



BAY AREA
AIR QUALITY
MANAGEMENT
DISTRICT

ADVISORY COUNCIL REGULAR MEETING

WEDNESDAY
SEPTEMBER 10, 2003
10:00 A.M.

SEVENTH FLOOR
BOARD ROOM

AGENDA

CALL TO ORDER

Opening Comments
Roll Call

William Hanna, 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 Committee 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 Committee's purview. Speakers are limited to five minutes each.*

1. Approval of Minutes of July 9, 2003

COMMITTEE REPORTS

2. Report of the Air Quality Planning Committee Meeting of July 22, 2003 Chair Kurucz
3. Report of the Public Health Committee Meeting of August 28, 2003 Chair Zamora
4. Report of the Technical Committee Meeting of August 7, 2003 Chair Harley
5. Report/Minutes of the Public Health & Technical Committee Joint Meeting of June 30, 2003 Chair Zamora

PRESENTATION

6. Status Reports on Ozone Attainment Planning

- (a) U.S. EPA Action on 2001 Ozone Attainment Plan*
- (b) 2003/2004 Ozone Planning*
- (c) Federal 8- hour ozone standard designation process*

OTHER BUSINESS

7. Report of the Executive Officer/APCO

William C. Norton

8. Report of Advisory Council Chair

William Hanna

9. Council Member Comments/Other Business

Council or staff members on their own initiative, or in response to questions posed by the public, may: ask a question for clarification, make a brief announcement or report on their own activities, provide a reference to staff about factual information, request staff to report back at a subsequent meeting concerning any matter or take action to direct staff to place a matter of business on a future agenda.

10. Time and Place of Next Meeting

10:00 a.m., Wednesday, November 12, 2003, 939 Ellis Street, San Francisco, CA 94109.

11. Adjournment

BH:jc

CONTACT CLERK OF THE BOARDS - 939 ELLIS STREET SF, CA 94109

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- 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 within three working days of the meeting, so that arrangements can be made accordingly.

BAY AREA AIR QUALITY MANAGEMENT DISTRICT
939 ELLIS STREET, SAN FRANCISCO, CALIFORNIA 94109
(415) 771-6000

CLERK OF THE BOARDS OFFICE:
MONTHLY CALENDAR OF DISTRICT MEETINGS
S E P T E M B E R 2 0 0 3

TYPE OF MEETING	DAY	DATE	TIME	ROOM
Board of Directors Regular Meeting	Wednesday	3	9:45 a.m.	Board Room
Board of Directors Public Outreach Committee	Monday	8	9:45 a.m.	4th Floor Conf. Room
Advisory Council Executive Committee - CANCELLED -	Wednesday	10	9:00 a.m.	Room 716
Board of Directors Personnel Committee - CANCELLED -	Wednesday	10	9:30 a.m.	4th Floor Conf. Room
Advisory Council Regular Meeting	Wednesday	10	10:00 a.m.	Board Room
Board of Directors Mobile Source Committee	Thursday	11	9:30 a.m.	4th Floor Conf. Room
Board of Directors Regular Meeting	Wednesday	17	9:45 a.m.	Board Room
Regional Agency Coordinating Committee (RACC)	Friday	19	1:30 – 3:00 p.m.	MTC 101 Eighth Street Oakland, CA 94607
Board of Directors Budget & Finance Committee	Wednesday	24	9:30 a.m.	4th Floor Conf. Room
Advisory Council Air Quality Planning Committee	Tuesday	30	9:30 a.m.	Board Room

MR:mr
9/3/03 (1:05 p.m.)
P/Library/Calendar/Moncal

BAY AREA AIR QUALITY MANAGEMENT DISTRICT
939 ELLIS STREET, SAN FRANCISCO, CALIFORNIA 94109
(415) 771-6000

CLERK OF THE BOARDS OFFICE:
MONTHLY CALENDAR OF DISTRICT MEETINGS

OCTOBER 2003

TYPE OF MEETING	DAY	DATE	TIME	ROOM
Board of Directors Regular Meeting	Wednesday	1	9:45 a.m.	Board Room
Board of Directors Mobile Source Committee	Thursday	9	9:30 a.m.	4th Floor Conf. Room
Board of Directors Regular Meeting	Wednesday	15	9:45 a.m.	Board Room
Advisory Council Technical Committee	Monday	20	9:30 a.m.	Board Room
Advisory Council Public Health Committee	Monday	20	1:30 p.m.	Board Room
Board of Directors Budget & Finance Committee	Wednesday	22	9:30 a.m.	4th Floor Conf. Room
Board of Directors Executive Committee	Wednesday	29	9:30 a.m.	4th Floor Conf. Room

MR:hl
8/26/03 (11:05 a.m.)
P/Library/Calendar/Moncal

BAY AREA AIR QUALITY MANAGEMENT DISTRICT
939 ELLIS STREET - SAN FRANCISCO, CALIFORNIA 94109

Draft Minutes: Advisory Council Regular Meeting – July 9, 2003

Call To Order

Opening Comments: Chairperson Hanna called the meeting to order at 10:05 a.m.

Roll Call: Present: William Hanna, Chair, Sam Altshuler, P.E., Elinor Blake, Harold M. Brazil, Pamela O'Malley Chang, Irvin Dawid, Rob Harley, Ph.D., Stan Hayes, John Holtzclaw, Ph.D., Kraig Kurucz, Norman A. Lapera, Jr., P.E., Kevin Shanahan, Linda Weiner, Brian Zamora.

Absent: Louise Bedsworth, Ph.D., Patrick Congdon, Ignatius Ding, Fred Glueck, Victor Torreano.

Public Comment Period: There were no public comments.

1. Approval of Minutes of May 14, 2003: Ms. Blake moved approval of the minutes; seconded by Dr. Holtzclaw; carried unanimously.

Committee Reports

2. Report of the Air Quality Planning Committee Meeting of May 27, 2003

Mr. Kurucz stated that the Committee received a report on pending legislation from District staff. SB 655 (Sher) will create planning requirements for particulate matter on the same level as for ozone. On July 22, staff will brief the Committee on diesel fuel issues and regulations.

3. Report of the Public Health Committee Meeting of May 19, 2003

Mr. Zamora stated the Committee met in Rodeo and received input from community members on the data generated by the optical monitors along the fence lines of the ConocoPhillips Refinery. The community feels the data it generates is indeed useful. In the near future, the Contra Costa County Health Department will post these monitoring data on the County's website.

4. Report of the Technical Committee Meeting of May 29, 2003.

Dr. Harley stated the Committee received a presentation on refinery flaring systems and combustion efficiency from Barry Friedman, P.E., of The Washington Group International. It endorsed the District's assumption of 98% flare combustion efficiency of hydrocarbons. This assumption will be used in the District's air quality management planning process for ozone attainment. Also, the Committee discussed the role of the flare operator in overseeing flow rates and adjusting steam input. Julia May from Communities for a Better Environment (CBE) noted that high combustion efficiency does not affect the conversion of flare emissions of sulfur into sulfur dioxide (SO₂).

5. Report of the Public Health and Technical Committee Meeting of June 30, 2003.

Mr. Zamora stated the two Committees received presentations from Ted McKelvey of Terra Air Services, Inc., Houston Texas, and Dr. Robert Spellicy, President of IMACC, Red Rock, Texas, on the remote optical measurement of refinery flares and flare emission content. The petrochemical industry will be invited to the next Public Health Committee meeting to offer its perspectives of this technology. The District's regulatory perspective on optical emissions monitoring and measurement will also be sought. Questions that remain for further discussion include the lack of quality assurance protocols for this equipment and how well the system functions in inclement weather and the extent to which it would be unable to capture plume rises.

6. Report of the Executive Committee Meeting of July 9, 2003

Chairperson Hanna stated that the Committee met earlier today and discussed forthcoming Standing Committee work plans and issues of upcoming importance. Staff reported that the Environmental Protection Agency (EPA) will render approval on the 2001 Ozone Plan.

Presentations:

7. Report on the Air & Waste Management Annual Meeting: June 2003.

Mr. Altshuler stated:

- The key issue in the conference concerned the atmosphere and global warming impacts of carbon dioxide (CO₂) emissions. The technology that captures CO₂ out of flue gases and sequesters it through injection into abandoned gas wells entails a major energy penalty. He believes it is preferable to reduce CO₂ through improvements in efficiency and fuel choice. The concept of coal gasification is resurging in discussions of new power plant construction.
- He visited a conference site demonstrating the Rodeo refinery optical remote sensing equipment. It may help address public concerns, but the data produced by it is different from standard monitoring data. Quality assurance/quality control is difficult to develop because known concentrations cannot be inputted and their output measured with a percentage of error.
- A manufacturer of catalysts for diesel engines could not affirmatively answer whether the catalysts will meet state's maximum 20% nitrogen dioxide (NO₂) emission limit in 2004.

Mr. Brazil stated:

- A transportation session sponsored by Desert Research Institute staff concerned the mechanics of measuring particulate matter (PM) and developing emission factors for different vehicle types and sizes. This will be applied to transportation conformity analysis. Another session dealt with transportation conformity planning associated with the eight-hour ozone standard.
- One session reviewed transportation conformity and how pending litigation has adversely affected the efforts to coordinate the Transportation Improvement, Regional Transportation, and State Implementation (SIP) Plans.
- Another presenter addressed Michigan's experience with the NO_x SIP call and transport issues, which dealt with whether EPA is taking control of the local air quality planning process.

- He also attended a presentation that compared door-to-door travel time measurements for transit and private vehicle transit modes in major cities throughout the country. Dr. Matthew Barth of UC Riverside noted that there are optimal congestion levels that prevent cars from going too fast (at which they emit at high levels) or too slow (which also leads to congestion).
- He attended another session sponsored by the Federal Highway Administration, which took credit for vehicle emission reductions through successful transportation conformity planning, while criticizing transportation control measures as being low emission reduction achieving.
- A session on marine shipping indicated that NO_x emissions from these operations are not regulated and could lead to ozone attainment problems in the future.
- He attended sessions on the use by regional transportation planning agencies of emission factor models. California uses the Emission Factor Model (EMFAC), while the rest of the country uses the EPA's MOBILE emission factor model, a new version of which has been developed. It has some major structural differences with previous versions of the model. Several papers reported on a number of sensitivity runs of the new MOBILE emission factor model.

Mr. Dawid stated:

- He found that the AWMA participants had extensive technical backgrounds. There were several excellent sessions on water quality and security. An educational tour was held of the 700 megawatt (MW) South Bay Duke power plant, which was built in 1960. Due to a state power contract with New Mexico and Arizona, it only produces 30 MW at present.
- He attended the International Urban Air Quality Forum from June 25-27. Information presented concerned the recent banning of two-stroke, three-wheelers. The reduction of lead emissions from power plants in Ghana would require \$230 million.
- On June 27 he attended a Local Government Commission seminar on Planning and Building More Livable Communities. In its public health track, a paper was presented by Howard Frumpkin, M.D., Ph.D., entitled "Urban Sprawl and Public Health," which opines that public health professionals need to figure more prominently in the field of urban planning, where urban planners and architects have taken the reigns.

Mr. Hayes stated:

- The main issue at the AWMA Conference was climate change. The District's charter to regulate criteria pollutants is connected with greenhouse gases (GHGs) in that 85% of GHGs are carbon dioxide byproducts of fuel combustion. Therefore, increases in vehicle efficiency and public transit ridership, and reduction of vehicle miles traveled (VMT), benefits the earth's climate by reducing GHGs. This issue should be put on the Council's radar screen. Guest speakers could be invited from the California Climate Action Registry, as well as Stanford University's program on the effect of energy technology on climate change.
- He moderated a panel session on homeland and environmental security. An AWMA task force on environmental security will be formed to further investigate some of the issues raised.
- He presented a paper on the air toxics composition of jet exhaust, which included information that had not previously been routinely incorporated into data used by regulatory agencies. Some advances have been made in understanding jet engine exhaust emissions.

Dr. Holtzclaw stated:

- He attended several transportation sessions. Dr. Matthew Barth of U.C. Riverside, who addressed the Council four years ago, gave a paper on how motor vehicle emissions change at varying speeds. The Council would greatly benefit from hearing this presentation.
- He presented a paper on how various development patterns affect driving patterns.
- He also attended the subsequent Local Government Commission smart growth conference.

Mr. Kurucz stated:

- At the opening plenary session noted that energy intensity is down in Mexico, although total GHGs have increased. Energy intensity is higher in the entire United States than in California, which is second in gas and diesel purchasing in the world, behind only the entire United States.
- Sessions discussed the magnitude of PM_{2.5} non-attainment problem and ways of reaching attainment with the national PM_{2.5} standard. An EPA staff member gave a presentation on the chemistry of PM analysis, showing the chemical mechanisms through which some nitrates and sulfates emitted from combustion are converted to PM through secondary formation.
- A representative of the electric industry stated that half of all of the counties in the United States will be out of attainment or lack sufficient data to demonstrate attainment either way. The electric utility industry is lobbying EPA to delay implementation of standard.
- District Deputy APCO Peter Hess gave a local agency perspective on how PM_{2.5} and ozone are linked. He suggested addressing the linkage through (a) speciation of the monitoring data, (b) source identification, (c) development of control measures for stationary and transportation sources, and (d) treatment of PM_{2.5} as a gaseous pollutant formed through secondary atmospheric formation. Linking ozone and PM increases control measure cost-efficiency. The main sources of PM are wood burning (25%), ammonium nitrate (45%) and vehicles (30%).
- Professor Ron Henry of USC reported on his receptor modeling analyses. Through the use of non-parametric linear regression for emission back-casting, he develops refinery and industrial plant emission profiles in a given region. This profiling work first began in Houston and focused on PM, and now it includes volatile organic compounds (VOCs). Dr. Henry also presented a paper on perceived changes in atmospheric visibility and pollutant levels.
- A paper presented by the California Air Resources Board (CARB) staff concerned enhanced vapor recovery at gasoline dispensing facilities. It noted that systems that use “vacuum assist” tend to pull a lot of air into the system, which may in turn force some vapors out of the system. New technology, such as a dripless nozzle, is also under development.
- A pollution prevention session discussed how air pollution could be reduced through improving energy efficiency.
- He attended a session on risk communication in which it was noted that the public is concerned about health but does not necessarily know the language for air quality. Various professional fields were evaluated for credibility with the public. In public forums, manifestations of empathy are helpful, and logistical barriers between the public and the presenters should be removed.

Other Business:

8. Report of the Executive Officer/APCO.

William C. Norton stated:

- Three Spare the Air days were called in June, but there have been no exceedances of the federal one-hour ozone standard despite some periods of high temperature. However, there were two exceedances in June of the national eight-hour ozone standard
- Based on data from the District from the last three years, excluding this year, CARB will recommend to EPA that the District be declared in compliance with the eight-hour ozone standard. EPA has until April 2004 to render a decision on this designation. If the District is declared in attainment, then a Maintenance, rather than an Attainment, Plan will be required.
- The EPA has last indicated it will approve the District's 2001 Ozone Attainment Plan that was submitted in November 2001. Whether it will be approved with conditions is still unknown. One of the commitments in that Plan was to prepare a 2004 Ozone Plan Update. Prior to the District's adoption of the 2001 Plan, it held six community meetings. For the 2004 Plan, six meetings will be held prior to the public hearing, in such communities as Rodeo, Crocket, Concord, Livermore, Napa and Sonoma. The Council members are invited to attend.

Ms. Weiner offered to assist Mr. Norton in providing e-mail listings through the Bay Area Clean Air Task Force, to send out information about the community meetings. Ms. Blake suggested staff also ask the county health departments to announce these meetings. Mr. Norton indicated staff would request health department staff attendance as well.

- A recruiter has been hired to interview and screen applicants for the District's Executive Officer/Air Pollution Control Officer (EO/APCO) position. Applications were due by June 20, and recruiter interviews have been held. Initial recommendations will be given to the Board on July 16. Two sets of interviews will be held on July 29, and if necessary on August 7, by a committee of the Board as well as an advisory panel comprised of stakeholder groups, which will provide its recommendations to the Board. The Advisory Council Chair, or a designee, has been asked to serve on this panel. There will be no Board meetings in August. Discussions on the appointment will begin in September. The goal is to provide the new EO/APCO with sufficient time for vacation and giving notice to the previous employer, with official employment to begin on November 1. A one-month period of transition to work with the present EO/APCO will commence. The latter's employment will end on November 30, 2003.
- A new Board member, Patrick Kwok of the City of Cupertino, has been appointed. A briefing and orientation session will be conducted for him on July 16, 2003. Members of the Advisory Council are welcome to attend. A tour of the District facility will follow the orientation.

9. Report of the Chairperson.

Chairperson Hanna:

- Welcomed new Council member Pamela Chang, representing the "Architect" category.

- Stated he has asked Dr. Holtzclaw to represent the Council on the EO/APCO selection group.
- Stated that the Sonoma County Climate Protection Campaign did receive approval from the Board for the \$25,000 it requested in District funding. The Advisory Council had noted for the Board of Directors that the Campaign was not coordinated with the State Registry, and had, therefore, recommended the Campaign receive District staff support instead of funding. At the July 2, 2003 Board meeting, the Campaign representatives stated that coordination with the Registry was problematic in that the Registry had some major data extraction problems. The Campaign has been lending its expertise to the Registry in fixing this problem.

10. Council Member Comments/Other Business

Mr. Altshuler stated that there was a hearing in Sacramento in June between the CEC and ARB to investigate getting the state more energy independent from foreign oil. Energy efficiency, CO2 and air pollution are interconnected. The Air District should track these hearing activities.

Mr. Lapera reported on an issue that was discussed last year by the Technical Committee regarding the impact of the East Bay eucalyptus grove on air quality. The staffs of the Air District and East Bay Regional Park District have met, and a test project for thinning the grove is now underway. This will lead to air quality improvements, re-growth of the native habitat, and fire hazard reduction. Conservation camp crews are removing one acre of eucalyptus trees per day. Air District, Fire Department and Park District staffs are coordinating prescribed burn times. The Park District is also exploring the broadcasting of woodchips in place as well as sending the chips to a local waste management transfer station for subsequent conversion into mulch. However, the transportation of woodchips to the facility would greatly increase the price of this approach.

Ms. Weiner stated she was in Thailand on a social marketing campaign on air quality project on green fleets sponsored by the San Francisco Clean Cities Coalition. There the demand for electric vehicles is greater than the supply, which provides an interesting contrast with the United States. In the city of Chang Mai, 25 electric vehicles are used for transportation at a campus with 30,000 students. Traffic in the City of Bangkok is constantly gridlocked, but behavior patterns provide a contrast with the transportation experience here in the United States, because no one honks their horn or screams at cars or pedestrians to "get out of the way."

11. Time and Place of Next Meeting: 10:00 a.m., Wednesday, September 10, 2003, 939 Ellis Street, San Francisco, California

12. Adjournment: The meeting was adjourned at 11:45 a.m.

James N. Corazza
Deputy Clerk of the Boards

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

DRAFT MINUTES

Advisory Council
Air Quality Planning Committee
9:30 a.m., Tuesday, July 22, 2003

1. **Call to Order – Roll Call.** 9:40 a.m. Quorum Present: Kraig Kurucz, Chairperson, Harold M. Brazil, Pamela Chang, Patrick Congdon, Irvin Dawid, John Holtzclaw. Absent: Fred Glueck, Kevin Shanahan.
2. **Public Comment Period.** There were none.
3. **Approval of Minutes of May 27, 2003.** Dr. Holtzclaw moved approval of the minutes; seconded by Mr. Congdon; carried unanimously.
4. **Legislative Update.** Peter Hess, Deputy Air Pollution Control Officer, noted that the State budget dominates the discussions at the Legislature. The District conceptually supports SB 288 (Sher), the New Source Review Restoration (NSR) Act of 2003 and is seeking amendments. Some reform to the NSR program is necessary. The California Association of Air Pollution Control Officers (CAPCOA) and the National Association of State and Local Air Pollution Control Agencies advocate that the NSR program consider the net air quality benefit of a retrofit or plant modification as surpassing the associated emission impacts of a single pollutant. The District and CAPCOA are working with the Environmental Protection Agency (EPA) to develop principles of acceptability that will meet the federal NSR program requirements but not weaken the existing NSR program. The EPA has agreed to several tenets of NSR in California, which declare that NSR should:
 - a) minimize emissions from new sources and modifications of existing sources
 - b) protect public health
 - c) encourage the installation of the cleanest technology and pollution prevention
 - d) affirm that the most practical and cost effective time to control a source of air pollution is the time of initial construction and modification
 - e) ensure enforceability of provisions through permitting, record keeping and reporting
 - f) not provide disincentives to pollution reduction or act as a barrier to environmentally beneficial projects
 - g) recognize investments made by companies in state-of-the-art air pollution control
 - h) allow sources to respond rapidly to changing markets and plan for future investments in air pollution control and prevention activities

Air districts in the State advocate these NSR program improvements. EPA Region IX has been informed that there is no conflict between the federal reforms and the foregoing NSR tenets, and that it has the authority to reach an agreement with the State Air Districts regarding them. The EPA will also allow California NSR programs to be more stringent than the federal NSR program—an allowance that is not granted to any other state in the country.

Mr. Dawid requested that at the next Committee meeting staff address (a) SCA 11 (Alarcon) and ACA 14 (Steinberg), which would lower the threshold for transportation sales taxes and thus impact state air quality programs, and (b) the vehicle license fee bills AB 204 (Nation) and AB 1546 (Simitian), which affects only specific counties in the Bay Area. Also, future staff legislative reports should list the sponsors of a bill, as this would provide further insight into its intent.

Chairperson Kurucz inquired as to the status of SB 656 (Sher) on particulate matter (PM) regulation. Mr. Hess replied that it is not presently funded and is moving forward slowly. He added that in the Bay Area nitrates are a major source of PM, along with woodsmoke and diesel fuel. The District is uniquely prohibited by State legislation from using TFCA funds for preparing air quality plans as required by the California Clean Air Act. Therefore, the District is asking Senator Sher to expand the funding mechanism in SB 656 to include planning for ozone and PM.

- 5. Status of State and Federal Efforts to Reduce Diesel Emissions.** Michael Murphy, Environmental Planner, stated diesel emissions in the Bay Area derive primarily from trucks, buses, ships, trains, construction, agricultural and other off-road equipment, and small gasoline engines. On-road and off-highway mobile source emissions contribute the majority of nitric oxide (NO_x) and reactive organics (ROG) emissions, and a sizeable fraction of PM₁₀. Off-road engines emit significant sulfur dioxide (SO₂) emissions because they do not use ultra low sulfur diesel (ULSD). Forthcoming requirements to use ULSD should greatly reduce emissions from off-road sources.

Bus transit fleets are the traditional experimental ground for federal and state regulation of heavy-duty engines. The California Air Resources Board (CARB) has adopted a separate rule for transit buses that includes options for compliance paths that use either alternative fuel or diesel. NO_x is a large contributor to diesel PM. Most Bay Area transit properties have chosen the diesel path, but they have yet to attain the rule's fleet-wide NO_x average. In adopting fleet-specific regulations for other fleets, CARB may choose to consider different types of fleet-wide NO_x averages.

Zero emission (fuel cell) bus demonstration projects will be conducted by AC Transit in partnership with Golden Gate Transit and San Mateo County Transit in partnership with Santa Clara Valley Transit Authority. Through the Transportation Fund for Clean Air (TFCA), the District has contributed \$1 million to each of these two demonstration projects.

The 1998 CARB standard for urban transit bus NO_x of four grams per brake-horsepower hour will be lowered nearly to zero in 2007. Presently, PM traps are already reducing PM emissions below this level, and natural gas engines will likely meet these limits by 2007. The CARB retrofit strategy for transit bus diesel PM is based on diesel emissions as a toxic air contaminant. It fixes January 1, 2002 as the baseline and requires that in each succeeding year a higher percentage of the fleet must be retrofitted. CARB is also considering retrofit strategies for other on-road fleets.

Out of a total of 4.6 million vehicles registered in the Bay Area, approximately 90,000 are heavy-duty trucks. These trucks represent 5-6% of the daily vehicle miles traveled. CARB has regulated heavy-duty truck engines since 1987. Since October of 2002, as a result of litigation filed by CARB and EPA, the engine manufacturers have largely complied with CARB standards for 2004. The 2007 standards will further reduce emissions and are similar to the 2007 transit bus emission standards. CARB is also proposing that, when an engine is rebuilt, its on-board computer controls be reprogrammed to remove off-cycle emissions. The reprogramming is not technically difficult, but the task is labor-intensive. CARB believes that the engine manufacturers rather than the truck owners should bear the cost of the reprogramming. The issue is likely to prove controversial.

CARB has a proposal for 2007 that would require installation of devices that limit vehicle idling. It is also considering a requirement for PM10 retrofit requirements for heavy-duty engines similar to what it requires for transit fleets. In September 2003, CARB will consider a PM trap retrofit rule for garbage trucks. This will be the first application of such a rule to private fleets. The requirement to use ULSD will also follow, thereby reducing SO₂ and further enable PM retrofit technologies. On July 31, 2003, CARB will hold a public hearing to adopt fuel specifications for ULSD, which will be similar to EPA's efforts to establish a nation-wide ULSD specification that will become effective in 2006. In California, this would apply to on and off-road components.

EPA and CARB have cooperated to adopt similar off-road diesel engine standards for construction equipment, ground support equipment and portable equipment, which would apply nationwide. EPA recently defined agricultural engines as off-road engines, thereby subjecting them to its off-road standards. There is controversy over whether state or federal rules govern the emissions from this equipment as well as whether it must use CARB diesel fuel, which has lower sulfur content than diesel fuel in the federal program. Federal regulations for this equipment contain three tiers, which become effective with each successive year. While CARB does not employ the terms of federal emission standard designations for this equipment, its emission standards are the same.

EPA regulates emissions from ships and boats, and recently adopted rules will become effective in 2004. It has divided commercial vessels into three categories. The standards are based on a pending international treaty with which manufacturers are trying to comply, possibly because it contains backdated compliance requirements. While EPA has applied these standards to smaller vessels, its application to large ocean-going vessels is still under consideration. CARB and EPA have parallel regulations for in-board and out-board recreational engines. The District is participating with CARB in this regulatory effort. There are two tiers of emission standards for commercial marine engines. These have not yet been applied to large ocean-going vessels. With regard to gasoline powered marine engines, large reductions in NO_x and hydrocarbon (HC) have occurred since 1998, and CARB required further major emission reductions in 2001.

EPA adopted three tiers of regulations for railroad locomotive emissions in 1997. Tier 0 requires emission reductions upon engine remanufacture. Tier 1 addresses already manufactured engines, and Tier 2 will apply to new engines in 2005. The standards will be applied differently to various locomotive types and applications ranging from freight and passenger hauls to yard switching.

CARB also regulates emissions of gasoline engines less than 25 horsepower (hp). A single 25 hp engine powering a two-stroke chain saw emits the equivalent of 10 cars driven 250 miles.

Other available control technologies include electronic fuel injection, which improves fuel economy and combustion. New diesel engines use common rail fuel injection: a single fuel line that equalizes the pressure across the cylinders. On-board diagnostics are becoming more common, and may set the stage for smog check programs for heavy-duty diesel engines. Dual fuel or pilot ignition engines employ ignition by compression. This increases fuel economy and engine power. The successful development of fuel cell technology remains on the horizon.

Major after-combustion devices include oxidation catalysts, PM filters, lean NO_x catalysts, NO_x absorbers, and selective catalytic reduction for NO_x from engines to meet the 2007 standards.

Engine idling control devices/systems are coming into vogue, and truck stops are now beginning to offer electronic power for parked trucks to reduce engine idling.

Fuel modifications include Fischer Troppe Diesel (natural gas converted into a stable liquid and blended into diesel fuel), biodiesel, emulsified diesel, ethanol diesel, and hydrogen for fuel cells. CARB and the California Energy Commission will hold a fuel symposium next month.

Apart from regulations, there are government incentive programs to reduce emissions, such as the Carl Moyer and TFCA programs. Some tax credits are available for alternative fuels, along with emission reduction credit programs for mobile sources. The latter is not prevalent in the Bay Area. Local land-use development agreements can include mitigation measures. Government purchase orders could stipulate that equipment to be shipped should be transported by low-emitting trucks.

In reply to questions and comments from Committee members, Mr. Murphy noted:

- It would be ideal if funding for the Carl Moyer program were increased and its funding mechanism corrected so that the District is no longer under-funded. Financial incentive programs should go beyond NOx and ozone and directly include PM10. Air Districts should be allowed to prioritize for PM10 reductions. The turnover of older vehicles nets the greatest emission reduction, followed by the accelerated deployment of cleaner engines.
- Most transit districts receive bus transit replacement dollars from the federal government. Both the Santa Clara Valley VTA and San Francisco Municipal Railway (MUNI) have delayed purchase of new buses by previously extending the definition of the useful life of the bus.
- Concern over the lack of lubricity in ULSD has been addressed by adding a small amount of lubricating agent to the fuel. CARB has adopted a lubricity specification for its new fuel. The federal specification for diesel fuel has a higher sulfur content than the CARB specification.
- Biodiesel improves combustion and reduces PM emissions, but it burns hotter and increases NOx. The advantage of reducing the waste stream must be factored into the evaluation.
- The re-circulation of exhaust gases in heavy-duty engines requires a larger cooling system. A costly, customized modification of existing trucks and construction equipment is, therefore, required. Financial incentive programs assist in this work.
- Emissions from two-stroke scooters are comparable to chainsaw engines.
- Bay Area hybrid buses use a diesel engine. CARB recently adopted a certification procedure for hybrid design. On-board engines would have to meet the same requirements that apply to non-hybrid applications. Hybrid buses that use CNG power to generate electricity for the on-board batteries, along with regenerative braking, were proposed for use at the San Francisco International Airport, but the high cost proved prohibitive. MUNI operates two diesel-electric hybrids, and the hybrid design in the South Bay uses a micro-turbine to generate electricity for the battery. The Bay Area company “CalStart” has a long-term contract with the United States Defense Department to evaluate hybrid designs, and could provide further insight into hybrids.
- Construction and other off-road equipment are scheduled for rule-making with regard to PM10 retrofit strategies. The possible application of the three tiers of federal standards to the manufacturers of off-road equipment is not presently being considered by either ARB or EPA.
- The prohibition on importing liquid natural gas (LNG) into California, based on concerns over volatility, applies to marine shipping. LNG transport is allowed either by railcar or truck.

- In the Bay Area there is a lack of funding for alternative fuel programs, and the Air District has been the main source of funding for them. Funding from other entities would be desirable.

6. Committee Member Comments/Other Business. Mr. Dawid stated that a meeting of the South Bay Clean Cities Coalition would be held on August 6, 2003. He added that recently the Palo Alto City Council announced that TFCA funding was approved for signal retiming. He observed that TFCA funds would be better spent on programs that remove vehicles from the road than on ones that increase the speed at which they travel on them. The Committee should review this matter.

Ms. Chang summarized the proceedings of a conference on sustainable mobility at which it was noted that vehicle emissions are responsible for over 50% of total emissions. She added that in April of 2002 she attended an environmental design conference in Seattle, at which statistical data were presented that indicates 1.5% of gasoline moves passengers and the remaining 98.5% moves the vehicle; and less than 4% of the American public take transportation. A proposal to address this problem was offered, in which neighborhood sub cars would be used as transportation feeders to mobility centers for transfer to public transit. The Committee may wish to consider this matter in the future.

7. Time and Place of Next Meeting. At the call of the Chair.

8. Adjournment. 11:54 a.m.

James N. Corazza
Deputy Clerk of the Boards

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

September 3, 2003

To: Advisory Council

From: Brian Zamora, Chairperson
Public Health Committee

Re: Report of Public Health Committee Meeting of August 28, 2003

This item will be presented as an oral report.

:jc

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

DRAFT MINUTES

Advisory Council Technical Committee Meeting
9:30 a.m., Thursday, August 7, 2003

- 1. Call to Order – Roll Call.** 9:35 a.m. Quorum Present: Robert Harley, Ph.D., Sam Altshuler, P.E., Louise Bedsworth, Ph.D., Stan Hayes, John Holtzclaw, Ph.D., Norman Lapera. Absent: William Hanna.
- 2. Public Comment Period.** There were no public comments.
- 3. Approval of Minutes of Joint Public Health & Technical Committee Meeting of June 30, 2003.** Dr. Holtzclaw moved approval of the minutes; seconded by Mr. Hayes; carried. Mr. Lapera abstained.
- 4. Presentation Refinery Flare Emissions Distribution Frequency.** Kevin Buchan, Western States Petroleum Association, presented a slide entitled “Refinery Flare Emissions (tons/day),” noting that aggregate flare emissions from Bay Area refineries have decreased from 7 tons per day (tpd) in February of 2002 to 0.2 tpd in March of 2003. Voluntary monitoring began in June of 2002.

Allan Savage, Environmental Manager, Tesoro Refinery, Martinez, presented “Refinery Flaring Statistical Analysis: June 2002 – May 2003,” which addresses flaring extent and frequency, as well as the special and common causes of flaring. He noted that average emissions of non-methane hydrocarbon (NMHC) emissions from all Bay Area refineries from June 1, 2002 to May 31, 2003 have decreased by 50% from 5 tpd to 2.5 tpd. Tesoro was emitting an average of 2 tpd of NMHCs in June of 2002 and by May of 2003 had reduced this to 0.5 tpd. Following the installation of gas recovery compressors at Tesoro in February of 2003, emissions of NMHCs were reduced from about one ton to one-tenth of a tpd. This comprises approximately one-fifth of the total quantity of current emissions from refinery flaring.

Special causes of flaring events were distinguished from common causes for all five refineries and plotted over time to discern any pattern. Fewer events occur in the winter than in the summer. Analysis of emissions from flaring events in tons per month reveals that for all five refineries there were greater levels in the summer than in the winter of 2002. No relationship was found between tonnage and the extent or size of the events: (a) 180 events were each from zero to one-half tpd; (b) six events were greater than 3.5 tpd; and (c) one was 6.5 tpd. The size of an event can be related to both the rate at which emissions occurred and the duration of the event. A destruction efficiency rate of 98% was used in the calculations, although refineries believe it is 99.5%. Refinery flares have high BTU levels and steam and/or air mixing at the flare tip to improve combustion. On Spare the Air Days, ambient wind flow is usually stagnant and would not affect combustion efficiency. A baseline was established from June to September of 2002 for special causes of flaring and flare NMHC emissions from the five refineries, after which a downward trend in emissions appears. Prior to February of 2003, the Tesoro refinery emitted one-half of the aggregate flare emissions.

Results from the statistical analysis on the number of special and common events are as follows:

- start up, turnaround and shut downs – 90
- emergency upset/emergency shutdowns – 68
- flare equipment problems – 68
- normal operating/ maintenance procedure – 23
- flare equipment maintenance – 12
- unit equipment problem – 3
- other – 2
- human factors – 1

The order of priority changes when tpd are assigned to each of the foregoing events:

- unit upset/emergency shutdown - 0.25tpd
- unit startup/shutdown/turnaround 0.16tpd
- flare equipment problems - 0.85tpd
- flare equipment maintenance - 0.2tpd
- normal operating/maintenance procedures - 0.2tpd
- other - 0.1
- human factors - .05

The analysis of event causal factors prior to February 8, 2003 show the following priority:

- unit upset/emergency shutdown - 0.32tpd
- unit startup/shutdown/turnaround - 0.85tpd
- flare equipment problems - 0.45tpd
- flare equipment maintenance - 0.2tpd
- normal operating/maintenance procedure - 0.2tpd
- other - 0.1tpd
- unit equipment problem - 0.1tpd
- human factors - 0.05tpd

The order of priority for event causal factors after February 8, 2003 changes as follows:

- flare equipment problems – 0.175tpd
- unit upset/emergency shutdown – 0.14tpd
- unit startup/shutdown/turnaround - 0.1tpd
- flare equipment maintenance - 0.2tpd
- normal operating maintenance procedure - 0.2tpd
- other - 0.1tpd
- unit equipment problem - 0.1tpd
- human factors - 0.05tpd

Regarding causal factors after February 8, 2003 for all five refineries, Tesoro contributed 75% of the total problem related to flare equipment. This derived from the installation of, and adjustments to, the flare compressors. Their reliability has recently been greatly improved. Tesoro contributed to 20% of the .13 tpd from unit upset/emergency shutdowns, and approximately 30% to unit startup/shutdown/turnaround. Data gathered today would probably show flare equipment problems ranked in third rather than first place. Each refinery has a specific area in which it can improve.

The management of a release takes into account the quantity of gas and the design specifications per unit, and controls the release to the flare accordingly. However, some units may not allow for a totally systematic throttling of fuel gas. Heating factors and the capacity of the recovery compressor must also be accounted for in depressurizing a vessel. Tesoro is further conducting a review of the startup and shutdown procedures in relation to recovery compressor capacity.

Of the five refineries, Tesoro was the major contributor of common causes of NMHC emissions from June 2002 to September 2002 and from October 2002 to February of 2003. After the installation of the recovery compressors in February 2003 at Tesoro, common cause flaring emissions were reduced from 2 tpd to a few pounds a day. In reply to a question from Messrs. Hayes and Lopera about the difference between the District's 22 tpd and the refineries' 2 tpd estimates, Mr. Savage noted that Tesoro typically runs an NMHC content of 11%. The District's assumption of a 75% NMHC content did not adjust for each refinery. The District included methane in its calculations, which is only 20% of the fuel content at Tesoro. The District audited Tesoro's flow rates and analyzed half of the refinery samples. The flare-monitoring rule will provide more accurate data on which to base public policy. Overall, the statistical analysis indicates that flaring has been significantly reduced to levels well below the levels published in the District's Technical Assessment Document (TAD).

In reply to Chairperson Harley, Mr. Savage agreed that increased summer driving increases summer refinery work, which may cause shutdowns to occur disproportionately in the winter. Recovered gases and their sources increase in the summer, thereby reducing the ability of the system to reject heat and condense those gases and retain them in the system. Further analysis is needed regarding seasonal common cause effects associated with heat rejection. In reply to Mr. Altshuler, Mr. Savage noted that the recovery compressors recycle the HCs and CO₂ emissions into the refinery fuel gas system where they are combusted at a very high destruction efficiency.

Gary Kendall, District Technical Division Director, inquired as to how hydrogen levels vary in a flaring event and if there were flow data for the year 2000. Mr. Savage replied that further analysis of assigned causes is necessary. Some data for the year 2000 is available from Tesoro but not for all five refineries. Mr. Hayes inquired as to worst-case events on high ozone days, and how these interface with emissions forecasting for purposes of ozone attainment planning. Mr. Savage replied that probability forecasts would have to be extrapolated to assess the impact on ozone.

Mr. Hayes inquired if the difference between the District and refineries' estimates of HC tonnage is due primarily to different assumptions or to tracking to emissions at different points in time. Mr. Savage replied that the refineries would willingly join the District in analyzing the components that lead to that discrepancy. Mr. Altshuler observed that in some air districts data from an extraordinary release event that leads to an exceedance is thrown out as being atypical. Mr. Kendall clarified that such data is not discarded but flagged and classified as an exceptional event.

Mr. Buchan stated that flares are safety devices. Flaring emissions in 2003 are about one-half of a ton per day. The South Coast AQMD has implemented a flare-monitoring rule and is gathering data from it before it moves ahead with a flare control rule. The District has only very recently passed a flare-monitoring rule and yet is discussing a flare control rule. This appears premature.

- 5. Presentation on Refinery Flaring Impacts, Monitoring and Emissions Reduction.** Due to a schedule conflict that was experienced by the guest speaker, this presentation was canceled.

6. Discussion of South Coast AQMD Refinery Rule 1118. Kelly Wee, Director of Enforcement, stated that the South Coast AQMD's proposed refinery flare control rule is in internal staff review. Alex Ezersky, Air Quality Specialist, stated that in estimating HC emissions, the District and the refineries used two different data sets, with the District using some historical data. Staff had some concerns over the validity of the data provided by the refineries. One refinery submitted several sets of adjusted data, and another refinery data arrived a week prior to publishing the TAD. Due to the lack of actual data in some cases engineering judgments and assumptions were also made. HC content could reach 100% or be lower. The purpose of the TAD was to address the broad picture, and so it addressed methane and sulfur. It is a living document and will be revised with new data.

The purpose of the South Coast Rule 1118 is to monitor and gather data on refinery and related flaring operations for analysis to determine if there is a need for, or level of, any controls required to minimize flare emissions. It seeks data on fuel flow rates, heating values, composition and sulfur content. It requests facilities to present a plan describing the flare system, classifying the flaring service and identifying alternatives as to how to arrive at the composition and flow data. The District's flare monitoring rule seeks to identify what flows to the flare and has detailed reporting requirements on fuel composition changes, whereas Rule 1118 uses federal emission factors for criteria pollutants and heating values for sulfur. The District's rule contains an option to install continuous analyzers to improve understanding of fuel composition, and requires flow verification every six months. It also has a provision for video monitoring based on public demand. The South Coast AQMD is still analyzing its flare monitoring data, and it will move forward with its flare control measure after it completes its internal review. The District is proceeding forward today with preliminary discussions with the refineries on a flare control rule.

Mr. Ezersky reviewed the timeline for the District's flare monitoring rule, and noted that the District and the refineries are in agreement as to the need for flare monitoring. They differ on the matter of confidence in the historical data, the assumptions used in making estimates of HC content, and on whether the destruction efficiency estimate should be 99.5% or 98%. The latter is supported by the majorities of studies. The District is closely following flare efficiency studies in Texas and Alberta, Canada. Staff has not yet had the opportunity to closely examine the data presented by Mr. Savage today. Refineries have provided the District with relevant data on rates and hydrocarbon content of flows to their flare stacks, and District staff have audited the measurement methods that were used at each refinery to determine this information. This has been accomplished despite disagreements surrounding the District's initial estimate of 22 tons/day of HC emissions from flare systems at Bay Area refineries.

Wayne Kino, Supervising Air Quality Specialist, stated that the District is looking preliminarily at flare emission controls regarding startup/shutdown emission reduction potential, casual flow that reduces compressor capacity to handle episodic emissions, and episodic prevention measures. At this time there is no timeline for a flare control rule. Mr. Hayes stated that the flare monitoring rule timeline would not ensure the creation of a database for use in the April 2004 Ozone Attainment Plan. Therefore, engineering judgments will be required. Mr. Ezersky noted that the emissions reductions from the flare recovery compressors could be included in the ozone plan.

Mr. Savage stated that the staff concerns about refinery data accuracy are problematic when staff asked for refinery data but never identified such concerns. None of Tesoro's 400 samples confirm the 75% composition assumption in the TAD. District use of historical data by definition excludes the reductions from the recovery compressors. The TAD specifically focuses on reducing ozone precursors for ozone attainment. Mr. Lapera stated that he read the staff presentation differently.

Mr. Savage replied that public policy will be based on the published estimate of 22 tons, and that the TAD was published without any refinery review.

Dennis Bolt, Western States Petroleum Association, stated that the South Coast AQMD collected objective data through its flare-monitoring rule for three years, and this data is not disputed. It has since been deliberating over flare controls and has not yet committed to a rule. In the Bay Area, it appears that the politics of ozone planning have overtaken good science. The District's increased estimate of 13 tons up from 200 pounds in the 2001 emission inventory was guesswork. The TAD was also based on assumptions that are refuted by six months of lab samples. Staff did not confer with the refineries on the TAD until it was published. District staff now claims that it has conducted a reasonableness analysis of flare controls for a rule. This was recently published on the District's website, affirming that it (a) has an inventory, (b) has assessed controls to reduce that inventory, (c) measured the amount of those reductions and (d) has determined that the controls that are available and cost-effective. None of these rules are in place anywhere. The process used in the South Coast AQMD works with real information rather than assumptions leading to emission estimates. The Advisory Council may be in a unique position as an objective body to assess the disconnect between the ozone planning process and the technical work. The latter must be done properly. The Committee has spent much time on this issue and will hopefully devote more time to it.

Mr. Kendall noted that staff is analyzing episodic periods in 2000 and looked for unusual refinery events. The refineries provided data on flaring events and marine loading. Staff made emission estimates for these and included them in the 2000 inventory to assess their impact on ozone formation. When the District published the TAD it did not have Tesoro's 400 samples, and the results of their analysis became available later. Also, one facility modified its flow rates several times. Another facility submitted emission estimates that were driven by flow rate and composition data and revised those two or three times. This invariably raises questions about the data quality. The District does intend to revise the TAD, which contains estimates made up to December 2002 and does not have the benefit of referring to data from the subsequent six months.

Regarding a draft set of comments for discussion at the next meeting, District Counsel Brian Bunger explained that a group of less than a quorum of the Committee could compose, circulate and discuss it. Chairperson Harley assigned Mr. Hayes, Dr. Bedsworth and himself to this group.

7. **Committee Member Comments.** Mr. Altshuler noted that manufacturers of particulate traps for diesel engines will likely not be able to meet the 20% nitric oxide limit in 2004, and the District is considering funding the installation of these high emitting traps after the state deadline. Chairperson Harley stated that, time permitting, District plans for PM trap retrofits in light of the state of the art in manufacturing will be agendized for brief discussion at the next meeting.
8. **Time and Place of Next Meeting.** 9:30 a.m., Monday, October 20, 2003, 939 Ellis Street, San Francisco, CA 94109. Board Room.
9. **Adjournment.** 12:06 p.m.

James N. Corazza
Deputy Clerk of the Boards

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

APPROVED MINUTES

Advisory Council Regular Meeting
Joint Public Health & Technical Committee Meeting
1:30 p.m., Monday, June 30, 2003
4th Floor Conference Room

- 1. Call to Order – Roll Call.** 1:36 p.m. Public Health Committee Quorum Present: Brian Zamora, Chair, Elinor Blake, Ignatius Ding, Victor Torreano, Linda Weiner. Technical Committee Quorum Present: Robert Harley, Ph.D., Chair, Louise Bedsworth, Ph.D., William Hanna, Stan Hayes, John Holtzclaw, Ph.D. Technical Committee Members Absent: Sam Altshuler, P.E., Norman Lapera. Other Advisory Council Member Present: Irvin Dawid, Air Quality Planning Committee.
- 2. Public Comment Period.** Irvin Dawid, Air District Advisory Council, referred the Committee members to a paper that he received at a recent Local Government Commission conference in San Diego, California, entitled “Urban Sprawl and Public Health” by Howard Frumpkin, M.D., Ph.D.
- 3. Approval of Minutes:**
 - (A) Public Health Committee Minutes of May 19, 2003.** Mr. Torreano moved approval of the minutes; seconded by Ms. Blake; carried unanimously.
 - (B) Technical Committee Minutes of May 29, 2003.** Dr. Holtzclaw moved approval of the minutes; seconded by Mr. Hanna; carried unanimously.
- 4. The Role of Optical Remote Sensing Technology in Flare Emission Evaluation.** Ted McKelvey, Terra Air Services Project Coordinator, stated he has been the Project Manager for the ConocoPhillips Refinery project since 1998. He described how Optical Remote Sensing (ORS) equipment projects a beam of infrared (IR) or ultraviolet (UR) light to measure fugitive emissions along fencelines or near process units, emissions from vehicle or ambient air content. Along facility fencelines, ORS is used for source identification/separation, early detection and employee safety. The data generated by the ConocoPhillips refinery fence line monitors can be accessed via dial-in and will soon be posted on the website of the Contra Costa County Health Department.

The application of ORS monitoring systems applied to refinery plume flare evaluation would be limited by several factors: (a) the requirement to have reflectors or transmitters behind the plume, (b) the relatively high elevation of the flare stacks, (c) the distance it takes for the flare plume to reach ground level, (d) the difficulty in intercepting the plume properly. Laser Detection and Ranging (LIDAR) systems have been used to monitor flare plumes. However, these systems are limited to measuring a single compound, and they are highly expensive. Fourier Transform Infrared Spectroscopy (FTIR) is currently being developed by the Environmental Protection Agency (EPA) to produce three-dimensional plots of a near ground level plume, and in Texas efforts are underway to use passive FTIR as a means of measuring the content of a variety of compounds from flare stack emissions.

Robert L. Spellicy, Ph.D., President, Industrial Monitor & Control Corporation (IMACC), Round Rock, Texas, presented “Tomographic Inversion and Flare Efficiency by Passive FTIR.” He displayed a diagram of a waste site in which radial plume mapping was conducted to identify emission hot spots. Infrared beams were transmitted to corner reflectors distributed in angular and radial patterns at and above ground level. The reflectors were fixed on grid vertices and the readings from them provided a series of measurements of the source emissions. This type of data allows for inversion of the individual integrated path measurements to produce a three-dimensional mapping of the plume. With the addition of wind field information one can determine total flux. Tomographic inversion can be used to map emissions from an area source or the plume at a refinery fence line.

EPA recently conducted validation tests of this system by distributing corner reflectors throughout a region. This region had controlled point sources as well as a simulated area source (soaker hose fed with cal gas). EPA then used the measured FTIR data in the tomographic inversion software, to see how well the software could replicate the actual measurements. For the point sources, the accuracy of the software in locating the position of the release was within one-half of a pixel (about 2.5 meters), and it recovered 93% of the total emissions. Lawrence Livermore Laboratory has conducted similar optical measurements for homeland security purposes, using multiple beams in a comprehensive crisscross pattern indoors to map possible releases in public buildings. However, this system is complex and very expensive.

EPA also used optical scanning to measure emissions of methane and ammonia at a Kentucky landfill. The system in this case had a computer-controlled scanner that measured transmission to a wide array of corner cubes on site. A single set of scans to all corner cubes can reproduce the source distribution and hot spots, but several cycles are usually averaged to account for source variabilities. Several hot spots in the landfill were identified. In another test, vertical paths were used to look at downwind plumes from a chicken farm before and after a waste area was covered. After the waste area was covered, ammonia emissions were seen to reduce from 0.33 to 0.07 grams/second with the methane remaining essentially unchanged at 0.62 to 0.67 grams/second. EPA is in the process of purchasing additional optical systems to evaluate landfills and other sources, and developing methodological protocols for this type of optical measurement method.

In terms of practical limitations of open path measurements, optical signal quality decreases as the distance of the measured path increases. Integrated path measurement works best between about 300 - 500 meters one-way and remains adequate up to approximately 700 meters. Measuring at distances greater than this will encounter significant interference by atmospheric constituents, particularly water vapors and carbon dioxide and the analysis of many compounds will suffer. The longer pathways generally require splitting the path up to maintain optimum detectivity. Monostatic systems (corner cube plus transceiver) if converted to bi-static systems (combined transmitter and receiver) will improve the signal-to-noise ratio perhaps 10 to 100 times. The path is cut in half, however, so this can degrade minimum detection levels in shorter path systems.

In reply to Committee questions, Dr. Spellicy noted:

- tomographic inversion works best along unobstructed pathways where there is an unobstructed path allowing for integration along the path. This type of scenario also allows for greater ability to measure total flux. In its vertical path configuration, it is designed primarily to provide maps of emissions leaving a site. Total flux can also be determined but this depends on the frequency of measurements, how often they are averaged, as well as the impact of wind speeds. Data from these systems can provide input to citizen warning systems or it can be used to provide evidence after a release for purposes of source attribution.

- Elevation of corner reflectors depends on the source. It would be difficult to suspend corner reflectors at refinery stack heights of 300 feet. Scissor jacks can elevate up to a maximum of 50-60 feet. Around some refineries, nearby hills allow the siting of a measuring device to within 50-60 feet of the top of the flare. However, this could access a high plume rise.
- tomographic models map emissions and provide concentration estimates at specific points within the course contour. The number of compounds measured does not entail a practical trade-off in routine operational feasibility. Rather, the challenge is to generate the spectrum at a high enough signal-to-noise ratio to be able to discern a sufficiently low concentration.

For major releases shorter averaging periods could be used to achieve a better temporal resolution and early warning. The speed of response is a function of the threshold of lowest concentration. FTIR gathers one spectrum per second. These scans are averaged to produce a higher signal-to-noise ratio in the spectrum. This allows smaller absorption features to be detected and thus lower concentrations of constituents of concern. Optical measurement systems are now sufficiently capable that they can be set up to discern both routine low-level data and high concentrations from a release. FTIR detection limits for emergency response are governed somewhat by the strength of absorbance of each measured gas. Through variable sequencing, five-minute averages could be used to detect fugitive emissions and low-level ambient concentrations along the fence line; and shorter scanning averages could be used to detect higher concentrations expected during an accidental release. Short averaging periods could be used to identify high emission levels. These high speed spectra could be averaged together to increase the signal-to-noise ratio allowing for post-process evaluation of low-level emissions. Longer averaging time allows for identification of consistently low-level emissions, although transient emissions would be less detectable.

New algorithms are now available that simultaneously allow for the evaluation of the infrared spectrum automatically correcting and refining the analysis procedure as needed. At a toxic waste site in Texas with relatively low emission levels, the system corrects for changing atmospheric water vapor due to seasonal variation in humidity. This is an important improvement that eliminates residual effects that usually interfere with the analysis.

Monostatic scanning equipment and accompanying software cost about \$100,000; pre-fabricated equipment housing from \$20,000 - \$30,000; and replicated corner cubes from between \$6,000 - \$10,000 each. Mr. McKelvey added that annual maintenance and data analysis for two monostatic systems with a total of four paths would cost between \$100,000 - \$200,000.

Dr. Spellicy stated that LIDAR technology is excellent for measuring plumes, but it is limited to a single compound and costs approximately \$1 million per unit. The Alberta Research Council has contracted with Spectrolite from the United Kingdom to perform measurements on SO₂ with a multiple-laser LIDAR to assess wildcat flares in Alberta. When new wells are drilled at these Alberta oil fields, the gases are sent to a flare while testing on flow, and pressure is conducted. The Alberta ambient air quality regulations require that emission levels from a plume when they reach ground level must be below the ambient air quality standards. Use of a LIDAR allows for mapping of the plume from the flare measuring concentration as a function of distance from the flare. This should allow LIDAR to assess if the regulations are being met when the plume reaches the ground.

Passive FTIR measurement of flare efficiency is underway in Texas to identify ozone precursors near industrial facilities. Houston is an ozone non-attainment area. NASA fly-bys identified hot spots downwind of certain facilities that could not be accounted for by current emission factors.

The issue was whether variance in normal flare operations at facilities affected such hot spots. FTIR should allow for the continuous, unmanned measurement of combustion and destruction efficiency of elevated flares in near real-time. The Texas program will demonstrate this and determine the measurement accuracy of such a system. The State of Texas is working on a protocol for continuous FTIR monitoring for flare measurement. This effort is based on emission spectroscopy. When gases are heated they emit radiation with the same infrared signatures as exhibited in their absorption spectrum. Therefore, hot gases emitted by a flare can be identified and quantified by measuring the flare radiant signature. The FTIR signal derives from measurements of background radiance, flare radiance, atmosphere path radiance and atmospheric transmission. Natural background radiance and atmospheric temperature are negligible. The major measurement is then the radiance of the plume as transmitted through the air.

Dr. Spellicy displayed spectral signal charts of several plumes showing emissions of organics and hydrocarbons, with water content and CO₂ content carefully distinguished in each. Comparisons with reference spectra and temperature provide the measurement criteria essential to this process. The measurement of combustion efficiency requires the quantification of carbon monoxide, carbon dioxide and organics. CO, CO₂, and an approximation to total organics is comparatively easy to determine, so combustion efficiency can be measured. Total hydrocarbons can be approximated by calibrating against a mix of heavy organics or using a representative heavy organic. The measurement of destruction efficiency requires analysis of individual organics and this is more difficult. Speciation of non-methane organics is possible for the lighter compounds (< C5).

Atmospheric path transmission between the FTIR and the flare is needed to correct the observations for atmospheric effects. This transmission can be measured by observing an infrared source over a horizontal path from the FTIR to the flare base. This signal is then corrected by measuring radiance with the black body removed which accounts for any atmospheric path radiance (this is usually very small). This path transmission is then used to deduce gas concentrations in the horizontal path, which in turn are used to compute slant-path atmospheric transmission to the flare exhaust. Flare radiance is measured with FTIR directly. An iterative calculation of flare temperature and its opacity is then performed using the intervening atmospheric transmission to correct for the air path. This produces concentrations of all compounds observed in the plume.

The Texas Flare Measurement Program will measure flare combustion efficiencies up to 99.95%, and destruction efficiencies for highly reactive organic compounds of concern in ozone production. Program phases include analytical simulation to assess maximum observable efficiency and minimum detectable concentration levels for organics, and controlled source-emission tests to demonstrate the accuracy of the inversion process. A plume generator spiked with typical gases at accurately known concentrations will be measured from a moderate distance with FTIR. Field tests will follow to scan several industrial flares to assess combustion/destruction efficiencies.

5. **Committee Member Comments/Other Business.** Ms. Blake stated that at the most recent Public Health Committee meeting in Rodeo, it was good to see several District field staff in attendance.
6. **Time and Place of Next Meeting.** 1:30 p.m., Monday, August 11, 2003, 939 Ellis Street, San Francisco, California
7. **Adjournment.** 3:06 p.m.

James N. Corazza
Deputy Clerk of the Boards