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

APPROVED MINUTES

Advisory Council Technical Committee
9:00 a.m., Monday, August 6, 2007

1. **Call to Order:** Chairperson Sam Altshuler, P.E., called the meeting to order at 9:05 a.m.

   Roll Call: Sam Altshuler, P.E., Chairperson, Louise Bedsworth, Ph.D., Robert Bornstein, Ph.D., John Holtzclaw, Ph.D., and Kraig Kurucz.

   Absent: William Hanna.

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

3. **Approval of Minutes of April 16, 2007.** The Committee provided minor revisions to the minutes that will be incorporated into the final version. Dr. Holtzclaw moved approval of the minutes; seconded by Dr. Bedsworth; the draft minutes were approved unanimously.

   Approval of Minutes June 11, 2007. The Committee provided a number of revisions to the minutes that will be incorporated into the final version. Mr. Kurucz moved approval of the minutes; seconded by Dr. Holtzclaw; the draft minutes were approved unanimously.

4. **Presentation on "Evaluating the use of Ethanol and its Impact on Ozone and Public Health as well as an Update on Carbon and Climate Change":** *Dr. Mark Jacobson, Professor of Civil Environmental Engineering at Stanford University, presented to the Committee his recent work on evaluating the use of ethanol and its impact on ozone and public health as well as an update on carbon and climate change.*

   Chairperson Altshuler introduced Dr. Mark Jacobson of Stanford University stating that Dr. Jacobson met with the Committee 4-5 years ago with a presentation on Black Carbon. Dr. Jacobson recently published an article on "Ethanol and Implications in Public Health," that was highly publicized. Mr. Altshuler thanked Dr. Jacobson for joining the Committee.

   Dr. Jacobson discussed two different studies, one being the ethanol study and the other, the latest research on black carbon. In addition, Dr. Jacobson reviewed the various energy sources, to look at solutions to energy, climate and air pollution issues in California in general.

   Dr. Jacobson spoke on a larger scale of global warming and the causes of global warming.

   The following topics were discussed relative to global warming:

- Greenhouse Gases;
- Fossil-Fuel Soot Particles;
- Urban Heat Island;
- Cooling Practice; and
- Net Observed Global Warming

Dr. Jacobson stated that the net observed global warming since 1750 is about 0.7°K to 0.85K (=°c). Numerical simulations of greenhouse gas impacts, versus particle impacts show that greenhouse gases cause about 1.5 to 1.6K warming and soot particles from fossil fuel sources including diesel tractors, off-road equipment, and jet fuel are also included and cause about 0.3K decrease. Numerical simulations were run on a global scale coming from the sub-grid urban surfaces. The total warming components are about 1.9K from the simulations and then offset by particles that are causing cooling, which are non-soot particles, primarily, sulfates, nitrates, ammonia, and organic carbon. These offset enough warming to cause the net observed change.

Dr. Jacobson noted that in no way, do we not want to control the particles because the health implications are so significant. "It really means that we have to control the greenhouse gases quickly as well." Dr. Holtzclaw asked what is the difference between the particle size and character. Dr. Jacobson's response referred to the slide entitled Fractal Soot Agglomerates (Arrows) Coated by Ammonium Sulfate, that shows numerical modeling. This slide depicts the size distribution of particles on a global scale and accounts for discrete size resolution from 1 nanometer up to 50 micron size particles. From diesel, that size distribution includes the lubricant oil for example, the soot mode, and also the larger soot for other components. The evolution of these particles with size over time, accounts for coagulation, condensation, and other types of internal mixing of chemistry on the particles, interaction of the particles with clouds, and with gases and the removal through rain out and wash out through cloud processing. It accounts for the composition of the particles as well. There is an emitted soot size distribution. Then there is emission of other things and other size distributions. Each size distributions interact with each other. The soot itself is broken down into black carbon, primary organic carbon and secondary organic carbon. Then there are sulfates and nitrates, and ammonium and sodium chloride, potassium, calcium magnesium, etc.

Mr. Altshuler asked if this study has been published and Dr. Jacobson's response was that the fossil fuel soot component had been published in 2003.

Dr. Bedsworth asked about the current U.S. death rate for PM2.5. Dr. Jacobson's response was that the estimate is about 50,000 to 100,000 people die of air pollution each year. Ozone death from vehicles is about 6,000 to 10,000 people.

The most recent and updated study looking at the lifecycle assessment of ethanol emissions in terms of carbon effect is by Mark Delucci at U.C. Davis. Dr. Jacobson stated that Mr. Delucci has accounted for things that were never accounted for including land use change, and the carbon store to the land. Mr. Delucci looked at pollutants that were not included in previous studies, for example, soot.

Dr. Jacobson stated that when ethanol is produced from corn, there is considerable use of tractors burning diesel fuel in the farming operations. Since ethanol can not be transported in a pipeline (it absorbs water too easily), you need to transport it through trains, diesel tanker

trucks, and barges. Not only is there a huge amount of petroleum carbon emitted, soot is also emitted, which has a climate impact and a health impact. This was never accounted for in any of the previous carbon balance studies. The net result that Mr. Delucci found was that there is just a 2% difference in the net carbon from corn ethanol versus gasoline. Cars produced in the U.S. as a whole, about 25.8% of the carbon and Californian cars have a higher percent of about 35%. So there is a 2% benefit from corn ethanol and if you multiple that by 26%, you are down to about 0.62% which is the benefit of corn ethanol, with 100% conversion to E85.

Dr. Jacobson stated that wind electricity is 98% carbon free. If wind is used for battery electric vehicles, there is a 25.5% benefit and the same applies for hydrogen fuel cell vehicles. Solar is about 90% carbon free, so there is a little less carbon benefit than wind. Solar energy is much more efficient to use than other technologies.

The land area needed to run all of the US vehicles on corn ethanol is an average of 15% of the entire U.S., including Alaska. Cellulosic ethanol needs an average of between 5% and 16% depending on the estimate. To run all the vehicles in the U.S. you would need about 70,000 to 120,000, five-megawatt wind turbines, as long as they are in the location where there is sufficient wind. You need about 8 meters per second or faster of wind speed to get the adequate machine efficiencies. If there were plans to replace all the other carbon in the U.S. for coal and electricity with wind turbines alone, it would be take 120,000 to 160,000 turbines or 45,000 to 60,000 natural gas power plants.

In order to address global warming, there is a need to reduce carbon emissions by 80%.

Birds tend to play a significant factor when it comes to development of wind farms. This information includes:

- U.S. bird deaths from current wind turbines – 10,000-40,000/yr. (a)
- U.S. bird deaths from communication towers – 50 million/yr. (a)
- Worldwide bird deaths from avian flu – 200 million/yr. (b)
- Est. bird deaths with 2,500,000 turbines worldwide – 2.5-10 million/yr.
- Outdoor human deaths reduced by these turbines – 800,000/yr. (c)

Also noted was that the effect of wind turbines on birds will be small relative to the benefit of reducing fossil-biofuels on human and animal illness.

(a) Bird Conservancy (April 2006)
(b) San Jose Mercury News (April 2006)
(c) World Health Organization (2002)

Overall summary of the presentation included:

- Global warming will hasten as aerosol (non soot) pollution decreases.
- CO_2 increases air pollution mortality due to its effect on temperature, water vapor, and atmospheric stability, which increase ozone and particulate matter in urban areas.
- 80% reductions in current emissions are needed to stabilize CO_2. Corn ethanol cannot practically reduce CO_2 in the U.S. by more than 0.07-0.2%; cellulosic ethanol cannot reduce CO_2 by more than 1.3-4%, based on current understanding.
- Wind-battery electric vehicles can reduce U.S. CO_2 by 25.5%; solar-battery electric vehicles can reduce it by 23.4%. Wind turbines require 30 times less land than corn ethanol and 20 times less land than cellulosic ethanol for the same power.
- Sufficient wind and solar are available worldwide to supply all electric and non-electric energy needs simultaneously several times over.
- Converting all U.S. gasoline vehicles to ethanol (E85) vehicles will not improve air quality. At 100% penetration, it may enhance (increase) air pollution mortality from 0 to 200/yr deaths above the 10,000/yr. due to gasoline in 2020. At 10-30% penetration, deaths may still be 0 to 20-60/yr. above 10,000/yr.
- The long lifetime of unburned ethanol in the atmosphere may result in a global source of acetaldehyde and ozone.
- Each ethanol or gasoline vehicle developed from now on will enhance air pollution and climate problems significantly compared with each renewable-powered battery-electric or hydrogen fuel cell vehicle produced.
- More info: www.stanford.edu/group/efmh/jacobson/E85vWindSol

Dr. Jacobson concluded his presentation. Mr. Altshuler asked Dr. Jacobson about plug in hybrids, and wanted to know the next step in the analysis while looking at the vehicle to grid concepts of plug in vehicles, as well as the use of vehicles, as a storage mechanism for electricity. Dr. Jacobson replied that Mr. Willit Kempton, University of Delaware is looking at the vehicle to grid and that Mr. Kempton recently met with PG&E who are currently working on the same vehicle to grid program.

Dr. Bedsworth, noted that there are two issues with ethanol that are somewhat separate; one is the energy balance question which is how much energy do you put in and how much do get out, which is a separate question from the carbon question because of the source of energy.

Mr. Altshuler thanked the speaker for his time and efforts.

5. **Presentation on Ambient Methane Trends:** *Sam Altshuler presented information on ambient methane trends for discussion.*

Mr. Altshuler noted that he took measurements for ambient methane in the 1970s. He looked at the analyzers to see if they were operating properly with background, clean air. The analyzers read 1.4 to 1.6 parts per million with clean background air. He noted that recently he looked at the current data on the Air District website, and it showed 1.8 parts per million during baseline or with clean air conditions.

Mr. Altshuler contacted Dr. David Fairley, Statistician, Research and Modeling Division to assist with trending data for methane within the Bay Area. Mr. Altshuler requested the lower methane values the 10% methane averages, which Dr. Fairley provided data that covered a span from 1981 to 2005. Mr. Altshuler generated a graph showing methane is indeed increasing, at a rate of 12.5% over the 25 years. Normalizing this to 100 years that would show an increase of 50% in methane for a century, this agrees very closely with a data point that was retrieved from the internet from an article by T.J. Blazeen and Carmen Smith. The report was published in July 2006, which showed a methane increase of 43% per century for the time period from 1750 to present.

To put things into perspective, the CO_2 increase from 1750 to current is estimated at 12% a year. This information is based on the data that were presented by Mr. Altshuler. Mr. Altshuler also noted that methane levels in the ambient seem to be rising at a greater rate than CO_2. Methane is 23 times more potent than CO_2, and even though it is at a much lower concentration than CO_2, Mr. Altshuler felt a need to shine light on this issue. Also noted, is that N_2O has risen 7% and tropospheric ozone 13%.

Mr. Altshuler asked the Committee how they should proceed to validate the simple trending that was conducted by Mr. Altshuler and not focus 100% of the Committee's efforts on CO_2. He suggested that maybe there is something concerning methane that the Committee should be aware of and potentially address for the District's benefit.

Mr. Kurucz asked about the percentage of the problem that it represents now; to see if it is growing from something insignificant, or is it already fairly significant and then growing at a faster rate. Mr. Altshuler indicated that if you normalize the methane to CO_2, (i.e. multiple the concentration by 23), that gives a CO_2 equivalent of 42 parts per million. Carbon Dioxide is 377 parts per million, so the methane is about a little more than 10% of the CO_2.

Dr. Bedsworth noted it would be interesting to know how this compares to other basins, particularly San Joaquin Valley, where there might be a different type of trend, urban versus rural. Mr. Altshuler reiterated that this study was based on the lower limit of the methane, which is the background and that the background in San Joaquin Valley may differ than the coast line in the Bay Area.

Mr. Kurucz also suggested that staff indicate the other sources of methane, to show that this is not just a local problem. Mr. Kurucz noted that the Air Districts' actions may only be limited to local, but perhaps the general methane levels are driven more by the kind of activities that are here at the Air District.

Mr. Altshuler asked Dr. Jacobson if he agreed with the trending, and what has been observed with regard to the 50% increase in emissions in the next century. Dr. Jacobson agreed with Mr. Altshuler's findings, but was not certain about the last three years, but indicated that he has seen data showing global trends decreasing.

Action: Mr. Altshuler asked staff to look at the methane data a bit closer, as well as look at other metrics and conduct research to see if it catches the attention of staff. Mr. Wee noted that since the initial request went to staff informally, that he would have staff look at the information from Dr. Fairley and provide the Committee with more thorough research and look at other sources of methane data to put things in perspective.

6. **Committee Member Comments/Other Business.** Mr. Altshuler spoke briefly about the upcoming Advisory Council Executive Committee and Mr. Kurucz followed up with information on a book that he recently read about running an Advisory Council and one of the suggestions was not to organize along the lines of the organization itself. Also noted, was the way the Council is presently organized, each year at the retreat, once a decision is made on how issues are going to be resolved, virtually every issue is given to either 2 or 3 of the existing Committees, as there tends to be an overlap on virtually every topic.

   Dr. Bornstein suggested that the preparation of the minutes to be more logical and suggested the following:

   - Encourage speakers to include more descriptions in their technical discussions;
   - Point out to the speakers that minutes have to be taken, so that their summary could be very complete of all their main points, as the most important material is what the speaker considers is the summary of what was said;
   - Perhaps send minutes to the speaker and have the speaker look at it to see that the technical terms and ideas are captured; and
   - Handouts from the speaker should be submitted in color, because without the color all the information is lost.

   Mr. Altshuler suggested this issue also be presented at a future Advisory Council Executive Committee meeting.

7. **Time and Place of Next Meeting**. 10:00 a.m., Monday, October 1, 2007, 939 Ellis Street, San Francisco, CA 94109.

8. **Adjournment.** 11:50 a.m.

/s/Vanessa Johnson
Vanessa Johnson
Executive Secretary