



BAY AREA
AIR QUALITY
MANAGEMENT
DISTRICT

ADVISORY COUNCIL MEETING

WEDNESDAY
JULY 10, 2013
9:00 A.M.

7TH FLOOR BOARD ROOM
939 ELLIS STREET
SAN FRANCISCO, CA 94109

AGENDA

CALL TO ORDER

Opening Comments
Roll Call

Robert Bornstein, Ph.D., Chairperson
Clerk

PUBLIC COMMENT PERIOD

Public Comment on Non-Agenda Items, Pursuant to Government Code Section 54954.3. The public has the opportunity to speak on any agenda item. All agendas for Advisory Council meetings are posted at the District, 939 Ellis Street, San Francisco, at least 72 hours before a meeting. At the beginning of the meeting, an opportunity is also provided for the public to speak on any subject within the Council's purview. Speakers are limited to three minutes each.

CONSENT CALENDAR

1. Approval of Minutes of the June 12, 2013 Advisory Council meeting.

DISCUSSION

2. Discussion of draft report on the Advisory Council's May 8, 2013 meeting.

The Advisory Council will discuss the draft report on the May 8th meeting on Black Carbon: Measurement and Exposure with Air District staff.

3. Report on the Annual Air & Waste Management Association (AWMA) Meeting, June 24, 2013 - June, 28, 2013.

Advisory Council members who attended the Annual Air & Waste Management Association meeting from June 24, 2013 – June 28, 2013 will report on their experiences.

OTHER BUSINESS

4. Chairperson's Report

Robert Bornstein, Ph.D., Chairperson

5. 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.

6. Time and Place of Next Meeting

Wednesday, September 11, 2013 at 9:00 a.m. at 939 Ellis Street, San Francisco, CA 94109.

7. Adjournment

**CONTACT THE CLERK OF THE BOARDS
939 ELLIS STREET SF, CA 94109**

**(415) 749-5073
FAX: (415) 928-8560
BAAQMD homepage:
www.baaqmd.gov**

- To submit written comments on an agenda item in advance of the meeting.
- To request, in advance of the meeting, to be placed on the list to testify on an agenda item.
- To request special accommodations for those persons with disabilities notification to the Clerk's Office should be given in a timely manner, so that arrangements can be made accordingly.
- 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 939 Ellis Street, San Francisco, CA 94109, at the time such writing is made available to all, or a majority of all, members of that body. Such writing(s) may also be posted on the District's website (www.baaqmd.gov) at that time.

**BAY AREA AIR QUALITY MANAGEMENT DISTRICT
939 ELLIS STREET, SAN FRANCISCO, CALIFORNIA 94109
FOR QUESTIONS PLEASE CALL (415) 749-4963**

**EXECUTIVE OFFICE:
MONTHLY CALENDAR OF DISTRICT MEETINGS**

JULY 2013

<u>TYPE OF MEETING</u>	<u>DAY</u>	<u>DATE</u>	<u>TIME</u>	<u>ROOM</u>
Board of Directors Regular Meeting (<i>Meets on the 1st & 3rd Wednesday of each Month</i>) - CANCELLED	Wednesday	3	9:45 a.m.	Board Room
Advisory Council Regular Meeting (<i>Meets on the 2nd Wednesday of each Month</i>)	Wednesday	10	9:00 a.m.	Board Room
Board of Directors Executive Committee (<i>Meets on the 3rd Monday of each Month</i>) - CANCELLED	Monday	15	9:30 a.m.	4 th Floor Conf. Room
Board of Directors Stationary Source Committee (<i>Meets on the 3rd Monday of each Month</i>) - CANCELLED	Monday	15	10:30 a.m.	4 th Floor Conf. Room
Board of Directors Regular Meeting (<i>Meets on the 1st & 3rd Wednesday of each Month</i>) - CANCELLED	Wednesday	17	9:45 a.m.	Board Room
Board of Directors Climate Protection Committee (<i>Meets on the 3rd Thursday every other month</i>)	Thursday	18	9:30 a.m.	4 th Floor Conf. Room
				And via videoconference at Santa Rosa Junior College Doyle Library, Room 4243 1501 Mendocino Avenue Santa Rosa, CA
Board of Directors Budget & Finance Committee (<i>Meets on the 4th Wednesday of each Month</i>) - CANCELLED	Wednesday	24	9:30 a.m.	4 th Floor Conf. Room
Board of Directors Mobile Source Committee (<i>Meets on the 4th Thursday of each Month</i>) - CANCELLED	Thursday	25	9:30 a.m.	Board Room
Board of Directors Personnel Committee (<i>At the Call of the Chair</i>)	Monday	29	9:30 a.m.	4 th Floor Conf. Room

AUGUST 2013

<u>TYPE OF MEETING</u>	<u>DAY</u>	<u>DATE</u>	<u>TIME</u>	<u>ROOM</u>
Board of Directors Budget & Finance Committee (<i>Meets on the 4th Wednesday of each Month</i>)	Monday	5	9:30 a.m.	4 th Floor Conf. Room
				And via videoconference at Santa Rosa Junior College Doyle Library, Room 4243 1501 Mendocino Avenue Santa Rosa, CA

AUGUST 2013

<u>TYPE OF MEETING</u>	<u>DAY</u>	<u>DATE</u>	<u>TIME</u>	<u>ROOM</u>
Board of Directors Executive Committee <i>(Meets on the 3rd Monday of each Month)</i>	Monday	5	11:00 a.m.	4 th Floor Conf. Room
Board of Directors Regular Meeting <i>(Meets on the 1st & 3rd Wednesday of each Month)</i>	Wednesday	7	9:45 a.m.	Board Room
Board of Directors Executive Committee <i>(Meets on the 3rd Monday of each Month) -</i> CANCELLED & RESCHEDULED TO MONDAY, AUGUST 5, 2013 AT 11:00 A.M.	Monday	19	9:30 a.m.	4 th Floor Conf. Room
Board of Directors Stationary Source Committee <i>(Meets on the 3rd Monday of each Month) -</i> CANCELLED	Monday	19	10:30 a.m.	4 th Floor Conf. Room
Board of Directors Mobile Source Committee <i>(Meets on the 4th Thursday of each Month) -</i> CANCELLED	Thursday	22	9:30 a.m.	Board Room
Board of Directors Regular Meeting <i>(Meets on the 1st & 3rd Wednesday of each Month) -</i> CANCELLED	Wednesday	21	9:45 a.m.	Board Room
Board of Directors Budget & Finance Committee <i>(Meets on the 4th Wednesday of each Month) -</i> CANCELLED & RESCHEDULED TO MONDAY, AUGUST 5, 2013 AT 9:30 A.M.	Wednesday	28	9:30 a.m.	4 th Floor Conf. Room

SEPTEMBER 2013

<u>TYPE OF MEETING</u>	<u>DAY</u>	<u>DATE</u>	<u>TIME</u>	<u>ROOM</u>
Board of Directors Regular Meeting <i>(Meets on the 1st & 3rd Wednesday of each Month)</i>	Wednesday	4	9:45 a.m.	Board Room
Board of Directors Public Outreach Committee <i>(At the Call of the Chair)</i>	Monday	9	9:30 a.m.	4 th Floor Conf. Room
Board of Directors Budget & Finance Committee <i>(Meets on the 4th Wednesday of each Month)</i>	Monday	9	11:00 a.m.	4 th Floor Conf. Room
				And via videoconference at Santa Rosa Junior College Doyle Library, Room 4243 1501 Mendocino Avenue Santa Rosa, CA
Advisory Council Regular Meeting <i>(Meets on the 2nd Wednesday of each Month)</i>	Wednesday	11	9:00 a.m.	Board Room
Board of Directors Executive Committee <i>(Meets on the 3rd Monday of each Month)</i>	Monday	16	9:30 a.m.	4 th Floor Conf. Room
Board of Directors Stationary Source Committee <i>(Meets on the 3rd Monday of each Month)</i>	Monday	16	10:30 a.m.	4 th Floor Conf. Room
Board of Directors Regular Meeting <i>(Meets on the 1st & 3rd Wednesday of each Month)</i>	Wednesday	18	9:45 a.m.	Board Room

SEPTEMBER 2013

TYPE OF MEETING

DAY

DATE

TIME

ROOM

**Board of Directors Climate Protection
Committee** (*Meets on the 3rd Thursday every other
month*)

Thursday

19

9:30 a.m.

4th Floor
Conf. Room

And via videoconference at
Santa Rosa Junior College
Doyle Library, Room 4243
1501 Mendocino Avenue
Santa Rosa, CA

**Board of Directors Budget & Finance
Committee** (*Meets on the 4th Wednesday of each
Month*)

Wednesday

25

9:30 a.m.

4th Floor
Conf. Room

**Board of Directors Mobile Source
Committee** (*Meets on the 4th Thursday of each Month*)

Thursday

26

9:30 a.m.

Board Room

HL – 7/5/13 (10:05 a.m.)

P/Library/Forms/Calendar/Calendar/Moncal

BAY AREA AIR QUALITY MANAGEMENT DISTRICT
Memorandum

To: Robert Bornstein, Ph.D. and
Members of the Advisory Council

From: Jack P. Broadbent
Executive Officer/Air Pollution Control Officer

Date: June 26, 2013

Re: Draft Minutes of the June 12, 2013 Advisory Council Meeting

RECOMMENDED ACTION

Approve the attached draft minutes of the Regular Meeting of the Advisory Council on June 12, 2013.

DISCUSSION

Attached for your review and approval are the draft minutes of the Regular Meeting of the Advisory Council on June 12, 2013.

Respectfully submitted,

Jack P. Broadbent
Executive Officer/APCO

Prepared by: Sean Gallagher
Reviewed by: Rex Sanders

Attachment

Bay Area Air Quality Management District
939 Ellis Street
San Francisco, CA 94109
(415) 749-5073

DRAFT MINUTES

Advisory Council Regular Meeting
Wednesday, June 12, 2013

Note: An audio recording of the meeting is available on the website of the Bay Area Air Quality Management District at <http://www.baaqmd.gov/The-Air-District/Board-of-Directors/Advisory-Council/Agendas-and-Minutes.aspx>.

CALL TO ORDER

Chairperson Robert Bornstein called the meeting to order at 9:03 a.m.

ROLL CALL

Present: Chairperson Robert Bornstein, Ph.D., Vice-Chairperson Sam Altshuler, P.E.; Secretary Liza Lutzker, M.P.H.; and Members Jennifer Bard, Benjamin Bolles, Harold Brazil, Jonathan Cherry, A.I.A., LEED A.P., Heather Forshey, Stan Hayes, John Holtzclaw, Ph.D., Kraig Kurucz, Kathryn Lyddan, J.D., Rick Marshall, P.E., P.L.S., Estes Al Phillips, Jessica Range, LEED A.P., and Murray Wood.

Absent: Members Jeffrey Bramlett, M.S., C.S.P., Gary Lucks, J.D., C.P.E.A., and Timothy O'Connor, J.D.

Also Present: None.

PUBLIC COMMENT PERIOD [OUT OF ORDER]: None.

CONSENT CALENDAR [OUT OF ORDER]

1. Approval of the Minutes of the Advisory Council meeting of May 8, 2013

Council Comments: None.

Public Comments: None.

Council Action:

Member Holtzclaw made a motion to approve the minutes of May 8, 2013; Member Altshuler seconded; and the motion carried unanimously.

Member Lutzker said to amend page 7, second paragraph in section 4, to replace “breathingcalifornia” with “californiabreathing.”

Member Holtzclaw made an amended motion to approve the minutes of May 8, 2013, as amended; Member Altshuler seconded; and the motion carried unanimously.

OPENING COMMENTS:

Chairperson Bornstein commented on the content of today’s agenda and provided guidelines in terms of the time available for each matter.

NOTED PRESENT: Member Kurucz was noted present at 9:07 a.m.

DISCUSSION

2. Discussion of draft report on the Advisory Council’s meeting on May 8, 2013

Members Lutzker and Altshuler made introductory comments regarding the drafting of the report.

Council Comments:

The Council deliberated upon proposed revisions to the draft report on the Advisory Council’s meeting on May 8, 2013.

NOTED PRESENT: Member Lyddan was noted present at 9:59 a.m.

Public Comments: None.

Council Action: None; informational only.

OTHER BUSINESS

3. Chairperson’s Report [OUT OF ORDER]:

Chairperson Bornstein said the Council must decide on the topic for the third cycle of Council meetings this year by no later than the next meeting. The Council and staff discussed potential topics.

The Council and staff discussed the formatting of future Council minutes.

Chairperson Bornstein asked for an update on recruitment efforts to fill the vacant regional park district seat on the Council, which question was answered by Eric Stevenson, Director of Technical Services.

4. Report on Air and Waste Management Association (AWMA) Critical Review Paper

Member Altshuler deferred presentation of the report for lack of time.

Council Comments: None.

Public Comments: None.

Council Action: None; informational only.

5. Council Member Comments/Other Business:

Mr. Stevenson said letters of appreciation to the employers of those Council members who requested them will be issued forthwith and extended the offer again.

Chairperson Bornstein offered letters of appreciation from the Air District directly to members and said to contact Mr. Stevenson to request one, if desired.

6. Time and Place of Next Meeting: Wednesday, July 10, 2013, Bay Area Air Quality Management District Office, 939 Ellis Street, San Francisco, CA 94109 at 9:00 a.m.

7. Adjournment: The meeting adjourned at 12:20 p.m.

Sean Gallagher
Clerk of the Boards

BAY AREA AIR QUALITY MANAGEMENT DISTRICT

Memorandum

To: Chairperson Robert Bornstein, Ph.D.,
and Members of the Advisory Council

From: Jack P. Broadbent
Executive Officer/Air Pollution Control Officer

Date: June 26, 2013

Re: Discussion of Draft Report on the Advisory Council's May 8, 2013 Meeting

The attached draft report of the May 8, 2013, Advisory Council Meeting on Black Carbon: Introduction to Measurement and Exposure was discussed with Air District staff and revised by the Council at its June 12, 2013 meeting. The Council will finalize the recommendations at its July 10, 2013 meeting.

Respectfully submitted,

Jack P. Broadbent
Executive Officer/APCO

Prepared by: Sean Gallagher
Reviewed by: Rex Sanders

Attachment

DRAFT REPORT ON THE MAY 8, 2013 ADVISORY COUNCIL MEETING ON THE
BLACK CARBON – MEASUREMENT AND MODELING AND BLACK CARBON –
EXPOSURE AND MITIGATION

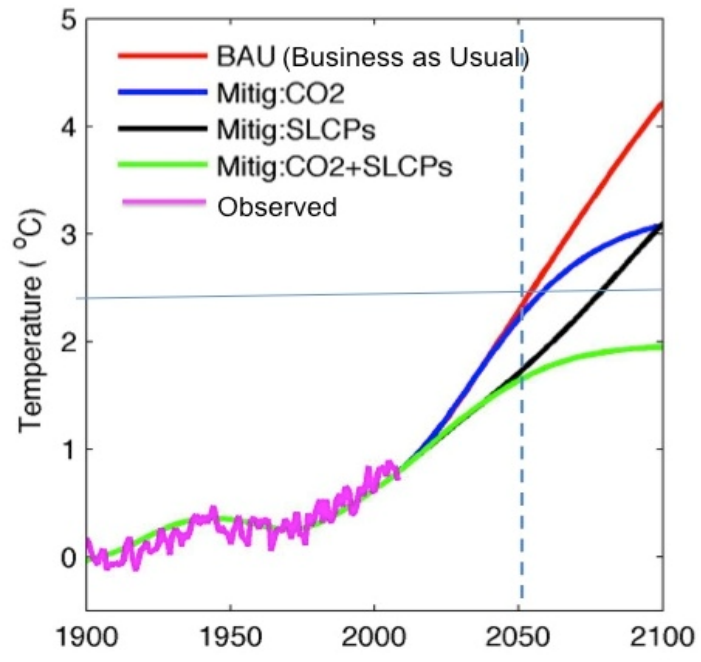
Key Points

Ramanathan

1. Black carbon (BC; all acronyms are defined in the Glossary), along with methane, ozone, and some hydrofluorocarbons (HFCs), are termed short-lived climate pollutants (SLCPs) and are positive (i.e., warming) climate forcers.¹ BC is second only to CO₂ as a warming climate forcer. The Global Warming Potential (GWP) of BC is estimated to be 2,500-4,000 times that of CO₂ (not accounting for the warming effects of BC through the reduction of snow and ice pack albedo after its deposition). The range of GWP values (2,500-4,000) depends upon the time frame examined (100 vs. 20 years), respectively.
2. Effective approaches to mitigate global climate change must include a two-part strategy to reduce both SLCPs and long-lived pollutants (such as CO₂). As shown in Figure 1 (below), while mitigating CO₂ or SLCPs alone will produce measurable decreases in global temperatures when compared to proceeding with business as usual, mitigating both types of climate pollutants simultaneously could avoid approximately half the warming expected by 2050. Of the total warming avoided by 2050 through the mitigation of SLCPs and CO₂ in concert, 90% is attributable to SLCP mitigation. While effects from the mitigation of long-lived pollutants like CO₂ might not be felt until well into the future, reduction of SLCPs can mitigate near-term impacts, e.g., immediate SLCP control could reduce expected 2050 increases in sea level by an estimated 30%.

Figure 1: Observed and simulated global mean surface temperature under different mitigation strategies

¹ Positive (i.e. warming) climate forcers (see Glossary) cause more solar energy to be retained by the planet, thus producing a warming effect for global climate change. Negative (i.e. cooling) forcers have the opposite effect, i.e., they act as “mirrors” to reflect solar energy, thus producing a cooling effect.



Source: Hu A, Xu Y, Tebaldi C, Washington WM, Ramanathan V. Mitigation of short-lived climate pollutants slows sea-level rise. *Nature Climate Change*, advance online publication, 14 Apr 2013.

3. Exposure to BC results in significant health impacts. A recent WHO study estimated that ambient particulate matter (PM), of which BC is a major component, accounts for approximately 3.1 million deaths annually worldwide. Additionally, it is estimated that indoor air pollution from solid-fuel combustion, during which BC is produced, accounts for 3.5 million deaths annually worldwide. Local reductions in BC emissions result in immediate improvements in local health.
4. California actions since the 1980s to reduce PM, especially from diesel sources, have resulted in an approximately 50% reduction in BC concentrations, and this reduction in BC has occurred in spite of increased diesel consumption. At the same time, there has been only a negligible reduction in many of the co-emitted pollutants that act as cooling climate forcers. These results justify diesel emission reduction programs as a continued component of climate change mitigation.
5. BC emissions are increased from vehicles in congestion situations, due to idling, stopping, and restarting.
6. BC emissions are a significant problem in Asia, Africa, and other developing regions with weak diesel regulations and high use of traditional solid-fuel cookstoves. California has been successful in reducing its BC emissions primarily through regulations mandating adoption of improved diesel technologies in recent decades. California can assist developing countries in reducing their BC emissions by sharing expertise on policy implementation and technical innovations (e.g., diesel control technologies and the development of cleaner, low-emitting cookstoves).

7. BC can be measured in real time using cellphones augmented with relatively inexpensive thermal-optic technologies. These technologies could be deployed to community members to provide better estimates of local BC concentrations.
8. Brown carbon (BrC), a subcomponent of organic carbon (OC) defined by its optical absorption properties, is commonly co-emitted with BC during biomass burning. It appears to have a warming effect on climate, with a GWP of 20-25% of that of BC.
9. Some components of biomass burning (e.g., ash and nitrate precursors) are cooling climate forcers, while others (BC and BrC) are warming climate forcers. It is now thought that the net effect of biomass burning on climate is either zero or slightly warming.

Harley

1. Results from a recent Denver-based speciated PM_{2.5} study indicate that the BC fraction of traffic-related PM_{2.5} is highly correlated with adverse cardiovascular and respiratory hospital admissions. It is still unclear, however, whether BC is directly toxic, or whether BC particles carry toxic chemicals on their surface.
2. Coefficient of haze (COH) is an excellent surrogate for BC concentrations. Long-term COH measurements in the Bay Area were available until 2003, when their samplers were discontinued due to lack of available parts. These measurements show that Bay Area BC concentrations have steadily decreased over decades.
3. Real-time BC monitoring in the Bay Area can be accurately accomplished using relatively low cost “online” light absorption methods. Within the Air District monitoring network, BC is explicitly observed by fine-particulate speciation at four sites and by “online” absorption at three sites.
4. Bay Area BC accounts for approximately 10% of winter PM_{2.5} emissions, almost exclusively from mobile sources and wood smoke. Combining the Air District’s winter PM_{2.5} emissions inventory with the source apportionment results from Dr. Lynn Hildemann shows that heavy-duty trucks and off-road mobile sources together account for 73% of emissions, while 21% are from wood smoke.² Some of these emissions may originate from areas outside the Bay Area.
5. Bay Area studies of BC show:

² A recent analysis by Air District staff attributes Bay Area BC emissions as follows: 50% from diesel engines, 15% from other fossil fuel combustion, 25% from residential wood-burning, and 10% from other wood smoke sources. These data can be viewed on page 51 of the 2012 report: *Understanding Particulate Matter: Protecting Public Health in the San Francisco Bay Area*.
baaqmd.gov/~media/Files/Planning%20and%20Research/Plans/PM%20Planning/ParticulatesMatter_No%207.ashx

- a. BC concentrations (like PM_{2.5} in general) are highest in the winter due to stable meteorological conditions (i.e. poor mixing) and increased seasonal residential wood-burning.
 - b. BC emissions rates for diesel-fueled vehicles are currently 50 times greater per vehicle on average than those of gasoline-fueled vehicles.
 - c. As the diesel fleet gets cleaner, the majority of Bay Area BC traffic emissions will come from an increasingly small number of vehicles. This remaining group of uncontrolled vehicles thus represents an important target for reducing overall BC concentrations.
 - d. BC concentrations in West Oakland have not decreased despite emission controls on port drayage and increased use of shore power (i.e., cold ironing), likely due to other sources such as adjacent railroads and traffic on nearby highways.
6. BrC emissions from lubricating-oil burning are higher in diesel (as compared to gasoline) vehicles, as diesel engines consume more lubricating oil (except in the case of gasoline gross polluters).
 7. Major decreases in BC are expected to continue as California regulations pertaining to heavy-duty diesel engines take effect. Additional California regulatory efforts to control BC emissions from goods movement, light-duty vehicles, and wood-burning are also underway.

Emerging Issues

Many issues raised by the speakers are well covered in pages 47-58 of *Understanding Particulate Matter: Protecting Public Health in the San Francisco Bay Area* (cited in footnote #2 above).

1. Efforts aimed at BC reduction are essential components in the mitigation of the adverse effects of climate change and thus must be implemented in concert with efforts to reduce CO₂.
2. While climate change is generally considered on a global level, widespread local control of BC emissions can result in significant immediate local health benefits and important near-term climate benefits at the global level and also at the local level (e.g., through increased albedo and consequent lower risk of reduced water supply and drought).
3. BrC appears to be a contributor to climate change, but further quantification of its influence on climate change is necessary.
4. Co-emitted species produced during biomass burning in California (such as nitrate precursors and ash) are cooling climate forcers and must be considered when developing BC and BrC mitigation strategies.

5. The underlying mechanisms behind, and the relative magnitude of, the health effects of both BC and BrC are not fully understood. Further research in these areas will help to refine and clarify priorities for emission reduction targets.
6. A detrimental positive feedback loop (see Glossary) exists, in which BC-induced climate change results in increased drought, leading to increased wildfire risk, and in turn, again, to greater BC emissions.
7. California regulations to limit diesel emissions and PM have been successful in reducing BC concentrations, but more reduction is needed. Targets for BC emission reductions in the Bay Area include:
 - a. Diesel sources, e.g., rail, ship, airport ground equipment, back-up generators, gross polluting mobile sources;
 - b. Traffic management, including congestion mitigation and speed flow control;
 - c. Residential and commercial cooking, especially charbroiling and barbecuing; and
 - d. Residential (indoor and outdoor wood-burning devices), recreational, agricultural, and open biomass burning.
8. Using the 2,500-4,000 GWP range of BC and a current market value of \$10-15 per ton of CO₂, BC should be worth \$25,000-60,000 of carbon credits per ton.
9. Burning of vehicle engine lubricating oil is linked to BrC emissions.
10. BC and BrC are seasonal in their statewide effect on climate. Due to greater wintertime emissions, more stable meteorological conditions, and the presence of Sierra snow and ice for deposition, BC and BrC emissions in the winter are of greater concern than emissions at other times of the year.
11. Continued measurements of Bay Area BC and BrC can help verify the success of regulatory and incentive programs. Empirical evidence of successful mitigation efforts can support similar models for BC and BrC reduction programs that can provide health and climate benefits to communities worldwide.

Recommendations

The Advisory Council recommends that the Air District:

1. Make improvements to Bay Area BC and BrC monitoring networks, which will be beneficial for improving understanding of sources that contribute to PM_{2.5} health effects and for tracking the impacts of emissions control progress over the next decade. Increased monitoring is needed, especially in locations with existing long-term measurements. To that end:

- a. Continue and expand Bay Area BC monitoring, concentrating on locations where historical COH measurements were once collected. Consider redeploying COH monitors, if possible.
 - b. Track progress on the development of BrC monitoring technologies.
 - c. Further investigate BC in West Oakland and other high concentration areas, and expand ambient monitoring and source apportionment studies.
 - d. Explore supplementing the BC monitoring network through the deployment of low-cost monitoring technologies to stakeholders. These monitors could be useful during air pollution episodes, such as the recent Richmond refinery fire.
 - e. Continue to refine and develop BC, BrC, and OC emissions inventories.
 - f. Research the magnitude of the inter-basin transport of BC and BrC, e.g., to and from the Central Valley.
2. Continue and expand the Air District's focus on the reduction of diesel emissions and wood smoke pollution to address Bay Area BC and BrC. In particular, residential wood-burning devices should be reviewed to target emission reductions.
 3. Continue and accelerate efforts to target emission control of BC and BrC within the Bay Area. Additional control measures to consider or enhance, include:
 - a. Incentives and regulatory mechanisms that target:
 - Diesel sources (including gross polluting vehicles, off-road mobile equipment, rail, ship, airport ground equipment, and back-up generators)
 - Residential (indoor and outdoor fireplaces and wood stoves, including chimineas and fire pits), recreational (bonfires and campfires), agricultural, and open biomass burning
 - Residential and commercial cooking (including charbroilers, barbecues, and wood-burning pizza ovens)
 - b. A greater emphasis on regulations and incentives that reduce BC and BrC emissions during the winter months. For example, consider lowering the PM threshold for calling a Winter Spare the Air Day.
 - c. Continued incentive funding for programs to scrap vehicles with high-emitting diesel and gasoline engines.
 - d. Working with the business community and others to develop more sustainable transport of freight and goods.
 - e. Assisting planning agencies to implement strategies that minimize traffic and optimize flow on Bay Area roads.
 - f. Supporting federal, state, and local policies and programs that reduce emissions, especially as they relate to ongoing ARB diesel reduction regulations.
 4. Assess the current and potential buyback-type programs (for old cars, old diesels, and wood burning devices) and consider making modifications to buyback formulas to incorporate information on BC's climate forcing potential. For example, using the per-ton BC carbon credit value of \$25,000-60,000, vehicle buyback and fireplace removal/retrofit programs could be amended to reflect the value of BC (and other climate forcing co-emitted pollutants, as applicable) removed from the emissions inventory. Such

programs could be subsidized by money collected from the purchase of carbon credits. For example, reducing the life of an old light-duty diesel vehicle could reduce BC emissions 0.01 tons, potentially a value of \$250-\$600 (though examining co-emitted pollutants could increase or decrease this value).

5. Assess the relative health and climate effects of a range of contaminants (specifically, CO₂, PM_{2.5}, BC, BrC, OC, nitrate precursors, ash, and methane) from a variety of source categories (e.g., fossil and renewable fuels burned in various engines, in heating and cooking appliances, and during wildfires). When developing climate and/or health improvement strategies, examine how the mitigation of one contaminant may have an unintended adverse consequence on the climate and/or health impacts of another important contaminant.
6. Educate the public about: 1) the role BC and BrC play as SLCPs and 2) the fact that the technologies and tools to reduce their emissions are presently available.
7. Given the rapidly growing field of research on numerous climate pollutants and appropriate mitigation strategies, consider enhancing or expanding Air District staffing to designate a climate change point person.

Glossary

ABAG: Association of Bay Area Governments in the San Francisco Bay Area

Albedo: The fraction of solar energy (shortwave radiation) reflected from the earth back into space. It is a measure of reflectivity of the earth's surface. Pure ice, especially with snow on top of it, has a high albedo. Ice or snow contaminated with carbon loses some of its albedo, is less reflective, and therefore absorbs more of the sun's energy.

ARB: California Air Resources Board

Ash: Inert, non-combustible chemical compounds (generally similar to earth crustal elements) present in fuel or wood that can be co-emitted with combustion emissions (CO₂, water vapor, BC, NO_x, etc.). Refined fuels (diesel, gasoline, and jet fuel) have low ash content. Ash can act as a mirror to solar radiation, thereby having a cooling effect on the climate. In the atmosphere, ash contributes to ambient PM_{2.5} and PM₁₀ concentrations.

BC: Black Carbon. The solid form of mostly pure carbon, produced by the incomplete combustion of diesel and other fuels. It is the most effective form of PM (by mass) at absorbing all wavelengths of solar radiation.

Biomass: Organic materials, such as wood and agricultural wastes, which can be burned to produce energy or converted into a gas for use as a fuel.

BrC: Brown Carbon. A component of OC related to the burning of biomass and lubricating oil in vehicle engines. BrC absorbs ultraviolet and visible solar radiation, though not as efficiently as BC.

Chimineas: A freestanding, front-loading, wood-burning fireplace or oven with a bulbous body used in decorative backyard settings. Through biomass burning, chimineas are a source of BC and BrC emissions.

Climate forcers (negative and positive): Pollutants causing cooling or heating of the earth, respectively.

CO₂: Carbon dioxide. A climate-warming product of combustion of organic materials (fuels and biomass).

COH: Coefficient of Haze. A measurement of ambient air particulates that is highly correlated with BC measurements. Manufacture of COH analyzers has been discontinued.

Co-Emitted Pollutants: Gases and particles emitted concurrently with BC emissions (e.g., OC, sulfur dioxide, nitrate and sulfate precursors).

GWP: Global Warming Potential. A measure of a chemical's relative contribution to global warming in comparison to CO₂.

HFC: Hydrofluorocarbon. A fluorocarbon used as a refrigerant.

Mirrors: A term sometimes used to describe certain air pollutants (e.g. nitrates, sulfates, and ash) that reflect solar radiation back into space and thus have a cooling effect on climate.

MTC: Metropolitan Transportation Commission in the San Francisco Bay Area.

OC: Organic carbon. Compounds containing carbon (bound with hydrogen and other elements, e.g., oxygen). May be a product of incomplete combustion or formed through the oxidation of atmospheric VOCs.

PM: Particulate matter. A complex mixture of small particles and liquid droplets suspended in atmosphere in various size ranges (i.e., PM₁₀, PM_{2.5}, and ultrafine).

PM_{2.5}: Ambient particulate matter less than 2.5 microns in diameter.

Positive Feedback Loop: A series of events that reinforce the original action. In the context of this report, BC emissions lead to increased global warming, which results in increased frequency of forest fires, which in turn emit BC, thus perpetuating and enhancing the BC cycle.

SLCP: Short lived climate pollutants (e.g. BC, BrC, and methane), that have relatively short lifetimes in the atmosphere compared to CO₂ and nitrous oxide (N₂O).

WHO: World Health Organization. The health authority of the United Nations, responsible for providing information, health-based standards, and guidelines on a broad spectrum of health issues, including the health effects of various air pollutants.