BAY AREA
AIR QUALITY
MANAGEMENT
DISTRICT

ADVISORY COUNCIL MEETING (REVISED AGENDA LINK)

THIS MEETING WILL BE CONDUCTED UNDER PROCEDURES AUTHORIZED BY EXECUTIVE ORDER N-29-20 ISSUED BY GOVERNOR GAVIN NEWSOM

- **MEMBERS OF THE ADVISORY COUNCIL MAY PARTICIPATE BY TELECONFERENCE**

- **THE PUBLIC MAY OBSERVE THIS MEETING THROUGH THE WEBCAST OF THE MEETING BY CLICKING THE LINK AVAILABLE ON THE AIR DISTRICT'S AGENDA WEBPAGE FOR THE MEETING AVAILABLE AT**

https://www.baaqmd.gov/about-the-air-district/advisory-council/agendasreports

PLEASE CLICK THE LINK BELOW TO JOIN THE WEBINAR
WEBINAR ID: 946 9865 7522

https://bayareametro.zoom.us/j/94698657522

- **PUBLIC COMMENTS WILL BE TAKEN DURING THE TELECONFERENCE. INSTRUCTIONS WILL BE PROVIDED ON HOW TO COMMENT AT THE START OF THE MEETING. COMMENTS MAY ALSO BE SUBMITTED AT**

Comments@baaqmd.gov

TUESDAY
MAY 12, 2020
9:00 A.M.

AGENDA

1. **CALL TO ORDER - ROLL CALL**

PUBLIC MEETING PROCEDURE

The Council Chair shall call the meeting to order and the Clerk of the Boards shall take roll of the Committee members.

Comment on Agenda Items: *The public may comment on each item on the agenda. Email Comments for items on the agenda must be submitted to Comments@baaqmd.gov prior to the Council taking up the particular item and indicate the agenda item to which the comment relates. Emailed comments will be considered as the agenda item is taken up by the Council. Emailed comments containing 250 words or less will be read aloud by staff. Emailed comments exceeding 250 words may be summarized during the meeting, if feasible. Comments may also be made during the teleconference. Instructions will be provided at the start of the meeting.*

Staff/Phone (415) 749-

2. **APPROVAL OF THE MINUTES OF DECEMBER 9, 2019**

Clerk of the Boards/5073

The Advisory Council will consider approving the draft minutes of the Advisory Council Regular Meeting of December 9, 2019.

3. **PARTICULATE MATTER (PM) SYMPOSIUM OVERVIEW** **J. McKay/4629**
jmckay@baaqmd.gov

The Council will receive an overview of the Air District's Particulate Matter: Spotlight on Health Protection Symposium and review the October PM Symposium Summary and the December Advisory Council Meeting Summary.

4. **COMMUNITY PARTICULATE MATTER (PM) DISCUSSION OVERVIEW**
J. McKay/4629
jmckay@baaqmd.gov

The Council will receive an overview of a community PM discussion held on February 27, 2020, in Richmond, CA.

5. **UPDATE ON AIR DISTRICT PARTCIULATE MATTER (PM) POTENTIAL POLICY STRATEGIES**

J. McKay/4629
jmckay@baaqmd.gov

The Council will receive an update on the Air District's potential policy strategies regarding particulate matter.

6. **CHAIRPERSON'S REPORT**

The Chairperson will provide the Advisory Council with a report of recent and upcoming activities.

7. **REPORT OF THE EXECUTIVE OFFICER/APCO**

8. **PUBLIC COMMENT ON NON-AGENDA MATTERS**

Emailed comments indicating the comment pertains to non-agenda matters will be considered under this item. Emailed comments containing 250 words or less will be read aloud by staff. Emailed comments exceeding 250 words may be summarized during the meeting, if feasible. Comments may also be made during the teleconference. Instructions will be provided at the start of the meeting.

9. **COUNCIL MEMBER COMMENTS / OTHER BUSINESS**

Council members may make a brief announcement, provide a reference to staff about factual information, or ask questions about subsequent meetings.

10. **TIME AND PLACE OF NEXT MEETING**

At the Call of the Chair.

11. **ADJOURNMENT**

The Council meeting shall be adjourned by the Chair.

CONTACT:
MANAGER, EXECUTIVE OPERATIONS **(415) 749-4941**
375 BEALE STREET, SAN FRANCISCO, CA 94105 **FAX: (415) 928-8560**
vjohnson@baaqmd.gov **BAAQMD homepage:**
www.baaqmd.gov

- Any writing relating to an open session item on this Agenda that is distributed to all, or a majority of all, members of the body to which this Agenda relates shall be made available at the District's offices at 375 Beale Street, Suite 600, San Francisco, CA 94105, at the time such writing is made available to all, or a majority of all, members of that body.

Accessibility and Non-Discrimination Policy

The Bay Area Air Quality Management District (Air District) does not discriminate on the basis of race, national origin, ethnic group identification, ancestry, religion, age, sex, sexual orientation, gender identity, gender expression, color, genetic information, medical condition, or mental or physical disability, or any other attribute or belief protected by law.

It is the Air District's policy to provide fair and equal access to the benefits of a program or activity administered by Air District. The Air District will not tolerate discrimination against any person(s) seeking to participate in, or receive the benefits of, any program or activity offered or conducted by the Air District. Members of the public who believe they or others were unlawfully denied full and equal access to an Air District program or activity may file a discrimination complaint under this policy. This non-discrimination policy also applies to other people or entities affiliated with Air District, including contractors or grantees that the Air District utilizes to provide benefits and services to members of the public.

Auxiliary aids and services including, for example, qualified interpreters and/or listening devices, to individuals who are deaf or hard of hearing, and to other individuals as necessary to ensure effective communication or an equal opportunity to participate fully in the benefits, activities, programs and services will be provided by the Air District in a timely manner and in such a way as to protect the privacy and independence of the individual. Please contact the Non-Discrimination Coordinator identified below at least three days in advance of a meeting so that arrangements can be made accordingly.

If you believe discrimination has occurred with respect to an Air District program or activity, you may contact the Non-Discrimination Coordinator identified below or visit our website at www.baaqmd.gov/accessibility to learn how and where to file a complaint of discrimination.

Questions regarding this Policy should be directed to the Air District's Non-Discrimination Coordinator, Rex Sanders, at (415) 749-4951 or by email at rsanders@baaqmd.gov.

BAY AREA AIR QUALITY MANAGEMENT DISTRICT
375 BEALE STREET, SAN FRANCISCO, CA 94105
FOR QUESTIONS PLEASE CALL (415) 749-4941

EXECUTIVE OFFICE:
MONTHLY CALENDAR OF AIR DISTRICT MEETINGS

MAY 2020

TYPE OF MEETING	DAY	DATE	TIME	ROOM
Board of Directors Community & Public Health Committee – CANCELLED & RESCHEDULED TO WEDNESDAY, MAY 20, 2020 AT 2:30 P.M.	**Thursday**	**7**	**9:30 a.m.**	**Webcast only pursuant to Executive Order N-29-20**
Advisory Council Meeting	**Tuesday**	**12**	**9:00 a.m.**	**Webcast only pursuant to Executive Order N-29-20**
Board of Directors Technology Implementation Office (TIO) Steering Committee	**Friday**	**15**	**1:00 p.m.**	**Webcast only pursuant to Executive Order N-29-20**
Board of Directors Legislative Committee	**Wednesday**	**20**	**8:30 a.m.**	**Webcast only pursuant to Executive Order N-29-20**
Board of Directors Mobile Source Committee	**Wednesday**	**20**	**10:00 a.m.**	**Webcast only pursuant to Executive Order N-29-20**
Board of Directors Personnel Committee	**Wednesday**	**20**	**11:00 a.m.**	**Webcast only pursuant to Executive Order N-29-20**
Board of Directors Budget & Finance Committee	**Wednesday**	**20**	**1:00 p.m.**	**Webcast only pursuant to Executive Order N-29-20**
Board of Directors Community & Public Health Committee	**Wednesday**	**20**	**2:30 p.m.**	**Webcast only pursuant to Executive Order N-29-20**
Board of Directors Budget & Finance Committee – CANCELLED AND RESCHEDULED TO WEDNESDAY, MAY 20, 2020 AT 1:00 P.M.	**Wednesday**	**27**	**9:30 a.m.**	**Webcast only pursuant to Executive Order N-29-20**
Board of Directors Legislative Committee - CANCELLED AND RESCHEDULED TO WEDNESDAY, MAY 20, 2020 AT 8:30 A.M.	**Wednesday**	**27**	**9:30 a.m.**	**Webcast only pursuant to Executive Order N-29-20**
Board of Directors Mobile Source Committee - CANCELLED AND RESCHEDULED TO WEDNESDAY, MAY 20, 2020 AT 10:00 A.M.	**Wednesday**	**27**	**11:00 a.m.**	**Webcast only pursuant to Executive Order N-29-20**
Board of Directors Community & Public Health Committee - CANCELLED AND RESCHEDULED TO WEDNESDAY, MAY 20, 2020 AT 2:30 P.M.	**Wednesday**	**27**	**12:30 p.m.**	**Webcast only pursuant to Executive Order N-29-20**

JUNE 2020

TYPE OF MEETING	DAY	DATE	TIME	ROOM
Board of Directors Meeting	**Wednesday**	**3**	**9:30 a.m.**	**Webcast only pursuant to Executive Order N-29-20**
Board of Directors Budget & Finance Committee - CANCELLED	**Wednesday**	**24**	**9:30 a.m.**	**Webcast only pursuant to Executive Order N-29-20**
Board of Directors Legislative Committee	**Wednesday**	**24**	**9:30 a.m.**	**Webcast only pursuant to Executive Order N-29-20**
Board of Directors Mobile Source Committee	**Wednesday**	**24**	**11:00 a.m.**	**Webcast only pursuant to Executive Order N-29-20**
Board of Directors Stationary Source Committee	**Wednesday**	**24**	**12:00 p.m.**	**Webcast only pursuant to Executive Order N-29-20**
Board of Directors Climate Protection Committee	**Wednesday**	**24**	**2:00 p.m.**	**Webcast only pursuant to Executive Order N-29-20**

HL – 5/7/2020 – 9:00 A.M. **G/Board/Executive Office/Moncal**

BAY AREA AIR QUALITY MANAGEMENT DISTRICT
Memorandum

To: Chairperson Stan Hayes and Members of the Advisory Council

From: Jack P. Broadbent
Executive Officer/APCO

Date: May 6, 2020

Re: Approval of the Minutes of December 9, 2019

RECOMMENDED ACTION

Approve the attached draft minutes of the Advisory Council meeting of December 9, 2019.

DISCUSSION

Attached for your review and approval are the draft minutes of the Advisory Council meeting of December 9, 2019.

Respectfully submitted,

Jack P. Broadbent
Executive Officer/APCO

Prepared by: Marcy Hiratzka
Reviewed by: Vanessa Johnson

Attachment 2A: Draft Minutes of the Advisory Council Meeting of December 9, 2019

Bay Area Air Quality Management District
375 Beale Street, Suite 600
San Francisco, CA 94105
(415) 749-5073

DRAFT MINUTES

Advisory Council Regular Meeting
Monday, December 9, 2019

An audio recording of the meeting is available on the website of the Bay Area Air Quality Management District at
http://www.baaqmd.gov/about-the-air-district/advisory-council/agendasreports

1. CALL TO ORDER

Advisory Council (Council) Chair, Stan Hayes, called the meeting to order at 10:04 a.m. Chair Hayes congratulated Ex-Officio Advisory Council member, Rod Sinks, for being appointed as Chairperson of the Air District's Board of Directors for 2020. Mr. Sinks talked about upcoming Air District regulations that the Board will be considering in 2020.

Roll Call:

Present: Council Chair Stan Hayes; Vice Chair Dr. Michael Kleinman; and Members Prof. Severin Borenstein, Dr. Tim Lipman, Dr. Linda Rudolph, and Dr. Gina Solomon, and Ex-Officio Council Member, Rod Sinks, Board of Directors (Board) Liaison.

Absent: Member Dr. Jane Long.

Also Present: None.

2. APPROVAL OF THE MINUTES OF OCTOBER 28, 2019

Council Comments

Chair Hayes requested that the following revisions (in blue and red) to page 1 of the Draft Minutes of October 28, 2019 be made:

Advisory Council (Council) Chair, Stan Hayes, called the meeting to order at 9:10 a.m. Chair Hayes gave opening remarks, explaining that while this was a regular meeting of the Council, the first in a series ~~*part*~~ *of a "Particulate Matter (PM) Symposia" would be held during this meeting. He stated that* the three years of *intense wildfire smoke*, the District's focus on reducing Diesel Particulate Matter (PM) emissions, and the conclusion that PM is the overwhelming health risk driver in Bay Area air, ~~*events since 2017 to present day*~~ *have caused the Air District*

to focus on the need for measures to further protect public health from PM and explained that two panels had been convened; one to address "Particulate Matter Health Effects," and another to address "Particulate Matter Exposure and Risk."

Prof. Borenstein asked when an appropriate time would be to discuss the Council's vision for the subsequent PM symposia, and Chair Hayes suggested discussing that during item 4.

Council Action

Prof. Borenstein made a motion, seconded by Dr. Solomon, to **approve** the Minutes of October 28, 2019 **as amended**; and the motion carried by the following vote of the Council:

AYES:	Borenstein, Hayes, Lipman, Rudolph, Solomon.
NOES:	None.
ABSTAIN:	None.
ABSENT:	Kleinman and Long.

3. PUBLIC COMMENT ON AGENDA MATTERS

Public comments were given by Dr. Ashley McClure, California Climate Health Now; Jed Holtzman, 350 Bay Area; and Greg Karras, Communities for a Better Environment (CBE).

Committee Comments

The Council discussed what has been informing its decision to recommend that PM standards should be lowered.

NOTED PRESENT: Vice Chair Kleinman was noted present at 10:16 a.m.

4. PARTICULATE MATTER SYMPOSIUM OVERVIEW

Chair Hayes gave the presentation *PM Protection Symposium (Advisory Council Meeting of October 28, 2019)*, including: PM focus; PM symposia; key points; speaker profiles; Air District's questions; discussion questions; Council initial deliberation; PM symposium series; ambient PM; mortality (long-term $PM_{2.5}$ exposure); Draft PM Integrated Science Assessment effects: causality determinations; populations potentially at increased risk of a PM-related health effect; summary of risk estimates; preliminary conclusions on the current primary $PM_{2.5}$ standards; primary $PM_{2.5}$ marginal damages; damages and premature mortality; regional-scale and community-scale modeling in 2017; clear evidence of an association between wildfire smoke and respiratory health; and wildfire-$PM_{2.5}$ increases heart attack and stroke.

Council Comments

The Council and staff discussed proposed PM symposia timeline into 2020; the request for a proposed plan that focuses on implementation that will address the current National Ambient Air Quality Standards, currently viewed by the Air District as inadequate; and whether the Air District believes that costs should be considered when these standards are revised.

Council Action

None; receive and file.

5. UPDATE ON PARTICULATE MATTER AIR DISTRICT WORK

Dr. Jeff McKay explained that various Air District staff, and a staff member from the California Air Resources Board (CARB), had separate presentations to present to the Council within this item.

Dr. Phil Martien, Director of Assessment, Inventory, and Modeling, gave the staff presentation *Regional-and-Local-Scale $PM_{2.5}$ Source Apportionment,* including: overview; regional modeling; primary and secondary contributions; 2016 Bay Area emissions summary for key secondary $PM_{2.5}$ precursors; $PM_{2.5}$ Bay Area emissions summary for primary $PM_{2.5}$; emissions inventory for information gaps; $PM_{2.5}$ Bay Area emissions apportionment; on-road vehicles; regional-scale and community-scale modeling in 2017; modeled primary $PM_{2.5}$; local versus regional; West Oakland example; unequal impacts: $PM_{2.5}$ in West Oakland; additional emissions inventory information gaps identified; $PM_{2.5}$ emissions from permitted facilities; and summary.

Council Comments: The Council and staff discussed different impacts that Primary $PM_{2.5}$ could impose on human health, depending on its proximity (regional versus localized); the annual average of $PM_{2.5}$ levels from local sources in West Oakland, and whether the Air District's modeling of this indicates variability on a weekly basis; the fact that uncertainty in the emissions for sources such as road dust, on-road wear, residential wood combustion, and commercial cooking are very high, outdated, still being evaluated, and not included in the data of presentation; the settlement between the U.S. Environmental Protection Agency (EPA) and Lehigh Cement Company, LLC and Lehigh White Cement Company, LLC, which addresses how the companies will rectify Clean Air Act violations at their facilities located in seven states, and the Air District's involvement as a plaintiff; how community-level source apportionment in the Bay Area affects global warming impacts; technologies for mitigating vehicle brake and tire wear; whether the Air District has the capability of modeling regional-level source apportionment; the suggestion that the Air District considers an air toxics approach that may also reduce PM emissions; the impact of vehicle exhaust and how speed and traffic flow affect that; and whether the Air District has the authority to regulate commercial cooking and residential wood combustion for $PM_{2.5}$ emissions, and if so, whether those reductions can be easily achieved.

Dr. Ranyee Chiang, Director of Meteorology and Measurements, introduced Assistant Managers, Ila Perkins and Kate Hoag, who gave the staff presentation *Monitoring,* including: measurements in the Bay Area; regional/regulatory network objective; monitoring network design criteria; PM measurements; Air District PM instrumentation; ultrafine PM (UFP) monitoring; new developments: hyperlocal, street-by-street monitoring, mobile laboratory, and portable platforms; what does the UFP data show; wildfire smoke dramatically affects Bay Area $PM_{2.5}$ levels; Air District's strategy to reduce impacts from wildfire smoke; combining monitoring strategies for multiple objectives; and integrated PM network assessment.

Council Comments: The Council and staff discussed the costs of UFP monitoring technology and the suggestion that the EPA, CARB, and Air District pool their resources to fund a challenge for companies to develop more affordable monitoring technology for UFP; sources of near-roadway UFP, and whether the Air District has considered implementing regulations to reduce near-roadway exposure to UFP; the difficulties of correlating UFP and $PM_{2.5}$ concentrations; how UFP precursors can be influenced by both photochemical reactions and anthropogenic activity; whether the Air District has the resources to monitor UFP concentrations at various distances from roadways, and whether the Air District has seen correlations between UFP concentrations and stationary sources; and the manner in which data from the Air District's Regional Network is made publicly available.

Karen Schkolnick, Strategic Incentives Division, gave the staff presentation *Air District Grant Programs Overview,* including: overview; background; grants overview and priorities; project evaluation; >$97 million awarded to eligible projects in 2018; eligible projects in on-road vehicle, off-road vehicle, trip reduction, and passthrough and other categories; supporting Air District initiatives: path to Diesel-Free by '33, Bay Area electric vehicle (EV) trends and goals, advanced technology demonstrations, and early emissions reductions at the Port of Oakland; results and highlights; and next steps.

Council Comments: The Council and staff discussed Diesel PM (DPM) emission reductions at the Port of Oakland that were achieved by retrofit projects sponsored by the Air District; which funds may finance vehicle miles traveled (VMT) reduction projects, and the comparison between funds allocated for VMT reduction projects versus other types of transportation projects; the intended objectives of the Air District's Diesel Free by '33 initiative; the type of PM that is used in the current cost-effectiveness formula dictated by the CARB Carl Moyer Program Guidelines; and the number of public EV charging ports that have been paid for with Air District funds that are powered by renewable energy.

The Council recessed at 12:38 p.m.; the Council resumed at 1:18 p.m.

Alvaro Alvarado, Air Pollution Specialist at CARB, gave the presentation *PM Exposure: CARB Health Research and Rule,* including: PM exposure is an important public health concern; additional evidence of PM's negative health impacts; $PM_{2.5}$ trend in the San Francisco Bay Area Basin; CARB's current efforts and new challenges; wildfire-related PM exposures; wildfire health impacts in Rhesus Macaques; wildfire emissions; PM from brake and tire wear; health risk from UFP; health effects of UFP; short-term PM exposure; and statewide Mobile Source Strategy overview: heavy-duty trucks, warehouses, passenger cars, and trains.

Council Comments: The Council and staff discussed potential developments that could help shape CARB's regulatory agenda; the suggestion of offering incentives for regenerative braking systems in passenger vehicles; the speculated severity of exposure to day-to-day PM emissions (non-wildfire events); whether the definition of "premature death" varies amongst state and federal public health and regulatory agencies; and historical concerns of increases in UFP due to the deployment of natural gas and diesel-reduction technologies, and whether such increases have occurred.

Victor Douglas, Rules Development Manager, gave the staff presentation *PM Rules and Regulatory Development,* including: overview; regulation of PM; regional approach; PM rules and regulations; PM rulemaking efforts; 2018 PM rules; and current and future efforts.

Council Comments: The Council and staff discussed how undifferentiated PM cannot yet be regulated in California; a global warming approach to regulating PM that the Air District is currently choosing not to utilize and why; Health Risk Assessment-based approaches, such as Air District Regulation 11-18 and California's Assembly Bill (AB) 2588 Air Toxics "Hot Spots" Program, created to identify and reduce localized impacts and health risks; and whether the Office of Environmental Health Hazard Assessment has established a timeline for evaluating undifferentiated PM, and whether the Air District has the authority to create its own standard for undifferentiated PM.

Public Comments

Public comments were given by Dr. Ashley McClure, California Climate Health Now; Jed Holtzman and Richard Grey, 350 Bay Area; and Greg Karras, Communities for a Better Environment (CBE).

Council Action

None; receive and file.

6. DELIBERATION AND POSSIBLE APPROVAL ON PARTICULATE MATTER SYMPOSIUM SUMMARY REPORT

Dr. McKay acknowledged Elizabeth Andrews, whom the Air District commissioned to write a Summary Report on the October 28, 2019 PM Symposium. He asked that the Council deliberate on the content of the Summary Report, as the Air District seeks to investigate health-focused attainment guidelines as a result of this deliberation.

Council Comments

The Council and staff discussed appreciation for capturing the individual public comments and the "Sense of the Council" at the end of the Summary Report; the suggestion that the last page of the Summary Report be given a more specific than "next steps"; the anticipated timeline of the rest of the PM Symposia series; concerns about the fact that multiple panelists at the October 28, 2019 PM Symposium agreed that there is a lack of evidence of a threshold for PM; how to archive the discussion questions that were asked of the panelists of the October 28, 2019 PM Symposium; the suggestion that the panelists from the October 28, 2019 PM Symposium be sent the Summary Report for review; the suggestion that Air District staff publishes a draft of the Summary Report on the Air District's website so that the public may comment on it prior to the next PM Symposium in spring 2020, and how that could be circulated among the Council members without violating the Ralph M. Brown Act; suggested revisions to the "Executive Summary" and "Council Deliberation" sections of the Summary Report; adding a section to the Summary Report called "Council Findings" and when those might be submitted to the Board of Directors.

Council Action

None; receive and file.

7. CHAIRPERSON'S REPORT

Chair Hayes reported the following:

- On November 6, 2019, the Board of Directors' Executive Committee received a report on the Advisory Council Particulate Matter Symposium from October 28, 2019.
- On November 20, 2019, the full Board of Directors received a report on the Advisory Council Particulate Matter Symposium from October 28, 2019.
- The Air & Waste Management Association's 113th Annual Conference and Exhibition will be held in San Francisco from June 29, 2020 to July 2, 2020. Council members are encouraged to attend, given that the events will be held in the Bay Area.

8. REPORT OF THE EXECUTIVE OFFICER/AIR POLLUTION CONTROL OFFICER

On behalf of Jack Broadbent, Executive Officer/Air Pollution Control Officer, Dr. McKay stated that there was nothing to report.

9. PUBLIC COMMENT ON NON-AGENDA MATTERS

Public comments were given by Dr. Ashley McClure, California Climate Health Now; and Jed Holtzman, 350 Bay Area.

10. COUNCIL MEMBER COMMENTS / OTHER BUSINESS

Ex-Officio Advisory Council member, Rod Sinks, announced that Brian Bunger, Air District Counsel, was elected President-Elect of the Air and Waste Management Association for 2020 and will be President in 2021.

11. TIME AND PLACE OF NEXT MEETING

At the conclusion of the meeting, it was announced that the next meeting would take place at the Call of the Chair, but following the meeting, the next meeting date was established as Tuesday, March 24, 2020, at the Oakland Marriott City Center, 1001 Broadway, Oakland, CA 94607. This meeting of the Council will also serve as the next PM Symposium in the series.

12. ADJOURNMENT

The meeting adjourned at 3:38 p.m.

Marcy Hiratzka
Clerk of the Boards

BAY AREA AIR QUALITY MANAGEMENT DISTRICT
Memorandum

To: Chairperson Stan Hayes and Members of the Advisory Council

From: Jack P. Broadbent
Executive Officer/APCO

Date: May 6, 2020

Re: Particulate Matter (PM) Symposium Overview

RECOMMENDED ACTION

None; receive and file.

DISCUSSION

Increasing evidence shows health impacts from particulate matter (PM) can occur well below the current national ambient air quality standards. Therefore, it is important that we reassess the health effects of PM in our communities.

Last year, the Air District's Advisory Council began convening a conference series on PM. This series will facilitate discussion among nationally recognized scientists, stakeholders, and the Air District, identifying the most effective measures to further protect public health. The symposia will shine a spotlight on this public health challenge and share information and tools to inform future policy decisions.

The first symposium took place on October 28, 2019, from 9:00 a.m. to 4:30 p.m., at the Bay Area Metro Center, 375 Beale Street, San Francisco, California. Topics for discussion included PM health effects and PM exposure and risk.

At the December 9, 2019, meeting of the Advisory Council, Councilmembers discussed the October 28, 2019, Particulate Matter (PM) Symposium Summary. Based on feedback from Councilmembers, staff made updates to the summary report and posted it to the web for community input. Comments received from the community have been incorporated. In addition, attached is a summary of the December 9, 2019, meeting for the Council's review.

On February 27, 2020, the Air District met with community members at the Bobby Bowens Center in Richmond, California to discuss PM impacts, monitoring, and regulatory efforts.

On March 24, 2020, at the second PM symposium, Councilmembers were to receive presentations from community members and input on PM control next steps. Due to the COVID-19 global pandemic, the second symposium has been postponed.

Air District staff are continuing to coordinate with community members and Councilmembers to receive input on PM control strategies and determine next steps in the symposium series.

BUDGET CONSIDERATION/FINANCIAL IMPACT

None.

Respectfully submitted,

Jack P. Broadbent
Executive Officer/APCO

Prepared by: Sonam Shah-Paul
Reviewed by: Jeff McKay

Attachment 3A: October 28, 2019 Advisory Council PM Symposium Summary: Health Effects and Exposures and Risk
Attachment 3B: Public Comments – October 28, 2019 Advisory Council PM Symposium Summary: Health Effects and Exposures and Risk
Attachment 3C: December 9, 2019 Advisory Council Meeting Summary: BAAQMD Update on Current and Emerging Efforts on Particulate Matter

Particulate Matter:
Spotlight on Health Protection

Symposium Summary: Health Effects and Exposures and Risk

October 28, 2019

BAY AREA AIR QUALITY MANAGEMENT DISTRICT

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Executive Summary

On October 28, 2019, the Bay Area Air Quality Management District (Air District) convened a symposium, at the request of its Advisory Council, to obtain input from leading experts on the best available science concerning impacts of particulate matter (PM). The morning panel focused on PM health effects; the afternoon panel focused on PM exposure and risk. After hearing from national and state air quality experts on the panels and from community members during public comment periods, the Advisory Council drafted the following Sense of the Advisory Council statement:

> **The current PM standards are not adequately health protective. Further reductions in particulate matter will realize additional health benefits. We ask the Air District staff to bring forward with urgency options within the legal authority of the Air District that would further limit PM exposure, especially in high-risk communities.**

This consensus was reached upon consideration of information presented by the panelists and public commenters demonstrating: adverse health effects of PM, including mortality, at concentrations below the current standard; disproportionate burden of PM exposure and risk on disadvantaged communities, including those within the Air District; and emerging evidence of the health impact of ultrafine particles (UFP) and wildfires, both of which are understudied.

PM Health Effects

Draft PM ISA. Jason Sacks**,** Project Lead on the Particulate Matter Integrated Science Assessment (PM ISA) and Senior Epidemiologist at the Environmental Protection Agency's (EPA) National Center for Environmental Assessment, reviewed the structure and findings of the Draft PM ISA (https://www.epa.gov/isa/integrated-science-assessment-isa-particulate-matter). His presentation demonstrated that PM causes more health problems than previously known, at lower concentrations than previously known, and disproportionately affects vulnerable populations. In particular, the Draft PM ISA found new causal or likely-to-be causal associations between nervous system effects and long-term exposure to $PM_{2.5}$ and, independently, to the portion of $PM_{2.5}$ considered to be ultrafine particles (UFP), and between cancer and long-term exposure to $PM_{2.5}$. Children and non-white populations are at increased risk of adverse health effects of PM, and there is no evidence of a concentration threshold below which effects are not observed.

Mechanisms of PM impact. Advisory Council Vice Chair Michael Kleinman, Professor of Environmental Toxicology at UC Irvine and Co-Director of the Air Pollution Health Effects Laboratory, focused on the formation, composition, and mechanistic health effects of PM and new insights from his research concerning the toxicity of PM. He discussed how the connection between PM and health effects can be traced mechanistically, with oxidative stress from biological reactions to PM leading to inflammation, cell death, and cardiovascular events. He

also discussed how the toxicity of PM may be attributable to its coating rather than its core, although metals in the core can also produce health effects.

PM burdens and wildfire impacts. Dr. John Balmes, Professor of Medicine at UC San Francisco, Professor of Environmental Health Sciences at UC Berkeley, and Director of the Northern California Center for Occupational and Environmental Health, covered numerous topics associated with particulate matter including sources, effects, challenges with UFP, disproportionate burdens of exposure, and wildfire impacts. His presentation demonstrated that PM exposure leads to a wide range of health problems and disproportionately affects low-income communities and people of color, who suffer cumulative impacts from multiple exposures and disadvantages. In California, exposure to wildfire smoke is associated with increases in health care utilization for both respiratory and cardiovascular problems.

Independent PM Review Panel. Christopher Frey, Chair of the Independent Particulate Matter Review Panel and Glenn E. Futrell Distinguished Professor of Environmental Engineering at North Carolina State University, explained how recent changes to the review process for the federal National Ambient Air Quality Standards (NAAQS) led to the formation of the Independent Particulate Matter Review Panel. He summarized the conclusions of that panel:

- The scientific evidence for $PM_{2.5}$ health effects is robust.
- The current $PM_{2.5}$ standards are not adequately protective of public health.
- The annual standard should be lowered to 10 micrograms per cubic meter ($\mu g/m^3$) to 8 $\mu g/m^3$ (versus the current 12 $\mu g/m^3$ standard).
- The 24-hour standard should be lowered to 30 $\mu g/m^3$ to 25 $\mu g/m^3$ (versus current 35 $\mu g/m^3$ standard).
- These changes would save thousands of lives.
- The PM_{10} standard should be adjusted downward consistent with these changes.
- There appears to be no threshold; lower levels would produce still greater benefits.
- For African Americans, the relative risk of health impacts from PM is three times higher than for the U.S. as a whole.

<u>PM Exposures and Risks</u>

OEHHA research. Lauren Zeise, Director of the California Office of Environmental Health Hazard Assessment (OEHHA) and Leading Developer of CalEnviroScreen, described some of OEHHA's current research efforts to understand the relationships between specific PM sources and community health outcomes. After explaining that there is great variability in the relationship between PM concentration and health risk, she discussed how OEHHA is conducting biomonitoring studies to track whether biomarkers indicate reductions in risk following reduced air pollution concentrations. These data, along with indoor air samples, questionnaires, activity diaries, and information from GPS trackers, will be combined with source pollution mapping data to determine how exposures are occurring. Dr. Zeise also demonstrated that wildfires are causing PM standards to be exceeded for both 24-hour and annual averages. OEHHA is presently investigating relationships between the 2017 Northern California Wildfires and

numerous health outcomes in the area including respiratory, cardiovascular, and neurological problems.

Silver buckshot, not silver bullet. Julian Marshall, Kiely Endowed Professor of Civil & Environmental Engineering and Adjunct Professor of Global Health at the University of Washington, described an approach to reducing health risks from PM involving combined analysis of sources of emissions, concentrations at geographical locations, levels of exposure to different sources of emissions, and racial and income disparities affecting environmental justice. Because PM comes from many sources, he concluded that reducing PM exposure requires many strategies, describing this approach as "silver buckshot, not a silver bullet." With respect to health risks from PM, he demonstrated that income matters, and race matters, but race matters more than income. To get the most "bang for the buck" on health impacts, he argued that interventions should focus on areas where high impact from PM meets high inequity in terms of environmental justice.

Draft PM Policy Assessment. Scott Jenkins, Project Lead on the EPA's review of National Ambient Air Quality Standards for PM and Senior Environmental Health Scientist in EPA's Office of Air Quality Planning and Standards, presented an overview of the approach and conclusions of the EPA's Draft PM Policy Assessment completed in response to the Draft PM ISA. The PM Policy Assessment featured a risk assessment indicating that thousands of lives per year in the U.S. could be saved if annual average $PM_{2.5}$ concentrations are reduced. The assessment included an argument for revising the annual $PM_{2.5}$ standard downward based on the science, as well as a discussion of how retaining the current standard could be justified by placing very little weight on the epidemiological evidence and risk assessment and greater weight on the uncertainties and limitations of the data.

West Oakland Community Action Plan. Phil Martien, Director of Assessment, Inventory, & Modeling for the Air District, described the analysis conducted for the recently completed West Oakland Community Action Plan, the first in a series of community emissions reduction programs that the Air District is developing in response to California's Assembly Bill 617 legislation (AB 617). Per the community's requests, the study took a hyperlocal approach, modeling block-by-block exposures. Disparate exposure levels were seen within West Oakland: the cleanest blocks are experiencing on average 3 $\mu g/m^3$ lower PM concentrations than the most polluted blocks. Sources of PM also differed, with some areas experiencing $PM_{2.5}$ emissions primarily from street traffic and others experiencing the greatest proportion of $PM_{2.5}$ emissions from highways or permitted sources. The West Oakland Community Action Plan demonstrates how hyperlocal modeling can be accomplished, but also highlights the need for other agencies to act, such as California Air Resources Board (CARB), the City of Oakland, and the Port of Oakland, in order to reach community emissions reduction targets.

<u>Public comment</u>

Public comment was taken during two designated periods during the event. The general sentiment expressed by many commenters was, "We need action, not more discussion."

Several people spoke about their personal experiences with toxic emissions in their neighborhoods. The disproportionate impact of air pollution on disadvantaged communities was a central point of focus.

Discussion and Deliberation

The discussion between the Advisory Council and the morning panel focused on cost considerations and the appropriateness of a "no safe level" stance, and broached the topic of recommending Air District priorities, which led to further discussion regarding the monitoring of ultrafine particles. The discussion between the Advisory Council and the afternoon panel was brief and comprised of one question concerning margin of safety considerations in the Draft Policy Assessment (which Dr. Jenkins clarified was the exclusive domain of the EPA Administrator).

The Advisory Council's deliberation followed, resulting in the Sense of the Advisory Council statement presented above. Advisory Council members also expressed interest in further exploring the potential for:

- Treating PM as a toxic;
- Monitoring ultrafine particles;
- Encouraging the State of California to adopt stricter PM standards;
- Ensuring local permits are consistent with the PM standard supported by the science;
- Disaggregating solutions with climate co-benefits, solutions unrelated to climate strategies, and emergencies;
- Identifying strategies to maximize impact or "bang for the buck"; and
- Creating an Air District Implementation Plan.

Next Steps

The Advisory Council will reconvene on December 9, 2019. During that meeting, in response to the Advisory Council's requests, the Air District will present on its current activities to reduce PM exposures, including monitoring of ultrafine particles. It will also discuss additional "options within the legal authority of the Air District that would limit PM exposure, especially in high-risk communities," in accordance with the Sense of the Advisory Council, in order to inform the Advisory Council's advice to the Air District's Board of Directors. The Advisory Council is expected to receive and comment on this symposium summary document during the December 9 meeting.

Planning continues for a second PM symposium focused on community and other stakeholder input and engagement; the event will take place in Spring 2020.

Background

On October 28, 2019, the Bay Area Air Quality Management District (Air District) convened a symposium, at the request of its Advisory Council (Council), in order to obtain input from leading experts on the best available science concerning health effects of particulate matter (PM). Serving as an official meeting of the Advisory Council, which advises and consults with the Air District's Board of Directors and Executive Officer on technical and policy matters, the symposium sought to discuss:

PM Health Effects

- what health effects are observed from PM exposure, including exceptionally high acute PM exposures (e.g., wildfire smoke);
- what biological systems are affected and by what mechanisms;
- what population groups are most at risk; and
- what uncertainties are most relevant.

PM Exposure and Risk

- what the emission sources are that contribute to PM;
- what exposures to airborne PM occur and to whom;
- what health risks are posed by those PM exposures; and
- what subset of sources contribute most to PM risk, particularly in the most highly impacted communities.

The symposium followed several relevant policy developments at the state and federal levels. In California, Assembly Bill 617 passed in 2017 directing the California Air Resources Board and all local air districts to protect communities disproportionally impacted by air pollution. Implementation in the Bay Area Air Quality Management District to date includes the development of a community-led plan for air quality improvement in West Oakland (adopted by the Air District's Board of Directors in October 2019) and an air quality monitoring program for the Richmond area (underway).

At the federal level, staff of the Environmental Protection Agency (EPA) released a Draft Integrated Science Assessment (ISA) for Particulate Matter (PM) in October 2018, followed by a Draft PM Policy Assessment regarding the standard-setting implications of the PM ISA in September 2019. These drafts were submitted for review to the Clean Air Scientific Advisory Committee (CASAC), which provides advice to the EPA Administrator on the setting of national ambient air quality standards. Additionally, a separate, independent response to both EPA draft documents was released in October 2019 by the Independent Particulate Matter Review Panel, whose members served previously on the CASAC PM Review Panel until their dismissal in October 2018 by EPA Administrator Andrew Wheeler.

The timing of the symposium also coincided with the outbreak of the Kincade Fire in Sonoma County and associated evacuations. Additionally, widespread power outages within the Air

District's jurisdiction were intentionally executed by Pacific Gas & Electric (PG&E) as wildfire prevention measures given the dry conditions and high winds. This crisis formed a backdrop to the proceedings.

Particulate matter experts presenting at the event included the lead authors of the EPA PM ISA (Jason Sacks), the EPA PM Policy Assessment (Dr. Scott Jenkins), the Independent Review Panel document (Professor Christopher Frey), and the West Oakland Community Action Plan (Dr. Phil Martien). They were joined by Independent Particulate Matter Review Panel Members Professor Michael Kleinman and Dr. John Balmes, Director of the California Office of Environment Health Hazard Assessment Dr. Lauren Zeise, and University of Washington Professor Julian Marshall. These speakers were organized into a morning panel focused on PM health effects and an afternoon panel focused on PM exposure and risks.

The event, which was open to the public, included two public comment periods. The midday lunch break featured a keynote address by former EPA Administrator Gina McCarthy, who also answered questions from community attendees.

The morning and afternoon panels were each followed by joint discussions between the Advisory Council members and panelists. The event concluded with a brief Advisory Council deliberation.

The event was shared live via webcast, the video archive of which can be viewed at http://baha.granicus.com/MediaPlayer.php?clip_id=6194.

Morning Panel: PM Health Effects

Current State of Particulate Matter Science: Particulate Matter Integrated Science Assessment (Working Draft Conclusions)

Jason Sacks
Project Lead, Particulate Matter Integrated Science Assessment (PM ISA)
Senior Epidemiologist, National Center for Environmental Assessment, EPA

Main takeaway	**PM causes more health problems than previously known, at lower concentrations than previously known, and disproportionately affects vulnerable populations.**

Presentation Summary

Mr. Sacks reviewed the structure and findings of the initial draft of the EPA's recent Particulate Matter Integrated Science Assessment (PM ISA), which aims to provide an updated review of the science in order to assist federal rulemaking. The Draft PM ISA addresses the question:

> *"Is there an independent effect of PM on health and welfare at relevant ambient concentrations?"*

The PM ISA drafters reviewed the body of new research since 2009 including epidemiological studies, animal toxicological studies, and controlled human exposure studies at PM levels analogous to ambient concentrations in U.S. communities.

The Draft PM ISA can be found at https://www.epa.gov/isa/integrated-science-assessment-isa-particulate-matter.

Health effects. The Draft PM ISA found new causal or likely-to-be causal associations between:

- Nervous system effects and long-term exposure to $PM_{2.5}$ and, independently, to the portion of $PM_{2.5}$ considered to be ultrafine particles (UFP)
- Cancer and long-term exposure to $PM_{2.5}$

The science also confirmed and strengthened the evidence of previously known causal or likely-to-be-causal associations between respiratory, cardiovascular, and mortality effects of both short- and long-term exposure to $PM_{2.5}$. Additional PM exposure associations with metabolic and reproductive effects suggested causality but did not meet the strict criteria for "causal" or "likely-to-be-causal," often due to a limited quantity of data.

At-risk populations. Children and non-white populations are at increased risk of adverse health effects of PM. Further evidence regarded as "suggestive" points to increased health risk for people with low socioeconomic status, overweight and obese populations, people with pre-existing cardiovascular and respiratory disease, and people with certain genetic variants.

Chemical components of PM. The evidence does not indicate that any one specific chemical component of PM is a disproportionate concern over others.

Advisory Council Q&A with Panelist

No threshold. Council Member Rudolph inquired whether any evidence supported a threshold concentration value below which health effects from $PM_{2.5}$ could not be observed. The panelist responded that there does not appear to be any such threshold.

Changes to health effect determinations. Chair Hayes requested further clarification on the new findings from the ISA since 2009, which are outlined above and in Slide 15 of the presentations.

Relevance of animal studies concerning UFP. Council Member Solomon asked if there was any reason to question whether results seen in animal studies concerning UFP would be consistent with human health effects. The panelist replied that the inconsistency was in the size of the particles considered to be UFP. There has not been a consistent metric or definition for UFP, which has limited the ability to draw conclusions.

Publication bias. Council Member Borenstein inquired whether studies with null results were being published; if not, there may be a concern that the presentation represented only the fraction of research that observed positive associations with health effects. The panelist clarified that this concern drove the decision to focus on multi-city studies in order to ensure that null results would be incorporated.

Wildfires and sub-daily exposures. Given the Kincade Fire that was burning at the time of the event, Chair Hayes inquired about the influence of sub-daily exposures to high levels of PM. The panelist responded that there are some controlled human exposure studies that would be equivalent to a person walking along a busy road, during which some changes in cardiac and lung function have been observed, but sub-daily studies are scarce and he was not aware of research that would be directly relevant to wildfire exposures.

Particulate Matter: A Complex Mixture that Affects Health

Michael Kleinman
Professor of Environmental Toxicology, University of California, Irvine
Co-Director, Air Pollution Health Effects Laboratory

Professor Kleinman is also Vice Chair of the Air District's Advisory Council.

Main takeaways	**PM can be mechanistically and causally linked to cardiovascular health effects. The toxicity of PM may be more attributable to its coating than its core, although metals in the core can also produce health effects.**

Presentation Summary

Professor Kleinman's presentation focused on the formation, composition, and mechanistic health effects of PM and new insights from his research concerning the toxicity of PM.

Basic PM process. A key source of PM is the combustion of fossil fuels. After these fuels break down during combustion, they cool, become radicalized, and agglomerate. Additional chemicals adhere to these particles and can form highly toxic compounds that may include contaminants such as chlorine, bromine, and metals. When these particles are inhaled and enter the respiratory tract, they can react with proteins and fluids in the lungs and release highly reactive free radicals, causing chemical imbalances throughout the body. If these free radicals overwhelm the body's antioxidant self-protection capabilities, the process can result in inflammation, cell death, and organ failure. Because oxidative stress can oxidize lipids in the blood, it can also lead to the development of atherosclerotic plaque and coagulation factors that can contribute to cardiovascular events such as stroke and heart attack.

"The icing, not the cake." Professor Kleinman's laboratory experimented with removing the organic coating from ambient air particles to which animals were exposed to determine whether, in the words of Chair Hayes, the problem was "the icing or the cake." They found that stripping the particles of their organic coating appeared to mitigate their toxicity.

Additional key points:

- Data limitations concerning chemical components. $PM_{2.5}$ total mass is regarded as a more relevant concern than specific components within it, but this may be due to the much smaller database available for chemical components than for $PM_{2.5}$ as a category.
- Measurement challenges. Ultrafine particles are difficult to measure and monitor because they have almost no mass.
- Risks for California. Sunlight, which is plentiful in California, is involved in the formation of pollutants. In addition to PM, health is also affected by air pollutants such as ozone, which is a strong oxidant. The combined effects of PM and ozone, which can be

experienced in the same day, may cause high levels of oxidative stress. Additionally, Professor Kleinman's research indicates that particles formed on warmer days result in worse health effects than those formed on cooler days, which portends additional problems in an era of climate change.

Advisory Council Q&A with Panelist

Incomplete combustion and control technology. Council Member Long inquired whether UFP resulted from incomplete combustion and whether newer technologies were effective in controlling their formation. The panelist responded that to his knowledge all combustion resulted in the formation of ultrafine particles (along with other particles). He noted that although modern diesel engine afterburner controls denuded particles in a manner similar to his animal toxicology experiments, they also produced high amounts of UFP.

Greenhouse gas impacts. Council Member Rudolph asked whether the process of stripping components from PM would change the release of carbon dioxide from combustion, emphasizing that "climate change is the greatest existential threat to human health right now." She questioned whether targeting the toxicity of the results of combustion should be a goal rather than trying to reduce combustion itself in order to reduce greenhouse gas emissions. The panelist shared his view that in the short-term "we can improve public health by mitigating what we're making right now," while in the long-term pursuing strategies to reduce reliance on fossil fuels.

Particulate Matter Health Effects: What Do We Know and What Do We Still Need to Know?

John Balmes, M.D.
Professor of Medicine, UC San Francisco
Professor of Environmental Health Sciences, UC Berkeley
Director, Northern California Center for Occupational and Environmental Health

Main takeaways	**PM exposure leads to a wide range of health problems and disproportionately affects low-income communities and people of color, who suffer cumulative impacts from multiple exposures and disadvantages. In California, exposure to wildfire smoke is associated with increases in health care utilization for both respiratory and cardiovascular problems.**

Presentation Summary

Dr. Balmes covered numerous topics associated with particulate matter (PM) including sources, effects, challenges with UFP, disproportionate burdens of exposure, and wildfire impacts.

Sources of PM. PM derives not only from combustion particles, but also from crustal and biological sources; for example, road dust is a significant source of PM. Dust particles may carry biological components that can cause health effects.

Health effects. In addition to re-emphasizing the health effects covered in Mr. Sacks' and Professor Kleinman's presentations, Dr. Balmes further noted:

- the smaller the particle, the farther it travels into the body, with some PM particles small enough to enter the bloodstream and even cross the blood-brain barrier;
- $PM_{2.5}$ is associated with increased risk of metabolic effects, including diabetes;
- fetal $PM_{2.5}$ exposures can result in low birth weight, pre-term birth, and changes in gene expression; and
- brain inflammation from PM can affect both ends of the life spectrum - neurodevelopment and neurodegeneration.

Challenges with UFP. As mentioned by previous presenters, because UFP is not regulated independently from other $PM_{2.5}$, there is limited monitoring, which presents challenges for epidemiological research, although toxicological studies suggest UFP is a high-risk hazard. Further, innovations designed to reduce climate change impacts, such as gasoline direct injection, can result in higher UFP emissions.

Disproportionate burdens and cumulative impacts. People of color and people with low socioeconomic status are more likely to be exposed to PM, and the risk from these exposures is compounded by the lack of health-promoting resources in these communities such as health

care, fresh produce, and green spaces. Dr. Balmes shared the example of Richmond, CA, which is within the Air District's jurisdiction. People living in the Liberty/Atchison Villages in Richmond are next to the railyard, near the freeway, next to the General Chemical Corporation (which recently had a serious accident), and downwind from the Chevron Refinery. Stating, "This cumulative risk concept is something that we need to be including in our thinking about air quality management," Dr. Balmes also noted that the Air District is a leader in this regard.

Wildfires. While acknowledging that "we need to know more than we currently do," Dr. Balmes asserted that there is a well-known association between wildfires and increased health care utilization for people with respiratory conditions such as asthma and chronic obstructive pulmonary disease. Additionally, a recent California study associates wildfire smoke with cardiovascular events including heart attack, stroke, and heart failure.

Advisory Council Q&A with Panelist

Wildfire contribution to cumulative impact. Council Member Rudolph asked whether wildfires should be understood as an additional layer of cumulative impact. The panelist responded that although he hadn't considered that framing, it was accurate, as people with lower socioeconomic status are those most likely to be without the means to relocate during wildfires. Rural agricultural workers are one example of a community that may be working outdoors despite poor air quality from wildfires. Council Member Rudolph asked whether it was accurate to say, "It's even more important to reduce our baseline exposures because we know these acute exposures are going to be happening more frequently" due to climate change, or if the two issues of baseline and acute exposures should not be viewed as interrelated. The panelist asserted that Council Member Rudolph's statement was accurate.

Bay Area studies? Referring to slide 76, which mapped Los Angeles county data comparing the distribution of non-white people and people living in poverty alongside the distribution of cumulative air quality hazard, Council Member Solomon asked whether the same analysis could be performed for the Bay Area. The panelist replied that although he was not aware of such an analysis having been performed, it should be possible. He indicated that he would speak with an expert he believed to be capable of executing the task.

Recent Developments in the Scientific Review of the National Ambient Air Quality Standards for Particulate Matter

Christopher Frey
Chair, Independent Particulate Matter Review Panel
Glenn E. Futrell Distinguished Professor of Environmental Engineering, North Carolina State University

Main takeaways	**The federal administration truncated the National Ambient Air Quality Standard science review process and purged the Clean Air Scientific Advisory Committee (CASAC) and the supporting CASAC PM Review Panel of critical scientific expertise. The scientists who were dismissed from the CASAC PM Review Panel continued their review work independently and found that the current PM standards are insufficient to protect public health.**

Presentation Summary

Professor Frey explained how recent changes to the review process for the federal National Ambient Air Quality Standards led to the formation of the Independent Particulate Matter Review Panel. He then summarized the conclusions of that panel, which he leads.

Federal PM Review

Process: The scientific review process that for four decades involved an iterative sequence of assessments flowing from science to policy has been severely abridged. Notably, the EPA's PM Policy Assessment (PA) must now be finalized without reviewing the EPA's final PM Integrated Science Assessment (ISA). Additionally, members of the Clean Air Scientific Advisory Committee (CASAC) PM Review Panel were dismissed, leaving the current CASAC without, by its own admission, the necessary expertise to respond to the documents. Acknowledging the good work accomplished by EPA staff in completing the Draft PM ISA and Draft PM PA in difficult circumstances, Professor Frey emphasized the need for the Air District "to look elsewhere than the EPA's Chartered Clean Air Scientific Advisory Committee" for guidance on PM science review.

Findings: As of October 25, 2019, the remaining six CASAC members were split 4-2 on their national ambient air quality standards (NAAQS) recommendations, with the majority supporting retaining all current standards.

Independent Particulate Matter (PM) Review Panel

Process: Led by Professor Frey, the scientists that were dismissed from the CASAC PM Review Panel continued to meet, without compensation, to complete the public service to which they had committed as CASAC PM Review Panel members. With logistical support from the Union of

Concerned Scientists, the Independent PM Review Panel met for two days in October 2019 and developed a consensus report that was sent to the EPA Administrator. The report and the video-recorded proceedings can be accessed at https://ucsusa.org/meeting-independent-particulate-matter-review-panel.

Findings: The scientific evidence for $PM_{2.5}$ health effects is robust. The current $PM_{2.5}$ standards "are not protective of public health, not even close."

- The annual standard should be lowered to 10 µg/m^3 to 8 µg/m^3 (versus the current 12 µg/m^3 standard)
- The 24-hour standard should be lowered to 30 µg/m^3 to 25 µg/m^3 (versus the current 35 µg/m^3 standard)
- These changes would save thousands of lives
- The PM_{10} standard should be adjusted downward consistent with these changes
- There appears to be no threshold; lower levels would produce still greater benefits
- For African Americans, the relative risk of health impacts from PM is three times higher than for the U.S. population as a whole

See Slides 102 and 103 for Professor Frey's rapid-fire answers to questions posed by the Air District.

Advisory Council Q&A with Panelist

Response to Independent PM Review Panel. Council Member Long asked whether the Independent PM Review Panel received a response from the EPA Administrator or had been mentioned in the press. The panelist replied that the Administrator had not responded, but may not yet have received the report. However, the Independent PM Review Panel also submitted their report as public comment to CASAC, and several CASAC members referred to the report during their deliberations on October 25, 2019. There has been some press coverage of the Independent PM Review Panel, for example in the *Guardian* and *Rolling Stone*.

Safety at 8 µg. Council Member Solomon expressed the concern that, if there is no threshold below which health effects cannot be observed, 8 µg/m^3 cannot be regarded as safe, particularly for vulnerable individuals. The panelist replied that the recommendation is given within the policy context of national ambient air quality standards (NAAQS) and is intended to support a standard that could withstand judicial review. The number is based on the available science, which focuses on ambient air pollution levels observed in epidemiological studies. The Clean Air Act requires that the standards protect public health "allowing an adequate margin of safety," which should protect the general population and at-risk groups, but will not necessarily protect every individual.

The post-presentation Q&A segued into the general discussion between the Advisory Council and the PM Health Effects panel. This discussion is described in the following section.

PM Health Effects: Discussion Summary

The discussion between the Advisory Council and the morning panel focused on cost considerations and the appropriateness of a "no safe level" stance and broached the topic of recommending Air District priorities, which led to further discussion regarding UFP.

Cost considerations and appropriateness of "no safe level" language. Council Member Borenstein expressed discomfort with the language of "no safe level" of PM, emphasizing the need to assess the costs, including health costs, of implementing more stringent standards and using the analogy of motor vehicles to demonstrate that all areas of safety concern must accept some risks. Professor Frey responded that the U.S. Supreme Court's interpretation of the Clean Air Act expressly forbids cost considerations in setting National Ambient Air Quality Standards and stated that voluntary activities such as driving should not be equated to the involuntary act of breathing. He also clarified that the conclusion "there is no evidence of a threshold" is not in itself an argument for banning all particulate emissions. Dr. Balmes addressed the topic from his perspective as a physician member of the California Air Resources Board (CARB). He clarified that whereas CARB does consider economic impacts, the Independent PM Review Panel, following the procedures that had until recently governed CASAC, was restricted from mingling health and economic concerns. He also emphasized that while the most precautionary stance would consider levels below 8 $\mu g/m^3$, the lack of data on lower levels of exposure makes it appropriate to recommend 8 $\mu g/m^3$ for a present limit. In response to a question from Council Member Solomon, Professor Frey clarified that this 8 $\mu g/m^3$ recommendation did take into consideration the increased sensitivity to pollution impacts of African American populations.

Recommending Air District priorities. Chair Hayes asked for guidance in identifying the most important areas of focus for the Air District, given the science and the particular challenges for the area, including wildfires. Dr. Balmes emphasized the need for community-level monitoring in accordance with AB 617 to identify air pollution "hot spots" and hypothesized that black carbon, a form of PM, may be a vital concern for these communities. He also expressed support for monitoring ultrafine particles (UFP) and collecting epidemiological data concerning wildfires. Council Member Long emphasized the need for a strategic plan.

Ultrafine particles. The discussion of UFP continued with Mr. Sacks underscoring that while animal toxicological studies show effects of UFP, little is known about UFP's effects on the human population. One challenge for such research is that particles emitted as UFP may not stay in that size range. He further noted that UFP are contained within $PM_{2.5}$ and efforts to control $PM_{2.5}$ therefore may also bring down UFP concentrations. In response to Chair Hayes' requests for guidance regarding UFP, Professor Frey suggested establishing monitoring stations in carefully selected locations as a long-term strategy and public education/consumer ratings regarding automobile ventilation and filtration systems as more immediate tactics. Professor Kleinman noted that there may be an opportunity for regulation to stimulate innovation with respect to decreasing UFP emissions and that the European Union already requires vehicles to share "particle numbers" regarding in-cabin air quality.

Afternoon Panel: PM Exposure and Risk

Exposure and Risk Panel
Particulate Matter: Spotlight on Health

Lauren Zeise
Director, California Office of Environmental Health Hazard Assessment
Leading Developer, CalEnviroScreen

Main takeaways	**There is a high degree of variability among individuals in the relationship between PM exposure concentration and health risk. OEHHA is pursuing research to determine the most important sources of air pollution with respect to health effects. Wildfires are causing PM standards to be exceeded for both 24-hour and annual averages.**

Presentation Summary

After explaining how health risks from PM can vary, OEHHA Director Zeise described some of OEHHA's current research to understand the relationships between specific PM sources and community health outcomes. She also shared some initial data on PM levels from wildfire.

Variability. There is a high degree of variability in concentration-response relationships relating PM exposure concentration to resulting health risks, due to multiple factors including:

- variable individual vulnerability (e.g., health status, genetic factors, demographic factors)
- variable doses at a given concentration (e.g., breathing rates, other physiological factors)
- variable concentrations within a location (e.g., in West Oakland, can be five times higher)

Given this variability, one way to get the most "bang for the buck" is to focus on improving air quality in communities with the highest exposures and highest vulnerabilities.

Current research at OEHHA. Several relevant studies are underway in alignment with AB 617 that will provide valuable input to PM risk management efforts. A key feature of these studies is biomonitoring to determine whether biomarkers indicate reductions in health risk following reduced air pollution concentrations. For example, the East Bay Diesel Exposure Project is a pilot study measuring exposure to diesel exhaust among community residents. This project collects urine samples in addition to indoor air samples, questionnaires, activity diaries, and information from GPS trackers. These data collected from residents will be combined with source pollution mapping data to determine how exposures are occurring.

Wildfires. PM concentrations during the 2017 Napa Wildfire reached 24-hour averages close to 200 $\mu g/m^3$ and one-hour averages above 300 $\mu g/m^3$ in some areas. In West Oakland, wildfire

impacts on PM have driven annual averages above the national standard, to 12.9 μg/m^3 in 2017 and 14.4 μg/m^3 in 2018. OEHHA is presently investigating relationships between the Napa Wildfire and numerous health outcomes in the area including respiratory, cardiovascular, and neurological problems.

Advisory Council Q&A with Panelist

Wildfire research outcomes. Chair Hayes asked if any preliminary health outcome results could be shared from the Napa Fire study, to which the panelist replied that she could not yet share results but expected to do so in the near future. Chair Hayes also asked if OEHHA would be including other years in the study. The panelist replied that while the Napa Fire study is a stand-alone project, the OEHHA epidemiology team has also been involved in a study of primates (macaques) in captivity that tracks outcomes to exposure to wildfires that occurred in 2008. This natural experiment of mother-infant pairs indicates that the exposure resulted in impacts on lung function and immunological markers. Chair Hayes remarked that such findings were consistent with studies in Southern California indicating issues with lung function in children.

Communicating importance of sub-daily exposures. Council Member Borenstein introduced the topic of communicating with the public about risks and precautions, citing the example of a group of teenage girls, presumably a high school track team, who were running, outdoors, while a nearby wildfire caused the air quality index (AQI) to be over 150. The panelist agreed that there is a need for more effective communication strategies and highlighted the misconception that filtration masks allow the wearers to safely exercise outdoors. She referenced a forthcoming meeting in Sacramento in April that will bring together representatives from OEHHA, EPA, Center for Disease Control (CDC), National Institute of Health (NIH), and other agencies to specifically discuss how to advise the public with respect to filtration.

Approaching PM as a non-threshold contaminant. Council Member Solomon inquired about the process for quantifying risk if PM is approached as a non-threshold contaminant. The panelist replied that while it was a difficult task that would involve creating estimates of risk that would differ across communities, it can be done and she anticipates that “working together we can come up with approaches to implement pretty soon.”

Location- and source-specific strategies: Consider impact, marginal impact, and environmental justice

Julian Marshall
Kiely Endowed Professor, Civil & Environmental Engineering, University of Washington
Adjunct Professor, Global Health, University of Washington

Main takeaways	**Reducing PM requires many strategies: "silver buckshot, not a silver bullet." With respect to risks, income matters and race matters, but race matters more than income. To get the most "bang for the buck" on health impacts, focus on areas where high impact meets high inequity.**

Presentation Summary

Professor Marshall described an approach to reducing health risks from PM involving combined analysis of sources of emissions, concentrations at locations, levels of exposure to different sources of emissions, and racial and income disparities affecting environmental justice.

Many sources of PM. $PM_{2.5}$ comes from many sources, and not only from primary emissions but also through formation of $PM_{2.5}$ in the atmosphere from other compounds. No one single source is dominant. At the national level, several sources make up a substantial fraction of emissions, including fuel combustion, agriculture, road dust, and residential wood burning. However, there are many other meaningful contributors and therefore tackling $PM_{2.5}$ will require multiple strategies.

Intake fraction in California. When the levels of emissions from different sources are combined with the percentage of those emissions that are inhaled, relative contributions to exposure can more clearly be seen. In California, industrial emissions and on-road mobile sources are particularly high contributors to $PM_{2.5}$ exposure. Importantly, this conceptualization makes clear that emissions reductions are not all equal in impact. For example, reducing one ton of emissions from on-road mobile sources will have greater impact than reducing one ton of emissions from industrial sources because the former category has a higher intake fraction.

Race and income disparities. In California, white people and wealthier people are least exposed to pollution, and the racial difference is more predictive than the income difference. Looking at patterns of consumption, it is also evident that white people are the greatest consumers of the products of polluting activities despite being the least exposed to the resulting pollution.

Mobile measurements and low-emission zones. Dr. Marshall described mobile PM measurement technology as "really promising" for identifying local pollution hotspots and pointed to Google and Aclima as innovators. He also described the policy tool of "low-emission zones" that have been used around the world, although not yet in the U.S., to reduce risks for

vulnerable populations subjected to high PM concentrations. Even if some polluting activity relocates outside the zone, positive health outcomes can still be achieved with this strategy.

Advisory Council Q&A with Panelist

How much pollution comes from local sources? Council Member Long inquired how much of the contaminant load in West Oakland (depicted in the panelist's slide showing the results of mobile measurement) could be attributed to local versus regional sources. The panelist replied that the study did not investigate sources and deferred to Phil Martien, the final presenting panelist, to address the question of local versus regional contamination affecting West Oakland. (Dr. Martien's presentation revealed that the majority of $PM_{2.5}$ in West Oakland comes from regional sources; see Slide 198.)

Air District authority. In response to the panelist's question about the Air District's powers, Council Member Borenstein clarified that the Air District regulates stationary but not mobile sources and does not have the power to impose prices or taxes. Although the Air District does impose fines on a limited basis, these can only recover the costs of doing business, and emitters are not required to assume the costs of pollution below the standard. He went on to advocate for the Air District to "lobby Sacramento" for the authority to impose prices to help overcome a situation he described as "trying to make policy with one arm tied behind our back."

Other beneficiaries of polluting activities. Referring to the panelist's analysis of the drivers of pollution, which focused on consumption, Council Member Borenstein commented that additional beneficiaries of polluting activities should be considered: shareholders and workers.

Review of the National Ambient Air Quality Standards for Particulate Matter: Overview of the Draft Policy Assessment

Scott Jenkins
Project Lead, EPA review of National Ambient Air Quality Standards for PM
Senior Environmental Health Scientist, Office of Air Quality Planning and Standards, EPA

Main takeaways	**New studies available since the previous NAAQS review strengthen evidence of serious $PM_{2.5}$ health effects, including premature death, and add additional health concerns. Available scientific information calls into question the adequacy of the public health protection afforded by current standards. Risk assessment results show that reducing PM to alternative standard levels below the current standards would achieve significant additional health benefits, including thousands of lives spared per year in the U.S. Alternatively, retaining the current standards would require placing "little weight" on that information.**

Presentation Summary

Dr. Jenkins presented an overview of the approach and conclusions of the EPA's Draft PM Policy Assessment completed in response to the agency's Draft PM Integrated Science Assessment. He explained that the PM Policy Assessment is intended to serve as a bridge between science and rulemaking, which is expected to take place by the end of 2020. The assessment included an argument for revising the annual $PM_{2.5}$ standard downward based on the science, as well as a discussion of how retaining the current standard could be justified by placing little weight on the epidemiological evidence and risk assessment and greater weight on the uncertainties and limitations of the data.

Focus on "typical" exposures. The NAAQS review process focuses on exposures that represent the middle of the U.S. air quality distribution curve, rather than its extremes. In most U.S. locations, the annual standard is the controlling standard. Epidemiological data is not very informative with respect to the impact of 24-hour exposures on the upper end of the concentration distribution curve, and sub-daily (2-hour) controlled human exposure studies correspond to concentrations considered to be outside the typical distribution curve. The implication of this focus is that the review does not inform analysis of conditions analogous to those occurring during California wildfires.

Pseudo-design values and hybrid modeling. The review examined health effects seen in areas for which PM monitoring data could be used to calculate whether the area's air quality would have met the current standards. This "pseudo-design value" approach approximated the design value statistics used to describe air quality relative to the NAAQS. The review also examined

hybrid modeling studies that incorporated not only air quality monitoring but also a range of other data including satellite imagery and land use and transportation information.

Risk Assessment. The risk assessment considered likely mortality outcomes if national air quality was to "just meet" the current 12 μg/m^3 standard in comparison to "just meeting" 11, 10, and 9 μg/m^3. Although estimates differed according to the study being used and whether a primary or secondary PM-based modeling approach was employed, the overall implication was that thousands of lives would be spared at lower concentrations.

Conclusions. The Draft PM Policy Assessment states that "The available scientific information can reasonably be viewed as calling into question the adequacy of the public health protection afforded by the current annual and 24-hour primary $PM_{2.5}$ standards." This conclusion relies on the long-standing body of health evidence, strengthened in the latest review, and risk assessments indicating that current standards allow for thousands of $PM_{2.5}$-associated deaths per year at concentrations above 10 μg/m^3. However, the assessment also states that a conclusion that current standards are sufficient could be reached if very little weight is placed on the large body of epidemiological evidence, particularly the newly available studies regarding lower concentrations, and more weight is placed on uncertainties in the literature.

Advisory Council Q&A with Panelist

Wildfires excluding Bay Area from risk assessment. Chair Hayes asked for clarification on why the Bay Area was not included in the risk assessment. The panelist responded that the assessment aimed to simulate impact from anthropogenic sources, so the focus was on areas for which that adjustment could reliably be done using available data. The implication appeared to be that it was difficult to disentangle wildfire effects from anthropogenic effects.

Lessons for areas controlled by 24-hour standard? Given that the focus of the Draft PM Policy Assessment was on areas in which the annual standard is controlling, Chair Hayes asked what the Air District, which experiences 24-hour concentrations well above the standard during wildfires, should take away from the analysis. The panelist acknowledged that the epidemiology driving the assessment is focused on the middle of the air quality distribution and does not offer many insights for areas experiencing very high 24-hour and sub-daily concentrations.

Deaths from air pollution. Referring to Slide 155, Chair Hayes asked how the review process determines acceptable risk in terms of $PM_{2.5}$-associated deaths. The panelist responded that the estimates of $PM_{2.5}$-related deaths are not meant to be read as absolute numbers but rather used as a basis for comparison between outcomes at different concentration levels to indicate the magnitude of public health impact. He further noted that risk assessments have not historically been the drivers of decisions regarding NAAQS. Council Member Solomon asked if lower concentrations had also been considered in the risk assessment. The panelist replied that they had, and that estimated deaths are reduced by 10-15% for each 1 μg/m^3 reduction.

PM thresholds? Council Member Borenstein asked if the panelist had seen any evidence of a PM threshold. The panelist replied that he had not. However, he explained that there may be thresholds for individuals that cannot be seen in population-level studies.

Targeting Particulate Matter:
West Oakland Community Emissions Reduction Program

Phil Martien
Director, Assessment, Inventory, & Modeling, Bay Area Air Quality Management District
Project Lead, Technical Assessment of AB 617 West Oakland Community Action Plan

Main takeaways	**In response to California's AB 617 and in collaboration with communities, the Bay Area Air Quality Management District is implementing community-specific emissions reductions programs. The West Oakland plan demonstrates how hyperlocal modeling can be accomplished, but other agencies will also need to act in order to reach emissions reduction targets.**

Presentation Summary

Dr. Martien described the analysis conducted for the recently completed West Oakland Community Action Plan, the first in a series of community emissions reduction programs that the Air District is developing in response to California's AB 617 legislation.

Response to AB 617. California's Assembly Bill 617 mandates a statewide program to address long-standing air pollution concerns in disadvantaged communities. The Air District has committed to work collaboratively with disadvantaged communities experiencing disproportionately high levels of air pollution. The first year of implementation focused on Richmond and West Oakland; Richmond requires more measurements to be collected, but West Oakland had a large amount of data and was able to launch directly into planning an emissions reduction program. Beginning in year two, Air District efforts will expand to six more communities: Vallejo, the Pittsburg-Bay Point Area, Eastern San Francisco, the East Oakland-San Leandro Area, Tri-Valley, and San Jose.

Approach to West Oakland. West Oakland was chosen as the first implementation site both because its population experiences high socioeconomic burdens alongside low air quality and because West Oakland has a well-established and experienced community group, the West Oakland Environmental Indicators Project, that was able to guide the process in collaboration with the Air District. The study employed a hybrid modeling approach that first accounted for pollution originating outside the area in order to then zero in on local sources. In response to community requests, the study took a hyperlocal approach, modeling block-by-block exposures. Seven local impact zones were identified using data from specially equipped Google Street View vehicles. Sources modeled comprised the Port of Oakland, railyards and trains, vehicles on freeways and streets, truck-related businesses, and permitted stationary sources.

Results. Although the Port of Oakland was the primary contributor to diesel PM emissions, $PM_{2.5}$ showed a more distributed source allocation, with highway, street, port, and permitted sources all contributing significantly to $PM_{2.5}$ levels. However, approximately 34% of $PM_{2.5}$ came

from sources not included in the model, such as construction, restaurants, and residential wood burning. For each zone, the proportional contributions of the different sources were calculated, with different allocations evident for each zone. For example, 60% of modeled $PM_{2.5}$ could be attributed to street traffic in Zone 3, whereas street traffic made up only 28% of $PM_{2.5}$ emissions in Zones 1 and 2. Disparate exposure levels were seen within the studied West Oakland zones: the cleanest blocks are experiencing on average 3 $\mu g/m^3$ lower PM concentrations than the most polluted blocks.

Action priorities. The West Oakland Community Action Plan established the goal of bringing all zones to average levels for the area by 2025 and to the level of today's cleanest residential West Oakland neighborhood by 2030. However, it is important to note that most of the pollution experienced in West Oakland comes from regional sources outside the West Oakland local area, and most of the local pollution sources are outside the Air District's jurisdiction. That said, priorities for decreasing exposures from local sources center on addressing sources with higher shares of modeled impact, which include heavy-duty trucks and harbor craft for diesel PM and road dust and passenger vehicles for $PM_{2.5}$.

Advisory Council Q&A with Panelist

West Oakland levels in comparison to other District areas. Council Member Rudolph asked how the "average" and "cleanest" levels in West Oakland that were set as targets compare to air pollution levels elsewhere in the Air District. The panelist responded that he does not have that information because other areas have not yet been assessed. However, he asserted that differences in pollution levels between West Oakland other parts of the Air District are likely to be driven by local impacts, so addressing disparities within the Air District can be accomplished by considering local pollution sources.

Electric vehicles and road dust. Council Member Rudolph pointed out that if road dust is a significant concern in terms of $PM_{2.5}$ exposure, then solutions like electric vehicles will not address that problem. The panelist agreed.

Capturing unrecorded emissions. Council Member Rudolph asked whether further analysis would be conducted to better understand the $PM_{2.5}$ contributors that were not accounted for in the study. The panelist indicated that expanding the list of modeled sources was among the "homework activities" for the Air District team developing further AB 617 action plans.

Translating findings into action. Council Member Long asked for clarification on how the information presented would be translated into concrete actions to improve air quality in West Oakland. The panelist acknowledged the challenge of the Air District's limited jurisdiction and asserted that the West Oakland community had a "realistic perspective" on what can be done. He described the West Oakland Community Action Plan (which calls for the implementation of strategies by the City of Oakland, Port of Oakland, Caltrans, CARB, PG&E, and others in addition to the Air District) as "a starting point."

PM Exposure and Risks: Discussion Summary

Because the event was running long and Advisory Council members had addressed their questions to the individual panelists, the discussion between the Advisory Council and the afternoon panel was brief.

Margin of safety. Vice Chair Kleinman asked for clarification on whether the risk assessment within the Draft PM Policy Assessment considered margin of safety for particulate matter. Dr. Jenkins responded that the risk assessment does not address margin of safety because the concept of safety rests solely within the judgement of the EPA Administrator.

Public Comment

Public comment was taken during two designated periods during the event. A list of the commenters during those periods follows the summary. Questions were also addressed to the lunchtime keynote speaker, former EPA Administrator Gina McCarthy.

Comment Summary

The general sentiment expressed by many commenters was, "We need action, not more discussion." Several people spoke about their personal experiences with toxic emissions in their neighborhoods. The disproportionate impact of air pollution on disadvantaged communities is a central point of focus.

Additional themes that emerged in public comment:

Physicians. A group of physicians expressed their position that they are not able to protect the health of their patients due to air pollution, particularly children with asthma. They emphasized the return on investment from improving air quality.

African American communities. Two attendees who addressed Gina McCarthy during her keynote speech focused on the challenges of African American communities in the Air District relative to cumulative impacts of air pollution problems and the need for education, training, and investment in environmental health.

Refineries. Several speakers expressed concerns about refineries in the Air District, both with respect to air pollution and the need to reduce or eliminate reliance on fossil fuels.

Mobile-source increases from stationary permits. A speaker from East Oakland highlighted air quality challenges from a local crematorium, not only from its direct emissions but also from diesel trucks making frequent deliveries.

Climate change. Concerns about climate change aspects of air pollution were emphasized in addition to the need to address immediate health issues.

Community representation. The suggestion was made to form a community advisory board for the Air District "with teeth," i.e., with the power to make and enact decisions.

List of commenters

PUBLIC COMMENT ON AGENDA MATTERS (ITEM 3)
Dr. Ashley McClure, California Climate Health Now
Sarah Schear, California Climate Health Now

PUBLIC COMMENT ON NON-AGENDA MATTERS (ITEM 7)
Katherine Funes, Rose Foundation for the Communities and the Environment
Jed Holtzman, 350 Bay Area
Jan Warren, Interfaith Climate Action Network of Contra Costa County
Dr. Amanda Millstein, California Climate Health Now
Dr. Cynthia Mahoney, California Climate Health Now
Sarah Schear, California Climate Health Now
Maureen Brennan, Rodeo citizen
Charles Davidson, Sunflower Alliance
Ken Szutu, Citizen's Air Monitoring Network
Margie Lewis, Communities for a Better Environment
Steve Nadel, Sunflower Alliance

Advisory Council Deliberation

The symposium concluded with the Advisory Council's deliberation regarding the implications of the information presented. The Advisory Council arrived at the following Sense of the Advisory Council statement:

> **The current standard is not adequately health protective. Further reductions in particulate matter will realize additional health benefits. We ask the Air District staff to bring forward with urgency options within the legal authority of the Air District that would limit PM exposure, especially in high-risk communities.**

Council Member Borenstein reflected the sentiment of the Advisory Council in stating, "We need more science, and we should act."

Additionally, Advisory Council members expressed interest in further exploring the potential for:

Treating PM as a toxic. Council Member Solomon stated that the lack of evidence for a threshold for PM health effects argues for treatment of PM as a linear, non-threshold toxic in the same manner as other toxic air contaminants and carcinogens.

Monitoring ultrafine particles. Council Member Solomon indicated support for continuing monitoring of ultrafine particles in the Bay Area or increasing monitoring if the costs are not unreasonable. The Air District's Deputy Air Pollution Control Officer Greg Nudd proposed that the Air District present to the Advisory Council regarding the UFP monitoring that is already occurring in order to better inform the Advisory Council's recommendations.

Encouraging the State of California to adopt stricter PM standards. Acknowledging that the District does not have the authority to set ambient air standards, Vice Chair Kleinman suggested that those present in the room should encourage the State to adopt stricter PM standards.

Ensuring local permits are consistent with PM standards supported by the science. Vice Chair Kleinman stated that because local permits and emission requirements for stationary sources are the specific purview of the Air District, the Advisory Council should focus on advising the Board on how the Air District could make those determinations consistent with improved ambient air standards.

Disaggregating solutions with climate co-benefits, solutions unrelated to climate strategies, and emergencies. Council Member Long argued for separately approaching three different categories of strategies for addressing PM: 1) strategies that reduce particulate matter as a co-benefit of addressing climate change, such as making engines more efficient and decarbonizing electricity; 2) strategies regarding issues such as road dust that are independent of climate

action (given that more efficient or electric cars still produce brake, tire, and road dust); and 3) emergencies including wildfires and explosions at permitted sites.

Bang for the buck. Council Member Long stressed the need to identify strategies with the greatest potential for impact and to track the outcomes of the strategies that are implemented.

Air District Implementation Plan. Vice Chair Kleinman stated the need for an Air District Implementation Plan in accordance with cleaner air standards. Chair Hayes expressed interest in the idea of an Air District Implementation Plan but stated that he was not yet ready to endorse the strategy and needed to gain a better understanding of what it would entail.

Next Steps

Three primary action items emerged from the first PM symposium:

1. **Air District delivery of presentations** to the Advisory Council on the Air District's current activities and capabilities to monitor ultrafine particles and to address PM exposures;
2. **Advisory Council discussion and deliberation** on these current and potential activities in light of the information presented at the October 28 symposium and summarized in this document; and
3. **Planning for a second symposium** for Spring 2020 to focus on community and other stakeholder input and engagement concerning PM exposures and health risks.

The Advisory Council will reconvene on **December 9, 2019**.

During that meeting, in response to the Advisory Council's requests, the Air District will present on its current activities to reduce PM exposures, including monitoring of ultrafine particles. It will also discuss additional "options within the legal authority of the Air District that would limit PM exposure, especially in high-risk communities," in accordance with the Sense of the Advisory Council, in order to inform the Advisory Council's advice to the Board.

The Advisory Council is expected to receive and comment on this symposium summary document during the December 9 meeting.

Planning for the Spring 2020 event continues with input from community representatives and other stakeholders.

Public Comments - October 28 PM Symposium Summary: Health Effects and Exposures and Risk		
Commenter	**Organization/ Location**	**Comment**
Bob Bernstein		See: McDonald F, Horwell CJ, Wecker R, Dominelli L, Loh M, Kamanyire R & Ugarte C (2020) Facemask use for community protection from air pollution disasters: An ethical overview and framework to guide agency decision making. International Journal of Disaster Risk Reduction, 43, Art. No.: 101376. https://doi.org/10.1016/j.ijdrr.2019.101376
H. Christopher Frey	North Carolina State University	"air pollution standards" should be changed to "National Ambient Air Quality Standards." The prohibition on considering costs is specifically with respect to the NAAQS, not with respect to other federal air pollution standards. (submitted by H. Christopher Frey, 12/19/19)
Samuel L. Altshuler	Chair AWMA Critical Review Committee	I found the information presented at the subject symposium very interesting and well done. However, one point that was overlooked is that when considering exposure to air pollutants in epidemiological studies, we must begin to include exposures of individuals within their homes and workplaces. As outdoor, ambient pollutants are dropped to lower and lower levels, exposure indoors to various air pollutants, particularly UFPM and NO2, can become relatively significant depending on the various indoor sources (cooking appliances, fireplaces, candles, cleaning materials, etc.)

Public Comment Period: December 19, 2019 to March 6, 2020

Particulate Matter:
Spotlight on Health Protection

Advisory Council Meeting Summary: BAAQMD Update on Current and Emerging Efforts on Particulate Matter

December 9, 2019

BAY AREA AIR QUALITY MANAGEMENT DISTRICT

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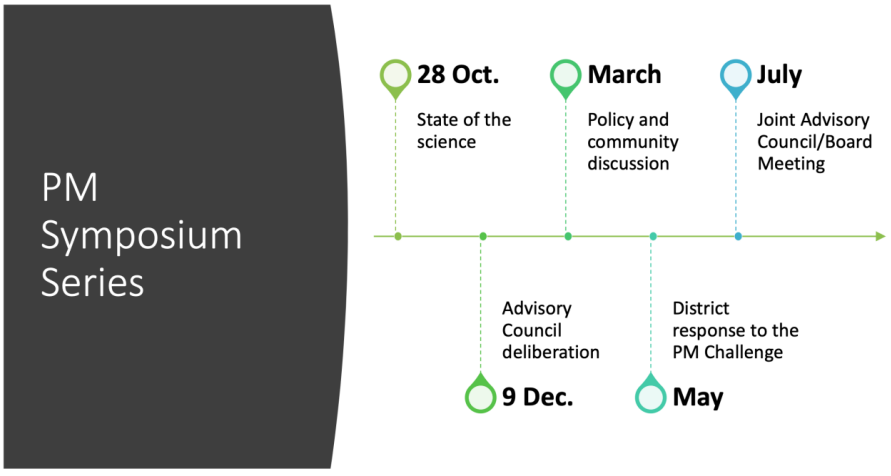
Executive Summary

The December 9, 2019 meeting of the Advisory Council (Council) of the Bay Area Air Quality Management District (Air District) focused on the Air District's current and emerging work to understand, monitor, reduce, and control regional and localized particulate matter (PM) concentrations.

As the timeline below illustrates, this Advisory Council meeting followed the October PM Symposium, which focused on the state of the science, and preceded the upcoming March PM Symposium. The March PM Symposium will focus on local community work, needs, and priorities. The PM Symposium Series as a whole will inform recommendations from the Advisory Council to the Air District's Board concerning further action the Air District can take to protect the health of Bay Area residents, particularly those who are disproportionately impacted by PM exposure.



The December meeting featured presentations regarding local, regional, and state PM reduction initiatives from Air District staff members and a representative from the California Air Resources Board (CARB). Additional agenda items included Advisory Council discussion of a written report on the October PM Symposium; development of a new document by the Advisory Council, which will provide responses to the questions originally posed by the Advisory Council and the Air District to the October PM Symposium panelists; and public comment.

Presentations

Source Apportionment. Phil Martien, Director of Assessment, Inventory, and Modeling, presented the Air District's current knowledge and information gaps regarding the sources of fine particulate matter (PM) in the Bay Area (excluding wildfires). New priorities require the Air District and its partners (CARB, Caltrans) to evaluate and update source apportionment procedures and corresponding regulatory frameworks. As PM emissions from previously

dominant sources (such as vehicle emissions) are reduced, additional sources emerge as priorities for controlling PM, yet less information is available about these newly emergent top sources. In particular, models for brake and tire wear and road dust have not been updated since the 1980s. Equally, the Air District's new focus on local-scale exposures requires new approaches to data collection, analysis, and rulemaking regarding stationary-source emissions. Point sources that are not significant at the regional level have not historically been prioritized for monitoring and control. These sources may be significant contributors of $PM_{2.5}$ at the local level.

Monitoring. Ranyee Chiang, Director of Meteorology and Measurements, along with assistant managers Ila Perkins and Katherine Hoag, presented regarding the Air District's monitoring network. They discussed both region-wide monitoring — largely designed to track progress against national ambient air quality standards — and more recently deployed monitoring approaches that are designed to address the Air District's emerging focus on community-scale concentrations or impacts from specific sources of emissions. In response to the Advisory Council's requests, additional information was shared regarding ultrafine particles and wildfires. Ultrafine particle monitoring has been in place for several years but is limited in scope by costs and scientific limitations of the instrument. Wildfires have caused dramatic increases to $PM_{2.5}$ concentration levels in the Bay Area, reversing a decade-long downward trend. The Air District is currently conducting an Integrated PM Network Assessment to evaluate its PM measurement network and recommend improvements.

Grants and Incentives. Karen Schkolnick, Director of Strategic Incentives, presented a summary of the Air District's grant revenue sources, current grants and incentive programs, and recent program results. Because these grant programs generally require emission reductions that go beyond regulatory requirements, the majority of the Air District's grant funding is targeted at reducing $PM_{2.5,}$ other criteria pollutants, air toxics, and greenhouse gases from mobile sources and complementing the Air District's regulatory PM reduction strategies targeting stationary sources. She highlighted several key initiatives focused on reducing mobile-source emissions through adoption of the cleanest commercially available technology (such as Diesel Free by '33 and Port of Oakland partnerships) and discussed how these programs connect to other Air District priorities including health risk reduction in communities disproportionately impacted by air pollution. Since 1991, more than $1.2 billion has been invested through the Air District's grants and incentives programs, resulting in significant emissions reductions and accelerated adoption of cleaner and zero-emission technology. However, each program is constrained by the requirements of its funding source — for example, only one of the Air District's sources of funding can be used to target vehicle miles traveled (VMT) reduction.

CARB PM Research and Rules. Alvaro Alvarado, Manager of Health & Ecosystems Assessment for CARB, described the PM research currently being conducted at CARB and the emerging regulations designed to further decrease PM emissions. In line with the Advisory Council's requests, he focused on research concerning wildfires, brake and tire wear, and ultrafine particles. Wildfire research includes study of a monkey colony at UC Davis, mobile platforms to monitor in-home exposures, and collaboration with NASA to track wildfires using aircraft. Brake

and tire wear research includes laboratory studies to quantify emissions as well as exposure studies with UC Riverside and health effects studies with UCLA. Studies of ultrafine particles include modeling annual average concentrations and speciation throughout the state and associating mortality with long-term exposures using the California Teachers Study cohort. With respect to rulemaking, several regulations are underway or forthcoming to reduce emissions from trucks, cars, and trains.

Air District PM Rules and Regulatory Development. Victor Douglas, Manager of Rule Development, presented a brief overview of the history, current efforts, and emerging directions for rule development in the Air District, which continues to update its rules and regulations to further limit PM exposures. As its focus shifts from an exclusively regional perspective to reducing risks for disproportionately impacted local communities, the Air District is exploring further regulation regarding restaurants, wood smoke, and indirect or magnet sources (e.g. warehouses), as well as the possibility of treating PM as a toxic air contaminant. Although the State of California does not presently recognize undifferentiated PM as an air toxic, it may be possible for the Air District to do so independently.

Discussion of Draft October PM Symposium Report

The Advisory Council discussed the draft report on the October PM Symposium prepared by consulting technical writer Elisabeth Andrews on behalf of the Air District, available online at https://www.baaqmd.gov/news-and-events/conferences/pm-conference. Three clarifying edits were made to the section on "Advisory Council Deliberation," and consensus was reached on releasing the draft report for public comment.

Advisory Council Q&A Document

Advisory Council Chair Stan Hayes introduced a document he initiated that provides responses to the questions originally posed by the Advisory Council and the Air District to the October PM Symposium panelists concerning PM health effects, exposures, and risks. His aim was to distill the information shared by the panelists into concise answers to each of the questions. Council Member Gina Solomon volunteered to assist Chair Hayes in further developing the question-and-answer document.

Public Comment

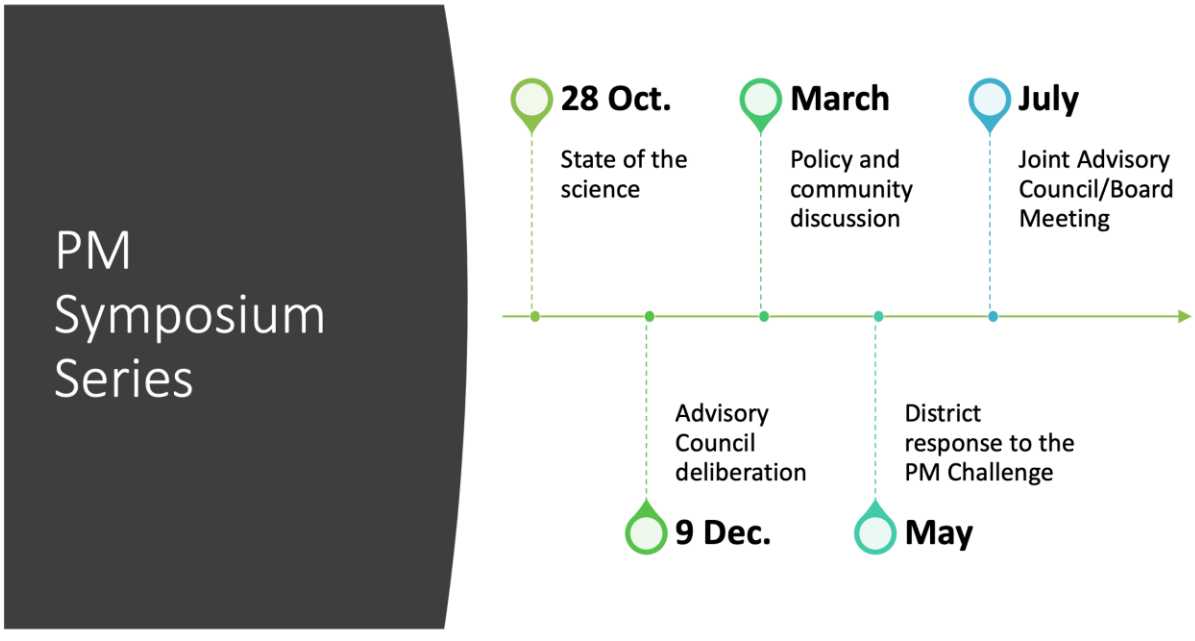
Commenters focused on the urgency of decreasing PM exposures and articulated a need to phase out fossil fuels and transition to a zero-carbon economy. Specific suggestions for the Air District included setting PM threshold levels based on sensitive subgroups rather than population averages, utilizing data from low-cost sensors and the California Household Exposure Study, and developing messaging campaigns focused on demonstrating the connection between specific sources of air pollution and health outcomes.

Next Steps

The next PM symposium will take place on March 24, 2020 in Oakland and is focused on presentations from community organizations and leaders. The May event is expected to focus on formulating potential Air District plans to further reduce Bay Area health risks from PM. The final event in the series brings together the Advisory Council and the Air District's Board of Directors to discuss the information and suggestions shared throughout the PM Symposium Series. During the July meeting, the Advisory Council is expected to present its findings to the Air District's Board of Directors regarding particulate matter and health in the Bay Area.

Background and Timeline

The December 9, 2019 meeting of the Advisory Council (Council) of the Bay Area Air Quality Management District (Air District) followed the October PM Symposium with updates on the Air District's current work on particulate matter (PM). Recognizing that PM is the overwhelming driver of health risks from Bay Area air quality, the Advisory Council requested that the Air District convene the PM Symposium Series in order to clarify the state of the science (October 28, 2019), describe current and forthcoming Air District work (December 9, 2019); learn about local community efforts, needs, and priorities (March 24, 2020); and present potential policy strategies (May 2020). As the timeline below illustrates, the series will culminate in recommendations from the Advisory Council to the Air District's Board of Directors concerning further action the Air District can take to protect the health of Bay Area residents, particularly those who are disproportionately impacted by PM exposure. An additional goal of the Air District and Advisory Council is to provide national leadership on improving air quality at a time when the federal government is retreating from this mission.



The first symposium took place on October 28, 2019, convening national, state, and local experts to discuss the state of the science on PM health effects, exposures, and impacts. Details on the presenters and the information they shared can be found in the Draft October PM Symposium Report available at https://www.baaqmd.gov/news-and-events/conferences/pm-conference. Following that event, Chair Hayes presented to the Air District Executive Committee of the Board of Directors on November 6, 2019 and to its full Board of Directors on November 20, 2019 concerning the Advisory Council's takeaways from the October PM Symposium.

Chair Hayes summarized those presentations at the December meeting. He highlighted several key topics discussed at the October PM Symposium: new evidence of causal relationships between PM and adverse health outcomes including premature death, evidence that the health of children and non-white people are disproportionately harmed by PM, strategies for understanding the sources and distribution of PM, and associations between wildfires and both respiratory and cardiovascular illness. He shared the Sense of the Advisory Council statement that emerged from deliberation at the close of the October PM Symposium:

> The current standards are not adequately health protective.
> Further reductions in PM will realize significant additional health benefits.
> We need more science, *and* we should act now.

Chair Hayes also listed the topics the Advisory Council sought to explore further: approaching PM as an air toxic, expanding monitoring of ultrafine particles, examining health effects of acute PM exposures (e.g. wildfire smoke), identifying PM species that are particularly dangerous, assisting the Air District in identifying strategies with the "highest bang for the buck" in terms of health protection, and pursuing strategies that have climate and other co-benefits.

These priorities set the agenda for the December meeting, which focused on the Air District's current and emerging work to understand, monitor, reduce, and control regional and localized PM concentrations. A representative from the California Air Resources Board (CARB) also presented on state-level PM research and regulations. Additional agenda items included Advisory Council discussion of a written report on the October PM Symposium as well as public comment.

The meeting was shared live via webcast, the video archive of which can be viewed at http://baha.granicus.com/MediaPlayer.php?clip_id=6369.

Update on Particulate Matter (PM) Air District Work: Regional- and Local-Scale $PM_{2.5}$ Source Apportionment

Phil Martien
Director, Assessment, Inventory, & Modeling, Bay Area Air Quality Management District
Project Lead, Technical Assessment of AB 617 West Oakland Community Action Plan

Main takeaway	**New priorities require the Air District and its partners (CARB, Caltrans) to evaluate and update source apportionment procedures and corresponding regulatory frameworks. As PM emissions from previously dominant sources are reduced, additional sources emerge as priorities for controlling PM, yet less information is available about these newly emergent top sources. This is particularly true for brake and tire wear and re-entrained road dust. Equally, the Air District's new focus on local-scale exposures requires new approaches to data collection, analysis, and rulemaking regarding stationary-source emissions.**

Dr. Martien presented the Air District's current knowledge and information gaps regarding the sources of fine particulate matter in the Bay Area (excluding wildfires). He first described how sources contribute to $PM_{2.5}$ concentration levels at the regional level and then turned to the Air District's community-scale analysis of local sources of $PM_{2.5}$ for West Oakland. The report provided here reflects both the presentation from Dr. Martien and the additional comments and clarifications from other Air District staff members during the presentation.

Current Air District Work

Proportion of regional vs local contributions. Regional sources are the main driver of Bay Area $PM_{2.5}$ concentrations: in West Oakland, local sources appear to contribute about 20% of the overall $PM_{2.5}$ burden in the community. However, time constraints on the West Oakland analysis precluded modeling approximately 30% of local $PM_{2.5}$ sources including construction, residential wood burning, and commercial cooking; these sources may constitute an additional proportion of local contribution to $PM_{2.5}$ concentration levels. Moreover, local sources may have highly significant impacts for people living or working in the immediate vicinity of those sources.

Regional Scale Apportionment

Based on newly updated modeling, peak levels of $PM_{2.5}$ in the Bay Area are on the order of 10 micrograms per cubic meter ($\mu g/m^3$), with the highest values seen in the Central Valley. It now appears that **secondary PM formation contributes almost half of $PM_{2.5}$**, which is higher than earlier estimates.

Sources of PRIMARY $PM_{2.5}$ in the Bay Area:

- **Permitted sources (23%)** - Within this category, refineries produce more than 40% of emissions from permitted sources. The top five emitters contribute approximately half of all $PM_{2.5}$ from permitted facilities.
- **On-road mobile sources (27%)** - Within this category, vehicle exhaust now contributes less than 20% of on-road mobile emissions. Brake and tire wear and road dust are far more significant contributors.
- **Non-road mobile sources (16%)** - Within this category, construction activity and commercial marine vessels each account for approximately one third of emissions from non-road mobile sources.
- **Area sources (34%) -** These sources tend to be individually small emitters that collectively make up a large portion of $PM_{2.5}$ emissions, including residential wood combustion and commercial cooking (largely char-broilers).

Sources of SECONDARY $PM_{2.5}$ in the Bay Area:

- **Diesel** trucks and off-road equipment contribute **NO_x**
- **Stationary sources** (including refineries and manufacturing plants) contribute **SO_2**
- **Agricultural activity** contributes **NH_3**

Community Scale Apportionment

Hyperlocal analysis of local-source primary $PM_{2.5}$ emissions was conducted for West Oakland, as described in the report on the October PM Symposium (https://www.baaqmd.gov/news-and-events/conferences/pm-conference) and the West Oakland Community Action Plan. Annual averages of $PM_{2.5}$ concentrations exclusively from local sources were calculated for each census block. $PM_{2.5}$ concentration levels were observed to vary seasonally, across the week, and even hour-by-hour with local activity.

Roadways and permitted facilities. Roadways and permitted facilities emerged as predominant local sources of primary $PM_{2.5}$ in West Oakland (acknowledging again that time constraints precluded modeling construction, residential wood burning, and commercial cooking).

Hyperlocal variation in source apportionment. Predominant sources of local-source $PM_{2.5}$ vary within West Oakland: in its southwest corner, the contributions of port and rail to local-source $PM_{2.5}$ are as high as 25%; roadway contributions in some locations are more than 75%; in other locations stationary sources contribute on the order of 40% of local-source $PM_{2.5}$.

Unequal impacts. Certain census blocks in West Oakland are exposed to much higher levels of local-source $PM_{2.5}$ than others.

Forthcoming Air District Work

The Air District faces challenges in overcoming information gaps concerning newly dominant sources of $PM_{2.5}$. As PM emissions from top sources are reduced, additional sources emerge as priorities, yet less information is available about these other sources. As a result of this lag between re-prioritization and updated scientific literature, there is considerable uncertainty in the estimates of source apportionment, and this uncertainty cannot yet be quantified.

Road dust. As emissions from vehicle exhaust are reduced, the proportion of $PM_{2.5}$ attributed to re-entrained road dust increases. However, calculations for re-entrained road dust were last updated in the late 1980s. These methods are being currently evaluated and updated by CARB and Caltrans.

More analysis of permitted sources. Point sources that are likely significant contributors of $PM_{2.5}$ at the local level may not be significant at the regional level. Because the Air District's focus has historically been at the regional level, direct measurements have not been collected for most of these sources. For example, because West Oakland permitted facilities account for only about 0.5% of emissions in the Bay Area, they have not historically been prioritized for monitoring and control. The Air District's new focus on localized impacts demands greater attention to these sources. For other Bay Area locations, particularly those in which the top five stationary-source emitters are located, the Air District is also in the process of determining local-scale impacts for residents. It is not yet clear how much exposure people experience from these emissions, particularly where emissions are distributed through tall stacks.

Post-Presentation Discussion

Brake and Tire Wear and Road Dust

- Council Member Linda Rudolph inquired about the **climate impacts** of newly emerging $PM_{2.5}$ priorities such as brake and tire wear and road dust. Dr. Martien responded that different $PM_{2.5}$ species can have different climate effects: soot tends to be warming, whereas secondary aerosol can be cooling. Air District Deputy Air Pollution Control Officer Greg Nudd added that road dust tends to be a localized issue as concentrations drop off quickly in spatial terms. However, brake and tire wear have emerged as water quality issues: microplastics in the San Francisco Bay have been shown to originate from tire wear.
- Council Member Severin Borenstein inquired about **technologies to reduce these effects**; Mr. Nudd and Air District Deputy Air Pollution Control Officer Damien Breen responded that reduction in vehicle miles traveled (VMT) is the primary control strategy as few technologies have emerged apart from vacuuming highways and some new European experiments in under-vehicle misting technologies. He later remarked that successful strategies for reducing road dust involve reducing the load on the road; while sweeping can have some positive effect, reducing track-out from construction and limiting roadside contributions through landscaping or paving tend to be more successful.

- Chair Hayes confirmed with Dr. Martien that brake and tire wear and road dust contribute significantly to both local and regional $PM_{2.5}$ exposures and remarked that addressing this issue will be an **important issue for the Air District**.
- Council Member Borenstein inquired about the **relationship between speed, congestion, and $PM_{2.5}$**. Mr. Breen explained that less speed generally means higher exhaust emissions; Dr. Martien stated that dynamometer testing is currently investigating the relationship between speed and brake wear for light- and heavy-duty vehicles.

Air toxics approach. Council Member Michael Kleinman suggested that the greatest benefit to public health may be gained through focusing on the most toxic components of $PM_{2.5}$. He provided the example of lead-contaminated particles from the cement plant in Cupertino posing more of a public health threat than ammonium sulfate aerosols (from secondary $PM_{2.5}$ formation) and stated that many of the secondary aerosols in $PM_{2.5}$ are less toxic than the primary aerosols.

Challenges with commercial cooking and residential wood burning. Council Member Solomon inquired about the Air District's authority with respect to commercial cooking, noting that the categories of regionally significant sources of $PM_{2.5}$ that are within the Air District's jurisdiction appear to make up 43% of the total regional apportionment. Mr. Nudd, with confirmation from Air District Legal Counsel Brian Bunger, explained that the Air District's regulatory authority for commercial cooking is clear. The Air District has an existing rule for large charbroilers. However, available post-combustion controls for restaurant cooking are too large to fit on a restaurant roof and too expensive to preserve profit margins. With respect to reducing residential wood burning, the challenge lies in overcoming cultural barriers.

Update on Particulate Matter (PM) Air District Work: Monitoring

Ranyee Chiang
Director, Meteorology & Measurements, Bay Area Air Quality Management District

Ila Perkins
Assistant Manager, Meteorology & Measurements, Bay Area Air Quality Management District

Katherine Hoag
Assistant Manager, Meteorology & Measurements, Bay Area Air Quality Management District

Main takeaway	**The Air District's new focus on community-scale monitoring complements its ongoing region-wide monitoring efforts. UFP monitoring has been in place for several years but remains limited in scope by costs and scientific limitations of the instruments. Wildfires have caused dramatic increases to $PM_{2.5}$ concentration levels in the Bay Area, reversing a decade-long downward trend.**

Dr. Chiang presented along with two assistant managers in Meteorology & Measurements, Ms. Perkins and Dr. Hoag, on the Air District's current monitoring network. They discussed both region-wide monitoring — largely designed to track progress against national ambient air quality standards — and more recently deployed monitoring approaches that are designed to address the Air District's emerging focus on community-scale concentrations or impacts from specific sources of emissions. In response to the Advisory Council's requests, additional information was shared regarding ultrafine particles and wildfires.

Current Air District Work

Regional/Regulatory Network

The Air District currently has 35 fixed air monitoring stations (as well as 20 meteorology stations) that provide timely air quality data to the public, compare PM concentration levels with national and state standards, inform air quality forecasts for the Spare the Air program, and support research studies. Most sites are selected based on the distribution of the population (2010 Census) and the concentration of pollutants, with some additional sites placed downwind of major pollution sources, to describe regional transport of pollutants, or in areas representing general background PM levels.

The measurement instrumentation used for Air District PM monitoring is described in Table 1. Mass measurements support compliance with California and national PM_{10} and $PM_{2.5}$ health-based standards and designate which areas are in attainment or nonattainment; chemically

resolved or speciated data measurements support emission reduction strategies; and particle counts of smaller particle sizes support science on emissions, air quality impacts, and health effects of types of PM for which there is currently no health-based standard.

Table 1 - Air District PM Instrumentation

Measurement Type	Mass		Chemically resolved or speciated		Particle count
Measurement application	Compliance with standards; Designate areas as attainment or nonattainment		Support emission reduction strategies		Assess air quality impacts and exposures
Analytical Target	PM_{10} mass	$PM_{2.5}$ mass	Black carbon	$PM_{2.5}$ speciation	Ultrafine particles ($PM_{0.1}$)
Analytical Methods	Gravimetric	Gravimetric or Filter-based beta attenuation	Filter-based light attenuation	Chemical extraction	Laser-based
Number of Active Monitors	7	20	7	4	6

Ultrafine Particle Monitoring

Strengths. The Air District has conducted ultrafine particle monitoring for more than seven years in a range of sites, producing data that can be used to understand diurnal and seasonal patterns and trends as well as differences between background, near-road, and typical urban settings.

Limitations. Ultrafine particle instrumentation is costly ($60,000-$100,000 per unit), requires frequent maintenance in PM-burdened areas, and cannot presently support identification of sources and sinks or robust links to specific health impacts.

Results. Air District ultrafine particle monitors installed in a variety of locations reveal that UFP concentrations reflect fresh, primary particulate emissions from both combustion and secondary formation. Higher levels of ultrafine particles are seen in near-road environments, with peaks at high-commute hours and the middle of the day, indicating a photochemical signature.

Wildfires

Prior to 2017, occasional impacts from wildfires did not have a significant influence on year-to-year trends, yet recent wildfires have dramatically affected Bay Area $PM_{2.5}$ concentration levels. Figure 1 shows the overwhelming effect of wildfires in 2017 and 2018. With wildfire days

removed, there has been a downward trend in $PM_{2.5}$ concentration levels for the past decade, yet wildfires have caused a sharp reversal of that trend, resulting in the Bay Area substantially exceeding the 24-hour federal standard for 2016 – 2018.

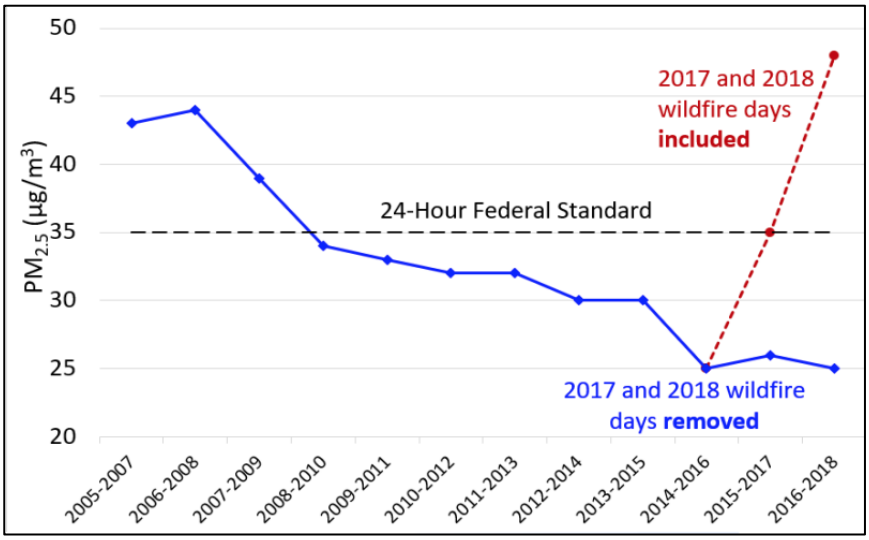


Figure 1 - Wildfire impact on 24-hour $PM_{2.5}$ concentration levels

Air District initiatives to minimize exposure to wildfire PM include:

- Communicating with the public about reducing personal exposure
- Collaborating with public health officers and other agencies to ensure consistent messaging
- Funding Clean Air Centers in which vulnerable people can seek refuge
- Offering grants and incentives for recovery assistance
- Providing guidance for local organizations, particularly schools

Forthcoming Air District Work

Community-Scale Monitoring

Several new developments support the Air District's new focus on community-scale monitoring:

Hyperlocal monitoring

In partnership with Aclima, the Air District is conducting street-by-street monitoring using vehicle-mounted sensor-based instrumentation measuring NO_x, CO, O_3, and $PM_{2.5}$, similar to previous studies Aclima performed in West Oakland and other areas. Measurements for a short-term study in the AB 617 Richmond-San Pablo study area will soon be available, and the Air District aims to use this technology to map average baseline hyperlocal air quality for the entire Bay Area within two years.

Mobile Laboratories

The Air District is also developing a van with mobile monitoring capabilities that can perform high-accuracy, detailed mobile or short-term measurements of PM and many specific gaseous air toxics, including the amount of PM of different sizes. Potential uses of this new monitoring van include supporting localized source apportionment and prioritization, confirming and improving the understanding of air quality issues identified by the AB 617 Steering Committees, and identifying locations for further fixed-site or portable monitoring.

Portable platforms

Highly portable, suitcase-sized monitoring systems will also be developed for battery-powered, continuous, real-time PM measurements. Although these technologies are expensive, they could enable measurements during power outages, which is important for supplying real-time air quality data during wildfires and periods of heightened wildfire hazard. These instruments can also be used to verify data from lower-cost sensor networks (such as PurpleAir).

Combining Monitoring Strategies

Whereas the regional fixed site network is primarily focused on large-scale assessments and long-term trends, the special projects and sensor networks described in Table 2 enable more community-specific assessment. The Air District's engagement in sensor networks involves working closely with community organizations and companies to provide technical capacity building and advice regarding the advantages, limitations, and uncertainties of different technologies.

Table 2 – Air District PM Monitoring Strategies and Objectives

Network	Measurements	Objectives	Limitations
Regional Network	$PM_{2.5}$ and PM_{10} mass	-Comparison with standards -Public information -Track long-term trends -Assess out-of-area transport	-High cost -Information gaps at community scale
Special projects: -fixed site -mobile laboratory -portable platforms	-PM size distribution -PM speciation -Ultrafine particles -Black carbon	-Source identification -Assessment of specific emission sources -Characterization of near-road environments	-High cost
Sensor networks: -fixed site -mobile/portable	-PM mass -Particle count	-Public education -Personal exposure monitoring -Identification of hot spots -Comparative assessment of local air quality -Tracking high-PM episodes	-Higher level of uncertainty

To strengthen these approaches, the Air District will complete an **Integrated PM Network Assessment by July 2020** to evaluate its PM measurement network and recommend

improvements. The assessment aims to determine how available resources and multiple monitoring approaches can best be deployed not only to continue addressing federal and state requirements but also to support and expand community-scale air monitoring activities and other Air District programs.

Post-Presentation Discussion

Ultrafine Particles

- **Monitoring costs.** Council Member Solomon inquired whether ultrafine particles monitoring equipment costs are expected to drop in the foreseeable future. Ms. Perkins replied that the Air District relies on one primary manufacturer and does not anticipate near-term cost reductions. Council Member Solomon introduced the idea of a challenge to technology developers to accelerate innovation in the direction of affordability. Dr. Chiang responded that she would contact representatives from the Environmental Protection Agency and CARB to investigate the possibility of pooling resources to propose such an initiative.
- **Data application.** Council Member Rudolph asked how the Air District's ultrafine particle data is being used to improve public health. Dr. Hoag responded that the data adds to the imperative to reduce roadway emissions. Mr. Nudd added that the Air District is implementing project grants to install filtration in near-roadway schools and is advising the Plan Bay Area initiative on limiting near-roadway exposures.
- **"We need more science, and we should act."** Chair Hayes reiterated the message from the first PM Symposium that while it is clear that more science is needed on UFP — including a federal reference method standardizing ultrafine particle measurement and epidemiological studies linking exposures to health effects — the Air District should also take immediate action.
- **Near-road health effects.** Following clarifications from Air District staff that the high levels of monitored UFP were due to roadway proximity, Council Member Kleinman pointed out that the documented health effects of near-road environments include low birth weight and cardiovascular problems. While there are many challenges for ultrafine particle research, including the difficulty of assessing dosage due to the extraordinarily low mass of UFP, studying the health effects of near-road environments may be an effective approach to understanding UFP exposures. He added that ultrafine particle concentrations drop precipitously as the distance from the roadway increases, with particle counts dropping by 80% at a 100-meter distance from the center of the road (and an additional 80% at a further 100 meters). Therefore, zoning regulations, berms, and buffers can make a significant difference in limiting exposures.
- **Combustion as source of UFP.** Dr. Hoag clarified in response to Council Member Borenstein's question about brake and tire wear and road dust that the source of UFP is combustion, not vehicle wear or road dust. She further clarified in response to Council Member Tim Lipman's question about ultrafine particle precursors that the sources of UFP appear to be anthropogenic.

- **Stationary sources and UFP.** Council Member Solomon asked whether the Air District has investigated UFP emissions from stationary sources. Dr. Hoag responded that such analysis has not been conducted, in part because UFP concentrations are unlikely to remain high outside the perimeter of the facilities due to the distance-based decreases in particle counts described above. However, she stated that this type of measurement could be a possible application for the new mobile and portable monitoring technologies.
- **UFP gradient studies in the Bay Area.** Council Member Solomon asked whether the Air District is conducting studies to assess the persistence of UFP concentrations at increasing distances from Bay Area roadways. Dr. Hoag replied that this analysis had not been undertaken as part of UFP monitoring in the Bay Area but that many previous studies had established the patterns of near-roadway UFP distribution, including the influence of meteorology, topography, and roadway design.

Data sharing. Council Member Rudolph also asked for clarification on how data is being shared with the public. Mr. Breen stated that regional network monitoring data is available on the Air District website (http://www.baaqmd.gov/about-air-quality/current-air-quality). Dr. Hoag added that the community-scale data being collected by Aclima will also be publicly available once it has undergone quality assurance.

Update on Particulate Matter (PM) Air District Work: Grants and Incentives

Karen Schkolnick
Director, Strategic Incentives, Bay Area Air Quality Management District

Main takeaway	**Since 1991, more than $1.2 billion has been invested through the Air District's grants and incentives programs, resulting in significant emissions reductions and accelerated adoption of cleaner and zero-emission technology. Because these initiatives are not subject to regulatory constraints, the Air District is able to use the great majority of funds to target mobile sources. However, programs are constrained by the requirements of the funder — for example, there is only one source of funding that can be used for VMT reduction.**

Ms. Schkolnick presented a summary of the Air District's grant revenue sources, current grants and incentive programs, and recent program results. She highlighted several key initiatives that incentivize the accelerated adoption of the cleanest commercially available technology and discussed how these programs connect to other Air District priorities including health risk reduction in communities disproportionately impacted by air pollution.

Current Air District Work

Prioritization Process

Because grants and incentive programs are not tied to regulatory constraints, the Air District is able focus almost all of its funding through these programs (90 to 95%) on reducing mobile-source emissions. Most of this funding goes toward accelerating the adoption of the cleanest commercially available technology. An additional priority is expediting emissions reductions in disproportionately impacted communities.

The cost effectiveness (CE) of nearly all programs is evaluated using the following formula (or a variant) from the Carl Moyer Program, established by the State of California and CARB:

$$CE = \frac{Funds\ Awarded}{Tons\ of\ NOx + ROG + (\boldsymbol{PM_{10}\ x\ 20})\ reduced}$$

Notably, this formula has changed over 20 years by incrementally increasing the weighting of PM from 1 to 20, reflecting the State's interest in health protection.

Current Funding Allocation

$97 million from grants and incentives in 2018 were allocated to:

- **On-road emissions reduction — $32 million (one third),** supporting both deployment and infrastructure for lower- or zero-emission light-, medium-, and heavy-duty vehicles (cars, trucks, and buses). Notably, pass-through programs also support this category, so the total amount of support is higher than this number.
- **Off-road mobile source emissions — $44.4 million (almost half),** from sources such as cargo handling equipment, agricultural equipment, marine and locomotive vehicles, and airport ground support. These are primarily diesel emissions and the cleanest commercially available technology in most cases is cleaner diesel, transitioning from Tier 0 or 1 to Tier 4 engines, although some electrification is now occurring such as Caltrain and lighter cargo handling and air ground-support equipment.
- **Vehicle Miles Traveled (VMT) reduction — $6.2 million (plus nearly $9 million in pass-through),** including shuttle and ride-share services connecting to mass transit, pilot services such as Bay Area Bike Share (now sponsored by Lyft), and expansion of bikeways and bike parking. The Spare the Air program is also funded in this category. For the Spare the Air program, funding is also supplied through pass-through programs, so the total amount of support is higher.
- **Household technology and local climate action — $5.1 million,** including lawn and garden equipment replacement, wood smoke reduction (now focused on reducing combustion through transition to heat pumps), and capacity-building for schools and local government.
- **Pass-through to county transportation agencies — $9.5 million,** primarily to implement trip reduction and on-road vehicle emissions reduction.

Notable Initiatives

Diesel Free by '33

This program focuses on introducing zero-emission technology in each category of vehicles and equipment as soon as it becomes commercially available. While the present focus is on the light-duty sector, the program is designed to incorporate categories such as marine, locomotive, and construction vehicles and equipment as technology evolves.

The **light-duty sector** demonstrates the expected pattern: While hybrid and natural gas vehicles were the best available technology 10 years ago, zero-emission vehicles have since emerged and become a focus for Air District grants and incentives funding. Currently:

- More than $15 million has been invested by the Air District, plus additional investments from the federal and state government and the private sector to help accelerate the adoption of light-duty zero-emissions vehicles
- Almost 8,000 electric vehicle charging ports are in place

- Renewables are included in 25% of Air District-supported charging ports
- Low-income residents are a focus for vehicle electrification programs
- 3% of Bay Area vehicles are electric
- 25% of all electric vehicles in the U.S. are in the Bay Area
- Goal: Five million vehicles by 2050
    - Presently ahead of schedule
    - Limitation is availability of vehicles

R&D advanced technology demonstration programs

The Air District also participates in advanced demonstration programs, which provide proof-of-concept for the deployment of improved technologies that are not yet commercially available. The Air District has recently been serving as the lead administrator for a $2.9 million project in partnership with Goodwill Industries, BYD (a manufacturer of heavy-duty battery electric vehicles and equipment) and CARB. This project will test and deploy 10 electric delivery trucks and one refuse hauler. Another $3 million project in partnership with Golden Gate Zero Emissions Marine and CARB will build, test, and deploy the first hydrogen-powered ferry for passenger service in mid-2020. Both of these projects are funded primarily through the California Climate Investments program from CARB's Low Carbon Transportation program.

Port of Oakland

Over the course of ten years, Air District grants have invested approximately $120 million in retrofitting and replacing vehicle technology and infrastructure at the Port of Oakland, including replacing approximately 2,000 drayage trucks and more than 1,000 on-road trucks, installing shore power at 14 berths, and updating harbor craft and cargo handling equipment.

Recent (since 2015) Results and Highlights

Significant reductions in regionwide emissions

- CO_2: nearly 600K tons
- NO_x: more than 3K tons
- Reactive organic gas: more than 1K tons
- PM_{10}: nearly 400 tons

Infrastructure and equipment implemented

- More than 1,000 electric vehicle charging stations
- Approximately 40 miles of bikeways
- More than 1,200 woodstoves and fireplaces replaced
- More than 100 zero-emissions transit and school buses

Supporting disproportionately impacted communities

Approximately 53% of funds went to programs in Community Air Risk Evaluation (CARE) areas.

More than $1.2 billion in total investments

Through 2020, clean air investments from Air District grants and incentives total over $1.2 billion. This figure represents significant growth since these programs were initiated in 1991 with approximately $5 million.

Forthcoming Air District Work

For 2020, an estimated $108 million will be invested through the Air District's Strategic Incentives programs. In addition to the continuation of the initiatives described above, including the expansion of eligible vehicles and equipment for Diesel Free by '33, the Air District will promote:

- expansion of **lawn and garden** equipment replacement programs,
- reducing **motorcycle** usage,
- funding **air filtration systems** and **clean air shelters**,
- funding **climate resilience** programs, and
- securing **new sources of funding** to expand eligibility of existing programs (such as VMT reduction) and initiate new efforts.

Post-Presentation Discussion

Successes. Chair Hayes and Council Member Rudolph commended the Air District's successes through its grants and incentives programs, particularly with regard to the Port of Oakland and other initiatives targeting diesel particulate matter.

VMT reduction. Council Member Rudolph asked why more funding had not been allocated to VMT reduction and inquired whether the Carl Moyer formula disincentivized VMT as a focus. Ms. Schkolnick explained that while VMT reduction is a priority for the Air District, efforts are limited by available funding sources. The only funding stream that allows for VMT reduction is the Transportation Fund for Clean Air. Annually, of that fund's approximately $25 million, $9 million is allocated as a pass-through to county transportation agencies and used primarily for VMT reduction. The Air District's remaining amount from that fund is split between light-duty emission reduction programs and reducing VMT. Additionally, the Air District partners with the Metropolitan Transportation Commission on regional efforts such as the Bay Area Carpool Program through 511.org and Spare the Air. Mr. Breen added that the new focus on VMT and reducing brake and tire wear and road dust comes as a result of the Air District's successes in reducing emissions from diesel particulate matter, which was previously the predominant source of PM and remains a significant health concern in disproportionately impacted communities. He noted that the science has not yet caught up to the change in priorities, and that the Air District can advocate for changes in legislation once that science is clear.

Retirement of diesel equipment. Council Member Lipman inquired whether the Diesel Free by '33 initiative is retiring diesel vehicles and equipment or only adding additional lower- and zero-emissions technologies to fleets. Ms. Schkolnick clarified that nearly all Diesel Free by '33 programs are replacement programs.

Evaluation formula. Chair Hayes asked for clarification on the use of the Carl Moyer guidelines for evaluating cost effectiveness. In response to Chair Hayes' question concerning the designation of PM_{10} as the focus of emissions reduction, Ms. Schkolnick affirmed that the formula does specify PM_{10} rather than $PM_{2.5}$. She added that there has been some discussion about converting the formula to $PM_{2.5}$, but it is not clear how the formula would need to be altered to result in an equivalent evaluation. She also clarified in response to Chair Hayes' question about sidebar calculations that the Air District does use additional and more complex calculations to further evaluate some programs, such as co-benefits, $PM_{2.5}$, brake and tire wear and road dust, and proximity to disproportionately impacted communities. Council Member Kleinman commented that the risk of specifying PM_{10} is that courser particles are easiest to remove and, due to their greater mass, will reflect a greater apparent reduction of emissions while potentially leaving in place all the $PM_{2.5}$. He noted that to ensure health protection it would be beneficial to apply an alternative formula that balances that risk. Mr. Breen clarified that while the Carl Moyer Program requires the application of the specified formula, the tools that the Air District uses (such as calculating Significant Emissions Rates and using diesel particulate matter filters) do capture $PM_{2.5}$. He acknowledged that the more difficult correlation to establish is the degree to which applying the Carl Moyer guidelines using Air District approaches succeeds in reducing ultrafine PM.

Renewable charging stations. Council Member Kleinman asked how many of the approximately 8,000 electrical vehicle charging stations use renewable energy. Ms. Schkolnick replied that while she did not have information about all of the charging stations in the area, approximately 25% of the stations that the Air District has funded use renewable energy (primary solar).

Update on Particulate Matter (PM) Work: CARB PM Research and Rules

Alvaro Alvarado
Manager, Health & Ecosystems Assessment, California Air Resources Board (CARB)

Main takeaway	**CARB is currently conducting research to better understand the air quality impact of wildfires, brake and tire wear, and ultrafine particles. New and forthcoming regulations will soon be implemented to further reduce emissions from mobile sources.**

Dr. Alvarado described the PM research currently being conducted at the California Air Resources Board and the emerging regulations designed to further decrease PM emissions. In line with the Advisory Council's requests, he focused on research concerning wildfires, brake and tire wear, and ultrafine particles. Several regulations are underway or forthcoming regarding trucks, cars, and trains.

Current CARB Research

Why PM? Dr. Alvarado began his presentation by highlighting the health impacts of PM including approximately 7,200 premature deaths each year in California. Although CARB regulations specifically track hospitalizations and emergency room visits as health outcomes of PM, CARB is also aware of and concerned with outcomes such as asthma attacks and other respiratory symptoms, adverse brain effects, and work loss days. He noted that regulations implemented over the past 25 years, particularly with respect to trucks, have contributed to substantial decreases in average $PM_{2.5}$ concentrations.

Wildfires

Millions of Californians — by some estimates, the entire State population — were exposed to wildfire smoke in 2018, and wildfires are expected to become more frequent and widespread as a result of climate change. Although the current assumption is that all PM is equally toxic, this may not be the case; as wildfires cause more extensive damage there will be more combustion of structures and vehicles that could cause more toxic smoke. Effects could be particularly pronounced for children and older adults. Current CARB research includes:

- **Monkey study at UC Davis.** As Office of Environmental Health Hazard (OEHHA) Director Lauren Zeise described during the first Air District PM symposium, UC Davis researchers are investigating the effects of the 2008 wildfires on an outdoor captive monkey colony. When compared to monkeys in the population born in 2009, monkeys that were infants in 2008 experienced impaired immune function, changes in lung structure, and reduced

lung function, which persisted into adulthood. Moreover, immune effects were passed on to the next generation.

- **Wildfire emissions research.** Researchers at UC Berkeley and UC Riverside are using mobile monitoring platforms to investigate in-home exposures to wildfire smoke, and CARB is partnering with NASA to use aircraft to collect wildfire data.

Brake and Tire Wear

As previously noted by other presenters, as tailpipe emissions are reduced, brake and tire wear become more predominant sources of mobile-source PM. These emissions are more localized; whereas tailpipe emissions are associated with secondary PM and downwind exposures, brake and tire wear primarily affect people living near roadways. Health effects from brake and tire wear may be distinct from tailpipe emissions due to the presence of metals and plastics in wear-based PM emissions. Current CARB research includes:

- **Laboratory studies** quantifying brake and tire wear emissions using dynamometers,
- **Community exposure** studies with UC Riverside, and
- **Health effects** studies with UCLA.

Ultrafine Particles

Dr. Alvarado reiterated that ultrafine particles are difficult to measure and study, that it travels from the lungs to other organs including the brain, and that concentrations vary by space and time with peaks near roadways and during traffic that taper off at a distance and at night. He noted that prior research, primarily in Europe, has limited utility as it tends to focus on short-term exposures (one to four days) measured at only one location and using the extreme outcomes of hospitalizations and premature death. If ultrafine particles are similar to $PM_{2.5}$, long-term exposures can be expected to be far more significant than short-term exposures and indexed to population proximity and vulnerability.

To begin closing these research gaps, current CARB research is 1) **modeling ultrafine particles** annual average concentrations and speciation throughout the state and 2) **associating mortality** with long-term exposures using the California Teachers Study cohort. Preliminary results suggest an increased risk of premature death with high exposure to ultrafine particles. Additionally, to better understand health effects of short-term exposures to UFP, CARB is working with Council Member Kleinman to identify gaps in available research and develop a research plan.

Forthcoming CARB Regulations

A number of regulations will soon be implemented to further reduce mobile source emissions.

Heavy-Duty Trucks

- Advanced Clean Truck Regulation will transition heavy-duty trucks to zero emissions starting in 2024.
- Heavy-duty vehicle inspection and maintenance will require trucks to pass an inspection similar to a smog check in order to register with the California Department of Motor Vehicles.
- Innovative Clean Transit will transition public transit buses to zero emissions.
- Airport shuttles will also be transitioned to zero-emission vehicles by 2035.
- The Heavy-Duty Low NO_x omnibus rule will reduce NO_x as well as PM from diesel trucks, thereby addressing both primary and secondary PM.

Warehouses

- CARB is developing a Freight Handbook outlining best practices for warehouses to reduce their contributions to emission levels.
- New regulations are being developed for:
    - Transport refrigeration units,
    - Drayage trucks, and
    - Cargo handling equipment.

Passenger Cars

- Advanced Clean Cars 2 will increase the number of zero-emission vehicles on the road and reduce tailpipe emission through 2026.
- Catalytic converter theft reduction is being implemented to ensure that converters are stamped by manufacturers and registered with cars.

Trains

CARB is currently working with railyards in southern California to reduce idling. Lessons from this effort will be applied statewide, potentially through regulation, to reduce emissions from trains.

Post-Presentation Discussion

Next steps? Chair Hayes asked for the presenter's opinion on the next steps to improve public health. Dr. Alvarado, who clarified that he was speaking on behalf of himself and not CARB, replied that his priority would be to utilize low-cost in-home monitors to better understand how short-term localized exposures are affecting people in disadvantaged communities. This information could be used to direct regulations and resources toward improving health among the most vulnerable Californians, in line with AB 617.

Addressing brake and tire wear and road dust. Noting that Dr. Martien's presentation revealed that the great majority of PM emissions experienced in West Oakland are from regional sources, Chair Hayes inquired whether brake and tire wear and road dust contribute to these regional-source exposures and whether these issues are under CARB's regulatory authority. Dr. Alvarado replied that he could not speak to CARB's authority on these matters, but that brake and tire wear and road dust are more localized issues. Council Member Kleinman commented that regenerative braking technology appears to reduce brake wear and could be a useful target for incentive structures. Council Member Lipman clarified that such technology can only be used with hybrid vehicles, but that it could be promising as an innovation that benefits both fuel efficiency and PM reduction.

Relative health impact of wildfires. Chair Hayes asked the presenter to characterize the relative contribution of wildfires to public health risk in comparison to day-to-day PM emissions from other sources. Dr. Alvarado responded that while there was not sufficient research to quantify the impact of wildfires at their newly intensified levels, it does appear that wildfire smoke has health effects similar to those of other types of PM exposure.

Defining premature death. Council Member Lipman asked for clarification on how premature death is defined in CARB's calculations. Dr. Alvarado, along with Council Members Kleinman and Rudolph, clarified that the calculation is a statistical analysis of population-level loss of life relative to life expectancy.

New technologies increasing UFP? Council Member Solomon recalled that when natural gas and diesel reduction technologies were first being developed for transportation, there was some concern that they could increase ultrafine particle emissions. She asked whether that prediction had been accurate. Dr. Alvarado responded that while he would need to check to be certain, he believed that an initial increase in ultrafine particles was seen in early natural gas vehicles, but the problem had since been addressed through controls.

Update on Particulate Matter (PM) Air District Work: PM Rules and Regulatory Development

Victor Douglas
Manager, Rule Development, Bay Area Air Quality Management District

Main takeaway	**The Air District continues to update its rules and regulations to further limit PM exposures. As its focus shifts from an exclusively regional perspective to reducing risks for disproportionately impacted local communities, the Air District is exploring the possibility of treating PM as a toxic air contaminant. Although the State of California does not presently recognize undifferentiated PM as an air toxic, it may be possible for the Air District to do so independently.**

Mr. Douglas presented a brief overview of the history, current efforts, and emerging directions for rule development in the Air District. He described how the Air District's emerging focus on health risks for local communities is prompting further consideration of rulemaking regarding stationary source emissions and potential treatment of undifferentiated PM as an air toxic.

Current Air District Work

Approaches

The Air District has approached PM regulation in three distinct ways:

1. As a **nuisance**, which was the initial approach in the first Air District regulations adopted in 1979 and 1980 regarding open burning and dust and aerosols.
2. As a **criteria pollutant**, which is the current, regional approach to undifferentiated PM governing attainment of ambient air quality standards. These regulations apply to both primary PM (filterable and condensable) and precursors of secondary PM (oxides of nitrogen and sulfur dioxide). With this approach, the Air District selects the most cost-effective strategies to achieve regional standards.
3. As an **air toxic**, which is the approach taken specifically to diesel PM to limit localized exposures. The air toxic approach can be either risk-based (utilizing modeling) or technology-based (limiting emissions from specific sources, such as dry-cleaning facilities or backup generators).

Mr. Douglas mentioned that a forth potential approach would be to consider climate impacts.

Regulations and Rules

There are 57 Air District rules that directly or indirectly address PM, housed within a range of regulations including those governing permits, open burning, inorganic gaseous pollutants,

hazardous pollutants, and miscellaneous standards of performance. Several PM regulations and rules have been updated since 2012, including a new Regulation 6 on Particulate Matter established in 2018.

Mr. Douglas specifically highlighted **Air District Rule 11-18: Reduction of risk from air toxic emissions at existing facilities.** Recent revisions to this rule reduced the threshold limit on toxic air contaminants by an order of magnitude (from 100 ppm to 10 ppm), requiring approximately 80 existing permitted facilities to develop plans to reduce their emissions or install best available control technologies. This rule is one example of the Air District's emerging focus on localized, community-specific exposures and health risk. Another example he mentioned is **Rule 6-5: Particulate emissions from refinery fluidized catalytic cracking units**, which was recently revised to further reduce localized PM emissions from refineries.

Forthcoming Air District Work

Localized Sources

As the Air District turns increasing attention to localized health impacts of PM for disproportionately impacted communities, it is exploring further regulation regarding:

- **Restaurants**,
- **Wood smoke**, and
- **Indirect or magnet sources** (e.g. warehouses, which do not directly emit PM, but attract PM-producing traffic such as diesel trucks).

PM as an Air Toxic

The Air District is also engaged in exploring the possibility of approaching undifferentiated PM as an air toxic. The present constraint is that the Air District has relied on the State of California's list of toxic air contaminants, which does not include undifferentiated PM. Air District rulemaking that treats PM as a toxic could potentially be developed, independent of state-level air toxics regulations, if the Air District is able to identify appropriate methodology to perform health risk assessments.

Post-Presentation Discussion

Shifting focus to greenhouse gas emissions and global warming? Council Member Rudolph asked how a hypothetical emphasis on climate impacts would shift the Air District's approach to PM regulation. Mr. Douglas responded that reducing climate impacts is a co-benefit of the other three approaches to PM (as a nuisance, criteria pollutant, and air toxic). Mr. Nudd added that an emphasis on climate impacts could shift the Air District's focus more heavily toward black carbon, but that he was uncertain of the effect such a shift would have on health risks.

Council Member Rudolph commented that climate change presents the greatest health risk to the population.

Toxics framework. Chair Hayes asked for clarification on the process by which undifferentiated PM could be introduced into the regulatory framework as a toxic air contaminant. Mr. Bunger explained that the first option was for OEHHA to add undifferentiated PM to its list of air toxics, which would immediately trigger its inclusion in several existing Air District rules including 11-18 (existing facilities) and 2-5 (new source review). The Air District has requested this action from OEHHA, and analysis is underway at the state level, but the Air District does not have the power to compel such action by the State. However, in theory, the Air District does have the ability to independently classify undifferentiated PM as a toxic air contaminant and treat it accordingly. To do so, the Air District would need to identify appropriate methodology to use for health risk assessment. Chair Hayes noted that the Air District already concerns itself with controlling source-specific PM emissions in its modeling regarding attainment of ambient air quality standards. Mr. Bunger clarified that such analysis does not presently apply to every source of PM emissions, as it would if PM were classified as an air toxic. Board Member Sinks asked whether OEHHA has committed to a schedule for evaluating undifferentiated PM for potential inclusion on its air toxics list. Mr. Nudd responded that he does not observe a willingness on the part of OEHHA to enact statewide recognition of undifferentiated PM as an air toxic in the near term, likely due to present challenges in some parts of the state with meeting existing federal air quality standards. However, he explained that OEHHA is assisting the Air District with its PM analyses, and does appear willing to support the Air District (at least through peer review) if it moves toward independently recognizing undifferentiated PM as a toxic. Mr. Bunger noted that the Air District is also exploring other distinct PM species (besides diesel PM) as air toxics.

Discussion of Draft October PM Symposium Report and Advisory Council Q&A Document

The Advisory Council discussed the draft report on the October PM Symposium prepared by consulting technical writer Elisabeth Andrews on behalf of the Air District, available online at https://www.baaqmd.gov/news-and-events/conferences/pm-conference.

The Advisory Council briefly considered potential updates such as revising the "topics for further exploration" identified in the draft report into Advisory Council findings and creating further content for the "Next Steps" section. Chair Hayes also introduced the prospect of incorporating an additional document into the report. That document, which he initiated, provides responses to the questions originally posed by the Advisory Council and the Air District to the October PM Symposium panelists (see Appendix for the list of questions). His aim was to distill the information shared by the panelists into concise answers to each of the questions. Ultimately, the Advisory Council determined that because the purpose of the October PM Symposium report was to serve as a record of the October PM Symposium, it was appropriate to limit that report's contents to what had been shared during that event.

Edits to Draft October PM Symposium Report. Three clarifying edits were made to the October PM Symposium report draft, all within the section on "Advisory Council Deliberation." The Advisory Council agreed to release the draft report for public comment following these edits.

Progress of Q&A document. Council Member Solomon volunteered to assist Chair Hayes in further developing the question-and-answer document. Several Advisory Council members made suggestions regarding the draft Q&A:

- Council Members Solomon and Kleinman supported recommending the treatment of PM as a non-threshold toxic. Council Member Kleinman noted that the dose-response relationship appears to be curvilinear rather than linear.
- Council Member Solomon argued for incorporating information from the forthcoming March PM Symposium (focused on community organizations) into the Q&A.
- Council Member Rudolph stated the need to emphasize new evidence for likely causal relationships between PM and specific health effects and the greater sensitivity of vulnerable populations. She also noted the importance of reducing ambient PM levels as much as possible in the presence of events such as wildfires that cannot be placed into a regulatory framework.

Public Comment

Three opportunities were provided for public comment: prior to presentations from Air District staff, following presentations from Air District staff, and toward the close of the meeting following Advisory Council deliberation on the October PM Symposium Summary draft report. A list of the commenters follows; their comments are categorized by topic and summarized below.

List of Commenters

Dr. Ashley McClure, primary care physician, Oakland
Jed Holtzman, 350 Bay Area
Greg Karas, Communities for a Better Environment
Richard Grey, 350 Bay Area

Comments

Structure of public comment. Dr. McClure suggested that comment on agenda items should take place after the agenda items had been discussed by presenters and the Advisory Council. Mr. Holtzman requested that the Advisory Council determine and publicize the timing of public comment periods in advance of Advisory Council meetings. Council Member Borenstein concurred with Mr. Holtzman's suggestion, and Chair Hayes indicated that the Advisory Council would implement this suggestion by formally determining public comment periods in advance so that people who wish to comment can plan when to be present at Advisory Council meetings.

Urgency. Dr. McClure stated that the October PM Symposium left little ambiguity regarding the health impacts of PM, and asked why further symposia were necessary prior to rulemaking. Mr. Holtzman also questioned the pace of progress and the duration of time between meetings. Council Member Borenstein stated that while the Advisory Council was interested in recommending the Air District move toward stricter PM controls, it was not yet clear precisely what the targets should be. He emphasized the importance of measured and deliberative action, as rulemaking is likely to be challenged in court.

Strong statements. Addressing the need to establish a public record to support rulemaking, Mr. Holtzman urged Advisory Council members to "be very fierce in your statements" regarding the implications of the science.

Zero-carbon economy. All four commenters spoke of a need to phase out fossil fuel combustion and transition to a zero-carbon economy. Tying fossil fuel combustion to the climate conditions that have led to increased wildfires, commenters emphasized that reducing

risks from wildfires can only be achieved by reducing the greenhouse gas emissions that ultimately contribute to their frequency.

Air District actions. Commenters recommended specific actions for the Air District:

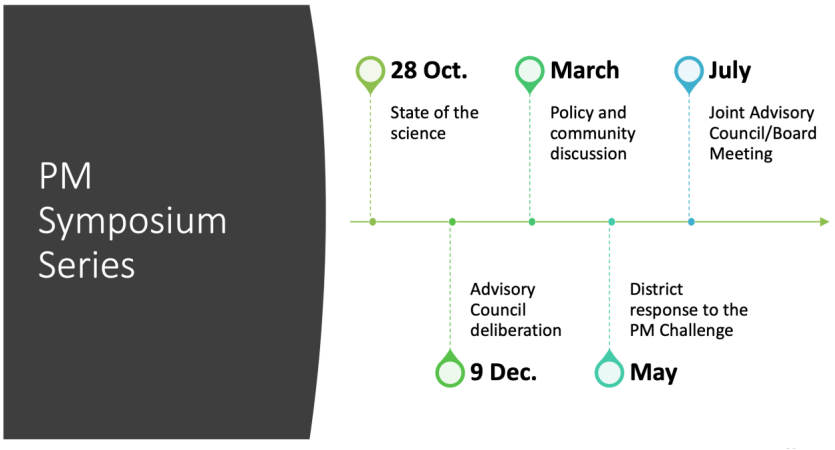
- Set PM threshold levels based on sensitive populations (Holtzman)
- Focus separately on top local and regional sources of PM (Holtzman)
- Update modeling approaches for brake and tire wear and road dust (Holtzman)
- Address agriculture as a source of NH_3 emissions (Holtzman)
- Use fees on PM emitters to support increased instrumentation for speciation (Holtzman)
- Increase attention to black carbon, which has both health and climate impacts (Holtzman)
- Verify low-cost sensors and utilize their data once verified (Holtzman)
- Tighten controls on ultrafine particles, exposure to which is an environmental justice issue as risks are closely associated with proximity to sources (Karas)
- Utilize findings from the California Household Exposure Study, which measured indoor and outdoor $PM_{2.5}$ concentration levels and found both to be higher near refineries (Karas)
- Focus attention on refineries and the oil industry, particularly fluid cracking units (Grey)
- Develop messaging campaigns to help the public recognize the connection between sources of air pollution and health outcomes (McClure)
- Emphasize, possibly at the March PM Symposium, the meaning and values driving the pursuit of tighter air quality controls; “Give us all something to believe in” (McClure)

Partner actions. Commenters also recommended actions that are outside Air District jurisdiction:

- Pursue a tighter state standard for PM (Holtzman)
- Offer free public transit, either on Spare the Air days or at all times (McClure)

Next Steps

The PM Symposium Series continues as depicted in the timeline below. The next symposium will take place on March 24, 2020, in Oakland, focused on presentations from community organizations and leaders. Planning is currently underway.



Following the March symposium, the May event is expected to focus on formulating potential Air District plans to further reduce Bay Area health risks from PM, particularly for disproportionately impacted communities.

The July event brings together the Advisory Council and the Board of Directors to discuss the information and suggestions shared throughout the PM Symposium Series. During this final meeting in the series, the Advisory Council is expected to present its findings to the Board of Directors regarding particulate matter and health in the Bay Area.

Appendix — Questions from the Advisory Council and Air District sent to October PM Symposium Panelists

GENERAL

- What is bullseye in clean air target? How clean is clean enough?
- How will we know when we get to target? What metrics should we use to track progress?
- How do we combine criteria pollutants and toxics? Cancer and non-cancer health endpoints? Short- and long-term effects?
- How can we make sure everyone is treated fairly?
- How can we ensure that everyone breathes clean air?
- What are most important actions that can be taken now? And, in future?

HEALTH EFFECTS PANEL

- Are current PM standards sufficiently health protective?
- Are some species of PM more dangerous than others?
- What is role of ultrafine particles (UFPs)?
- Should form of target expand to account for more than just mass?
- How should we include draft PM ISA's new "likely-causal" health endpoints (nervous system effects, cancer) and new more sensitive populations (children, lower socio-economic status)?
- What are health impacts of high-concentration acute events (e.g., wildfires)? How should we compare them to day-to-day PM impacts?

EXPOSURE AND RISK PANEL

- What are major sources of PM in the Bay Area?
- What PM levels exist in Bay Area? What health risks do they pose?
- How much additional health benefit can be achieved?
- How should we account for spatial scale of effects (i.e., regional versus local-scale impacts, including proximity to major sources)?
- How should we determine which measures would most move public health needle?

BAY AREA AIR QUALITY MANAGEMENT DISTRICT
Memorandum

To: Chairperson Stan Hayes and Members of the Advisory Council

From: Jack P. Broadbent
Executive Officer/APCO

Date: May 6, 2020

Re: Community Particulate Matter (PM) Discussion Overview

RECOMMENDED ACTION

None; receive and file.

DISCUSSION

On February 27, 2020, approximately 30 community members from a variety of local organizations met together with Air District staff at the Bobby Bowens Center in Richmond, California. At this meeting, community members received presentations from Air District staff on particulate matter sources, emissions, and policy approaches to reducing particulate matter in the Bay Area. Community members asked questions, shared their concerns regarding particulate matter and its health effects, and discussed policy strategies.

A summary of the discussion is included for the Advisory Council's review.

BUDGET CONSIDERATION/FINANCIAL IMPACT

None.

Respectfully submitted,

Jack P. Broadbent
Executive Officer/APCO

Prepared by: Elinor Mattern
Reviewed by: Gregory Nudd

Attachment 4A: Community Particulate Matter Discussion Summary

SUMMARY: Community Particulate Matter Discussion February 27, 2020

NOTE: A full transcript of the event is available from the stenographer. This summary aims to capture key themes in advance of the submission date for background materials for the next PM Symposium.

Overview

Community members, grassroots organization leaders, and Air District staff members met at the Bobby Bowens Center in Richmond on the evening of February 27, 2020 to gather community input on particulate matter (PM) impacts, monitoring, and regulatory efforts. The event was organized by a Design Team of community leaders with assistance from Elinor Mattern of the Air District's Community Engagement Section. Approximately 30 people attended to express their concerns regarding PM, its sources, and its health effects.

Input from community members centered on the following issues:

<u>Localized PM data availability</u>
- Desire for data beyond West Oakland
- Desire for real-time, continuous, publicly accessible localized monitoring
- Consolidating/sharing community-collected data (e.g. PurpleAir)

<u>Toxicity of different PM species</u>
- Concerns regarding severity of problems from refineries and other permitted sources (e.g. cement plant, concrete crushers, metal processing facilities)
- Skepticism regarding wood burning as a major driver of health impacts

<u>Lack of observable results from prior rulemaking</u>
- 2017 Clean Air Plan
- Crude slate inventory
- General enforceability issues

<u>Potential for problems to worsen</u>
- Issuance of new permits
- Emerging indoor air concerns (e.g. vapor intrusion) beyond the scope of the Air District
- Climate impacts
- Lengthy time horizon prior to implementation (e.g. diesel PM rules took 10 years)

This summary provides a brief background on the event. Additional details regarding these community concerns and the Air District's clarifications in reply are noted in the transcript.

Background

The February Community Discussion in Richmond was part of a series of Bay Area events focused on health effects of PM. This series began in October of 2019 and will culminate in a set of findings from the Air District's Advisory Council to be delivered to the Air District Board. The Community Discussion preceded a planned symposium that was to be held in Oakland, originally scheduled for March 24th, 2020, but postponed due to COVID-19, at which representatives from local community organizations would present to the Advisory Council regarding local PM efforts, needs, and priorities. The purpose of the Community Discussion was to gather additional community input and engagement prior to that next Symposium.

The following community leaders worked together to organize the event with assistance from Elinor Mattern of the Air District's Community Engagement Section:

- Katherine Funes - New Voices Are Rising
- Richard Gray - 350 Marin
- Jed Holtzman - 350 Bay Area
- Ashley McClure - California Climate Health Now
- Steve Nadel - Sunflower Alliance
- Ken Szutu - Vallejo Citizen Air Monitoring Network
- LaDonna Williams - All Positives Possible

A list of community members who attended the event is provided in the attached Appendix, along with information on the missions of the organizations with which they are affiliated.

Structure

The gathering began at 5pm with informal sharing of a meal, followed by introductions from discussion facilitators Azibuike Akaba (Senior Public Information Officer, Air District) and Laura Neish (Executive Director, 350 Bay Area). Jed Holtzman (350 Bay Area) also offered welcoming remarks. Brief presentations by Air District staff preceded the discussion portion of the event:

- Goals of the PM Symposium Series (Greg Nudd)
- Major Sources of Fine Particulate Matter (Phil Martien)
- Current & Potential Rules to Reduce PM (Jacob Finkle)
- Policy Approaches for Particulate Matter (Victor Douglas)

Attendees asked questions and contributed comments following each presentation in addition to participating in the discussion portion of the gathering. Facilitators concluded the event at 8pm. The content of these exchanges is summarized thematically in the following section. Details on Air District presentations are omitted as this information is also being shared in the PM Symposia and details are recorded in the transcript of the Community Discussion.

Key Concerns Expressed by Community Members and Air District Replies

Localized PM data availability

"I think the public needs to have more access to what is going on."

Desire for data beyond West Oakland. Several community members expressed frustration with the repeated presentation of West Oakland information, as such information has not been provided for other areas. For some community members, this emphasis on West Oakland felt "disrespectful" to other communities.

Air District reply: The localized analysis piloted in West Oakland is a very new approach, so it requires cautious expansion. Vehicle-mounted monitors are in the process of collecting data for the entire Bay Area. Richmond data is now available. Information for other communities will be rolled out over the next couple of years.

Desire for real-time, continuous, publicly accessible localized monitoring. Community members seek the capability to access "readouts" in real time to determine local air quality, particularly in the presence of unusual odors or flares. Concerns were expressed regarding current monitoring accuracy, with the example given of normal readings following permitted-facility accidents. An additional concern was the perception that polluters are not required to pay for monitoring: "Currently all this cost falls onto the community and we don't have the money. And if we don't have the money we don't have the monitoring and the business pollutes freely."

Air District reply: Monitoring is continuous and publicly accessible but not in real time. The Air District hopes to move toward real-time monitoring, but presently both sample analysis and data analysis create lags. Permitted facilities are required to conduct and pay for their own monitoring, and the Air District performs tests to confirm the accuracy of that monitoring.

Consolidating/sharing community-collected data (e.g. PurpleAir). As organizations and community members have begun collecting air monitoring data themselves using technology such as PurpleAir, they are seeking a means of consolidating and sharing those data. Steve Nadel of the Sunflower Alliance asked whether the Air District is working on that effort.

Air District reply: There is a new third-party "Bay Air Center" (independent of the Air District) that will provide technical support for monitor selection and siting. The California Air Resources Board has agreed to centralize air quality sensor data through their grant program. This process is likely to be challenging.

Toxicity of different PM species

"Just presenting the percentages [from different sources] doesn't give the full picture of toxicity. Not all particulate matter is created equal."

Concerns regarding higher severity of PM health effects from permitted sources. Depiction of PM contributions from different sources as percentages of a total raised concerns for attendees who stated that some types of PM are more toxic than others. Many comments in the meeting focused on permitted sources, including oil refineries, metal processing facilities, and concrete crushers. Community representatives want to understand where the "fault lines" lie in terms of permitted facility PM fallout — for example, a community may be downwind of a refinery yet not be considered a "refinery community" depending on where boundaries are drawn.

Air District reply: Compounds that are known to be toxic (e.g. toxic metals) are independently tracked. However, there is insufficient information regarding the toxicity of undifferentiated PM, which is why the Air District takes a precautionary approach assuming all PM to be highly hazardous. Regarding impacts from permitted facilities, studies are currently being conducted by the Air District to better understand PM emissions from refineries and to track exposures from local sources of PM in disproportionately burdened communities. Additionally, new rules regarding fluidized catalytic cracking units are in the final stages of development. With respect to the East Oakland AB&I metal foundry, the Air District is involved in resolving issues with Rules 11-18 and 12-13 regarding air toxics and PM.

Skepticism regarding wood burning as a major driver of health impacts. A significant amount of skepticism was expressed by community members regarding wood burning as a leading PM health issue. Air District measurement and monitoring methods were questioned. There was apparent frustration with the implied equating of wood smoke to refinery smoke.

Note: A community member who was not able to be present at the gathering, Richard Gray of 350 Bay Area, stated upon reading the transcript that in the San Geronimo area where he lives residential wood burning does have a substantial negative impact on air quality. He expressed that certain weather patterns can cause this wood smoke to remain in the immediate area rather than dissipate, and that problems associated with that smoke exposure have prompted numerous residents to relocate.

Air District reply: Data collection on wood burning involves not only surveys and modeling but also filter analysis to reveal the components of localized PM: "We can tell what is on those filters and what fraction is from wood burning." However, it is expected that wood burning is more prevalent in some areas than others, which will be clarified in the forthcoming community-level studies. Current science indicates that wood smoke is highly toxic.

Lack of observable results from prior rulemaking

"It seems like implementation is a problem."

2017 Clean Air Plan. Jed Holtzman of 350 Bay Area stated that many of the solutions that the Air District is currently presenting were already in the 2017 Clean Air Plan and asked what institutional constraints are preventing implementation. He also described an existing rule

requiring facilities to conduct health impact assessments and stated that two and a half years after the rule had been developed this is still not happening.

Air District reply: New approaches are being implemented to speed up the process. This PM Symposium Series is designed to ensure that the full impact of PM — as reflected in the science and the community — is clear to decision makers. In addition to the health costs, the economic costs of PM are being calculated in order to further incentivize action. Additionally, the Air District is pursuing innovative means of clarifying jurisdiction for local sources of PM, such as "magnet sources" like warehouses that attract truck traffic.

Crude slate inventory. Rule 12-15, requiring accurate crude inventories, was brought up by Shoshana Wechsler of 350 Bay Area/Sunflower Alliance, who asked for the status of this data.

Air District reply: There have been some reporting difficulties because legal constraints prevented the Air District from specifying formats for data collection. A means of requiring standardized reporting has now been identified and this information will soon be available.

General enforceability issues. Several issues with enforceability were raised, such as lack of moisture content measurement at construction sites to limit dust, and citations of violations being limited to "visibility" issues following fires at permitted facilities. Ken Szutu of the Vallejo Citizen Air Monitoring Network suggested that perhaps rather than arranging community meetings with the Air District's rulemaking teams, these meetings should be centered on the departments responsible for enforcement.

Air District reply: The Air District does not have "police powers." The enforcement process is carried out by the District Attorney. The Air District strives to work collaboratively with permitted facilities to ensure compliance.

Potential for problems to worsen

"You can't stop the cold air coming in if you close a window on one end and then open a different one on the other."

New permits continue to be issued. Much attendee support was expressed for a comment from LaDonna Williams of All Positives Possible that, despite all the discussion about reducing emissions, the Air District continues to issue permits to new sources.

Air District reply: The Air District is statutorily obligated to issue permits. However, the aim is to put the brakes on emissions in areas that are already overburdened. The Air District is developing an approach intended to consider existing PM exposures in the community in order to ensure that burden is not increased.

Emerging indoor air concerns. Residents are experiencing problems with toxic vapor intrusion of polychlorinated biphenyl (PCB) and trichlorobenzene (TCB) compounds in their water delivery systems. They asked how the Air District can help.

Air District reply: Although household indoor air is not within its authority, the Air District is seeking to collaborate with the Water Control Board and will be involved in a multi-agency workshop to try to speed resolution of this problem.

Climate impacts. A community member inquired about the connection between the health impacts under discussion and the public health threat of the climate crisis.

Air District reply: The 2017 Clean Air Plan demonstrates the linkages, with one of its three pillars focusing on health.

Lengthy time horizon prior to changes being implemented. Citing the example of diesel PM rulemaking taking 10 years, concern was expressed that the present process may be many years away from producing meaningful change: "How do we compress that?"

Air District reply: With the Board's buy-in, we can start working on elements of our strategy without having to wait years. We are working to compress that timeline.

APPENDIX - Attendee List for Community Particulate Matter Discussion – 2/27/2020

Organization	Representative(s) Attending (+ Organizational Role)	Website	Notes on Organization Mission (based on websites)
350 Bay Area	Jed Holtzman (Senior Policy Analyst)	https://350bayarea.org/	Bay Area organization supporting policies that promote clean energy, eliminate fossil fuels, and facilitate just and socially equitable solutions to ensure a livable planet for future generations.
350 Contra Costa	Jackie García	https://350bayarea.org/350contracosta	Contra Costa team of 350 Bay Area (see above)
All Positives Possible	LaDonna Williams (Programs Director), Pat Dodson and Janniece Murray	https://www.guidestar.org/profile/61-1588146	East Bay nonprofit supporting efforts of low-income communities of color to confront crises of environmental health and injustice.
Bayview Hunters Point Resident	Raymond Thompkins	N/A	N/A
California Climate Health Now	Ashley McClure, Cynthia Carmichael	https://www.climatehealthnow.org/	California physicians and health professionals "who recognize climate change as the public health and equity emergency of our lifetimes."
Communities for a Better Environment	Andrés Soto	http://www.cbecal.org/	California environmental justice organization focused on global climate issues and local transformation toward sustainable communities. Provides organizing skills, leadership training, and scientific and legal assistance.
Groundwork Richmond	Jen Fong	http://www.groundworkrichmond.org/	Richmond environmental organization helping youth develop leadership potential through science, technology, engineering, arts, and math.
Higher Ground Neighborhood Development Corp.	Khariyyah Shabazz (Assistant Programmatic Director) and Reggie Archie	http://www.highergroundndc.com/	Oakland-based neighborhood development corporation focused on youth.
Interfaith Climate Action Network of Contra Costa County	Will McGarvey,	http://www.ican-cc.org/	Contra Costa County organization educating faith and non-faith communities about mitigating climate change and providing advocacy on their behalf to ensure oppressed community voices are heard by policymakers, industries, and other organizations.

New Voices Are Rising/Rose Foundation	Katherine Funes (Youth Engagement Co-Director) & 3 youth	https://rosefdn.org/new-voices	Oakland-based project seeking to increase civic participation within underrepresented communities, increase young people's commitment to environmental justice, and reduce air and water pollution in the SF Bay Area. Part of the Rose Foundation for Communities and the Environment.
No Coal in Oakland	Misao Brown	https://nocoalinoakland.info/	Oakland-based organization campaigning to stop the threat of coal being transported by rail into Oakland for export overseas.
No Coal in Richmond	Jaime Perez	https://ncir.weebly.com/	Richmond-based organization supporting phase-out of coal and pet coke operations to protect health.
Physicians for Social Responsibility	Robert Gould (President), Jeff Ritterman (Vice President of Board of Directors)	http://sfbaypsr.org/	Bay Area chapter of organization seeking to promote public policies that protect human health from climate change and environmental degradation as well as nuclear war and other weapons of mass destruction, gun violence, and other social injustices.
Rodeo Citizens Association	Janet Pygeorge, Charles Davidsen	https://rodeocitizensassociation.org/	Non-profit organization devoted to issues concerning the unincorporated community of Rodeo, California. Their primary purpose is to address local concerns to health, safety and the environment.
Sierra Club Bay Chapter	Dave McCoard (Co-Chair of Energy Committee)	https://www.sierraclub.org/san-francisco-bay	SF Bay Area chapter of national grassroots environmental organization. Chapter has nearly 40,000 members. Issues include energy and climate, sustainable communities, parks and open space, environmental justice, water, and wilderness and wildlife.
Sunflower Alliance	Steve Nadel and Shoshana Wechsler	https://www.sunflower-alliance.org/	Bay Area citizen group focused on halting fossil fuel production and transport, particularly in the East Bay.
Vallejo Citizen Air Monitoring Network	Ken Szutu (Chair)	http://citizenairmonitoringnetwork.org/vallejo/	Vallejo citizen group collecting and publicizing local air quality data to enable rapid response to air quality problems.
Youth vs Apocalypse	2 youth	http://youthvsapocalypse.org/	Bay Area group of diverse young climate justice activists (ages 10-18) working to lift the voices of youth, in particular youth of color, and fight for a livable climate and an equitable, sustainable, and just world through policy advocacy. Supported by 350 Bay Area.

BAY AREA AIR QUALITY MANAGEMENT DISTRICT
Memorandum

To: Chairperson Stan Hayes and Members of the Advisory Council

From: Jack P. Broadbent
Executive Officer/APCO

Date: May 6, 2020

Re: Update on Air District Particulate Matter (PM) Potential Policy Strategies

RECOMMENDED ACTION

None; receive and file.

DISCUSSION

Staff will provide presentations on existing and future work regarding particulate matter (PM). Topics to be discussed will include:

- Emissions Inventory
- Control measures identified in the West Oakland Community Action Plan
- Rule development
- Potential approaches to regulating fine particulate matter moving forward

BUDGET CONSIDERATION/FINANCIAL IMPACT

None.

Respectfully submitted,

Jack P. Broadbent
Executive Officer/APCO

Prepared by: Sonam Shah-Paul
Reviewed by: Gregory Nudd