STATE OF CALIFORNIA
AIR RESOURCES BOARD

MEETING OF THE
RESEARCH SCREENING COMMITTEE

March 21, 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

March 21, 2025
10:00 A.M
Agenda

I. Approval of Minutes of Previous Meeting

January 27, 2025 *i-iii*

II. Discussion of Draft Final Reports

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 *1*

2. "HIFIVE – Health Impacts of Filtration ImproVements in Elementary Schools," University of California, Irvine, $840,000, Contract No. 20RD015 *8*

III. Other Business

1. Update on Research Planning

California Air Resources Board

Research Screening Committee Meeting
January 27, 2025
10:00 A.M

Minutes

Research Screening Committee Meeting Members in Attendance via Teleconference:

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

I. Approval of Minutes of Previous Meeting

November 15, 2024

II. Discussion of Research Proposals

1. "Quantifying Greenspace Impacts on Human Health in California," University of California, Davis, $697,489, Proposal No. 2889-315

In addition to a brief overview of the study, staff provided a summary of the comments received from Research Screening Committee (RSC or Committee) members and the responses to these comments from the investigators. The RSC found the responses to their questions to be very helpful. The RSC requested that additional information be added to the proposal clarifying the complex interactions of environmental factors, methods to measure accessibility, the temporal scale of health outcomes assessed, uncertainty analysis and the role of advisory group. There was a discussion on areas that are out of scope for the proposal including assessment of biodiversity, aeroallergens, and wildfire impacts. Staff noted that wildfire is a consideration in the design of Assembly Bill (AB) 1757's Nature Based Solutions that will inform the future greenness scenarios but will not be part of this project. Data on disabilities and usage of greenspace will not be available and is out of scope for the proposal.

The Committee provided the following major comments:

- The complex interactions between greenspace, air pollution, and health as well as the impacts of heat and noise needs to be addressed.
- The role of factors including air pollution, heat, and walkability needs to be examined as a confounder, as a mediator, and as an effect modifier in the models used.

- An acrylic graph to lay out the complex pathways between exposures and health that will be used to inform both the literature review and the workplan needs to be added.
- More detail on uncertainty analysis for all models, including health and economic models, needs to be added.
- A discussion of the role of the community advisory group in identifying data to incorporate into analysis needs to be added.
- A detailed workplan needs to be developed as an interim deliverable at the start of the project to plan and direct the model development.

Motion: Move to recommend that California Air Resources Board (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. Improved Assessment and Tracking of Health Impacts for California Communities Most Burdened by Pollution," University of California, Los Angeles, $499,971, Contract No. 21RD005

Committee members provided substantial comments, as detailed below.

- Report - Overall Organization:
    - Provide an overarching introduction with an initial diagram that shows how each of the three (3) major tasks of the project are, or are not, related: 1) data sources and health outcome selections; 2) community engagements and CalHealthMap development; 3) causal framework.
    - Re-organize such that there's an introduction, methods, results, and discussion for each of the three (3) major tasks.
    - Report - Community Engagement:
        - Describe what was asked of the community engagement, its outcomes, and how what was received did, or did not, substantively shape the development of CalHealthMap. Provide examples of ways communities informed the design and functionality of CalHealthMap. Provide documentation of how CalHealthMap was altered to incorporate feedback from the community workshops.
- Report – CalHealthMap:
    - Clarify that CalHealthMap is a static prototype that's currently utilizing a finite health outcomes dataset.
    - Methods: Explain why each health outcome was chosen, with supporting citations (especially review papers) on associations with air pollution.

    - Methods: Provide separate lay and technical explanations of what the metrics are (i.e., relative risks, standardized incidence ratios, excess counts), 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.
    - Results/Discussion: Provide descriptions of the advantages and limitations to the datasets utilized.
    - Provide a discussion that includes information about next steps, including how CalHealthMap can be expanded to include: additional years of data, a mechanism for annual updates, and iterative updates. How could CalHealthMap be expanded to include air pollution data (including wildfire data), plus data on other factors that affect health? How could CalHealthMap be expanded to include other health data (e.g., mental health outcomes)? How can CalHealthMap be used in conjunction with further engagement with communities?

- Tool - CalHealthMap
    - Include links to other information sources on air pollution and its effects on health.
    - Include links to other information sources on other factors that affect health (e.g., social determinants of health, food availability, etc.).
    - Include an email address for feedback (e.g., CalHealthMap@arb.ca.gov).
    - Define confidence interval level (90%, 95%, etc.)
    - Provide a lay-friendly definition of relative risk that's more initially visible (i.e., not hidden in a minimized box).
    - Provide a lay-friendly explanation of why each health outcome was chosen, with supporting links on associations with air pollution.
    - Provide all software computer code and its documentation, to support future dashboard expansion and maintenance.

- Report - Causal Analyses:
    - Overall: Provide an introductory narrative on the motivations and reasons for the causal analyses, plus its connections to CalHealthMap (if any.)
    - Overall: Provide introductory information about the different methods, choice of health outcomes (e.g., why birth outcomes and not health outcomes from CalHealthMap?), choice of intervention, and interpretations of the results.
    - Overall: Provide introductory explanations of why certain advanced statistical models were used, including information on what these methods do, in layman's terms, and how these methods perform in relation to other statistical models.
    - Health Outcome Data: Explain why some pregnancy outcomes couldn't also be looked at (e.g., spontaneous abortion).
    - Exposure Data: Include information on air quality changes over the course of the intervention in the different areas, as an intermediate outcome measure.

- Methods: Present all modeling approaches (Difference-In-Difference, Difference-In-Difference-in-Difference, pre-post, interrupted regression), and why each was chosen.
- Results: Present the results more clearly, including a table comparing results across the different modeling approaches to help drive home the overall result (i.e. that generally the analysis did not find a significant impact of the goods movement policy regardless of the analytical approach.) Provide a takeaway that's useful and valuable.
- Discussion: Provide a discussion of possible reasons that no effect of the intervention was observed. Was it due to there being no changes in air quality, or were there other things happening that could have interfered?

Motion: Move to recommend that CARB revise the report and bring it to the next meeting.

The Committee approved the motion.

IV. Other Business

1. Update on Research Planning

CARB Staff provided the following update on ongoing research planning efforts:

The CARB Research Program is currently working on both the FY25-26 Research Planning Process, and on drafting a proposed Five-Year Strategic Research Plan which will cover fiscal years 2025-2030.

CARB initiated the annual research planning process in February of 2024 with the annual collection of comments and concepts. CARB received over a hundred comments and concepts and after extensive internal review, presented a list of 16 project concepts to the public in November 2024. The Executive Office is currently reviewing the final proposed list of project concepts. After Executive Office approval, CARB research program staff will develop project concepts. A public solicitation for pre-proposals is expected in early March of this year. The RSC will have the opportunity to review final selected proposals later this year.

In parallel with the annual planning process, Research Program staff started developing the proposed Five-Year Strategic Research Plan or Five-Year Plan. The Five-Year Plan will guide research project selection for the next five years and it will provide a thorough background of all the research CARB does either through externally funded contracts or through in-house research and collaborations. This Five-Year Plan is being developed through a rigorous public engagement process. CARB has worked with seven (7) community-based organizations to incorporate environmental justice research priorities throughout the Five-Year Plan, in all major areas that CARB funds research in. The draft proposed research initiatives were presented to the public during the November public meeting. Currently, the

draft proposed Five-Year Plan is being internally reviewed and revised. A publicly available draft Five-Year Plan will be available for a 30 day comment period in mid-May and will be presented to the Board during the June Board Hearing. For this Board Hearing the public will be able to submit comments in the public docket system and provide verbal comments. After the Board approves the Five-Year Plan and CARB staff addresses final comments, a finalized version will be published.

Item No.: II.1
Date: March 21, 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

This 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

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 University of California, Los Angeles (UCLA or 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 impact 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, provides 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 CalHealthMap, in consultation with community stakeholders, incorporating results 1 and 2 above: CalHealthMap is a prototype of a user-friendly, web-based tool to track, visualize, and assess community-level health outcomes related to air pollution; and

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 CalHealthMap 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, CalHealthMap 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 CalHealthMap 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 to help inform and protect communities disproportionately impacted by air pollution. Initiatives under AB 617,directed by CARB and local air districts, provide 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 reductions 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, the project 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 visits, with conditions identified by International Statistical Classification of Diseases (ICD-10) codes for all-cause cardiovascular, all-cause cerebrovascular, all-cause respiratory, asthma, chronic obstructive pulmonary disease, diabetes, diseases of the circulatory system and diabetes, dysrhythmias, ischemic heart disease, and total emergency room visits. All-cause mortality data are from the California Comprehensive Death File.

Many aspects of the tool were specifically designed in response to community stakeholder requests as described in the following examples. The 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 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, 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; and 2) Relative Risks, 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 intervention that 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 CalHealthMap, 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 CalHealthMap 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, CalHealthMap 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 stakeholders in the Bay Area, Central Valley, and Los Angeles regions, quarterly conference calls with Allies in Reducing Emissions Collaborative members, virtual workshops, and online surveys.

III. Staff Comments

CARB met with the Contractor prior to the January 27 RSC meeting, after which several revision requests were implemented in CalHealthMap, including: 1) Adding information about the tool's objectives and its status as a prototype; 2) Making edits to the narratives; 3) Clarifying where to find more information on the different health outcomes and air pollution; 4) Adding explanations about the data sources and ICD-10 codes; and 5) Including information about other available health and pollution tools on the web.

On January 27, 2025, the RSC reviewed the Draft Final Report. The RSC agreed that the project's CalHealthMap online prototype tool is a great step toward helping communities see and understand local data about how air pollution may affect them. However, the RSC did recommend that the DFR and CalHealthMap tool be revised and brought to a future meeting. These requested revisions to the DFR, included improving the its organization by illustrating how the three (3) major tasks (data source and health outcome selections, community engagement, and causal framework) were related, describing how the community engagement outcomes were solicited and how these shaped the development of CalHealthMap, clarifying why CalHealthMap's health outcomes were chosen and the limitations of the datasets used, providing both lay and technical explanations of the metrics made available in CalHealthMap, and explaining the causal analyses more clearly with introductory and lay-friendly information and interpretation of the results. Requested revisions to CalHealthMap Tool included adding a mechanism for feedback, providing additional lay-friendly explanations and links to other information sources, and making the software code and datafiles readily available.

CARB met again with the Contractor after the RSC meeting to discuss the revisions described above that were requested by the RSC. Additional changes to the report's causal analysis section were also discussed, including requests to add clarification that the causal modeling was not part of CalHealthMap, but instead was designed to test out methodology for accountability research. In addition, CARB asked the Contractors to more clearly explain the original concept for the causal analysis and the reasons for changing the research plan to focus on analysis of birth outcomes in relation to the California Goods Movement Plan. CARB asked the Contractors to clearly explain the findings of the causal analysis and the possible reasons for the null results in the study. Lastly, CARB also requested that the causal modeling section of the report be made more concise.

As of the time of writing, active work remained ongoing toward implementation of changes. Moreover, the following revisions and additions had already been made:

- Report - Community Engagement: Additional information provided, including relevant appendices; “Feedback & Actions” table clarified.
- Tool - CalHealthMap
    - A survey was created for feedback, with results going to the email address CalHealthMap@arb.ca.gov, which will be managed by CARB staff.
    - The uncertainty metric of “credible intervals” will be specifically defined.
    - A lay-friendly definition of relative risk has been made more initially visible.
    - An R-script has been written for easy download of all the tool’s data in the form of shapefiles; Code and documentation has been made available via GitHub.
    - In addition, live Air Quality Now data has now been added to CalHealthMap, which can be seen at the zip code level.

IV. Staff Recommendations

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.

Item No.: II.2
Date: March 21, 2025
Contract No.: 20RD015

Staff Evaluation of a Draft Final Report

Title:	HIFIVE – Health Impacts of Filtration ImproVements in Elementary Schools
Contractor:	University of California, Irvine
Principal Investigator:	Veronica Viera, Ph.D. Scott Bartell, Ph.D.
Budget:	$840,000
Contract Term:	48 Months

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

I. Summary

The objective of this study was to investigate the benefits of improved air filtration in elementary schools using standalone High-Efficiency Particulate Air (HEPA) cleaners in overburdened communities in the South Bay region of Southern California. In close coordination with the Los Angeles Unified School District (LAUSD), 17 elementary schools located in the cities of Carson, Torrance, Harbor City, and Lomita, were chosen for this study. In this crossover randomized controlled trial, 435 instructional classrooms in these schools received the HEPA filter intervention over the course of two school years (2022-23 and 2023-24). Daily particulate matter levels in classrooms, with and without the portable air cleaner intervention, were measured and compared to determine the effect of the intervention on indoor air quality. Particulate Matter (PM) 2.5 levels in classrooms located in permanent buildings were also compared to levels in classrooms located in bungalows/portable buildings on the school campuses. In addition, two epidemiologic analyses were conducted to examine the effect of the intervention on: 1) Student attendance days by classroom; and 2) Parental report of children's asthma events and respiratory symptoms. The results of the air quality monitoring showed that the average indoor PM2.5 in classrooms with HEPA filters was significantly lower than average PM2.5 in non-HEPA filter control classrooms. Average PM2.5 concentrations in classrooms located in permanent buildings was significantly higher than the average PM2.5 in classrooms located in bungalows/portable buildings. For the epidemiologic

analyses, this study showed that further improvements in classroom air quality can be achieved with additional filtration, but statistically measurable impacts on attendance or health were not observed.

II. Technical Summary

Objectives

The priorities of this project were to provide air filtration interventions to elementary schools in a way that maximized the benefits to the school community and provided meaningful data for understanding the benefits associated with the intervention. To accomplish this goal, the study included the following objectives:

1) Monitor PM2.5 levels at school locations;
2) Analyze classroom-level attendance; and
3) Analyze individual-level health outcomes

Background

CARB has several programs to provide funding for air cleaners in communities. CARB's Community Air Protection Incentives Guidelines include an incentive program that provides funds for schools in AB 617 communities and priority populations to upgrade filtration in their classrooms via the installation of higher particle removal efficiency filters on existing Heating, Ventilation, and Air Conditioning (HVAC) systems or the purchase of standalone HEPA purifiers. CARB also provides funding for similar projects in schools and homes across the state through its Supplemental Environmental Projects program. These measures aim to reduce PM2.5 exposures inside homes and classrooms in these communities where in many cases children are already disproportionately exposed to PM2.5. There is a substantial body of scientific evidence supporting the link between air pollutant exposure and child respiratory outcomes; however, few intervention studies appear to be available for directly estimating the health benefits of air filtration improvements in schools.

Project Summary

From July 2022 to June 2024, investigators used a block randomized trial to evaluate the impact of portable HEPA filter air cleaners in LAUSD classrooms. It must be noted that there was no change to classroom HVAC system filtration (Minimum Efficiency Reporting Value 13; [MERV 13]) levels prior to

the study commencement. Classrooms were randomized into intervention groups for 2022-23 and switched in 2023-24, allowing each classroom to receive the intervention in alternating years. This design minimized confounders and enabled comparisons across time and conditions. An intention-to-treat analysis was conducted to control protocol deviations and post-randomization factors.

1) Monitoring PM2.5 Levels: IQair monitors were placed in 200 of 435 classrooms, with data collected every six months. Fourteen monitors were lost, leaving 186 classrooms with usable data. Indoor air quality was analyzed relative to outdoor levels and compared between HEPA and non-HEPA classrooms.

2) Classroom: Attendance Analysis Attendance data from LAUSD was analyzed across two years. After excluding incomplete records, the final dataset included 639 classroom-years. Attendance trends were compared between HEPA and non-HEPA classrooms.

3) Individual Health Outcomes: The HIFIVE CARES study enrolled 20 asthmatic students for a 12-week symptom survey in 2024. Recruitment challenges, including LAUSD approval delays and limited parent outreach, resulted in low participation, reducing the ability to detect statistically significant health effects.

Results

For the school year September 2022 through May 2023, the average annual PM2.5 level in HEPA treatment classrooms was 39.6% lower than the average annual PM2.5 in non-HEPA controls classrooms. Similar results were observed for PM10 and PM1. For the school year September 2023 through May 2024, the average annual PM2.5 level was 48.5% lower than the average annual PM2.5 in non-HEPA classrooms. Average PM2.5 concentrations for 2022-2024 in classrooms located in permanent buildings were statistically significantly higher than the average PM2.5 in classrooms located in bungalows/portable buildings by 19.5% and 18.7%.

The average annual outdoor PM2.5 levels from September 2022 to May 2024 ranged from 6.9 to 10.8 $\mu g/m^3$ and no major wildfires occurred in the region during that time. Ratios of indoor PM2.5 to outdoor PM2.5 was lower in HEPA classrooms compared to non-HEPA classrooms, and differences varied depending on the school. The rate ratio and 95% confidence interval for the effect of the HEPA filter

treatment on annual attendance rates was 1.000 (0.997, 1.003) in the model adjusted for 2021-22 baseline attendance and not statistically significant (p = 0.98). The average number of symptoms per week ranged from 1 to 10 symptoms and did not differ significantly by treatment group (p = 0.85).

III. Staff Comments

Staff from the Research Division reviewed the Draft Final Report and provided comments. The project team addressed all comments in the current version of the Draft Final Report.

The study findings showed that adding portable HEPA air cleaners to classrooms that already had HVAC systems with MERV 13 air filters resulted in lower measurable PM concentrations and lower ratios of indoor PM2.5 to outdoor PM2.5 compared to control classrooms with non-HEPA filters. This demonstrates that further improvements in classroom air quality, especially in environmentally burdened communities, can be achieved with additional filtration even if these devices are used to supplement existing HVAC filtration systems. In addition, results from this study will add to the current literature and databases, which are lacking, on real-world effectiveness of air cleaning devices in classroom settings by providing data from additional scenarios that can be used in future studies and analysis. Regarding the results from student surveys, the study did not find evidence that these improvements in air quality were sufficient for measurable attendance and health benefits. Among children with asthma, the use of classroom HEPA filters did not significantly reduce symptoms, but these analyses were underpowered. The lack of a significant association also may have been due to the already low levels of PM2.5 in classrooms from using the HVAC systems with MERV 13 filters and the generally good outdoor air quality at the schools during the two years of the study.

IV. Staff Recommendation

Staff recommends the RSC recommend that CARB approve this report for $840,000 subject to inclusion of any changes and additions specified by the Committee.