or regional strategies.

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

   The Committee approved the motion.

6. "Demonstration of Sensor Technologies for On-Road and Off-Road Heavy Duty Diesel Vehicles," University of California, Riverside, $750,000, Contract No. 21RD007

   Committee members commented that the report was clear with excellent literature review, well-defined methods section, and good results. The Committee provided minor editorial comments, and recommended that the implications of this work for regulatory uncertainty or future capabilities should be clearly stated.

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

   The Committee approved the motion.

7. "Characterization of Tire-Wear and Brake-Wear PM Emissions Under On-Road Driving Conditions," Eastern Research Group, $649,993, Contract No. 22RD002

   The Contract Manager gave a brief overview of the project, describing the motivation, objectives, results, and implications. The Committee noted the

thoroughness of the report, comprehensive brake-wear and tire-wear emissions measurements and analysis, and relevance to the emissions inventory.

Motion: Move to recommend that CARB accept the draft final report.

The Committee approved the motion.

III. Other Business

1. Update on Research Planning

CARB staff provided the RSC with an update on CARB's Research Planning efforts. Staff stated that CARB is preparing the proposed research concepts for fiscal year 2026-2027. The first round of pre-proposal solicitations will be released publicly before the end of this month. CARB is planning a virtual public solicitation meeting for Wednesday March 4, 3:30 pm. This solicitation will result in proposals that the RSC will be reviewing at the August RSC. An additional round of solicitations will be made public in May. The projects being proposed this year align with the Proposed Five-Year Strategic Research Plan, approved by the Board on September 25, 2025. Staff let anyone interested know that the "Research Activities" CARB listserv can be followed for updates on research activities like the solicitation.

Item No.: II.1
Date: May 5, 2026
Contract No.: 22RD038

Staff Evaluation of a Draft Final Report

Title:	Long-Term Chemical Characterization and Source Apportionment of PM2.5 in the San Joaquin Valley
Contractor:	University of California, Davis
Principal Investigators:	Qi Zhang, Ph.D.
Budget:	$950,000
Contract Term:	36 Months

For further information, please contact Morteza Amini at (278) 208-7544.

I. Summary

The San Joaquin Valley (SJV) continues to experience persistent air quality challenges and remains among the most polluted regions in the United States, despite decades of regulatory action. Exceedances of the 24-hour PM2.5 National Ambient Air Quality Standard (NAAQS) of 35 μg m^{-3} occur most often during late fall and winter, when stagnant weather conditions, shallow boundary layers, and increased emissions drive severe pollution episodes. Progress in understanding the processes that form fine particulate matter (PM2.5) in the SJV has been limited by the scarcity of chemically resolved PM2.5 measurements.

This project aims to improve understanding of emission sources, chemical formation pathways, and meteorological drivers of PM2.5 in the SJV. To address this, near-real-time, long-term measurements of speciated PM2.5 were collected using advanced Aerosol Chemical Speciation Monitors (ACSM) in Fresno and Bakersfield over a three-year period. In addition, an intensive field campaign during the winter of 2023–2024 was conducted in Fresno by deploying state-of-the-art online mass spectrometers, including the soot particle aerosol mass spectrometer (SPAMS) and the Filter Inlet for Gases and AEROsols – Chemical Ionization Mass Spectrometer (FIGAEROCIMS), to provide enhanced quantitative constraints on primary emissions and secondary aerosol formation.

Together, the datasets acquired from the multi-year ACSM measurements and the intensive campaign measurements were utilized to perform advanced positive matrix factorization (PMF) source apportionment analysis to quantify major PM2.5 sources in the SJV and evaluate the importance of secondary formation processes. This work delivers a comprehensive, quantitative framework for understanding PM2.5 sources and secondary formation in the SJV, provides guidance on improving air quality modeling efforts that inform the State Implementation Plan (SIP), and suggests data-driven PM2.5 mitigation strategies.

II. Technical Summary

Objective

This study aims to improve the understanding of PM2.5 sources and formation processes in the SJV through multi-year ACSM observations and a focused intensive campaign during the winter of 2023–2024. The primary objective is to determine the contributions from primary emissions and secondary pathways, as well as to assess key meteorological and chemical drivers of PM2.5.

Background

The SJV remains one of the most polluted regions in the nation, with frequent exceedances of the 24-hour PM2.5 NAAQS during late fall and winter. Stagnant conditions, shallow boundary layers, and seasonal emissions drive severe PM episodes. PM2.5 is largely composed of organic aerosol and ammonium nitrate from mobile sources, residential wood burning, cooking, agriculture, and growing wildfire impacts. Black carbon from biomass burning and fossil fuel combustion is a key contributor in urban areas like Fresno and Bakersfield. Strong diurnal and seasonal patterns reflect changes in emissions, boundary layer dynamics, and secondary formation.

The SIP sets PM2.5 reduction milestones through 2025, and Senate Bill 1383 requires a 50% cut in anthropogenic black carbon from 2013 levels by 2030. To achieve these objectives, continuous, long-term, chemically resolved PM2.5 measurements are needed. A previous CARB-funded study (Contract No. 17RD008) showed that near-real-time ACSM data provides critical insight into non-refractory PM2.5 and its

variability. Therefore, to further improve the characterization of PM2.5 emission sources and to support future PM2.5 mitigation strategies in the SJV, this study extends the effort with similar advanced measurements using ACSM and other advanced technologies, and the application of source apportionment modeling to the acquired datasets.

Project Summary

This project advances the understanding of the emission sources, atmospheric processes, and meteorological drivers that contribute to the PM2.5 pollution in the SJV. Building on prior CARB-supported work (Contract No 17RD008), this study deployed advanced ACSM instruments to conduct long-term, near-real-time measurements of non-refractory PM2.5 (NR-PM2.5) at Fresno and Bakersfield sites over a three-year period. These observations, paired with co-located regulatory and meteorological data, provided a robust foundation to perform advanced source apportionment modeling using PMF to quantify contributions from primary emissions and secondary formation of ambient PM2.5. To complement these long-term datasets, a focused intensive field campaign was conducted in Fresno during winter 2023–2024, employing high-resolution online mass spectrometers (SP-AMS and FIGAERO-CIMS) to capture detailed chemical signatures of primary and secondary organic aerosols.

This project included four major tasks: 1) continuous ACSM measurements and rigorous quality assurance at both Fresno and Bakersfield sites; 2) a month-long intensive campaign in Fresno during the winter of 2023-24 using state-of-the-art mass spectrometry technologies (SP-AMS, FIGAERO-CIMS); 3) Apply PMF model for comprehensive source apportionment analysis of long-term and intensive-campaign data to resolve primary and secondary PM2.5 sources, evaluate meteorological influences, and compare inter-site variability; and 4) communication of findings through stakeholder engagement. This report presents detailed results, including characterization of long-term NR-PM2.5 composition, development of rolling-window PMF analysis with multilinear engine-2 (ME-2) source apportionment methods, investigation of wintertime formation processes using high-resolution measurements, and improved quantification of cooking-related organic aerosol through PMF analyses.

When compared to the datasets obtained from the regulatory beta attenuation monitors (BAM), the long-term ACSM-measured non-refractory PM2.5 (NR-PM2.5) accounts for the majority of PM2.5 mass, with differences relative to BAM largely attributable to refractory components (e.g., black carbon, dust, and metal salts) that are not detected by ACSM. Comparisons with U.S. EPA CSN filter samples data show good agreement for ammonium and nitrate, moderate agreement for sulfate, and larger discrepancies for organic aerosol (OA), which is consistent with the previous understanding of volatilization losses in filter-based measurements. Seasonal patterns are pronounced and consistent across both Fresno and Bakersfield sites: OA dominates year-round (approximately 70-75% of NR-PM2.5), while wintertime PM2.5 is strongly influenced by ammonium nitrate, which can comprise up to half of total mass during severe pollution episodes. Fresno exhibits higher concentrations and stronger nighttime enhancements associated with residential combustion and boundary layer stagnation, whereas Bakersfield shows greater contributions from PM2.5 refractory components and more regionally uniform secondary aerosol. Rolling-window PMF ME-2 analyses resolved six OA factors at both sites and highlight the dominance of secondary OA even during winter periods with elevated primary emissions.

The Winter 2023–2024 intensive campaign datasets from SP-AMS and FIGAERO-CIMS provided unprecedented mass resolution for chemical tracers, enabling the identification of 19 distinct OA factors through combined PMF of SP-AMS and FIGAERO-CIMS measurements. These results reveal that winter PM2.5 episodes arise from both enhanced nighttime primary emissions and substantial secondary production. Secondary OA accounts for nearly half of total OA, with fog-driven aqueous processing and nocturnal residual layer chemistry acting as major contributors that cannot be resolved using the ACSM dataset alone.

Overall, the integration of long-term monitoring with advanced rolling-window PMF source apportionment and targeted intensive measurements provided a comprehensive, process-level understanding of PM2.5 sources in the SJV. The findings emphasize that further research could provide valuable information on both primary emissions, particularly nighttime residential combustion, and key precursor gases that

drive secondary aerosol formation. Differences between Fresno and Bakersfield also highlight the importance of location-specific approaches that consider emissions, meteorology, and atmospheric processing characteristics. This project offers critical scientific insights to guide air quality modeling to inform the PM2.5 SIP to design effective PM2.5 mitigation strategies in the SJV.

III. Staff Comments

Staff from CARB's Research Division (RD), Monitoring and Laboratory Division (MLD), and Air Quality Planning and Science Division (AQPSD) reviewed the previous version of this draft final report. All relevant staff from RD, MLD, and AQPSD supported this project and provided constructive comments. The contractors fully addressed the comments and provided the revised DFR.

The contractor ensured that all objectives of this project, including instrument deployment, calibration, troubleshooting, data processing, data analysis, and data sharing, were met. Dr. Zhang also met all the deadlines for the interim deliverables of the project and delivered the DFR on time to CARB. This study provided CARB with a scientifically robust and invaluable long-term chemical speciation dataset of PM2.5 in the SJV, which will guide the future modeling efforts to inform the SIPs to design targeted mitigation strategies. The findings from this project also established the foundation for the CARB High-Resolution Advanced Monitoring Program (CHAMP), which aims to support CARB's efforts to expand the long-term ACSM operations through a statewide monitoring network. This effort is designed to further address key research gaps and meet the growing need for high-resolution chemical speciation data for PM2.5.

IV. Staff Recommendation

Staff recommends that the RSC advise CARB to approve the report, contingent upon incorporating the additions and revisions identified by staff and the Committee.

Item No.: II.2
Date: May 5, 2026
Contract No.: 22STC016

Staff Evaluation of a Draft Final Report

Title:	State of Zero-Emission Vehicle Secondary Market and Accessibility Impacts in California's Underserved Communities
Contractor:	University of California, Davis
Principal Investigators:	Gil Tal, Ph.D.
Budget:	$500,000
Contract Term:	33 Months

For further information, please contact Anna Wong at (279) 208-7203

I. Summary

CARB implements light-duty Zero Emission Vehicle (ZEV) regulations and incentive programs with the goal of increasing ZEV deployment to meet California air quality and climate change goals and ensure equitable access to clean vehicles for all Californians. As CARB continues to develop and refine light-duty vehicle regulations, a clear understanding of how policies influence the full ZEV market, including the secondary market, is essential. This project helps answer foundational questions about which policy levers are most effective in shaping the ZEV sector by examining who participates in the used ZEV market, how vehicles circulate within and beyond California, and how existing incentive programs affect affordability and access. These insights provide an empirical basis for designing future light-duty regulations and complementary programs that support market growth, consumer uptake, and equitable access to clean transportation.

Used vehicles account for approximately two-thirds of the vehicles purchased, making the secondary ZEV market a critical component of the California's ZEV deployment and retention efforts. This project advances our understanding of the state's used plug-in vehicle (PEV), meaning both battery electric vehicles (BEV) and plug-in hybrid electric vehicles (PHEV) market by assessing the socioeconomic, demographic, geographic and

behavioral characteristics of used PEV buyers, and comparing them with the purchasers of new PEVs and new and used internal combustion engine vehicles. Despite the growing importance of the used PEV market, there is limited existing research on this segment, as prior studies have largely focused on the early ZEV market characterized by shorter-range BEVs than those available today.

The objective of this contract was to assess the structure, performance, and equity implications of California's used PEV market and to identify barriers to market growth. The principal investigator (PI) conducted a literature review and administered a statewide survey to collect data on used PEV drivers, including demographic characteristics, charging behavior, and vehicle purchase decision-making factors. The analysis also examined whether used PEVs remain, or, are transferred out of California, and identified destination patterns in the case when vehicles leave the state. The results of this project will be used to inform state policies aimed at supporting market development, advancing equity, and achieving emission reduction goals.

Overall, key findings suggest that policies to expand access to home charging, reduce upfront costs through targeted incentives, and improve transparency around battery health could strengthen the used PEV market. Additionally, enhanced incentives and programs that support used PEV adoption may help retain vehicles within California, thereby maximizing the long-term climate benefits of state investments.

I. Technical Summary

Objective

Through analysis of socio-economic, demographic, geographic, and behavioral characteristics of used PEV drivers, the project answers several foundational questions needed to shape the PEV sector. Specifically, it evaluates how used and new PEV buyers differ, how used PEVs are driven and charged, the extent to which vehicle incentives affect both new and used markets, and how vehicles move into and out of California. These findings directly support policy discussions regarding whether hidden barriers may affect resale value, what regulatory or programmatic tools may be

needed to guide the growth of the used PEV retail market, and how the secondary market contributes to (or limits) equitable access to clean mobility.

Background

The study integrates a literature review, analysis of vehicle registration and interstate movement data, and a statewide survey to assess differences between new and used PEV drivers. The approach provides a comprehensive understanding of the used PEV market and supports CARB's policy objectives by identifying key motivations, barriers, and decision-making factors influencing used PEV adoption. The analysis offers evidence on consumer behavior, market dynamics, and barriers to adoption that can inform policies and programs to expand equitable access to PEVs.

Project Summary

Methods:

The project was comprised of following major components:

- *Literature Review:* The literature review identified the reasons why people adopt used things, including ICE vehicles and PEVs. The PI found 23 studies met their requirements for this project. Similar research projects used online surveys, surveys using vehicle registration data, and interviews. The literature review revealed that socio-demographic characteristics of used PEV owners are similar to new PEV owners. However, used PEV owners are more sensitive to upfront costs. New and used PEV drivers voiced concerns with battery performance and the availability of charging stations.
- *Survey:* The survey served as the main research tool for this project, with the intent of understanding the behavior and motivations of vehicle owners, specifically those that own or have owned PEVs. The PI used the DMV data set to inform the survey recruitment strategy and generalize the results of the sample survey to the broader population. The survey included open-ended questions, and optional questions. The survey was estimated to take 15 to 25 minutes and respondents could win a $40 Amazon gift card. The survey was

distributed online to 50,000 vehicle buyers in California. The PI received 3,396 and after filtering the responses had 2,717 responses to analyze.

- *Understanding ZEV Movement across State Lines:* The PI looked to understand the effect of state-level incentives for new PEVs on the number of used PEVs that leave California. The PI used S&P Global interstate transfer data from 2016 to 2023. The PI also used this analysis to identify environmental implications, specifically the emission benefits California subsidized EVs once the vehicles leave the state.
- *Stakeholder Engagement Efforts:* The PI along with researchers conducted regular progress updates with various state agencies throughout the contract. The PI drafted a final report summarizing all the completed work, including several policy recommendations. The policy recommendations centered around these key themes: 1) improving access to charging; 2) building confidence in the vehicle technology; and 3) incentives and education.

The analytical approach was based on econometric methods including descriptive statistics to document key trends and patterns, exploratory statistical analysis to identify relationships between variables, and modeling correlations between demographic, attitudinal, and behavior factors. The PI used two sets of DMV data, both from 2023. The second data set contains all 2023 model year vehicles and a subset of model year 2024 vehicles. The first data set was used for sampling for the survey.

Key Findings:

- *Used PEV drivers resemble new internal combustion engine vehicle buyers but are more cost sensitive:* Used PEV buyers are more likely to come from a low-income or disadvantaged community, with an income level similar to a new internal combustion engine vehicle buyer. However, used PEV drivers identified high upfront costs as one of the barriers to adoption. This finding aligns with previous research conducted on used PEV drivers.

- *Used PEVs function similarly to new PEVs once adopted:* Used PEVs have similar annual vehicle miles traveled as new PEVs. However, used PEV drivers typically have vehicles with a shorter range, meaning that they rely more on public charging and reported higher rates of driving limits due to charging constraints.
- *Incentives drive both new and used PEV adoption equally:* Incentives drive adoption. The PI conducted a survey experiment and results indicated about 21% of current PEV drivers, regardless of if the vehicle was new or used at the time of purchase, would not have selected a PEV without an incentive.
- *Home charging access is essential, not optional:* Respondents indicated that home charging is necessary, citing concerns about public charging availability, reliability and time to find functional chargers as barriers.
- *Battery information gaps may suppress market development:* About two thirds of buyers asked about battery health before purchasing the vehicle. Most relied on sellers or dashboard displays rather than third party testing. Most respondents indicated their battery was still under warranty when purchased, suggesting that warranty coverage may act as a deciding factor in purchasing a used PEV.
- *California exports over 240,000 used PEVs to Other States:* States with strong new PEV incentives import fewer used PEVs, suggesting that strong new PEV incentives may weaken demand for used PEVs. While most states receive some share of PEVs from California, Oregon, Arizona and Nevada received the largest share.

II. Staff Comments

Initial Comments

This project enhances CARB's understanding of the secondary ZEV market and used ZEV buyers. Overall, the report provides empirical evidence on consumer behavior, interstate vehicle flows, and structural barriers affecting used ZEV adoption, offering actionable insights for state policymakers. Staff find the analysis to be well aligned with California's efforts to design effective, equitable light-duty vehicle policies. A similar

project was completed in 2018, focusing on vehicles that were used from 2011 through 2015. Since then, the ZEV market has grown, with increasing ZEV sales, increased model availability, and improvements in the technology with advanced features and longer range BEVs. The changes in the ZEV landscape may have changed people's perceptions and opinions, particularly people that are more likely to purchase a used vehicle. Additionally, the technological improvements may have changed the demographics and behavior of used ZEV drivers since 2018. The added task of researching interstate trade of used ZEVs adds another layer of understanding of who is purchasing used ZEVs and where those vehicles are coming from into California.

In 2024, the PI provided staff with a separate literature review document. While completing other project tasks, the PI continued to update the literature review. Those updates have been incorporated into the draft final report. Staff shared the draft final report with other CARB staff in Sustainable Transportation and Communities Division, Mobile Source Control Division, Research Division, California Energy Commission (CEC), and Department of Transportation (Caltrans) for comment. Staff are currently in the process of compiling comments for the PI to address.

The PI and CARB hosted quarterly meetings to discuss progress of the project. These meetings included discussions on survey data collection, hypothesis development, and methodology. Once the survey was distributed and the analysis of the survey began, the PI provided initial results on specific topics of their analysis (e.g., household fleet composition). CARB and other agency representatives asked questions on methodology and provided feedback on the initial results. These comments and questions have been incorporated into the draft final report. The PI worked with CARB and other agencies to refine the initial set of hypotheses. The refined hypotheses have been incorporated into the draft final report.

The PI noted that this report may reflect a higher degree of uncertainty than similar studies. Staff agree that the timing of the survey may have influenced the findings, as data collection occurred in 2025 during a period of heightened political and economic uncertainty. Under these conditions, survey respondent perceptions and attitudes toward ZEVs may have been more volatile than during a more stable period, potentially

affecting survey responses. However, staff find that this context underscores the value of the report. Understanding consumer behavior and market dynamics during periods of uncertainty provides important insights into how resilient the used PEV market is to external pressures and how policy signals, incentives, and structural barriers influence adoption when conditions are less stable.

In addition, due to the very limited number of hydrogen fuel cell electric vehicles (FCEV) in the used vehicle market, the PI was unable to conduct meaningful analysis of used FCEV drivers. Should FCEVs become more prevalent in the future, staff recommend revisiting this research to assess the characteristics and experiences of used FCEV drivers.

Updated Staff Comments

Staff presented a draft final report previously to the RSC members during the February meeting. The research team received comments from CARB staff as well as written and oral comments from the RSC members that were tasked with reviewing the draft report. The comments from both RSC members and CARB staff focused on clarity and organization to improve reliability. The RSC members also highlighted concerns with the usage of ChatGPT, and questions on sampling behavior. In this second draft final report, the research team addressed the comments and concerns raised by the RSC members. The latest draft expands on the survey sample, highlighting the differences between the survey sample and the general population, and emphasizes that the sample is not representative of the California household population. The sampling protocol was designed to allow the PI to compare characteristics of PEV households, emphasizing the characteristics of used PEV households. The insights presented in this report can be used to help inform policy decisions to incentivize the adoption of used PEVs. Additionally, the report explains why the research team did not compare the U.S. and non-U.S. samples in the literature review. The research team expands on how they used ChatGPT in their analysis, providing a step-by-step description of how they used it and any changes they made when compared to other academic papers. Further, the PI explained that ChatGPT was used as a tool to assist the researchers and not to replace them.

Staff finds the changes made to the report to address the comments and concerns raised by both staff and RSC members.

IV. Staff Recommendation

Staff recommends that the RSC advise CARB to approve the report, contingent upon incorporating the additions and revisions identified by staff and the Committee.