

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

## APPROVED MINUTES

Advisory Council Regular Meeting  
Joint Meeting of the Technical and Air Quality Planning Committees  
9:00 a.m., Tuesday, October 12, 2004

**1. Call to Order – Roll Call.** Chairpersons Brazil and Bedsworth called the Joint Committee meeting to order at 9:32 a.m. Air Quality Planning Committee Members present: Harold Brazil, Chairperson; Irvin Dawid, Emily Drennen, Fred Glueck, John Holtzclaw, Ph.D., Kraig Kurucz. Air Quality Planning Committee Members Absent: Kevin Shanahan. Technical Committee Members present: Louise Bedsworth, Ph.D., Chairperson, Sam Altshuler, P.E., William Hanna, Stan Hayes, John Holtzclaw, Ph.D. Technical Committee Members absent: Robert Bornstein, Ph.D., Norman A. Lopera, Jr.

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

### **3. Approval of Minutes:**

**A. Air Quality Planning Committee Meeting of August 3, 2004.** Mr. Dawid requested the last sentence in item (e) on page one be deleted. Mr. Glueck moved approval of the minutes as corrected; seconded by Mr. Kurucz; carried unanimously.

**B. Technical Committee Meeting of August 4, 2004.** Dr. Holtzclaw moved approval of the minutes as submitted; seconded by Mr. Hanna; carried unanimously.

### **4. Discussion of Vehicles and Fuels**

#### **B) Alternative Fuels Now... and in the future**

Mike Jackson, Director, Transportation Technology, TIAX LLC, stated he would discuss the emission and energy displacement benefits of alternative fuels and the possibilities for future technologies. Alternative fuels are motivated by considerations of energy conservation, national security and air quality. Studies of transportation fuel supply and demand at the state level predict a growing imbalance to the year 2050. Current refinery capacity in California shows that in the year 2000 supply met demand, but increased efficiencies and/or fuel importation will have to compensate for the increased demand resulting from population and vehicle increases, and the corresponding increase in vehicle miles traveled. California obtains approximately 47% of its crude oil from within the state, 30% from Alaska, and the remaining 23% from foreign sources in the Middle East, and Central-South America. However, Alaskan oil production is decreasing.

The economic impacts of petroleum price variation shows that every major increase in price on a global scale is followed by a recession in the United States. As California oil production is at capacity the market is therefore volatile, and any loss of production, or a late shipment of oil, results in a price increase of gasoline at the pump.

Smog and gross polluting vehicles are among the two most easily recognized sources of pollution. Vehicle emissions are regulated at the state and national level for nitrogen oxide (NO<sub>x</sub>), carbon monoxide (CO), hydrocarbons (HC), and particulate matter (PM), as well as for such toxic compounds as benzene, 1,3 butadiene, xylenes, and formaldehyde. Analysis of tailpipe emissions is now complemented by emissions assessment of the entire fuel cycle, including upstream and evaporative emissions. To date, tailpipe emissions have been particularly well controlled by state regulations and standards.

Large populations in California are exposed to unhealthy air either in terms of days over the state ozone or PM<sub>10</sub> standards. Global warming is becoming an increasingly important issue and the Air Resources Board (ARB) has adopted regulations to control CO<sub>2</sub>, methane, nitrous oxide and PM<sub>10</sub>. Increases in temperature are invariably linked with ozone exceedances, of which there have been few in the Bay Area and in the Central Valley this year due to lower than normal temperatures.

Reducing vehicle petroleum dependency is desirable, given that 62% of the state's transportation fuel use goes to on-road gasoline and 11% to on-road diesel. Approximately 52% of CO<sub>2</sub> emissions in the state are from on-road transportation, as are 43% of on-road NO<sub>x</sub> and reactive organic emissions.

Many alternative fuels have lower life-cycle emissions of ozone precursors, PM and global warming gases. For example, well-to-tank analyses of urban area emissions from reformulated gasoline in certain low emission vehicles show some reductions in evaporative and vehicle exhaust emissions, but emissions remain the same over the total fuel cycle. Battery electric and compressed hydrogen fuel cell power eliminate evaporative and vehicle exhaust emissions entirely and produce only minor emissions over the total fuel cycle. Well-to-tank analyses have been conducted for greenhouse gases emitted from a modern internal combustion engine for reformulated gasoline III, ultra low sulfur diesel, liquified petroleum gas, compressed natural gas, ethanol in a flexible fuel vehicle, methanol and reformulated natural gas in a fuel cell vehicle, battery electric, and a fuel cell vehicle with a natural gas power plant and electrolyzer. The results show that more energy is required to produce hydrogen through electrolysis than to reformulate gasoline. In the total petroleum fuel cycle (from oil production, bulk fuel transportation, refinement and product storage, storage, transportation and distribution to vehicles) alternative fuels can lessen dependency on foreign sources of oil and insulate the economy from price increases.

A well-to-wheel analysis for alternative fuels shows a 25% reduction in CO<sub>2</sub> emissions in a modern internal combustion engine. The technologies for producing fuels along with the fuels themselves must be considered thoroughly in order to obtain a complete picture. Estimates are that in the existing on-road fleet that the average vehicle costs \$1000/year as a result of petroleum dependence, air quality impacts, and global warming. Global warming emissions are higher from light-duty gasoline vehicles, but these are cut in half by certain alternative fuel vehicles and by 25% by diesel engines. Economic damages remain fairly constant.

Electric vehicles fill a niche market at present. Hydrogen fuel cells are thought to be the wave of the future. The key for heavy-duty vehicles will be to reduce PM and NO<sub>x</sub> simultaneously. Diesel technology presently offers a trade-off with increased NO<sub>x</sub> leading to decreased PM and vice-versa. Alternative fuels have had a role to play in reducing PM and NO<sub>x</sub>, although it is more difficult to reduce NO<sub>x</sub>. The 2010 standards will require a 90% reduction in both PM and NO<sub>x</sub>. Hence, the diesel industry will have to integrate fuel changes with NO<sub>x</sub> and PM after-treatment. A comparison of natural gas and diesels engine certification tests show a 50% reduction in NO<sub>x</sub> and a 70% reduction in PM<sub>10</sub> from natural gas without after-treatment, but after-treatment technology will become more important with the 2010 standards.

In California, on-road diesel use comprises 11% of mobile source fuel use, and off-road vehicles 6%, but the NO<sub>x</sub> emissions from these engines is nearly 45% of the total NO<sub>x</sub> in the inventory, with the remainder comprised of light-duty vehicles, trains, planes, ships, stationary and area-wide sources.

State modeling data indicate that in-use NO<sub>x</sub> emissions from heavy-duty vehicles were fairly constant in the 1990's. Emissions show a downward trend extending to the year 2010, with the in-use fleet contributing much to the emissions inventory.

The Multiple Air Toxics Exposure Study (MATES II) in the South Coast AQMD showed that the highest concentrations of toxics are nearest freeways. The results indicate that diesel PM from mobile sources is the primary cause of cancer risk in the South Coast AQMD.

Bus transit may be more of a congestion mitigation measure than a clean air solution. Estimates are that it would take several hundred low emission vehicles to emit the same PM<sub>10</sub> as a 40-foot bus for a 2002-2003 model year. This varies with the fleet composition and bus ridership. Several natural gas bus engines either meet or are within the range of the 2007 emission standards and in some cases even the 2010 standards, but how economical these are in comparison with diesel power remains to be seen.

Alternative fuels still provide emission advantages over gasoline, but with the increase in PZEV vehicles in the fleet that benefit begins to diminish. A policy or incentive that inclined the market toward PZEVs would further reduce emissions. To reduce greenhouse gas emissions, technology that emits lower CO<sub>2</sub> and provides higher fuel economy must be achieved. Alternative fuels can in some cases displace petroleum fuels and should be taken advantage of. However, hydrogen may be a more sustainable solution, notwithstanding that its production method is important to assess given the use of electricity. The matter of developing an infrastructure for the economy still requires further evaluation.

Alternative fuels in heavy-duty diesel engines can net significant reductions in PM and NO<sub>x</sub> today, and can be cheaper in certain niche market applications. The diesel manufacturers will meet the new standards and in a volume that will drive cost down; therefore, the penetration of alternative fuels into the market will remain difficult. Off-road diesel vehicles will also be regulated and will net further substantial particulate matter and NO<sub>x</sub> emission reductions.

#### **A) The Role of Advanced Technology Vehicles in Improving Air Quality and Reducing Greenhouse Gases**

John Boesel, President & CEO, West-Start/CalStart, stated that this company is a non-profit coalition that aims to create jobs, clean the air, reduce dependence on foreign oil and prevent global warming. At the present time, there are 115 member organizations worldwide.

Regulations have reduced the number of days in the state with unhealthy air, but work remains to be done. Heavy-duty vehicles are becoming cleaner due to standards adopted in 1998, 2002 and future standards in 2007 that will further lower NO<sub>x</sub>. Standards in 2010 will be much more difficult to meet and may result in a diesel engine that is less efficient, more expensive and less durable, making alternatives more competitive.

US dependence on foreign oil has increased since 1973, to about 65%. By 2020 OPEC will control 70% of world's oil reserves. Tar sands are now becoming profitable as a consequence. Mining these resources is environmentally destructive and energy intensive, requiring much water. This is the case particularly in Canada where the reserves in tar sands are equivalent to OPEC.

By 2020 China and the US will be at least 70% dependent on the Middle East, with major foreign policy implications. The scientific consensus is that worldwide oil production has reached mid-point.

Representatives of the oil industry have expressed concern over global warming increases stemming from increased emissions of carbon dioxide. Climatologists observe that carbon remains aloft for 100 years. Nevertheless, there is still time to stabilize the rate of emissions to reduce the global warming effect. Half of the CO<sub>2</sub> emissions in California are from the transportation sector. California is the leader in adopting legislation to address global warming, and other states and Canada may follow. Next month, WestStart/CalStart is sponsoring a 2020 Transportation Energy Future Conference on petroleum production in California and how to decrease oil consumption locally.

Car manufacturers consider improved internal combustion engines to be the short-term solution and hydrogen fuel cells to be the long-term solution. The Department of Energy has observed that fuel cells may not be economically viable until the year 2015. Infrastructure is needed, and hydrogen must be derived from renewable energy sources. Hence, cost-reduction challenges remain to be resolved.

There are diverse alternative vehicle technologies now available—particularly hybrids. The bus industry has aggressively adopted alternative fuels, with 7,000 natural gas buses on the road today, and 17% of orders for new buses as of January of this year are for hybrids. The diesel market share of the transit bus market has dropped below 60% for first time. The European Union has adopted a goal of 23% of transportation energy use to come from alternative fuels by 2020. California has adopted a goal of 20% of alternative fuel vehicles by 2020, but this has yet to be endorsed by the Governor.

Hybrid vehicles make more efficient use of fossil fuels, with demand outstripping supply, in fact. Four new light duty hybrids will enter in the market in December. Trucks and buses have adopted hybrid technology: FedEx sponsors a pilot program with 20 hybrid trucks in various cities in the United States. Over 10 different U.S. companies are developing heavy-duty hybrid systems. At a CalStart/-WestStart conference today, hybrid electric utility vehicles will be demonstrated for nine utilities.

Hydraulic hybrids for medium and heavy-duty vehicles are also being developed. These vehicles store braking energy and then use that energy to accelerate. For urban refuse vehicles this particular type of technology would make sense. Natural gas has proven reliable as an alternative fuel. A vehicle refueling product that taps into the natural gas line at one's home will come to the market in early 2005. Germany is the European leader in pursuing alternative fuels and natural gas and is working to establish a price advantage for it between now and 2020 via tax policy and increased infrastructure. While natural gas supplies are abundant at present, over the long-term this is not a viable strategy. In Sweden major efforts are underway to convert agricultural waste into methane gas ("biogas"), which has several uses and can supply as much as 10-20% of a city's needs. There is no absolute substitute for petroleum. This is a partial solution to fuel supply issues that also mitigates solid waste problems.

In California, WestStart/CalStart is endeavoring to conduct a pilot project for producing cellulosic ethanol, which generates fewer greenhouse gas emissions, through converting all cellulosic agricultural material into fuel. If successful, switchgrass, which yields five times more per acre than corn, can be the successor product for conversion to ethanol. Linkage of alternative fuels with hybrids will improve air quality, reduce global warming and reduce dependency on foreign oil.

The South Coast AQMD receives \$1.00 per vehicle registration fee to support its alternative vehicle and fuel research and development program. The Bay Area AQMD might consider having a similar approach for future innovative research, even if these do not meet current cost-effectiveness criteria.

The use of hydrogen in transportation faces cost challenges and a long-term time horizon for entry into the market. WestStart/CalStart is working on a national hydrogen bus technology initiative that will include six fuel cell buses in operation in the Bay Area at AC Transit and SCVTA. The Bay Area AQMD's support for this program would be welcome.

In terms of new policies, oil displacement signals are not being sent to the car companies, and fleet fuel economy is lower today than 20 years ago. Yet, alternative fuels are forced to compete with an oil industry that is considerably subsidized. There are also hidden costs involved in defending oil supply such as the invasion of the Persian Gulf at \$60 billion. When healthcare costs are added, the total amount spent annually on imported oil reaches approximately \$100 billion.

California and Texas are the leaders in developing incentive programs for vehicle emission reductions, such as the Carl Moyer program. Now that the Pavley bill has passed there is an opportunity to enter into a partnership with ARB and add a greenhouse gas criterion to such programs. Funds need to be set aside for technology advancement demos. An integrated approach using all these alternatives is needed to address air pollution and greenhouse gases. New cars are cleaner but air quality problems persist. The geo-political risk of oil is rising and there is only a limited time to address climate change. Hydrogen fuel is an increasing possibility but not on the immediate horizon for implementation. A poly-fuel approach appears to be what is required for the future rather than a single fuel baseline.

In response to questions from Council members, the following points were made:

- The Council may consider using the Pavley bill as a basis for recommending measures to reduce mobile source emissions of greenhouse gases beyond the light-duty sector. It may also consider supporting measures to increase funding, such as surcharges on vehicle registration fees for research and development for projects that result in emission reductions in the long-term future. (Boesel)
- That it is desirable to get clean vehicles on the road is true from a public health perspective as well. On the heavy-duty side, natural gas technology can net NOx and PM reductions quickly, albeit at a higher price, but the benefits balance out. Looking to the future, it is very important to have mechanisms that provide incentives for the development and use of technology. The Moyer program is very successful, and more of that should be pursued today. (Jackson)
- The Joint Committee needs to consider whether it will address alternative fuels both for stationary sources or focus on transportation. In connection with the latter, it would be interesting to review the charts of geographical concentrations of toxicity that will be developed by the CARE program, with and without diesel emissions, as well as with scenarios of emissions from cleaner cars and trucks that will have penetrated the market by a date certain. (Kurucz) The maps developed in the South Coast AQMD referenced concentrations of diesel emissions, which although it is a surrogate for toxics, does not provide the basis for drawing inferences on risk in the context of total toxics. (Hayes)

**5. Discussion of Advisory Council Activities.** Chairpersons Bedsworth and Brazil directed that the Committee members be surveyed via e-mail with questions that rate Council activities.

**6. Committee Member Comments/Other Business.** Dr. Holtzclaw recently visited South America and indicated he would apprise the Council of alternative transportation modes that he observed. Mr. Dawid expressed interest in attending a forthcoming conference on freight transportation.

7. **Time and Place of Next Meeting.** Thursday, December 16, 2004 at 9:30 a.m., 939 Ellis Street, San Francisco, CA 94109.
8. **Adjournment.** 12:34 p.m.

*James N. Corazza*

James N. Corazza  
Deputy Clerk of the Boards