ENVIRON

MEMORANDUM

To: Bay Area 2004 SIP Modeling Advisory Committee (MAC) Participants

From: Chris Emery, Craig Tremback, Jim Wilkinson,
BAAQMD Staff and Management

Date: December 12, 2002

Subject: Response to protocol comments received from DRI/SMAQMD

On December 2, 2002 the Bay Area Air Quality Management District (BAAQMD or District) and ENVIRON received comments on the Bay Area 2004 SIP Modeling Protocol from the Sacramento Metropolitan Air Quality Management District (SMAQMD) and their contractors, Desert Research Institute (DRI). Four documents were reviewed:

- The original response to comments received on the draft modeling protocol, dated September 6, 2002;
- The 2nd Draft of the Modeling Protocol, dated August 2002;
- The Districts' revised "Episode Representativeness" section;
- The Districts' revised "Meteorological Conditions" section.

This memorandum addresses each of the comments directly, referencing each according to DRI's numbering system. The original comments are not repeated here, but are available on the project web site (www.environ.org/basip2004, see "SMAQMD-DRI Protocol Comments"). Most of the comments refer to older project documents developed prior to the September 11 MAC meeting, and we believe that the latest Modeling Protocol directly addresses a number of the comments.

On Memo, "Response to comments received on draft mdoeling protocol", September 6, 2002

1. No response necessary. The latest Modeling Protocol describes the prevailing meteorology for the July 11-12, 1999 episode.

2. Each modeling episode will include a 3-day spinup for meteorology and air quality, as described in the latest Modeling Protocol. We plan on modeling 1 or 2 days beyond the last ozone exceedance day in the Bay Area if exceedances were observed to occur in neighboring/downwind districts on the following days (e.g., July 31 – August 1). This will be subject to available emissions and aerometric data.

3. We are unsure of the context of this comment. The comment refers to text in which we attempt to explain the obvious reasons why 2-way nesting should be superior over 1-way

nesting approaches (both for meteorology and air quality models). This discussion could be expanded, but we have no plans to run either of the models in 1-way nested mode purely for the reasons given.

4. No response necessary, as it repeats the referenced text.

5. We agree with the comment, and the Modeling Protocol shows that our 4-km (and ultimately 1-km) modeling grids will cover the key topographic features of the Bay Area that influence mesoscale flow patterns.

6. No response necessary.

7. We agree with the comment, and the Modeling Protocol (Section 7) discusses the model performance evaluation process in detail, including attempts to explain any failure of the models' to adequately approximate observations.

8. The project team is aware of the work in the SoCAB that is described. We are currently seeking additional information from the ARB in regards to this issue. Specifically, we are attempting to determine if the data that ARB has developed (is developing) can be generalized for use in all of California.

9. We agree that a potential difference in modeling results between CAMx with SAPRC99 and with CB-IV could be attributed to different VOC speciation profiles in the emissions inventory. These differences have been difficult to reconcile for consistency in past modeling applications. In this project, we will be using speciation profiles developed by the ARB.

<u>On Report "Modeling Protocol", August 2002</u>

1. We believe that there are actually several modeling systems that do contain all of the technical features necessary to simulate ozone air quality in the San Francisco Bay Area. Besides EMS95/RAMS/CAMx, these include such photochemical platforms as CMAQ, meteorological models such as MM5, and emission processing systems such as EPS2 and SMOKE. If no "model in existence" can meet this criterion, then EPA would not require that photochemical modeling systems be applied to support SIP development. The system we have chosen certainly meets this criterion, and as outlined in the protocol Sections 1 and 3, contains several advantages specific to this project (including a solid experience base by the contracting team and District staff, consistency with the ARB emissions development, and certain technical features not available with other platforms).

   Regarding the meteorological models, both RAMS and MM5 have been used successfully on numerous air quality-related projects over the years. Unfortunately however, there have been limited opportunities to compare the models in a true side-by-side manner, since this will basically double the cost of any project. We would welcome the opportunity to

perform a comparison, but the current project schedule and funding will not allow it. We are planning to test the response in CAMx to CCOS-episode MM5-generated meteorological fields from NOAA/ARB if final files are made available in sufficient time to include in this study.

While we are familiar with some RAMS simulations that were performed at CSU many years ago for Project MOHAVE, we are not familiar with MM5 comparisons. If such comparisons were performed 10+ years ago, they are rather dated since both models have undergone significant evolution since that time. If such comparisons were recently completed, the project participants would be interested in obtaining the results of the analyses. We have had an opportunity recently to directly compare RAMS and MM5 for the Texas Gulf coast region for two episodes. Generally, RAMS performed much better for one of the episodes and somewhat better for the second. Furthermore, in our experience RAMS often performs better in initial "out of the box" simulations than the best refined MM5 runs developed over several iterations.

In general, while there are some differences between RAMS and MM5, we feel it is the expertise and experience of the modeler that will determine if a particular simulation is successful. Numerous decisions must be made to configure a simulation, whether it be grid structure, choice of physical parameterizations, etc. Given that the BAAQMD has been running RAMS for almost a decade and have developed the experience, we feel that RAMS is the proper choice for the Bay Area system.

2. No response necessary, as it repeats the referenced text.

3. Section 2 of the Modeling Protocol attempts to establish that indeed three multi-day ozone modeling episodes should be adequate to characterize the broader conditions associated with ozone exceedance events in the Bay Area. The discussion hinges on the establishment of two clear-cut regimes, or categories, from a detailed cluster analysis of episodes from 1995 to present.

4. See response to comment (1) below.

5. We agree with this comment. Modeling the non-CCOS July 11-12, 1999 episode will suffer from a lack of supplemental data gathering activities beyond the standard monitoring networks. This issue entered heavily into the decision of whether or not to add an additional episode outside of CCOS. We believe the benefits of adopting this particular episode far outweigh any deficiencies associated with the available measurement database.

6. See response to comment (9) above.

7. It is true that CMAQ operates only in 1-way nested mode. The EPA developers of CMAQ are opposed to 2-way nested for this particular platform, as they cannot guarantee adequate mass conservation or consistency across 2-way nested grid boundaries. Tests with CAMx have demonstrated acceptable mass conservation and consistency across 2-way grid

boundaries. The reviewers are correct that CMAQ allows any nesting ratio other than 3:1, however, MM5 (the only meteorological model that currently can supply meteorology inputs to CMAQ) is typically run in 2-way nested mode, which requires a 3:1 nesting ratio. Therefore, CMAQ is run most often at 3:1. Project participants would be interested in a cited reference that supports the claim that "the best performance is observed at typical 3:1 ratio."

8. See response to comment (1) above.

On the revised "Episode Representativeness" section

1. With respect to the WE/WD issue, it seems that including a test for the weekend effect pulled attention away from the simple point being made, namely: High ozone is occurring BOTH on weekdays and weekends. Thus, BOTH kinds of days should be modeled, if possible. The statistical significance tests for weekend days could be removed if participants agree that it is inappropriate.

2. The District has found the 500 mb height somewhat less helpful for predicting high ozone in the Bay Area than some other variables such as 850 mb temperature. However, we understand that both of these are important for Sacramento and San Joaquin and are willing to add them along with Bethel Island winds to Table 2-4. Pressure gradients between San Francisco and Fresno could also be added.

On the revised "Meteorological Conditions" section

1. It would be desirable to model all four episodes. However, we do not currently have the resources to complete any more than the 2 or 3 episodes selected in the protocol within the schedule of our SIP (approximately a June 2003 deadline).

2. We agree with the caution regarding HYSPLIT topographic resolution. The latest analyses described by the District includes language very similar to the comment, and is reflected in the latest revision of the Modeling Protocol.

3. The District has reviewed the cited Ludwig et al. (1985) reference, but are concerned that the age of this work may no longer apply to the current (last ~5 years) ozone phenomenology between the Bay Area and Pinnacles. The paper's main conclusion is that the Pinnacles are in the inversion layer during high ozone days and surface met data alone cannot be used to characterize the high ozone conditions. This decoupling of the ozone in the inversion layer and at the surface requires separate consideration. Nevertheless, we will be looking into the transport effect to Pinnacles, both near surface and in the inversion layer, using results generated from the model simulations.