

Bay Area Air Quality Management District
939 Ellis Street
San Francisco, California 94109

APPROVED MINUTES

Advisory Council Regular Meeting
1:30 p.m., Wednesday, March 22, 2006

CALL TO ORDER – ROLL CALL

Opening Comments: Chairperson Kurucz called the meeting to order at 1:45 p.m.

Roll Call: Present: Kraig Kurucz, Chair, Cassandra Adams, Sam Altshuler, P.E., Louise Bedsworth, Ph.D., Ken Blonski, Robert Bornstein, Ph.D., Jeffrey Bramlett, Harold M. Brazil, Irvin Dawid, Emily Drennen, Fred Glueck, William Hanna, Stan Hayes, John Holtzclaw, Ph.D., Janice Kim, M.D., Steven Kmucha, M.D., Karen Licavoli-Farnkopf, MPH, Ed Proctor, Brian Zamora.

Absent: Linda Weiner.

Introduction of New Advisory Council Members: Chairperson Kurucz welcomed new Advisory Council members Janice Kim, M.D., Ed Proctor and Karen Licavoli-Farnkopf, MPH.

PUBLIC COMMENT PERIOD: There were no public comments.

CONSENT CALENDAR:

1. **Approval of Minutes of January 11, 2006.** Mr. Dawid moved approval of the minutes; seconded by Dr. Holtzclaw; carried unanimously.

COMMITTEE REPORTS:

2. **Executive Committee Meeting of March 22, 2006.** Chairperson Kurucz stated that the Committee met earlier this afternoon and received reports from the Standing Committee Chairs.
3. **Joint Air Quality Planning & Technical Committee Meeting of February 7, 2006.** Mr. Hayes stated that the joint Committee received a staff presentation on the District's climate protection program and adopted a motion "expressing the Council's support for the Board and staff's leadership on the Climate Change issue, in particular on the current efforts and future direction." He moved adoption of the motion for forwarding to the Board; seconded by Dr. Holtzclaw. Dr. Bornstein suggested the text reflect "proposed future direction." This was accepted by the motion maker and seconder and the motion carried unanimously.
4. **Report of the Public Health Committee Meeting of February 14, 2006.** Mr. Bramlett stated that the Committee received a staff presentation on District wood smoke abatement measures. In April, the Committee will receive presentations on wood smoke abatement in the Puget Sound and San Joaquin air districts. The Committee may meet monthly in the near future to attend to certain topics. It will begin its work on indoor air quality and asthma in the summer.

PRESENTATION

5. Particulate Matter (PM) Research and Abatement.

(a) Dr. Eric Fujita, Division of Atmospheric Sciences, Desert Research Institute (DRI), Reno, Nevada, presented “Source Apportionment of Ambient PM,” which concerns DRI’s research on PM emission profiles for mobile sources, wood combustion and meat cooking. Source characterizations and profiles were applied in a chemical mass balance methodology in order to apportion the sources of ambient PM. The presentation will describe source attribution techniques and how they are in turn used in PM source apportionment analysis. Dr. Fujita described the chemical mass balance equation that is used to predict source contributions from knowledge of ambient constituents and source composition profiles. Model inputs include ambient concentrations and associated uncertainties, as well as source composition, to produce estimates of source contributions, with uncertainty factors. Measurements used include PM mass, elements, ions, organic carbon, elemental carbon, organic compound concentrations in both ambient and source samples. The model assumes that:

- Compositions of source emissions are constant during ambient and source sampling
- Chemical species do not react with each other
- All sources with a potential contribution are accounted for
- The number of sources is less than or equal to the number of chemical species
- Source compositions are linearly independent of each other
- Measurement errors are random, uncorrelated and normally distributed

Dr. Fujita displayed a pie chart containing data from the 1997 Denver North Front Range Air Quality Study in Colorado displaying the fraction of PM_{2.5} and total carbon from diesel exhaust, gasoline, wood burning (hard and soft wood), ammonium nitrate, paved road dust, power plants, meat cooking and ammonium sulfate. The data indicate that PM nitrate and wood combustion are major contributors to the total PM_{2.5}. DRI studied what molecular markers could be used in distinguishing various combustion sources.

In terms of markers for wood combustion, several classes of organic compounds are useful for identification: lignin pyrolysis products, guaiacols and syringols are emitted in certain ratios in hardwoods and softwoods: in softwoods guaiacols are found in higher ratios to syringols and in hardwoods guaiacols and syringols are emitted in roughly equal amounts. Resin acids and their oxidation products—such as dehydroabietic acid—are associated with softwoods. Cellulose pyrolysis products such as levoglucosan are also found in combusted wood products. These compounds are variously volatile: some are found in the PM phase, while others are found in the semi-volatile phase and distributed in the gas and PM phases.

In the Northern Front Range Study, softwoods and hardwoods were combusted and tested in fireplaces and woodstoves. Hardwoods emitted more water-soluble potassium (a long-standing marker for residential wood combustion) than softwoods. Emissions were also greater from a fireplace than from woodstoves because the latter have a higher temperature and combustion efficiency. The same study identified other organic compounds in wood smoke: polycyclic aromatic hydrocarbons (PAHs) such as hopanes and steranes, and gas phase and particle phase guaiacols.

The Central California Particle Study in 2005 shows similar results, and when levoglucosan is added in a category of source composition, it is found in higher quantities in wildland fuels and prescribed burns. For emissions from specific species of trees, levoglucosan emissions vary in relation to total elemental carbon. Data from the same study comparing laboratory experiments with prescribed burns provided diverse emission profiles. Dehydroabiatic acid is a major constituent in wildland burns and is associated with resin acids.

Data from a District study in San Jose of PM collected on quartz filters collected in 2004 reveals that the samples indicate higher amounts of wood combustion constituents such as dihydroabiatic acid and levoglucosan during the winter (especially holidays and cold days).

Molecular markers for meat cooking include fatty acids (palmitic acid, stearic acid, oleic acid); sterols (cholesterol); and lactones (lactonization of beta-hydroxy fatty acids and oxidation of alkenals and oleic acid). The Northern Front Range Study evaluated meat cooking tracer compounds in emissions from cooking operations with automated charbroiled hamburger, charbroiled hamburger, charbroiled chicken with skin, and charbroiled steak. It found that these molecular markers are emitted in varying levels in all forms of cooking.

Wolfgang Rogge studied a wide variety of cooking techniques and found that such organic compounds as cholesterol, alkanals, alkanols, amides, lactones, furans, dicarboxylic acids, alkanolic acids and alkanes are found in varying levels in all types of meat cooking.

For motor vehicle exhaust, the "Gasoline Diesel/PM Split Study" attempted to distinguish the relative contribution of gasoline and diesel to urban areas. In the vehicle testing phase, the study showed that many factors contribute to vehicle emission rates and composition. The main parameters that affect emission rates and composition are vehicle range and accumulated mileage (i.e., state and quality of maintenance), emission control technology, lubricating oil and age of lubricating, vehicle operating mode and the load it is driven in, ambient temperature, sampling conditions and methods of analysis, in which there are variations. As to the relationship between vehicle age, mileage rate and emissions, the data indicated that PM emissions do not increase significantly until after 10 or 11 years of vehicle age or 150,000 miles.

The vehicle emission test cycles may affect variation in vehicle emission rate and composition. The modified unified driving cycle varies somewhat from the federal test procedure and is a bit more aggressive in the hot stabilized phase of the test. Emissions of black carbon were measured in real time for four different vehicles on the modified unified cycle. Most emissions were associated with the cold start mode and a few hard accelerations for the newer and generally cleaner vehicles. For the dirtier vehicles, high amounts of PM are emitted throughout all the stages of the test procedure. The distribution of organic and elemental carbon for composites of higher emitters and lower emitters in light-duty gas vehicles and heavy-duty diesel trucks reveals that the distinguishing feature is the higher amount of elemental carbon found in emissions from heavy-duty diesel than from gasoline vehicles.

There is considerable variation in the volatility of PAHs (naphthalene, flouranthene, benz(a)anthracene, ideno(1,2,4-cd)pyrene, benzo(ghi)perylene, benzo(k)flouranthene, coronene, hopenes, and steranes. The gas phase PAHs are naphthalene and fluoranthene.

Benzathracene is a transitional PAH. Indeno(1,2,3-cd)pyrene, benzo(ghi)perylene, benzo(k)fluoranthene) are particle phase PAHs and are markers for gasoline exhaust. Light-duty gasoline vehicle exhaust contains higher molecular weight PAHs in much higher quantity than diesel exhaust. Data from Kansas City and San Jose studies show that there is a linear relationship between the abundance of these particular markers to total carbon.

In a recent study of vehicular exhaust in selected areas in Los Angeles, data indicate that most of the total carbon is attributable to diesel exhaust. However, the results can be different depending on where measurements are made. Measurements taken at the Rose Bowl after a sporting event would reveal a predominance of gasoline exhaust, but in the central part of the Los Angeles basin there is an even distribution of gasoline and diesel exhaust. Charts with plots of black carbon on freeway arterials in the Los Angeles area near the port areas indicate considerable diesel exhaust as these have significant truck traffic.

Organic markers exist for most major combustion sources. However, the abundances of markers are variable and profiles must be specific to the region in which sampling is taking place. The particular analytical method for determining the ratio of organic to elemental carbon must be noted when setting forth results concerning this ratio.

- (b) Dr. David Fairley, District Statistician, presented "PM Source Apportionment for the Bay Area." He stated he would review a summary of a previous study based on chemical mass balance analysis of filters loaded with ambient PM available from existing studies and review new studies conducted to fill information gaps, via carbon-14 analysis and organic speciation analysis.

Dr. Fairley noted that PM poses serious health problems, and that the District complies with the national, but not the state, annual and 24-hour standards for PM₁₀ and PM_{2.5}. Peak periods of PM concentration in the Bay Area occur in the months of November through January. Wintertime periods of stagnation and cool temperatures tend to produce ammonium nitrate which is a constituent of PM_{2.5}. The two most recent winters have had high levels of precipitation, whereas from 2001-2003 PM has been higher during the winter when there was less precipitation. Wood smoke emissions are highest during the winter season.

Two approaches are used to estimate PM sources: analysis of ambient PM sample filters, and engineering calculations based on the emissions inventory. Measurements of ambient air samples have been compared with measurements of the compounds sampled from various sources. The goal was to determine what the sources of PM are and if these were man-made or from secondary formation in the atmosphere. Chemical mass balance can discern the difference between directly emitted constituents and those constituents from secondary atmospheric formation. The data indicate that meat cooking, and also tire and break wear, are fairly minor sources of PM.

In measuring geological dust, higher levels were found at the Pt. Reyes station monitor than at other sites. Peak levels of PM_{2.5} do not appear to be significant in evaluating the overall levels of particulate matter. Dr. Fairley noted that in his CMB analysis, he found that most of the PM_{2.5} is carbonaceous.

The District has conducted a Carbon-14 study in order to distinguish between recent carbon and old carbon in the samples. New carbon tends to derive from meat cooking and wood burning, and old carbon from fossil fuel combustion. The analysis set forth in terms of annual averages at each site studied revealed that in 10 out of 14 cases for the data in 2004, more than 50% of the PM is new carbon. This suggests that wood burning and cooking contribute more carbon to the atmosphere than fossil fuel combustion from trucks and autos on an annual basis in the Bay Area. Filters from 1998 show higher levels of old carbon than in 2004, which may suggest that the vehicle fleet overall is getting cleaner.

In the efforts to separate sources of old and new carbon in the major sources of PM, further questions remain to be answered. Initial conclusions that have been drawn include (1) ammonium nitrate is a large contributor to both annual and PM_{2.5}. (2) ammonium sulfate is a significant contributor to annual but not to peak PM_{2.5}. (3) road dust/geological dust/break and tire wear are insignificant sources of PM_{2.5} in the Bay Area. (4) most PM_{2.5} derives from combustion, directly or indirectly.

- (c) Dave Vintze, Air Quality Planning Manager, presented “Bay Area PM Control Measures for SB656.” He stated that prior to the adoption of SB656 the District regulated PM through several rules: Regulation 5 on Open Burning, Regulation 6 on Particulate Matter and Visible Emissions, and Regulations 8, 9, and 12 on volatile organic compounds, nitrogen oxide and sulfur oxide, respectively. Mobile source incentive programs such as the Carl Moyer, Transportation Fund for Clean Air, Vehicle Buy-Back and Low Emission School Bus and Solid Waste Collection Vehicle programs also reduce emissions of PM and dust. Wood burning emissions are addressed through the Spare the Air Tonight program, a model wood burning ordinance and incentives to replace high polluting wood burning appliances.

SB 656 requires the California Air Resources Board (CARB), in consultation with local air districts, to develop a list of the most readily available, feasible, and cost effective control measures to be used by CARB and the districts to reduce PM₁₀ and PM_{2.5}. CARB recently conducted a survey of air districts in the state and obtained 103 possible control measures for PM. Of these, 69 have already been implemented by the District; 13 are not significant for emission reductions; seven are part of the evaluation in the 2005 ozone study; 10 are slated for further study; two can enhance some existing PM reduction programs; and there are two new potential measures that can reduce PM emissions.

As to measures that can expand or enhance existing programs—in this case the Spare the Air Tonight program and the voluntary curtailment program—enhancement of these is possible. The District has expanded the number of residents that receive its survey for wood combustion, as well as the text of the survey itself. The District can also lower the threshold for the voluntary wood-burning curtailment advisories, amend the existing public awareness program to provide additional outreach and education resources, and enhance the existing wood-burning model ordinance program.

The two potential stationary source control measures include commercial charbroiling (conveyerized and under-fired boiler) operations and stationary and internal combustion engines. There are 500 conveyerized broilers and 5,000 under-fired broilers in the Bay Area. For conveyor char broilers there are control options that include catalytic oxidizers, fiber-bed filters, thermal incinerators, electrostatic precipitators and wet scrubbers.

For under-fired broilers, high efficiency multi-stage filters are under consideration as control measures. The rule development process for stationary and portable internal combustion engines is also underway; stakeholders are being contacted and a review is underway regarding existing regulations for such engines in other agencies.

AIR DISTRICT OVERVIEW

6. Report of the Executive Officer/APCO. Jean Roggenkamp, Deputy APCO, stated that:

- a) the District has selected Jack Colbourn as the new Director of the Outreach & Incentives Division (formerly entitled Public Information & Outreach Division).
- b) the Spare the Air Tonight program concluded in February and to date no exceedances of the ozone standard were recorded. The abundance of rainfall this winter contributed significantly to such monitoring results.
- c) the Spare the Air summertime program will begin on June 1 of this year and will differ from last year's program in that the free transit days on forecasted Spare the Air days will include free transit all day rather than only for the morning commute.
- d) staff continues to move forward with its work on climate protection as well as the Community Air Risk Evaluation (CARE) program.
- e) regulatory work will commence on commercial char broilers and agricultural sources of PM.
- f) the District's budgetary process for the next fiscal year is under way and the last two years of state subvention fund losses no longer occurs this year, but the District must still allocate funds with care.

Mr. Glueck inquired if the combustion of natural gas in home space and water heating in the Bay Area constituted a major source of carbon. Mr. Altshuler noted that, if burned correctly, natural gas does not create a significant source of carbon. Gary Kendall, Technical Division Director, agreed with Mr. Altshuler, and noted that residential space and water heating is included in the District's emission inventory but is generally considered clean burning. Mr. Kendall inquired of Dr. Fujita if this question could be assessed through sampling analysis and source apportionment. Dr. Fujita replied that to date no interest in conducting this type of analysis has been expressed.

OTHER BUSINESS

7. Report of Advisory Council Chair. Chairperson Kurucz stated that selections for Council member attendance at the Air & Waste Management Conference in New Orleans have been made. The Council has been able to fund an additional position due to obtaining one additional registration payment from another source.

8. Council Member Comments/Other Business. Mr. Hanna inquired as to the status of the EPA proposal to eliminate the PM standard for sparsely populated areas. Ms. Roggenkamp replied that EPA has proposed to lower that standard, and staff is looking into it further. Mr. Hanna also requested that staff keep him apprised of developments relative to SB 700 which concerns emissions from agricultural equipment.

Mr. Dawid noted that the Sierra Club has testified at three EPA hearings opposing the lowering of the PM standard in rural areas. Mr. Dawid inquired if the District has adopted a position on Assemblyman Ruskin's currently proposed legislation concerning vehicular emissions. Ms. Roggenkamp indicated she would look into this matter and respond to Mr. Dawid at a later time.

PRESENTATION (continued)

5. Particulate Matter (PM) Research and Abatement.

Chairperson Kurucz stated that Council members who did not have to depart the building for other obligations could ask additional questions of the speakers on this item at this time.

Mr. Altshuler inquired of Dr. Fujita if there were any takeaways in what he had observed with respect to the common use of fireplaces: for instance, whether fireplace users should use soft or hardwood and how these influence start-up, smoldering and combustion temperatures. Dr. Fujita stated that within the context of residential wood combustion, indoor exposure is one of the most important criterion. The exposure to smoke from back draft is of particular concern. People need to be aware of the best way to start a fire and avoid indoor exposure. The same applies to meat cooking. Peter Hess, Deputy Air Pollution Control Officer, suggested that the Public Health Committee investigate the acids and phenols, and how these may be linked to asthma and asthma attacks, and any correlation with wintertime asthma data.

Chairperson Kurucz noted that the results from Dr. Fujita's and Dr. Fairley's studies seem to be in contradiction to one another, although some of the difference may lie in the methodologies that are applied. One set of results suggests that carbon comes from mobile sources, and the other set suggests it is from other sources. The question as to how this is resolved is important. Mr. Hess indicated this will require further evaluation. This will be a topic of discussion at the Air & Waste Management Association Conference in June in New Orleans.

Mr. Glueck inquired if the Community Air Risk Evaluation (CARE) program would address this PM exposure of residences near a freeway arterial or a cluster of several restaurants. Mr. Kendall replied that the grid scale for the CARE program is 2x2 kilometers, and does not reach the micro-scale level to which Mr. Glueck refers.

Mr. Hayes suggested that reductions in outdoor emissions that also reduce indoor emissions should be formally accounted for in evaluating a rule. Also, the large fraction of ammonium nitrate that contributes to PM levels at peak times and for annual averages is noteworthy. Dr. Fairley replied that although more information from additional monitoring sites is required, this result has consistently shown up in the studies that have been conducted to date in the District.

Dr. Holtzclaw suggested that the District take PM measurements downwind from freeways, which may be overlaid on gridded emissions mapping. Dr. Fujita noted that papers have indicated emissions from freeways drop off exponentially with distance away from the freeway. Dr. Fujita and Mr. Kendall indicated they would provide Dr. Holtzclaw with these studies.

Mr. Dawid noted that while truck and gasoline emissions have been the subjects of the speaker presentations today, vehicular congestion is another category of any vehicle emissions study.

He added that an elected official in his jurisdiction is concerned over exposure to freeway emissions of residences that are built next to arterials. Dr. Fujita replied that although the fleet is getting cleaner over time, gross polluting vehicles still contribute to most of the emissions.

Dr. Bornstein inquired if conclusions have been drawn on the basis of samples and measurements, but do not include dispersion. Dr. Fujita replied that at a monitoring site which is used for determining compliance with a standard, then it works for that standard. However, the issue is how representative is that monitoring site in the region in which it is located.

Mr. Altshuler urged that, in presentations such as those given today, the use of percentages of given constituents to the total picture is useful for source apportionment but does not provide the clearest picture in terms of questions for public exposure to pollution.

Mr. Altshuler thanked the Outreach & Incentives staff for sending out topical news articles. One article concerned how California was challenged by a manufacturer in Arkansas for setting strict standards for small engine lawnmowers, and, as a consequence, a national study was conducted. The outcome of the study was to confirm California's regulatory approach on this matter.

9. Time and Place of Next Meeting. 10:00 a.m., Wednesday, May 10, 2006, 939 Ellis Street, San Francisco, CA 94109.

10. Adjournment. 4:12 p.m.

James N. Corazza

James N. Corazza
Deputy Clerk of the Boards