



**BAY AREA
AIR QUALITY
MANAGEMENT
DISTRICT**

**ADVISORY COUNCIL
MEETING**

**WEDNESDAY
JUNE 12, 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 May 8, 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.

OTHER BUSINESS

3. Report on AWMA Critical Review Paper

Sam Altshuler, PE, Member

Member Altshuler will provide a brief report on his work with the Air and Waste Management Association regarding stratospheric ozone and global warming.

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, July 10, 2013 at 9:00 a.m. at 939 Ellis Street, San Francisco, CA 94109.

7. Adjournment

CONTACT EXECUTIVE OFFICE - 939 ELLIS STREET SF, CA 94109

(415) 749-5130
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.

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

JUNE 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	5	9:45 a.m.	Board Room
Board of Directors Legislative Committee <i>(At the Call of the Chair)</i>	Thursday	6	9:30 a.m.	4 th Floor Conf. Room
Advisory Council Regular Meeting <i>(Meets on the 2nd Wednesday of each Month)</i>	Wednesday	12	9:00 a.m.	Board Room
Board of Directors Executive Committee <i>(Meets on the 3rd Monday of each Month)</i>	Monday	17	9:30 a.m.	4 th Floor Conf. Room
Board of Directors Stationary Source Committee <i>(Meets on the 3rd Monday of each Month) - CANCELLED</i>	Monday	17	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	19	9:45 a.m.	Board Room
Board of Directors Budget & Finance Committee <i>(Meets on the 4th Wednesday of each Month) - CANCELLED</i>	Wednesday	26	9:30 a.m.	4 th Floor Conf. Room
Board of Directors Mobile Source Committee <i>(Meets on the 4th Thursday of each Month) - CANCELLED</i>	Thursday	27	9:30 a.m.	Board Room

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>	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>	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) - CANCELLED</i>	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>	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

JULY 2013

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
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Board of Directors Mobile Source Committee <i>(Meets on the 4th Thursday of each Month)</i>	Thursday	25	9:30 a.m.	Board Room
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AUGUST 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	7	9:45 a.m.	Board Room
Board of Directors Executive Committee <i>(Meets on the 3rd Monday of each Month)</i> - CANCELLED	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	Wednesday	28	9:30 a.m.	4 th Floor Conf. Room

HL – 6/3/13 (5:11 p.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: May 30, 2013

Re: Draft Minutes of the May 8, 2013 Advisory Council Meeting

RECOMMENDED ACTION

Approve the attached draft minutes of the Regular Meeting of the Advisory Council on May 8, 2013.

DISCUSSION

Attached for your review and approval are the draft minutes of the Regular Meeting of the Advisory Council on May 8, 2013.

Respectfully submitted,

Jack P. Broadbent
Executive Officer/APCO

Prepared by: Sean Gallagher
Reviewed by: Ana Sandoval

Attachment

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

DRAFT MINUTES

Advisory Council Regular Meeting
Wednesday, May 8, 2013

Note: Audio and webcast recordings of the meeting are 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 9:02 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, Heather Forshey, Stan Hayes, John Holtzclaw, Ph.D., Kraig Kurucz, Gary Lucks, J.D., C.P.E.A., Kathryn Lyddan, J.D., Rick Marshall, P.E., P.L.S., Timothy O'Connor, J.D., Jessica Range, LEED A.P., and Murray Wood.

Absent: Members Jeffrey Bramlett, M.S., C.S.P., Jonathan Cherry, A.I.A., LEED A.P., and Estes Al Phillips.

Also Present: None.

OPENING COMMENTS: None.

PUBLIC COMMENT PERIOD: None.

PRESENTATIONS

1. Black Carbon: Introduction to Measurement and Exposure [OUT OF ORDER]

- A. Black Carbon – Exposure and Mitigation
Professor Veerabhadran Ramanathan
Distinguished Professor
Scripps Institution of Oceanography
University of California, San Diego

Jean Roggenkamp, Deputy Air Pollution Control Officer, introduced Professor Veerabhadran Ramanathan, Distinguished Professor, Scripps Institution of Oceanography, University of California, San Diego and provided a brief description of his background.

NOTED PRESENT: Member Kurucz was noted present at 9:04 a.m.

Prof. Ramanathan gave a presentation entitled, “Black Carbon – Exposure and Mitigation” (*a copy of which 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>*), with supplemental comments from and discussion with the Council as follows:

NOTED PRESENT: Member O’Connor was noted present at 9:10 a.m.

NOTED PRESENT: Member Bard was noted present at 9:11 a.m.

NOTED PRESENT: Member Wood was noted present at 9:13 a.m.

Chairperson Bornstein asked, regarding slide #19, [untitled], about the meaning of “SSA” which Prof. Ramanathan provided.

Prof. Ramanathan concluded the presentation.

Council Comments:

Member Kurucz asked for elaboration on the statement regarding the effectiveness of black carbon (BC) controls on climate change and for advice for those who might impose further regulations, which Prof. Ramanathan provided, noting the need to conduct more research to determine the real causes.

Member Lutzker asked for more information on brown carbon (BrC), which Prof. Ramanathan provided while noting the information contained in slides #22, *Now BrC?*, through 24, [untitled].

Member Hayes asked, regarding slide #19, [untitled], if the data is relative to California alone and how a graph like this would look for other regions, which questions were answered by Prof. Ramanathan and by Thomas W. Kirchstetter, Associate Adjunct Professor, University of California, Berkeley.

Member Altshuler asked for the climate impact ratio between BC and carbon dioxide and Prof. Ramanathan answered, noting a point of disagreement.

Member Altshuler asked about the effect of ammonium nitrates as climate forcers, which Prof. Ramanathan answered.

Member Bard asked about the contributions to total climate heating that can attributed to BrC, which question was answered by Prof. Ramanathan.

Public Comments: None.

- B. Black Carbon – Measurement and Modeling
Professor Robert Harley
Professor of Environmental Engineering
Department of Civil and Environmental Engineering
University of California, Berkeley

Ms. Roggenkamp introduced Professor Robert Harley, Professor of Environmental Engineering, Department of Civil and Environmental Engineering, University of California, Berkeley, and provided a brief description of his background.

Prof. Harley gave a presentation entitled, “Black Carbon in the San Francisco Bay Area: Trends in Ambient Concentrations and Emissions” (*a copy of which 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>*), with supplemental comments from and discussion with the Council as follows:

Prof. Harley noted, regarding slide #7, Seasonality in Ambient BC, that a variance does exist between weekday and weekend levels.

Chairperson Bornstein asked, regarding slide #16, Tunnel Fine Particle Mass and Speciation, the meaning of “QBT,” which Prof. Harley responded provided.

Prof. Harley concluded the presentation.

Council Comments:

Member Marshall asked, regarding slide #13, Ambient BC at West Oakland, about a possible correlation between the rebounding economy and the slow increase in monthly average BC concentrations shown from 2010 through 2012 and speculated the levels will continue to increase as the economy improves, to which Prof. Harley responded.

Member Hayes asked, regarding slide #3, BC Introduction, for elaboration on the second bullet, which Prof. Harley provided.

Chairperson Bornstein said California is in the lead in emissions reductions and asked about the resulting downwind impacts, which Prof. Harley answered.

Member Bard noted slide #22, BC Fraction in Fine PM [particulate matter] Emissions, and asked for more information regarding the health effects of various types of carbon emissions, which Prof. Harley provided.

Dr. Saffet Tanrikulu, Research and Modeling Manager of Planning, Rules and Research Division, pointed out, regarding slide #7, Seasonality in Ambient BC, seasonal fluctuations and said this is partly due to BC transport from other regions, serving to elevate background levels and mask proper measurement comparisons, resulting in uncertainties in comparing trends in emissions and ambient levels of BC. Chairperson Bornstein said that one cannot compare locations against each other, only various points within each location. Prof. Harley agreed.

Phil Martien, Air Quality Engineering Manager of Planning, Rules & Research Division, noted that the West Oakland monitor is not so different than other monitors in that it is influenced by various sources, not just the Port, and asked for suggestions on how to improve monitoring for tracking purposes, which Prof. Harley provided.

Public Comments: None.

PANEL DISCUSSION

2. Black Carbon – Measurement and Exposure [OUT OF ORDER]

Mr. Stevenson asked if any difference in BC has been observed in terms of emissions from agricultural burning as compared to residential burning, which question was answered by Prof. Ramanathan.

Member Holtzclaw asked, regarding Prof. Harley's slide #12, Ambient Elemental Carbon (EC) Data for the Bay Area, if the EC attributed to Pinnacles and Pt. Reyes may be coming from Asia and if one may conclude that its levels are decreasing, which questions were answered by Prof. Harley.

Chairperson Bornstein asked if it is true that China particles travel at a relatively high elevation, which question was answered by Prof. Harley.

Member Holtzclaw clarified that Prof. Harley's presentation suggests sources are decreasing.

Member Lucks asked, regarding Prof. Ramanathan's slide #8, Near and Long Term Mitigation, for regulation recommendations, which Profs. Ramanathan and Harley provided.

Ms. Roggenkamp provided clarification regarding the District's retirement policy regarding diesel truck programs.

Member Lutzker asked for clarification regarding the cumulative cooling or heating effect attributed to biomass burning, which was provided by Prof. Ramanathan. Chairperson Bornstein asked if the same is true globally and locally, for comparisons to an urban area, and about the modeling that has been done in this area, which questions were answered by Profs. Ramanathan and Harley, as well as Associate Adjunct Prof. Kirchstetter.

Member Lutzker asked for clarification regarding the chemical composition of BrC in biomass burn emissions, which was provided by Prof. Ramanathan.

Chairperson Bornstein clarified that BrC is not being defined by its composition but by its effect on radiation, which question was answered by Profs. Ramanathan and Harley.

Member Lutzker asked for clarification regarding BrC being defined optically, as opposed to chemically, which clarification was provided by Prof. Harley.

Member Hayes said, regarding Prof. Harley's slide #22, BC Fraction in Fine PM Emissions, the Air District is able to effect the control of emissions from particular sources and asked if a look

at BC in the source categories provided might illuminate some action the Air District should be taking but currently is not, which question was answered by Profs. Ramanathan and Harley.

Member Hayes said diesel is a big success story in California and improving wood burning practices globally will have an even greater impact, then asked if there are recommendations for the Air District if it were not basing its strategy only on mitigating PM health effects, which question was answered by Prof. Ramanathan.

Chairperson Bornstein noted that models do not show a decrease in total precipitation in California but rather a shift from snow to liquid, resulting in less usable water due to runoff, to which Prof. Ramanathan responded.

Member Kurucz asked about the short-lived versus seasonal, or carry-over, longer terms relative to Dr. Jacobsen's calculations and the long-term impact of deposits on snow pack, which questions were answered by Prof. Ramanathan.

Member Kurucz asked about the BC contribution from coal-fired power plants, which question was answered by Prof. Harley.

Member Altshuler recalled mention of the contribution of lube oil burning vehicles and asked for additional comments or recommendations and whether there is a metal of concern in lube oil, which questions were answered by Prof. Harley.

Member O'Connor noted the ongoing problems of BC and BrC for various communities in California and the progress made on diesel emissions reductions, and asked if further work towards additional diesel-related reductions is worthwhile or if the Air District should be turning its limited resources towards a BrC focus, which questions were answered by Profs. Ramanathan and Harley.

Member Bard urged a wider dialogue on where the focus of Air District efforts should be, suggested moving forward on both biomass/wood smoke and diesel emissions, and asked if the presenters agreed.

Member Altshuler recalled that use declines for those engines that are exported due to Air District retrofit programs and the decline should be factored into emissions calculations and then urged for a comparison, either by staff or the Council, of the total climate issue as it relates to a diesel engine, a biodiesel engine and a wood-burning fire, in order to better consider future strategy.

Chairperson Bornstein asked if local climate impact would be measurable if a local source of BC emissions were to be removed, which question was answered by Prof. Ramanathan.

Chairperson Bornstein asked the presenters for suggested Emerging Issues and Recommendations for the Council to consider for its report to the Board of Directors.

Prof. Ramanathan said he supported the point made by Members O'Connor and Lutzker relative to continued efforts at mitigating diesel emissions and wood smoke, and that transportation is a good focus because traffic contributes more emissions when stopped than while moving.

Prof. Harley said he supported monitoring, especially for BC, for the next ten years. Chairperson Bornstein and Prof. Harley discussed instrumentation. Prof. Harley recommended addressing BrC and BC, knowing that both with likely help with climate change, and prioritize based on public health concerns, if necessary.

Member Bolles, Prof. Harley and Mr. Stevenson discussed the concept of crowd sourcing air monitoring by delivering inexpensive devices to students in Bay Area schools. Mr. Stevenson will provide a staff update on the efforts in this regard by the United States Environmental Protection Agency. Members Kurucz and Lutzker recalled similar projects involving street sweepers and asthma inhalers, respectively. Member Altshuler noted the similarity in these trends and suggested every square mile is not in need of monitoring.

Prof. Harley added his support for encouraging the retirement, rather than exporting of, older equipment replaced through Air District programs.

Member O'Connor said BrC emission controls were mentioned by Prof. Ramanathan but not identified and asked if the Council should have someone present on the topic of wood smoke controls.

Chairperson Bornstein asked for recommendations on modeling, which Prof. Harley provided.

Member Lucks, Mr. Martien and Chairperson Bornstein discussed the possibility of the Air District working to mitigate emissions from airport ground equipment in light of its limited authority in regards to locomotives.

Member O'Connor suggested the Air District has various tools at its disposal that are not regulatory in nature, provided examples of transportation changes and efficiencies implemented in other regions and by various companies, and asked for recommendations outside of the regulatory realm. Member Lutzker recalled the presentation by Rajiv Bhatia, M.D., M.P.H., Director of Occupational and Environmental Health, San Francisco Department of Public Health, who talked about congestion management in this light.

Chairperson Bornstein stated his disagreement with the Air District's numbers relative to the number of fatalities attributed to various pollutants and suggested their estimate for toxics is very low, asked how this might be occurring and suggested it as an area of study. Prof. Harley was unable to answer.

CONSENT CALENDAR

3. Approval of the Minutes of the Advisory Council meeting of April 10, 2013

Council Comments: None.

Public Comments: None.

Council Action: Member Holtzclaw made a motion to approve the minutes of April 10, 2013, as amended in today's meeting, and Member Lutzker seconded.

Member Lutzker said to amend page 4, last paragraph in section 5, to replace “Maltz” with “Balmes” and requested a more specific internet address be provided for accessing the audio recording of the meeting.

Member Range said to amend page 3, first paragraph in section 2, to move the opening paragraph into the “Council Comments” subsection.

Chairperson Bornstein said to move the internet address for accessing the audio recording of the meeting to the top of the minutes.

Chairperson Bornstein and Member Bolles discussed the advantages of the new approach to Council minutes.

The motion carried unanimously.

OTHER BUSINESS

4. Council Member Comments/Other Business [OUT OF ORDER]:

Members Altshuler, Bolles and Bard and Mr. Stevenson discussed whether beach fires should be explored as an emissions source in need of regulation and the difficulties that may present.

Member Lutzker said a comprehensive report, Asthma in California: A Surveillance Report, was recently released by the California Department of Public Health and is available at breathingcalifornia.org.

Member Marshall commended staff on their recent outreach to Napa County regarding dust control at construction sites and discussed the same with Henry Hilken, Director of Planning, Rules & Research.

Member O’Connor said University of California, Davis is holding a workshop on Friday, May 10, 2013, regarding improving the diesel freight sector and that he will provide more information to the Council.

Member O’Connor mentioned the Hackenschmidt Symposium is next week, asked if Air District staff plan to attend and offered to report back.

5. Chairperson’s Report:

Chairperson Bornstein said the Chairperson’s name will be on all future speaker invitations, announced the Council members that will be attending the Air and Waste Management Conference as Air District representatives, mentioned the need to select a topic for the third cycle of Council meetings this year, said the July meeting may allow time for a staff presentation, noted the Air District is recruiting for the vacant Council seat in the regional parks category and asked Member Lyddan to assist with the same, said he will be presenting the Council quarterly report at the meeting of the Board of Directors Executive Committee on May 20, 2013, and

reminded Council members to notify Mr. Stevenson if they would like a letter of gratitude from the Air District to be sent to their employer.

The Council discussed the time allotment for presentations and the panel discussion and the ideal population of report drafting work groups.

Mr. Stevenson asked that the draft report be delivered to staff by no later two weeks after the meeting and the Council discussed the same.

6. Report of the Executive Officer/Air Pollution Control Officer: None.

7. Time and Place of Next Meeting: Wednesday, June 12, 2013, Bay Area Air Quality Management District Office, 939 Ellis Street, San Francisco, CA 94109 at 9:00 a.m.

8. Adjournment: The meeting adjourned at 12:21 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: May 30, 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 will be discussed with Air District staff and 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: Ana Sandoval

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 hydrofluorocarbons (HFCs) are termed short-lived climate pollutants (SLCPs) and are positive climate forcers.¹ BC is second only to CO₂ as a positive climate forcer. Removal of one ton of BC is equivalent to removing 2,500-4,000 tons of CO₂ (not including warming effects from BC through the reduction of snow and ice pack albedo after its deposition) – **clarification requested from speaker re: lifespan.**
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). Mitigation of both could avoid approximately half the expected 2050 warming, with SLCP mitigation responsible for 90 % of that. While effects from the mitigation of long-lived pollutants might not be felt until well into the future, reduction of SLCPs can mitigate near-term impacts, e.g., immediate SLCP control could slow sea level rise by 30%.
3. BC has 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.
4. BC is a significant problem in Asia and Africa. California has had success in its reduction of BC emissions, a demonstration that the technology to reduce BC at local levels exists. Effects from BC reductions are immediate and include improvements in local health and mitigation of climate change.
5. California actions since the 1980s to reduce PM, especially from diesel sources, have resulted in an approximately 50% reduction in BC concentrations, or the equivalent of the elimination of 21 million metric tons of CO₂ annually. The concurrent reduction in co-emitted species (negative climate forcers), however, has been negligible. This reduction has occurred in spite of increased diesel consumption. These results justify diesel emission reduction programs as a continued target in climate change mitigation.

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

6. BC can be measured in real time by inexpensive cellphone-mediated thermal-optic technologies. These technologies could be widely deployed to community members to provide better estimates of local BC concentrations.
7. Brown carbon (BrC), a subcomponent of organic carbon (OC) and 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 potential of 20-25% that of BC.
8. Some components of biomass burning (e.g., precursor conversion to nitrates and ash) are negative climate forcers, while concurrent BC and BrC production are positive climate forcers. It is now thought that the net effect of biomass burning on climate is either zero or slightly warming.
9. BC emissions are incrementally greater from vehicles in congestion situations, due to idling, stopping, and restarting.

Harley

1. Results from a recent Denver-based speciated PM_{2.5} study indicate that BC is highly correlated with adverse cardiovascular and respiratory health effects. The study also likewise implicated other traffic-related emissions. It is still unclear, however, whether BC is directly toxic, or whether it is toxic because of chemicals on its 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 was discontinued. These measurements show that Bay Area BC concentrations have steadily decreased over the decades.
3. Real-time BC monitoring in the Bay Area can be carried out at relatively low cost by use of accurate “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. Combination of the Air District winter PM_{2.5} emissions inventory with source apportionment results from Dr. Lynn Hildemann showed that heavy-duty trucks and off-road mobile sources account for 73% of emissions, with 21% from wood smoke.²

² A recent analysis of Bay Area BC emissions by Air District staff 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_v%207.ashx.

5. Bay Area studies of BC show:
 - a. BC concentrations (like PM_{2.5} in general) are highest in the winter due to stable-stability meteorological patterns and residential wood-burning.
 - b. BC emissions rates for diesel-fueled vehicles are 50 times greater than those of gasoline-fueled vehicles.
 - c. 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 railroads and traffic on nearby highways.
 - d. As the diesel fleet gets cleaner, the majority of Bay Area BC traffic emissions come from an increasingly small number of vehicles. The older diesel fleet thus represents a crucial target for reducing overall BC concentrations.
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 gasoline gross-polluters).
7. Major decreases in BC are expected to continue as California regulations pertaining to heavy-duty diesel engines take effect (though concern exists that older diesel BC emitters not meeting these standards will be exported to other states and countries). Additional California regulatory efforts are underway to control BC emissions, including with goods movers, light-duty vehicles, and wood-burning.

Emerging Issues

Many issues discussed by the speakers are well covered in pages 47-58 of the report footnoted above on page 2.

1. Efforts aimed at BC reduction are essential components in the mitigation of the adverse effects from climate change and thus must be used in concert with efforts to reduce CO₂.
2. While climate change is generally considered on a global level, local control of BC emissions can result in significant immediate local health benefits and crucial near-term climate benefits.
3. BrC appears to be a contributor to climate change, but further quantification of its influence on climate change is necessary.
4. Nitrates and ash are commonly co-emitted with BC and BrC during biomass burning and are negative climate forcers. Sulfates are also negative climate forcers; however, they are less of an issue in California, given its use of low sulfur fuels.
5. The underlying mechanisms behind, and the relative magnitude of, the health effects of both BC and BrC are not fully understood, and thus research will assist in setting priorities for BC emissions reduction targets.

6. A positive feedback loop exists, in which BC-induced climate change results in increased drought, leading to increased wildfire risks, and in turn to greater BC emissions.
7. California regulations to limit diesel emissions and PM have been successful in reducing BC concentrations, but more work is needed, especially for sources other than heavy-duty diesel vehicles. Other targets for further reduced BC emissions in the Bay Area include:
 - a. Other diesel sources, e.g., rail, ship, airport ground equipment
 - b. Traffic management, including congestion mitigation and speed flow control
 - c. Residential and commercial cooking, especially charbroiling and barbequing
 - d. Residential (fireplaces and wood stoves), agricultural, and open biomass burning.
8. Lubricating oil burning is linked to BrC.
9. Improvements to Bay Area BC and BrC monitoring networks would 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.

Advisory Council Recommendations

1. Measurements of Bay Area BC and BrC can verify the success of regulatory and incentive programs, and can serve as a model for such mitigation efforts, providing health benefits to communities worldwide. To that end:
 - a. Continue and expand Bay Area BC and BrC monitoring, concentrating on locations where historical COH measurements were once collected. Consider redeploying COH monitors, if possible.
 - b. Further investigate BC in West Oakland and other high concentration areas, to expansion of ambient monitoring and development of emissions inventories for on- and off-road sources.
 - c. Explore supplementing BC monitoring network by deployment of low-cost monitoring technologies to stakeholders. These monitors could be useful during air pollution episodes, such as the recent Richmond refinery fire.
 - d. Continue to refine and develop BC, BrC, and OC emissions inventories.
 - e. Research the magnitude of the longer-range transport of BC and BrC, e.g., to and from the Central Valley.
2. Continue and expand the Air District focus on the reduction of diesel emissions and wood smoke pollution to address Bay Area BC and BrC. In particular, wood smoke from residential fireplaces should be reviewed to target emission reductions.
3. Because BC reductions, and to a lesser degree BrC reductions, results in near-term climate-change mitigation, continue and accelerate efforts to target emission control of these two species within the Bay Area. Additional control measures to consider include:

- a. Incentives and regulatory mechanisms that target heavy-duty diesel vehicles; residential, agricultural, and open biomass burning; off-road mobile sources; rail; airport ground equipment; ships; and commercial and residential cooking.
 - b. Measures to increase control of emissions from stationary sources not currently regulated, e.g., back-up diesel generators, bonfires, barbecues, outdoor fire pits, chimeneas???, wood-burning pizza ovens, charbroilers.
 - c. Continued incentive-funding for programs to scrap vehicles with high-emitting diesel and gasoline engines. Measures that retire or “repower” old engines should be encouraged, so that they will not be moved elsewhere.
 - d. Work with the business community and others to develop more sustainable transport of freight and goods throughout California.
 - e. Assist ABAG, MTC, and other planning agencies to implement Plan Bay Area (i.e., the regional integrated long-range plan), which contains strategies to optimize traffic flow on Bay Area roads.
 - f. Support federal, state, and local policies and programs that would reduce emissions, especially as they relate to ongoing CARB diesel reduction regulations.
4. Research the relative emissions of CO₂, PM_{2.5}, BC, BrC, nitrate precursors, ash, and methane from a variety of sources (e.g., fossil and renewable fuels burned in various engines and in heating and cooking appliances). In particular, focus on situations in which BC or BrC emissions compete with CO₂ emissions with respect to climate change and public health outcomes.
 5. Support and monitor research on BC and OC (especially BrC) health effects, especially on the health effects from traffic-related pollution and biomass burning. Include the health effects of commonly co-emitted species (e.g., NO_x and ash) and their end products (e.g., nitrates and NO₂).
 6. Educate the public about the importance of BC and BrC emission reductions as a significant tool for mitigating global climate change *in the immediate future*.

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 and is less reflective.

ARB: California Air Resources Board

BC: Black Carbon, a particulate in air related to combustion of diesel fuel and other fuels consisting mainly of relatively pure carbon. (FROM PREVIOUS REPORT: Solid form of mostly pure carbon, produced by incomplete combustion; 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, an organic carbon particulate in air related to the burning of biomass and lubricating oil in engines. (FROM PREVIOUS REPORT: Class of particulate OC that absorb ultraviolet and visible solar radiation. Can be directly emitted during incomplete combustion, or it can form as atmospheric pollutants age.)

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

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

CO₂: carbon dioxide, the product of combustion of organic materials (fuels and biomass).

COH: Coefficient of Haze, a measurement of ambient air particulates that correlates with black carbon measurements. Manufacture of COH analyzers has been discontinued.

Co-Emitted Pollutants: Gases and particles emitted with BC, e.g., OC, sulfur dioxide, nitrogen oxides precursors to sulfates and nitrates respectively.

GWP: Global Warming Potential, a measure of a chemical's relative contribution to global warming compared to carbon dioxide.

HFC: A fluorocarbon used as a refrigerant.

Mirrors: A term used to describe some air pollutants (e.g. nitrates, sulfates, and ash) that reflect solar radiation back into the heavens.

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

OC: Organic carbon, Compounds containing carbon (bound with other elements, e.g., hydrogen and 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.

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

WHO: World Health Organization, a source of information and health based standards and guidelines on health effects of various air pollutants.