August 1, 2002

EPA's Comments on July 2002 Draft Modeling Protocol for Bay Area 2004 SIP

1. Clarify and expand the discussion of the the primary and secondary goals described on p. 1-2. Explain how the current grid selection will support the goal of modeling transport.

2. EPA modeling guidance specifically calls for examining three or more episodes. The protocol states that only two episodes will be modeled. Discuss the conflict between EPA and State requirements and address the EPA guidance requirement. At a minimum, a better characterization of the episodes being modeled should be included with some discussion of episode representativeness.

3. In addition, I would like to reiterate a concern that I expressed at the initial MAC meeting. As CCOS modeling choices are made, those options should be considered and reflected in the protocol or addendum to the protocol. It may be premature to address this in the protocol at this time.

Winston H. Hickox
Agency Secretary

Air Resources Board

Alan C. Lloyd, Ph.D.
Chairman
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Gray Davis
Governor

July 29, 2002

Mr. Chris Emery
ENVIRON Corporation
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Dear Mr. Emery:

Thank you for the opportunity to comment on the draft modeling protocol document entitled "Development of a CAMx/RAMS/EMS95 Photochemical Modeling System for The San Francisco Bay Area Air Quality Basin." In general we find the document to be a good starting point for a reference to the model development effort that ENVIRON is conducting for the Bay Area Air Quality Management District (BAAQMD). I hope that our comments are useful to you in refining the document.

As you know, the Air Resources Board (ARB) has made a significant, in-kind commitment to support Central California Ozone Study (CCOS) projects that can be used for State Implementation Plan (SIP) purposes. Timeframes are very tight and will require a large amount of staff resources to honor this commitment. The ARB recognizes that the BAAQMD's modeling project is a very high priority and it is certainly our intent to collaborate with the ENVIRON team to the maximum extent possible. We are committed to participate in an advisory capacity on the BAAQMD Modeling Advisory Committee and to provide data that have been approved for distribution by ARB management and CCOS Study Agency stakeholders, including the BAAQMD.

In preparation for SIP modeling in the CCOS region, and under contract to the CCOS Study Agency, Dr. Gail Tonessen of the University of California at Riverside will be conducting an air quality model inter-comparison. Her analysis will include model performance evaluations and in-depth analyses of three air quality models (CMAQ, CAMx, and SAQM). The information from her analysis will facilitate selection of a SIP model for the CCOS region. We would hope that the information provided by Dr. Tonessen would be considered as part of your project.

Our comments below are grouped into areas of general comments followed by some specific comments.

General Comments

Episodes – The discussion of the episodes in the document is rather brief. This may be out of necessity since much of the work of characterizing the CCOS episodes is ongoing. As more information becomes available, the episode descriptions should be expanded to better characterize the episodes from both local planning and transport perspectives.

More specifically, two episodes from summer 2000 will be developed and simulated during this project: June 14-15 and July 30 - August 2. However, the peak observed ozone concentration during the latter episode was only 126 ppb, which is barely above the ozone attainment threshold. Also, winds were unusually strong during the June 14-15 episode. The document should discuss the representativeness and applicability of these episodes for attainment planning.

Transport - It is likely that the issue of inter-basin transport will be of paramount importance to the BAAQMD as well as to neighboring districts. Yet the document and technical approach are ambiguous as to the importance of transport to the project. On page 1-6 there is language that would leave one to believe that transport will be addressed as an integral part of the project. Yet language in other parts of the document hint at a lesser priority for transport. Also, the choice of nested grids, with coarser resolution outside of the SFBA, would lead one to believe that transport is not a high priority for the project. Given the importance of transport issues, we would suggest that the document and technical approach be consistent with respect to the priority of addressing inter-basin transport.

The proposed multi-scale air quality modeling domain (Figure 6-1) consists of 1 km resolution over the San Francisco Bay Area (SFBA) and 4/12 km resolution over the San Joaquin and Sacramento Valleys. The protocol document focuses on the SFBA but does indicate that pollutant transport will be explicitly addressed (page 1-6). It is unclear how the air quality model will address transport which crosses from a fine grid resolution (1 km) to a coarser resolution (4, 12 km). Will the numerical approach in CAMx handle a pollutant mass wave crossing two different grid densities without possible numerical mass reflections occurring in the grid interface? How does CAMx deal with the mass dilution issue across a grid interface between different grid resolutions?

Emissions Modeling - For preliminary modeling inventories that are ready for distribution, the ARB prefers to exchange documented, day-specific sets of gridded, hourly emissions estimates versus foundation-level data. This will minimize the need to synchronize and provide version control for so many input files and cross-references. Similarly, it also minimizes the possibility of incurring post-processing differences that might occur with any external adjustments. After CCOS inventories are further developed, a full set of inputs and associated documentation could be provided. When available, the ARB will provide gridded, hourly CCOS episode CO, NOx, and TOG emissions for stationary, area-wide, and mobile sources in EMS-95 formats (ptemis, areaemis, and gridmv). Also, when available, gridded, hourly methylbutenol (MBO), monoterpene (MON), isoprene (ISO), and OVOC (20-30%) biogenic emission estimates will be provided in the EMS-95 format (bioemis). It may be useful to describe the format of these EMS-95 file structures in an appendix. In addition, all cross-reference data for use in generating model-ready datasets for use in photochemical models can be provided once they are available for distribution (e.g., stack parameters and speciation).

Specific Comments

Page 1-2: We would suggest changing the next-to-last sentence in the BACKGROUND section to the following: "In March 2001, the EPA disapproved portions of the SFBA SIP. As a result, the BAAQMD was required to submit a SIP, which it did on November 30, 2001. Included in this SIP submittal is a commitment to revise this 2001 SIP by April 15, 2004."

Page 1-9: Please note that the phone number for John DaMassa is incorrect. His new phone number is (916) 322-6048. Also, his title should read "Chief, Modeling and Meteorology Branch."

Page 2-7: Delete the following statement in the last sentence: "It was designated a "practice" IOP". July 23-24 was a practice IOP.

Page 3-2: Overstates the ARB's position on EMS-95: "Use of any other processing system would likely be unacceptable to CARB and thereby jeopardize the SIP." As stated elsewhere in the document, the overwhelming reason for utilizing EMS-95 is compatibility with CCOS inventory products and to facilitate the exchange of emissions data.

Page 3-3: Please provide a reference for the MM5-RAMS comparison.

Page 3-3: It is stated that MM5 is limited to a 3:1 ratio. Actually, MM5 can take any ratio, but the best performance is obtained if the ratio is 3:1.

Page 3-3: A new version of CMAQ was released (July 16, 2002) which allows for generation of hourly-averaged, in addition to instantaneous, fields.

Page 3-3: Please provide a reference for the comparisons of CMAQ vs. CAMx.

Page 4-2: Prognostic meteorological models are known to generate artificial slope flows. RAMS should be evaluated for the presence of these artificial slope flows.

Page 4-3: In the proposed set up, the RAMS 4km domain will treat both Sacramento and the San Joaquin Valleys as open-ended valleys. As a result, the low-level jet, the Schultz eddy, etc. will not be characterized in the 4 km domain accurately. This, in turn, may degrade the model performance in the Bay Area.

Page 4-3: 41 levels, and a 20 km modeling height with a maximum of 1000 m grid thickness are proposed for RAMS. It is not clear how a high resolution vertical grid spacing can be obtained in the lower atmosphere from this set up.

Page 4-8: It looks like the evaluation of RAMS will heavily depend on statistical analyses. A mechanistic model evaluation method should be developed and discussed in the protocol.

Page 6-3: The CAMx domain height is proposed to be set at about 4 km above the surface. It is also stated that the top of the air quality modeling domain will follow the terrain-following coordinates of RAMS. Thus the top boundary of the CAMx domain is not flat. It is not clear how the top boundary conditions will be set along a slanting surface. Since the accuracy of the vertical velocity calculated by prognostic models is not known, leaving the top boundary at that level may potentially introduce an error. Please explain how the top boundary conditions are set in the model and how flux across the top boundary is handled in the mass conservation calculations.

Page 6-5: CAMx initial and boundary conditions should utilize aircraft data.

Page 7-2: CAMx should be compared with ARB's simulations.

Page 7-2: CAMx process analysis was previously mentioned, but it is not clear how it will be used for model evaluation. Model evaluation for ozone precursors was mentioned but a detailed list will be most useful.

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

Sincerely,

/s/

John DaMassa, Chief
Modeling and Meteorology Branch

cc: Mr. Dave Souten
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101 Rowland Way
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Mr. Phil Martien
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August 1, 2002

Bob Nunes' Comments on July 2002 Draft Modeling Protocol for Bay Area 2004 SIP

Dear Mr. Emery:

Thank you for the opportunity to provide input on the above draft modeling protocol. I hope that the following comments and questions useful for establishing the protocol for this study.

General

Overall, the protocol is nicely organized and detailed and, once a few issues are clarified, it should provide a good reference for the overall direction and intent of the project.

Purpose and Objectives of this Study, Pg 1-2

A concern with the proposed approach is the apparent decoupling of the time frames of the immediate need to develop a SIP revision for the San Francisco Bay Area (SFBA) with the goal of assessing regional transport. If the time frames for these two assessments are too detached, it is possible that a NOx rich SIP plan could be developed which shows reduced ozone locally in the SFBA that is later discovered to contribute to higher ozone downwind. Since the optimum VOC/NOx ratios for the Bay Area SIP may not be the same as what is best for reducing transport to areas downwind of the SFBA, the local and regional assessments should be developed concurrently. Since mutually exclusive results are possible, we feel that transport modeling should be an integral part of the SIP modeling process.

The language in the protocol for the longer range objective regarding transport is also somewhat ambiguous. The objective states that the project will "Provide the District with a modern tool base that can be used to analyze regional ozone problems and inter-basin transport.." This suggests that a modeling tool will be developed that can be used by the Bay Area to analyze transport, although regional transport assessments are not necessarily stated as being part of this study. However, based on the discussion at the MAC meeting it sounded like at least some transport modeling would be part of the subject modeling project. It should be clarified that not only will a transport modeling tool be developed but that a certain amount of analysis will be done with it as well, if that is the actual plan for this project.

Assuming that transport is to be evaluated, it should be clarified in the protocol how transport will be assessed in relation to the SIP development modeling. For instance, will emission masking runs be developed for the primary SIP scenarios developed in the modeling?

Episode Selection/Representativeness, Pg 2-1

The interim report prepared by T & B Systems entitled "Characterization of the CCOS 2000 Measurement Period" November 2001, suggests that the summer 2000 field study period was characterized by transient weather systems moving over Central California which inhibited the development of extended ozone episodes and limited multi-day carryover of ozone. This suggests that the limited episodes available from the CCOS field study may not have been very strong. If the events available to characterize SFBA episodes do not carry a strong signal, then the weakness of the events could be of concern in terms of achieving the two objectives of the study.

As described in Section 2., only two episodes (mid-June and late July) involving federal exceedances in the SFBA were captured during the CCOS field study. Unfortunately, the mid-June episode was an unusual early season event which preceded the Primary Study period and the late July event featured a peak ozone value in the SFBA of only 126 ppb, just several ppb's above the standard. This represents a near base case attainment situation where very little emission reduction would need to be demonstrated. More severe exceedances have occurred in the Bay Area since then suggesting that the late July CCOS event was not a strong test.

The basic questions are, can these episodes provide a solid foundation for developing an effective SIP attainment strategy for the SFBA and can more severe synoptic conditions be expected that typically produce episodes that are more testing than those encountered during CCOS?

Are the ozone levels from the available episodes higher or lower than the current design value?

If design value scaling is applied, as suggested on Pg. 8-1, is there any assurance that this approach will compensate for "real-world" deficiencies in the episodes themselves?

In the downwind North Central Coast Air Basin (NCCAB), the CCOS episodes were very weak, short in duration and not very representative of typical exceedance periods. This was likely due to the limited strength and persistence of the episodes. Much stronger events occurred in 1995, 1996, 1998 and more recently, in July 2002.

How will the available episodes be used to characterize transport in the NCCAB, especially if the transport signal in the available episodes is weak?

It would be useful to include a study that focuses on these questions, either based on existing or yet to be developed references. Although there is some general discussion in the protocol regarding cluster analysis of the CCOS episodes, it would be useful to expand on this to address the specific issues of how strong these events are compared to past episodes, such as the air stagnation events back in the mid-1990's that originally put the Bay Area back into nonattainment and produced significant transport to surrounding areas. If existing references

are not complete, a study of how representative the available episodes are for addressing the two objectives of the program could be added to the project. This would help to answer the question of how the modeled episodes compare to other episodes that have historically occurred in the Bay Area and affected downwind areas.

Grid Domain, Pg. 6-2

The proposed multi-grid domain shown in Figure 6-1 provides a high (1 km) degree of definition of conditions over the urban SFBA and then quickly transitions into a coarse (12 km) grid in the downwind areas. Other photochemical modeling projects have generally maintained a 4 km grid structure over most of Central California. Developing a high resolution grid for RAMS and CAMx over the SFBA seems understandable since the Bay Area is the focus of the SIP modeling objective and past modeling with RAMS at 4 km suggested that local flow enhancements caused by terrain may be better simulated with a higher resolution grid. However, a concern is whether or not the 12 km coarse grid is adequate to achieve the objective of characterizing transport into the downwind region.

Is the proposed 12 km grid adequate to address transport and will urban emissions from the Bay Area, especially from the area and mobile sources, be diluted in the model as they travel into the course grid downwind domain?

Air monitoring data from the National Park Service station at Pinnacles National Monument is used to establish the NCCAB's designations for the state and federal ozone standards. Prior analysis of exceedances at Pinnacles by the ARB indicated that this site is impacted by overwhelming transport from the SFBA. In looking at Figure 6-1, it appears that this site is very close to the southerly transition between the 4x4 and 12x12 km grid domains. For transport analysis, it would be preferable to slightly extend the 4 km grid so that Pinnacles would be well within the fine grid domain, rather than near the boundary.

Regarding the vertical resolution of the grid, how will that be determined and will aloft measurements of temperature and ozone be taken into account in order to make sure that elevated layers of ozone aloft are adequately captured by the model?

Future/Attainment Year Ozone Modeling, Pg. 8-1

The year 2006 (pg 8-1) is indicated as the target attainment year required by EPA.

Given this date as a fixed reference point, will the basic product of the modeling described in Section 8. be to determine the configuration(s) of the inventory necessary to achieve this goal or whether or not this near-term date is feasible?

Minor Notes:

1. Exceedance Threshold, Pgs 2-1, 2-4, 2-5 - For purposes of determining exceedances of the federal 1-hour standard, hourly average concentrations of 125 ppb and higher are regarded as

exceedances (120 ppb appears on various pages). This is because of the standard was originally promulgated in units of ppm (0.12 ppm) so exceedances begin at 0.13 ppm or 125 ppb and higher

2. MAC Contact List, Pg 1-9 - Please note the number for John DaMassa is (916)324-7167, (322-7167 is shown on the contact list).

Feel free to contact me regarding any of these items,

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Monterey Bay Unified APCD

Review of Draft Modeling Protocol for
2004 Bay Area SIP.
July 15, 2002

Rob Demandel-BAAQMD
Tom Perardi-BAAQMD
Chris Emery-Environ
Dave Souten-Environ
Mary Mahoney-Environ

Overview: This first draft is succinct, and appears to address most of the issues. In a number of instances, the protocol anticipated issues that I noted in the early chapters and addressed them in the appropriate latter chapters. As noted in the summary, this is a work in progress, and more detail will be added as work starts and more specific issues arise. But, given the number of projects and the total number of years in modeling that the Environ staff has, I would expect a decent first draft. Specific comments follow.

Chapter 2: Episode Selection
It is clear that there are only two episodes in the CCOS data base that will even qualify for modeling, and neither is good. This is no fault of the District or Environ staff. What would be useful in updated versions are more detailed meteorological analyses, or summaries of analyses done under the CCOS contracts, to show where each of these episodes fit into the representativeness of episodes in the Bay Area. Initial analysis suggests that the late July episode is similar to the August 3-6 SARMAP episode. But the June 15, 2000 episode does not appear to be typical of past episodes since only a single site-Livermore-exceeded. However, with the most recent exceedances on July 9 and 10 of this year, the question in my mind is whether these are two "weird" episodes or representativeness of what we may expect to see in the future when temperatures become extreme in the central Bay Area?

Later on, there will be need to discuss how the June 15 episode will be simulated. That detail is not yet in Chapter 5 of the protocol. But it should be expanded when timely. I would suggest that after adequate performance is achieved with the late July episode, that the initial simulation for the June 15 episode be run in a hands off manner. This approach would assume that those changes in model formulation, model inputs, etc., should translate into appropriate chemistry and physics applicable to the June episode. The only ringer is a much more limited and routine database.

Chapter 3: Model Selection
In the bullets under Photochemical Modeling (3-1, 3-2), I would suggest that process analysis and other probing tools be added. These are discussed in later chapters. Similarly in the Regulatory Issues, I would suggest listing the 1999 EPA draft 8-Hr. Guidance (which appears in later chapters). Under Strategic Issues, I have two which should also be discussed in more detail in later chapters. The first is whether the predictions for attainment can be placed in a

probabilistic framework, per some of the work that S. T. Rao has published. The second is whether the changes in ozone with respect to changes in emissions are significant, or within the noise of the system. This has been a real issue in previous regulatory actions, as for instance with respect to the Bay Area refinery NOx rule. Certain agencies considered changes in ozone as real and significant even though the response to emissions reductions was 1 ppb or less. One may think of this as uncertainty analysis, and it needs to be addressed. A reference to recent work by Moore and Lodergan , under API support, speaks to one approach, and can be found in Atmos. Envir. 35, 4863-4876 (2001).

With regard to selected modeling systems, while all can be used for PM SIPs, one needs to be cautious. Both the District and Environ are well aware that to date there has not been a full fledged evaluation of model performance for PM due to lack of a data base that can support such evaluation. CRPAQS may remedy this.

Chapter 4: Meteorological Modeling

Does RAMS allow for the development of 3 D trajectories so that one can follow a parcel of air to determine where it goes? For other applications, such as the ARB transport mitigation assessment, I have only seen 2 D trajectories. These are extremely questionable under most circumstances. Having the ability to look at a 3 D trajectory means that one does not even have to incorporate chemistry if the trajectory does not move a parcel to an area of high ozone concentrations commensurate with those high concentrations. Thus, it may be a good preliminary analysis tool.

Should there be some discussion of RAMS's ability to handle fog formation and dissipation? While clouds are mentioned, there is not enough information in the text to know how well cloud (and fog) formation are simulated. As I remember, this is a difficult area for prognostic models. Moreover, how does one evaluate and make changes to improve the physics of the model if need be?

In terms of the statistical parameters, and evaluation using REVU-GS, are there concerns with missing problems because statistics applied domain-wide can generalize results? Are statistics applied on sub domains? Or in ways that don't allow problems to averaged away?

Chapter 5: Emissions Modeling

Based on the definitions in the appendices, VOC does include methane and ethane. Therefore, should we assume that these two compounds will be accounted for in both the anthropogenic and biogenic inventories? These compounds, along with CO are important to have in the inventory as recent work by Reynolds and Blanchard have shown that as reactive VOCs are reduced, these relatively "inert" species can contribute to ozone formation in some places in Central California.

The American Petroleum Institute funded a review study by Matson and Hall, U C Berkeley in 1995 on soil NOx. I will forward a copy of the report to Jim Wilkinson this week. It has been shared with ARB. I also believe that ARB did try to develop soil NOx emissions factors in the mid 90s based on experiments in the San Joaquin Valley.

At the last meeting, during the emissions discussion, I mentioned ship emissions. I went to the BAAQMD 2001 CAP to look at the emissions for ships. The estimate is 10 tpd of NOx. I believe that it will be worthwhile to determine whether this estimate is appropriate on a day specific basis for the two episode periods. My gut level impression is that it is low. But equally as important, these emissions lie in the expected flow field for moving precursors from the central Bay area to downwind receptors.

Finally, with respect to the 2000 base case, it is understood that between ARB, the District, the co-lead agencies and Environ, that the 2000 census data will be used to develop the final 2000 base case inventory for modeling.

With respect to the future year emissions inventory, the protocol lays out the normal approach to projection to 2006. However, there are few instances in which these projections have really come close to reality on a retrospective review. It is clear that in 1999 no one would have predicted the "dot com" crash, and the impacts that economic event had on area and mobile source emissions. Recognizing that there is probably little flexibility in the regulatory guidance with regard to use of more than one projected future inventory, there is still need to project a few alternatives so that for some major source categories we have upper and lower bounds estimates. We need to at least make a set of future base case simulations with these alternative projections to see if there are significant differences in ozone reduction. This is particularly important given that most of the stationary sources are already controlled to the point that very little additional reductions will occur within that category regardless of projections. But with mobile and area sources probably responding to different economic projections more than all other sources, and also being the largest categories, alternative future base year emissions inventories should be estimated and simulated.

Chapter 6: CAMx Input Data Preparation

While the protocol speaks to a 1 km nesting for sensitivity tests, I would assume that, if warranted, the modeling effort will use the 1 km nesting for regulatory purposes. Since topography is a major factor in ozone formation in the Bay Area, it is clear that a 4 km nest will not resolve some of the wind flow features critical to ozone formation.

The protocol notes that in the vertical, CAMx will match every RAMS layer within ~ 1 km of the surface. Does this statement have a technically supportable basis? While there is acknowledgment of sensitivity tests for vertical resolution, 1 km height seems low given the topography and critical flow features that need to be resolved.

In the discussion of the initial and boundary conditions, it would be useful to expand the discussion to provide more detail. For instance, will boundaries be treated as uniform in the vertical and/or horizontal? I believe that this was done for SARMAP. Yet the 1990 aircraft measurements showed that a flux plane in the northern Valley was not uniform. Admittedly this was not a boundary flux plane, but the analogy may be appropriate. This may be critical especially for those boundaries which do not represent, "clean ocean" conditions-which may

not be clean. In terms of the initial conditions, will there be sensitivity simulations to show that the spin up reduces their influence to essentially zero?

Chapter 7: Base Year Model Performance Evaluation

I am happy to see that the draft 8-hour ozone modeling guidance will be used as a guide for evaluation. It really supercedes the out-of-date 1991 EPA guidance and the older ARB guidance. As one of the external participants in that process, there was a lot more knowledge about modeling and the real world available than back in the early 1990s-and perhaps more cynicism about use of the model results without corroborative analysis to challenge the model. As a general question, while the focus of this effort is on the Bay Area, what happens if the performance varies among sub domains? For instance, if the Bay Area performance is acceptable, but other portions of the overall domain do not show good performance, even after diagnosis, will the simulation be accepted. I think that this is an area for discussion. While poor performance in a sub domain may be due to problems with that sub domain, it may also be due to problems of compensating error throughout the modeling system. We need to ensure that we don't accept the model in the latter case.

With regard to the above point and the use of model statistics, will the statistics be done by sub region as well as the entire domain? Similarly, will all of the other recommended tests be done both on the full domain and sub domains as appropriate?

While it is mentioned in the next chapter, I would encourage generation of ozone response surfaces (see page 8-2, Matrix) be done on the base case simulation rather than on the future case simulation. While I recognize that estimates of growth could shift the sensitivity of precursor, a matrix analysis done on the future base case incorporates all of the uncertainties associated with growth projections, and adds uncertainty to the resultant ozone response surface. This is minimized in the base case. Moreover, application to the base case, with generation of response surfaces for many sites allows comparison of these results to those generated through observational modeling. It also allows one to look at reductions and use process analysis to understand how the underlying chemistry responds to reductions.

In addition to the sensitivity simulations listed on page 7-5, I would also suggest that at least one simulation be done by changing the base case emissions inventory to reflect the changes in both VOC and NOx emissions that occur on a switch from a week day to weekend. There is enough information that has been generated on these differences through the ARB Weekday/Weekend Effects program that generation of the weekend inventory should not be tremendously difficult. We need to understand how a strategy developed for a weekday episode will affect weekend ozone levels.

Finally, as previously noted in my comments on Chapter 2, it would be very useful to provide some uncertainty analysis. We really need to understand whether the projected changes in ozone due to reductions in precursor should be considered significant or within the noise of the system.

Chapter 8: Future/Attainment Year Ozone Modeling
I have already suggested that the Matrix runs be done for the 2000 base case. Given the potential uncertainty with projected emissions, I am not sure if it is worth doing a second set for the future year base case. Maybe that decision should be made after looking at the base case matrix simulations.

As mentioned in my comments on Chapter 3, is it possible to add a probabilistic assessment of attainability for the Bay Area? While I referenced the Rao work, there may be other approaches. Given the history of the Bay Area, such an assessment would be very useful both technically and from a policy aspect.

Steve Ziman
Chevron Texaco Energy, Research and Technology, WSPA

Cc:
Tom Umeda-BAAQMD
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Comments on July 2002 Draft Modeling Protocol for Bay Area 2004 SIP

Prof. Robert Harley
Department of Civil and Environmental Engineering
University of California at Berkeley

Comment 1: On page 1-3, I am concerned about the rigidity of project requirement #7, that photochemical modeling will meet or exceed EPA/CARB model performance criteria. Uncertainties in various inputs used for the modeling may lead to predicted "base case" ozone levels that disagree with observations to a larger degree than desired. This project requirement (#7) may force the contractors to select among available input data fields based on which ones yield the best agreement between model predictions and observed ozone. This has proved to be a poor basis for selecting among alternative input data fields in the past, and can lead to the introduction of significant compensating errors in the modeling. This in turn undermines the accuracy of the model when applied to future-year scenarios for which model performance is no longer "tuned".

As an example, in prior regulatory air quality modeling for the SoCAB, a variety of diagnostic and prognostic meteorological models were applied to 3 different air pollution episodes. Different approaches to met modeling were selected for each episode based on which gave the "best" ozone predictions. Likewise in past modeling for the SoCAB, boundary conditions were artificially increased to compensate for bias in emission inventory estimates within the modeling domain. In the current project, there are different versions of RAMS that will be used, analysis vs. observation nudging, alternative chemical mechanisms, decisions to be made about appropriate boundary conditions for each episode, etc. For the met modeling, I recommend that a performance evaluation as described on p. 4-8 provide the basis for selecting among available meteorological input fields.

Comment 2: I have several concerns about the selection of air pollution episodes that will be the focus of this study. The justification for selecting the two episodes identified on p. 1-3 (item #5) is inadequate and some relevant criteria may not have been considered. I recommend further consideration and elaboration of relevant criteria before selecting episodes.

The selected episodes do not include any high-ozone weekend episode days. The 14-15 June 2000 episode is a Wednesday/Thursday, and the 30 July-2 August episode extends from Sunday through Wednesday (Monday 31 July was the only high-ozone day within the Bay Area). Therefore the attainment demonstration will not reflect conditions that are known, on average in the Bay Area, to lead to higher ozone. The protocol document should describe how attainment of the ozone standard under weekend conditions will be demonstrated. Perhaps ongoing parallel efforts of BAAQMD staff to simulate a summer 1998 episode that includes weekend high-ozone days can address this issue.

Although there is discussion in Chapter 8 about the use of design value scaling, it would be helpful to include in Chapter 2 more information about the recent history of high-ozone days in the Bay Area from 1998-2001. This would improve credibility of the modeling effort, by showing that the episodes selected include some of the most adverse meteorological conditions with respect to ozone formation, and that the resulting emission control program is likely to be adequate to attain air quality standards.

The 14-15 June 2000 episode had high ozone within the Bay Area (152 ppb), but occurred before the CCOS field program was fully "up and running". For example, key instrumentation at the main Bay Area research site, located in Sunol just upwind of Livermore, was still being installed at this time. Nevertheless, it is essential to include severe Bay Area ozone episodes, possibly including 14-15 June, in the modeling effort.

The later episode (30 July – 2 August 2000) will probably be most useful for assessing transport of ozone and precursors into the Central Valley. Within the Bay Area, a peak ozone concentration of 126 ppb was observed for this episode.

Comment 3: The schedule for the modeling effort appears realistic given the expertise of the contractors and the modeling tools and data that are readily at hand. However, the schedule for attainment of the ozone standard may not be realistic, if this study concludes that significant additional control measures are needed. There will not be much time to implement major new control measures that will affect ozone in the 2004-06 timeframe.

Comment 4: On p. 3-2, I am concerned by the inclusion of the Carbon Bond-IV mechanism as part of a "current" and "state-of-the-science" modeling effort. The Carbon Bond IV or "CB4" mechanism provides a description of the relevant atmospheric chemical reactions that form ozone, as summarized by Gery et al. in the late 1980s. Although an up-to-date chemical mechanism (SAPRC99) is mentioned, it is made clear elsewhere in the protocol document (see p. 6-6) that CB4 is the "default" mechanism that will be used in this study, and that SAPRC99 may not be used at all.