



BAY AREA  
AIR QUALITY  
MANAGEMENT  
DISTRICT

## ADVISORY COUNCIL TECHNICAL COMMITTEE

### COMMITTEE MEMBERS

ROB HARLEY, PH.D., CHAIRPERSON  
WILLIAM HANNA  
JOHN HOLTZCLAW, PH.D.

SAM ALTSHULER, P.E.  
STAN HAYES  
NORMAN LAPERA

MONDAY  
OCTOBER 20, 2003  
9:30 A.M.

4<sup>TH</sup> FLOOR CONFERENCE ROOM

1. **Call to Order – Roll Call**
2. **Public Comment Period**

*The public has the opportunity to speak on any agenda item. All agendas for 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.*

3. **Approval of Minutes of August 7, 2003**
4. **Discussion and Adoption of Recommendations on Refinery Flaring**

*The Committee will discuss and adopt recommendations on refinery flaring—in particular, regarding refinery flaring combustion efficiency, frequency distribution and daily emissions estimates.*

5. **Committee Member Comments/Other Business**

*Committee members, or staff, 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 his or her own activities, provide a reference to staff regarding factual information, request staff to report back at a subsequent meeting on any matter or take action to direct staff to place a matter of business on a future agenda.*

## **6. Time and Place of Next Meeting**

*At the call of the Chair.*

## **7. Adjournment**

RH:je

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

**(415) 749-4965**  
**FAX: (415) 928-8560**  
**BAAQMD homepage:**  
[www.baaqmd.gov](http://www.baaqmd.gov)

- 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 at least 3 working days prior to the date 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**  
**OCTOBER 2003**

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

MR:jc  
(10/14/03) 2:16 p.m.

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**(415) 771-6000**

**CLERK OF THE BOARDS OFFICE:**  
**MONTHLY CALENDAR OF DISTRICT MEETINGS**  
**N O V E M B E R 2 0 0 3**

<b>TYPE OF MEETING</b>	<b>DAY</b>	<b>DATE</b>	<b>TIME</b>	<b>ROOM</b>
<b>Board of Directors Public Outreach Committee</b>	<b>Monday</b>	<b>3</b>	<b>9:45 a.m.</b>	<b>4<sup>th</sup> Floor Conf. Room</b>
<b>Board of Directors Regular Meeting</b>	<b>Wednesday</b>	<b>5</b>	<b>9:45 a.m.</b>	<b>Board Room</b>
<b>Advisory Council Executive Committee</b>	<b>Wednesday</b>	<b>12</b>	<b>9:00 a.m.</b>	<b>Room 716</b>
<b>Advisory Council Regular Meeting</b>	<b>Wednesday</b>	<b>12</b>	<b>10:00 a.m.</b>	<b>Board Room</b>
<b>Board of Directors Mobile Source Committee</b>	<b>Thursday</b>	<b>13</b>	<b>9:30 a.m.</b>	<b>4<sup>th</sup> Floor Conf. Room</b>
<b>Board of Directors Legislative Committee</b>	<b>Monday</b>	<b>17</b>	<b>9:30 a.m.</b>	<b>4<sup>th</sup> Floor Conf. Room</b>
<b>Board of Directors Regular Meeting</b>	<b>Wednesday</b>	<b>19</b>	<b>9:45 a.m.</b>	<b>Board Room</b>
<b>Regional Agency Coordinating Committee (RACC)</b>	<b>Friday</b>	<b>21</b>	<b>1:30 p.m.</b>	<b>MTC 101 Eighth Street Oakland, CA 94607</b>
<b>Board of Directors Stationary Source Committee</b>	<b>Monday</b>	<b>24</b>	<b>9:30 a.m.</b>	<b>Board Room</b>
<b>Advisory Council Air Quality Planning Committee</b>	<b>Tuesday</b>	<b>25</b>	<b>9:30 a.m.</b>	<b>Room 716</b>
<b>Board of Directors Budget &amp; Finance Committee</b>	<b>Wednesday</b>	<b>26</b>	<b>9:30 a.m.</b>	<b>4<sup>th</sup> Floor Conf. Room</b>

MR:mr  
10/6/03 (11:41 a.m.)

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 CO<sub>2</sub> 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

Advisory Council Technical Committee Report on Emissions from Refinery Flares

9 OCTOBER 2003

DRAFT FOR COMMITTEE DISCUSSION PURPOSES  
THIS HAS NOT BEEN APPROVED AS A COMMITTEE REPORT

Context

The Advisory Council Technical and Public Health Committees have devoted several committee meetings this year to the issue of refinery flares. We received input in the form of presentations to the committee and extensive discussion and public comments. Presenters and commenters included District staff, oil refinery and WSPA representatives, experts in fence-line monitoring and optical remote sensing, an expert in refinery flare system design and operation, environmental groups, and members of the communities neighboring Bay area refineries.

Earlier this year, the District's Board of Directors adopted a rule requiring flare monitoring at Bay area refineries. A controversial issue still remains: whether to adopt a further rule requiring emission controls from flare systems.

Findings

1. Flare stacks are an important safety system at refineries, and are needed to deal with emergency and process upset conditions. An issue of great concern to the committee is the potential for large releases of noxious pollutants from refineries as a result of unpredictable events including earthquakes, fires, electrical power failure, accidents, and other hazards. High hydrocarbon flows to the flare system and/or loss of the steam and air supply to the flare stacks can cause the HC to burn in a very undesirable fuel-rich mode that leads to emissions of black smoke and other products of incomplete combustion in the exhaust plume.
2. Foul odors, visible smoke plumes, and adverse health effects that may result from exposure to refinery emissions are the foremost air quality concerns among those living near the refineries.
3. While unit shutdowns, startups, and turnarounds are the most common cause of flaring events, they are not the largest source of air emissions. It is unanticipated process upsets and accidents (the second most frequent cause of flaring events) that lead to the highest emissions.
4. District staff and the oil refiners are focusing at present on discussions of HC emissions from flare systems. There are large differences in the estimates of unburned HC emissions from Bay area refinery flares, ranging from ~2 tons/day (industry estimate) to over 20 tons/day (District staff estimate). We do not accept either of these emission estimates at this time. Improved estimates need to be developed, based on measurements of all relevant parameters that affect flare emissions. Those parameters include the flow rate of gas to the flare stack, the hydrocarbon content of those gases, the hydrocarbon speciation, and the hydrocarbon destruction efficiency within the flare system.

5. The District's recently adopted flare monitoring rule will provide measured data that can be used to improve the estimates of HC emissions. However, the adopted rule does not address or measure hydrocarbon destruction efficiency in the flare system. As a basis for air quality planning and assessment, in the absence of on-site measurements, we agree that 98% is a reasonable assumption for the HC destruction efficiency.
6. Flares have the potential to emit numerous other air pollutants in addition to unburned hydrocarbons. Those pollutants include carbon dioxide (a greenhouse gas); carbon monoxide, aldehydes, and soot (products of incomplete combustion); as well as nitrogen oxides and sulfur oxides.
7. Hydrocarbon emissions from flares have been reduced during the last year. This has occurred due to installation of gas recovery systems at one refinery (hydrocarbons were not recovered from the flare header at this refinery previously), and due to more attention to this issue by the refineries.

### Recommendations

1. District staff should develop improved estimates of HC emissions from flares at refineries, using new data resulting from the adopted rule on flare monitoring. The refining industry and other interested parties should be kept informed and consulted as this effort progresses.
2. District staff and refiners should investigate further the use of optical remote sensing or other appropriate plume monitoring techniques to measure the HC destruction efficiency in flare systems.
3. Refiners should be encouraged to install backup systems to insure flares continue to burn in a smokeless condition, with high HC destruction efficiency, whenever possible, and especially during serious emergency situations.