

9/10/02

From: Julia May, Lead Scientist, CBE

To: Members of the Modeling Advisory Committee (MAC):

Re: **Major Problems with District Inventory, Comments regarding the Modeling Protocol**

As I've been unable to attend the MAC meetings so far and will also be unable to attend tomorrow's meeting (due to a scheduling conflict with another Air District meeting on control of Refinery Wastewater Ponds), I wanted to at least send some quick comments to the group. I wanted to express CBE's (Communities for a Better Environment's) keen interest in the work of the MAC. Clearly this modeling will be key to attaining Clean Air Act ozone standards in the region. CBE is very concerned not only about the modeling protocol, but also about the inventory inputs to the model, which we know to contain major gaps.

Flaring emissions underestimated: For example, up until just last year, refinery flares were in the inventory at only 0.1 ton per day (tpd). It appears that this only included flare pilots and purge gases, but didn't include the huge flow of hydrocarbons to the flare from process vessels. As a result of our inquiries, the District added 13 tons per day of emissions from just this one source to the inventory. There is evidence that these emissions may be much larger than 13 tpd (up to ten times higher or more).

Ongoing investigations of other refinery source emissions show underestimation: There are ongoing investigations as part of the Clean Air Plan proceedings to evaluate emissions from flares and other refinery sources including vessel depressurization, wastewater ponds, marine loading, and tanks. For example, results of source testing of marine loading of products currently exempt from District regulations showed much higher emissions than the emissions factors used by the refineries to characterize this source. In the case of certain exempt products for which there is a very large amount of marine loading, the source tests showed emissions up to thousands of times higher than the extremely low emissions factors used. I'm not sure exactly how these sources are reflected in the inventory at this time, but I know that the exempt products are not present at the levels shown by the recent source tests.

Refinery "incidents" underestimated: Another source which seems clearly drastically underestimated is the category of refinery "incidents." The huge incident at the Phillips Rodeo refinery this summer was estimated on the District website to dump from 480 to 720 tons of emissions in a few hours, since the entire refinery shut down, and since all of the gases dumped through the flare in short order.<sup>1</sup> These huge emissions can overwhelm the District inventory. Many other major refinery "incidents" occur regularly, about every 2 months. They appear not to be reflected in the inventory.

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<sup>1</sup> This flaring incident was caught on videotape, which showed huge clouds of black smoke from the flare, indicating poor combustion. The District used lower combustion efficiencies to come up with the website estimate. Refiners have argued that flare combustion should be considered to be 98 or 99% efficient, or higher, under even the worst conditions. However, a recent Canadian study found that flare efficiencies can go down to 70% or lower.

Pressure Relief Valve emissions underestimated: Yet another refinery source has been known by the District for quite a while to be likely underestimated: Pressure Relief Valves. These sources have no monitoring. When they open to vent and then close, it is very difficult to determine whether they have vented or not. District inspectors cannot determine this unless rupture disks are installed on the PRV. PRVs are safety devices to ensure that vessels don't explode when the pressure gets too high. Approximately half of the refinery-wide population of PRVs vent to the atmosphere, and the other half go to refinery gas recovery systems. A District staff report found that it was likely that the number of ventings go underreported. The average from one PRV lifting was calculated by the District at 9 tons, and the worst known release was 150 tons (in less than one day).

NOx source controls underestimated: There are many other examples of source underestimation, and the list above only touches on VOC emissions. I am certain from recent review of Title V permit documents that NOx sources are poorly characterized as well. We are especially concerned that weekend-effect studies are being used by the refineries to avoid regulation of NOx sources. Clearly NOx emissions not only cause ozone, but deadly particulate emissions as well. A combined strategy of VOC and NOx control should be the District's mission for a number of health reasons, and the modeling protocol needs accurate data on both VOC and NOx emissions.

Houston study found industrial emissions are highly reactive: We would also ask if the MAC is reviewing the recent Houston studies which show that industrial VOCs are much more reactive than mobile source hydrocarbons. We request that the committee include these effects in the modeling protocol.

Advisory Council Meeting presentation on inventory should be provided to the Modeling Committee I understand from the minutes of the Advisory Council that a presentation was provided by Jim Karas of the District, on refinery further study measures and how they relate to the inventory. I suggest that this presentation would be highly relevant to the MAC as well and should be scheduled.

Please keep me in the loop with your distributed comments. I have only briefly summarized the issues above. If anyone wants further documentation, please contact me at [jmay@cbecal.org](mailto:jmay@cbecal.org), or 510/302-0430 x300. Thank you for considering these issues!

Julia May, CBE



Winston H. Hickox  
Agency Secretary

# Air Resources Board

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Gray Davis  
Governor

September 24, 2002

Mr. Chris Emery  
ENVIRON Corporation  
101 Rowland Way  
Novato, California 94945-5010

Dear Mr. Emery:

Thank you for the opportunity to review the second draft of the modeling protocol document entitled "Development of a Photochemical Modeling System to Support the Bay Area Air Quality Management District's 2004 State Implementation Plan." We find the protocol document much improved over the previous version. However, we do have a few comments on the revised draft document, which are provided below. I hope that our comments are useful to you.

## General Comments

The episode characterization is based on ozone air quality only. While useful, it does not consider meteorological factors affecting air quality. We would strongly recommend that meteorology be integrated into the episode characterization to make it more robust.

Design value scaling is proposed for use, yet the exact methodology for implementation is not clear. For example, how will peak model predictions away from monitoring sites be addressed in the scaling? What if the design and observed values at a monitoring site are significantly different? If model performance is poor at some monitoring sites, how will this affect the design value scaling? Our experience is that there are a number of issues that need to be considered for design value scaling. We would suggest that these issues be carefully considered and addressed early on in the process.

## Specific Comments

- It is proposed to match the vertical resolution of the air quality model to that of RAMS up to about 1 km. Above that level the resolution of the air quality model decreases fairly rapidly with height. Is there a concern that the afternoon mixing depths during the episode may not be properly resolved with the current vertical structure? Should a decision on the vertical structure be delayed pending analysis of mixing depths during the episode?

*The energy challenge facing California is real. Every Californian needs to take immediate action to reduce energy consumption. For a list of simple ways you can reduce demand and cut your energy costs, see our Website: <http://www.arb.ca.gov>.*

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California Environmental Protection Agency

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- The protocol recommends the use of the PPM scheme for calculating horizontal advection. Even though the Bott and PPM advection schemes are comparable in certain aspects, such as accuracy and mass conservation, the PPM scheme may reduce predicted peaks significantly in some cases. The Bott scheme may not have this undesirable feature. Alternatively, while the formulation of the Bott scheme appears to be sound, we are unable to rule out numerical problems with the computer code implementation. We are aware of one attempt to evaluate the computer code by scientists at the University of California at Davis, and the findings from that work would be relevant to this modeling effort. In short, we strongly recommend sensitivity testing and evaluation of both schemes before selecting one.
- The proposed meteorological model (RAMS) uses a different map projection than the emission inventory and air quality models. Although touched upon in the protocol document, we would like to reiterate that care must be exercised in dealing with the different map projections.

If you have any questions regarding our comments, please call me at (916) 322-6048.

Sincerely,

John DaMassa, Chief  
Modeling and Meteorology Branch

cc: Mr. Dave Souten  
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Via e-mail:

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Hello,

Thanks for facilitating for the telecon connection with the BAAQMD at the last MAC meeting. Due to other commitments, that was the only way I could participate that day.

Regarding the issue of episode selection and the general limitations of the episodes provided by nature during the CCOS field study, here are my suggestions:

#### 1. CCOS Validation

Develop simulations using the data intensive CCOS episodes and use the results for primarily to validate the model and develop confidence in its performance.

#### 2. Other Episodes

Once model performance is deemed acceptable, run the model on several other data lean periods that are better suited to achieve specific objectives. For instance, one episode mentioned was the July 11-12, 1999 event which seemed like a good candidate for Bay Area SIP development. However, the transport signature in our area for that particular event was rather weak.

Since for the downwind areas it is very important that the SIP modeling address the issue of transport, I would suggest that several additional non-CCOS episode periods be considered.

Candidate periods I would suggest for assessing transport include:

July 15-18, 1998,  
August 2-4, 1998,  
August 28 to September 1, 1998 and more recently,  
July 9 and 10, 2002

One approach for selecting the number and dates for the transport episodes to be modeled is to form a consensus committee of downwind districts who would come up with recommended periods based on common concerns over transport.

Another advantage of this multi-episode approach is that a lot more is learned about the characteristics of regional ozone formation under a variety of met regimes than is learned with a single data intensive event, which tends to be a one dimensional view of the problem.

Thanks for the opportunity to comment on this project,

Bob Nunes  
MBUAPCD