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

APPROVED MINUTES

Advisory Council Technical Committee
9:30 a.m., Monday, February 11, 2008

1. **Call to Order – Roll Call.** Chairperson, Kraig Kurucz called the meeting to order at 9:38 a.m.

   Present: Sam Altshuler, P.E., Louise Bedsworth, Ph.D., Fred Glueck, John Holtzclaw, Ph.D., Kraig Kurucz, Chairperson.

   Absent: Robert Bornstein, Ph.D.

2. **Public Comment Period.** There were no public comments.

3. **Approval of Minutes of August 26, 2007 and October 1, 2007.** The Committee provided minor revisions to the minutes. After discussion, Mr. Altshuler moved that the approval of the minutes be deferred until Dr. Marc Fisher reviews that portion of the minutes containing his presentation; seconded by Mr. Holtzclaw carried unanimously without objection.

4. **Update on PM Inventory Development, Modeling and Data Analysis:** *Air District staff members Dr. Saffet Tanrikulu, Research and Modeling Manager, and Dr. David Fairley, Statistician, gave a presentation to the Committee on PM inventory development, modeling and data analysis.*

   Dr. Tanrikulu, Research and Modeling Manager introduced himself to the Committee and provided his topic of discussion which was the ongoing PM study effort. The study of PM started several months ago and the focus will include the data analysis, emissions inventory development and modeling. Dr. Fairley addressed wood burning inventory improvements after his talk.

   Dr. Tanrikulu mentioned that PM 2.5 concentrations exceed 35µg/m3 (current 24-hour national PM 2.5 standard) in the Bay Area. The number of exceedances changed from one year to the next. Since PM 2.5 measurements started in the Bay Area (1999), the concentrations exceeded 35µg/m3 as low as five and as high as thirty seven times.

   The expected Environmental Protection Agency (EPA) designation includes:

   - The U.S. EPA plans to designate districts in 2009, based on PM measurements in 2005-2007;
   - Bay Area is expected to be in non-attainment for the federal 24-hr PM standard (35µg/m3);
   - Bay Area is expected to meet the federal annual standard (15 µg/m3); and

- Purpose of the Air District effort is to understand PM formation in the Bay Area and provide technical information to planners

As part of the on-going PM study, a Chemical Mass Balance (CMB) analysis was conducted using data from the following air monitoring stations: San Jose, San Francisco, Livermore and Bethel Island.

The findings of the CMB analysis showed that PM 2.5 in the Bay Area is coming from the following sources or processes:

- 18% of PM 2.5 is from burning fossil fuel (mostly diesel)
- 36% from burning wood and cooking
- 44% from the formation of ammonium nitrate and ammonium sulfate
- 1% from sea salt
- 0.5% from geologic dust
- 0.5% from other sources

Analysis also showed that particulate matter transport from the Central Valley may significantly contribute to the Bay Area's PM 2.5 levels.

The on-going PM study activity includes:

- Collaborating with ARB in the CRPAQS effort (regional inventory development, data analysis and modeling) - $28 million study over Northern CA
- Developed an ammonia emissions inventory: STI
- Improved emission estimates from wood burning: phone survey
- Studying the relation between meteorology and PM: UCD
- Simulating PM for CRPAQS measurement period (00-01)
- Conducting simulations with the wood burning and diesel PM inventories (06-07) – winter period

December 2006 and January 2007 period was extensively studied. Key finds and observations are summarized below:

- Measurement stations have good aerial coverage over the Bay Area
- In the Bay Area PM does not go to zero, even when it is raining
- PM levels go up and down together over the entire Bay Area stations, unlike ozone
- No single site is consistently higher than others, unlike ozone
- PM 2.5 exceeds the standard for 1-6 days, longer than Bay Area ozone episodes, but shorter than San Joaquin Valley or Sacramento PM episodes
- Most exceedances are in mid 40's, some are in mid 50's, lower than Sacramento and San Joaquin Valley levels
- High PM during Christmas due to above average wood burning
- No clear correlation between temperature and PM
- A strong correlation between PM and rain
- Winds are rarely calm in Bay Area, minimum daily average wintertime wind speed was about 3 miles/hr during the study period
- Low PM, when daily average wind speed exceeds 7 miles/hr

- Winds were mostly from the east during high PM days
- PM build up period was 1-3 days

Dr. Tanrikulu made these points showing various charts and tables. Additional information regarding charts and tables include:

PM 2.5 was plotted from 10 Bay Area stations from November 15, 2006 through February 15, 2007. The PM levels tend to go up and down at all stations simultaneously. Dr. Tanrikulu also stated that there is no single site consistently reporting PM 2.5 higher or lower than others. In terms of the number of days, there are some sites consistently higher than others. Duration for exceedances were as low as 1 day; and as many as 6 days of exceedances, which is longer than the ozone episodes.

Dr. Tanrikulu stated that if you look at the November, December and early January exceedances, that they are in mid to upper 40s. Also, the chart displayed one unusually high PM day, which was Christmas Day. It is believed that this was due to excess wood burning.

Mr. Altshuler commented that there are normally high readings around Christmas and Thanksgiving from wood smoke, but feels that this is mostly due to fireplaces and not from wood stoves. Mr. Altshuler explained that fireplaces are less clean and inefficient and the wood stove is relatively efficient and is not as dirty. Perhaps that the Air District may want to target fireplaces more than just generically wood burning.

Mr. Gary Kendall, Director Technical Services, responded to Mr. Altshuler stating that the Air District is considering this approach, as there were comments referring to that same topic and that there is a possibility that once the final proposal is out for the wood burning rule, it may have a tiered approach with some allowances for the us of EPA certified wood stoves. On nights when one is not allowed to burn in a fireplace, but one may be allowed to use the certified wood stove.

Dr. Holtzclaw asked if the firework particulates are included in the measurement. Dr. Tanrikulu's response was yes, and that the PM from all sources is included in the analysis. Mr. Altshuler asked about the chemical footprint.

Dr. Holtzclaw asked about the location of the PM monitor in San Francisco, Dr. Fairley responded that it is located at 16th and Arkansas Streets. Dr. Fairley stated that he used gun powder and while conducting the CMB analysis and that there were some anomalies on January 1st and researched the chemical profile of gun powder and the results were significant on certain days. Mr. Altshuler asked if there were any heavy metals associated with fireworks. Dr. Fairley was not certain when Dr. Holtzclaw asked if this is how the different colors and Mr. Kendall replied that with the PM 2.5 monitors that the Air District has noticed that in the evening, and in the early morning hours after the fourth of July, that if you are looking at hourly measurements the levels go up. The Air District feels that there is a direct correlation between the firework activities and an increase in hourly PM levels.

Mr. Altshuler also asked if he thought this was more toxic and Mr. Kendall stated that he could not comment without the list of metals being used, but noted that metal compounds are used to get the various colors.

Additional slides included:

- Bay Area PM 2.5: Winter 2006-2007 – beige lines minimum temperatures
- Bay Area PM 2.5: Winter 2006-2007 – blue lines amount of rain
- Bay Area PM 2.5: Winter 2006-2007 – blue lines average wind speed; wind average 3 mph
- Bay Area PM 2.5: Winter 2006-2007 – purple lines east winds in Vallejo and Pt. San Pablo; blue lines – wind speed

Dr. Tanrikulu also covered the topic of modeling currently used by the Air District.

- MM5 for meteorological modeling
- CAMx for air quality modeling
- 4 km horizontal grid resolution
- PM emissions from wood burning and diesel combustion (no secondary PM formation)
- Initial and boundary conditions were zero

Dr. Tanrikulu stated that what the Air District is trying to do is find out whether the model is able to capture the main features of PM formation, as this is the purpose of the initial effort. Dr. Tanrikulu indicated that the information noted in the wintertime PM 2.5 emissions from residential wood combustion may be under estimated in both Livermore and Napa.

Comparison between simulation and observation include:

- Simulation is multiplied by 4.5 for the time-series and by 3 for areal plotting purposes
- Good agreement between simulation and observation
- We do not expect one to one match between simulation and observation because of assumed zero initial and boundary conditions in modeling and the use of only emissions from wood burning and diesel combustion

Mr. Altshuler commented on fireplaces versus wood stoves and that the Christmas phenomena is a fireplace and not a wood stove issue. Mr. Altshuler indicated that individuals that have wood stoves tend to use them continuously and fireplaces add the esthetic value that occurs during the holidays.

Future work includes:

- Plan to convert the 2005 CARE inventory to model ready inventory (for primary and secondary PM simulation)
- Evaluate the modeling inventory – several components include ammonia, and wood burning
- Improve meteorological simulations – currently using MM5 and in the future will consider using a different model
- Simulate PM (primary and secondary) using both CAMx and CMAQ
- Study model performance and identify areas need improvements
- Improve model performance

- Simulate emission scenarios under various meteorological conditions to better understand PM formation in the Bay Area and provide information to planners

Dr. Tanrikulu concluded his presentation. Dr. Holtzclaw asked if the Air District is more out of compliance with PM 2.5 and why is there a more severe target for PM 10 than 2.5. Mr. Kendall, responded to Dr. Holtzclaw noting that the state PM standard is 50 and that the National PM 10 standard is 150, and when taking that into account the Air District has a long was to go, in terms of meeting both the annual and the 24-hour state PM 10 standard.

There was extensive discussion regarding the presentation and the weather patterns during the study. Dr. Tanrikulu noted that the weather pattern significantly impacts the weather as a whole. The pattern includes the wind speed, wind direction, humidity and rain fall as it effects PM 2.5 concentrations and transport from the valley and secondary PM formation in addition to the spare the air tonight calls may be impacting PM 2.5 concentrations.

Mr. Kendall noted that he assumed that the rain washes the PM out of the air, and his staff informed him that we are receiving relatively clean marine air coming in that just does not have as much PM associated with it.

Chairperson Kurucz noted that as the Air District identifies the weather conditions that have the most impact to go back to the past few years and see if they correlate to that pattern. Mr. Kendall noted that because of the 10 years of data at Santa Rosa, the seasonal rainfall is not perfect and it does correlate pretty well, but it does not explain the PM exceedances experience completely. Mr. Altshuler asked if there would be less variability from year to year if all of the bay area stations were not included in the plot to only look at specific cities such as Livermore and Napa, if it would have the same affect. Dr. Tanrikulu replied to Mr. Altshuler informing him that the Air District will use various methods for the best results.

Chairperson Kurucz thanked Dr. Tanrikulu for the presentation.

David Fairley, Statistician thanked the Committee for inviting him to participate with the presentation. Dr. Fairley stated that he will provide information to the Committee to try and improve the emission inventory estimates for wood burning. Dr. Fairley stated that he will show how ARB conducts its word burning.

Dr. Fairley noted that a survey was conducted and this is what was used to make new estimates. Dr. Fairley stated that ARB estimates woodstove emissions and that it is based on census data where individuals were asked what is their primary source of heat; the response was that 1% of the bay area heats with wood. Dr. Fairley noted that the percentages are based on a survey county by county that was conducted by ARB.

Dr. Fairley stated that the survey was conducted for 22 days starting November 22, 2005 through February 17, 2006. This period covered the highest PM levels. Key questions from the survey were:

- What wood burning device(s) a household had (fireplace, wood stove, pellet stove).
- “Did you burn wood yesterday or last night?”
- “In a typical day that you burn wood, how many hours of the day do you have a fire burning?”

- "In a typical day that you burn wood, how many logs do you burn throughout the entire day?"

Mr. Glueck asked if these same households asked the same questions every day and Dr. Fairley's response was no, that each household was only asked one day. Dr. Holtzclaw asked if the days were selected randomly. Mr. Fairley responded by informing Dr. Holtzclaw that it was a mixture and that the Air District oversampled weekends and also included holidays.

The information was gathered for the months of November through February and estimates were calculated based on the questions:

- Estimated total daily household hours burned and total daily household logs burned by county for each month Nov thru Feb.

- Also asked:
  "Do you ever burn wood in non-winter months, between March and October? *If no, record. If yes, ask:* Which months during this period to you tend to burn wood?"

- ➔ This provided rough estimates for remaining months.

Comparison of survey-based emissions and ARB inventory shows that there is a difference between the estimate based on hours and logs. Dr. Fairley noted that the urban counties seem to have been over estimated by ARB, for example Alameda and San Francisco, whereas Sonoma and Marin Counties were both under estimated. Dr. Holtzclaw asked about the comparison made county by county and if this was compared by percent of the bay area total and if this was close to what ARB determined. Dr. Fairley stated that yes, the determination was based on relative amounts and not absolute. Dr. Fairly did state that the absolute did come close in comparison.

Dr. Fairley provided a summary of spatial allocation which included:

- How to estimate wood burning emissions to smaller geographic areas (e.g. neighborhoods or 4x4 km grids)

➔ Use regression analysis to find variables that predict wood burning.

Dr. Fairley stated that the survey provided the zip code of every respondent, so get to the geographic level and to use the regression analysis to compare the amount of wood burning zip code by zip code, with various demographic variables zip code by zip code. They response is the amount of wood burning in either hours or logs and that the independent variables. The data included:

- Response: wood burning rates by zip code (from wood burning surveys)

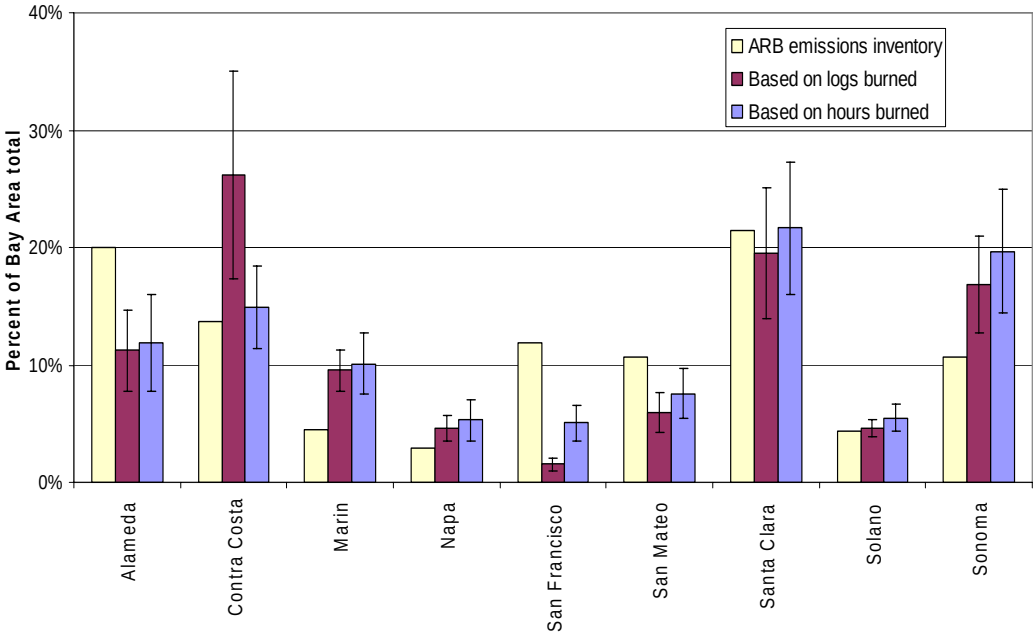
- Independent variables from the 2000 census: population, # of households, ethnicities, income distribution, occupation, house age, housing type, # of rooms, heating fuel, down to the *block-group* level.

Dr. Fairley stated that the information is down a block group level. The census data is a smaller geographic area in tracts, within the tracts are block groups and within blocks are individual blocks and information was provided block by block. Dr. Fairley clarified for Chairperson Kurucz that census blocks are equivalent to city blocks.

The results were:

<u>Statistically significant variables:</u>

- House type (single-detached vs. apartment)
- % of households using wood as their primary source of heat
- County
- (Without county, income was statistically significant); stating that the higher the income the higher the amount of wood burning



Dr. Holtzclaw noted that it would be expected that lower income people would be using wood burning for heating and also expect that more wealthy homes would use it just for the ambiance. Dr. Fairley responded by stating that wood burning only increase with income, lower income households did not burn less. Dr. Holtzclaw also asked if wood burning for heating increased as well. Mr. Fairley stated that it was only wood burning.

Dr. Fairley concluded his presentation.

Chairperson Kurucz ask Dr. Fairley if he is able to conduct a sensitivity analysis where a variable is removed and see how it would look, for example the natural gas for heating to see what the impact would be if everyone had natural gas service. Dr. Fairley responded that yes, this can be done.

Mr. Altshuler suggested that going forward that there should be a combination of geography and the meteorology. Mr. Fairley responded to Mr. Altshuler and noted that this is something that the Air District will do during the modeling process.

Dr. Tanrikulu informed the Committee that the presentation consisted of 20%-25% of the work completed by the Air District to date. Dr. Tanrikulu also stated that staff has done additional work that was not presented. Also, Dr. Tanrikulu stated that the Air District is also in the process of making some assumptions for the modeling purpose (i.e. what if the Bay Area permits the use of only EPA certified wood stoves and what impact or changes would we see in emissions and what benefit would we see in reducing PM 2.5 concentration and what impact does this hypothetical rule have in the northern area versus the southern area.

Chairperson Kurucz asked if the analysis lead staff to draw any conclusions or direction with respect to the impact of local climate or local climate on particulate matter levels, where climate change would affect how the Air District would comply or attain the standards. Dr. Fairley stated that there are numerous affects of the particles and that there is some progress in the reduction of carbonaceous fraction of PM 2.5.

Dr. Holtzclaw asked if there is any consideration for the same type of modeling and analysis of the ammonium nitrates and ammonium sulfates, pre-cursors, the transport and how it is affected by weather and so on. Dr. Fairley responded to Dr. Holtzclaw stating that this would require a full photochemical model where there is ammonium inventory and includes chemistry, which is the next step and would be quite valuable.

Mr. Glueck stated that the survey did not have the consistency with regard to the number of households that were questioned, but were not questioned on a continual daily basis to identify the patterns, indicated that this would have to affect some of the randomness and that income and temperature did not seem to be a correlation and the emissions that were identified. Dr. Fairley responded to Mr. Glueck that there may be some relation with income, and that it is a surprising one that it appears the higher the income, that it appears the higher the amount of burning.

Chairperson Kurucz noted that in the future this subject matter could be revisited if there has been significant progress made. Mr. Altshuler suggested revisiting the monitoring network for woodsmoke and the COH measurement is very simple means of conducting this, but it is a real time device, to see where some of the exposures are and look at the cities that have actually adopted woodsmoke ordinances ahead of time to see if this is an improvement, and use that city as an example.

Mr. Kendall commented that the COH instruments are no longer being made and that there is a newer device by the name of aethalomometer that would provide useful readings.

Chairperson Kurucz thanked Dr. Fairley.

5. **Discussion on Objectives for 2008:** *The Committee discussed their objectives for 2008.*

Chairperson Kurucz stated that a memo was sent to the Committee members summarizing their notes from the retreat and asked if there were any corrections to the direction that was

set at that time. The primary agenda for the committee is to explore implications of climate change.

Subtopics will include:

- Synergies and Conflicts of Climate Change and Criteria Pollutant Programs;
- Implications of Fuel Choice; and
- Modeling – Integrated Multi-Pollutant Management

Chairperson Kurucz commented on the speakers scheduled going forward, that Dr. Harley is willing to come to the next meeting and that there could possibly be a conflict, as Dr. Bornstein may obtain a speaker for that same meeting as well, which corresponds with the National Convention that is scheduled and that Dr. Bornstein hopes to get a leading expert who may already be in town. Chair Kurucz asked if the Committee would be willing to extend the upcoming meeting if necessary. Chair Kurucz also asked if there would be additional time needed spent this year to build towards a conclusion and a synthesis of all the information provided, such as modeling, the potential need for additional modeling capability as the Committee decides the impact of climate change and air quality and the relationship with PM. Chair Kurucz asked if the Committee preferred additional meetings or longer meetings, stated that it has been done both ways in the past.

Mr. Glueck asked if there is a presentation update on climate change within the Bay Area and feedback with respect to the emission impacts. The consensus of the Committee is to have an extended meeting.

6. **Committee Member Comments/Other Business.** Chair Kurucz requested that lunch be provided at the next meeting scheduled in April.

7. **Time and Place of Next Meeting**. 9:30 a.m., Monday, April 7, 2008, 939 Ellis Street, San Francisco, CA 94109.

8. **Adjournment.** 12:00 p.m.

/s/Vanessa Johnson
Vanessa Johnson
Acting Clerk of the Board