UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VIII
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MEMORANDUM

From: Kevin Golden, Regional Meteorologist

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To: Dennis Doll, Model Clearinghouse Coordinator
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Subject: Selection of Intersections for Modeling in Regulatory Application of UAM/CAL3QHC

The purpose of this memo is to present a modeling issue involved with the use of UAM and CAL3QHC in the Denver CO carbon monoxide SIP attainment demonstration. We have indicated Region 8's interpretation of guidance on the issue, and request the Model Clearinghouse position on this topic.

BACKGROUND

Denver is classified as a moderate Carbon Monoxide non-attainment area with an 8 hour average design value of 16.2 ppm. The Denver CO modeling protocol was approved by the region in May 1992. Specific intersections to be modeled were not identified in the protocol. The State showed attainment on each of the six highest ranked intersections selected for modeling, following screening criteria contained in "Guideline for Modeling CO from Roadway Intersections", EPA-454/R-92-005. The State subsequently found that the six busiest intersections for traffic congestion were located in the suburban areas, where background air quality levels are relatively low. Application of CAL3QHC at these six locations, combined with UAM predicted background levels, showed the year 2000 concentrations at levels well within the CO NAAQS. The Region also requested the State to model an additional intersection in the central business district, to ensure that control strategies provide for attainment at hot spot locations in the urban core area, not just at suburban locations exposed to significantly lower background concentrations.

The State performed preliminary CAL3QHC modeling at three additional intersections in the Downtown area: Speer & Auraria Blvd.; Broadway & Colfax; and Broadway & Champa. These preliminary 1995 results showed predicted concentrations at the Speer/Auraria and Broadway/Colfax intersections were up to 6 ppm higher than concentrations modeled at the CAMP monitor (Broadway & Champa). Because of modeling uncertainties, the State opted not

to include the CAL3QHC modeling results for the two higher intersections in the current SIP, deferring consideration of these locations until additional saturation monitoring studies could be conducted at these intersections. The State selected Broadway and Champa as the intersection to use in the SIP attainment demonstration because the on-site air quality/meteorology monitoring data at this location provided more confidence in the results. There are significant and unique micro-meteorological effects influencing each of the three central business district intersections, including: high-rise office buildings, channeling of the wind down "urban street canyons", and urban heat island effects. Since the Diagnostic Wind Model does not include any of these effects, the State did not consider these data appropriate for use in microscale modeling.

REGION 8 POSITION

Our position is that the State's intersection analysis is consistent with national policy and other recent UAM/CAL3QHC modeling applications. Consequently, Region 8 would not require the State to demonstrate attainment of the NAAQS for the downtown intersections (other than CAMP). The SIP control requirements would be based on the State's UAM/CAL3QHC predictions at the CAMP intersection in the downtown area and at other intersections in the outlying areas. Our position is based on the following factors:

1) Hourly concentrations calculated with CAL3QHC in the downtown area during both episodes are generally not valid because of calm wind conditions. The CAL3QHC predictions at the two downtown intersections without on-site weather data are particularly questionable. At these locations, estimated wind speeds were frequently below the starting threshold of nearby wind speed sensors. Typically, predicted and observed wind speed values were less than the 1 meter per second threshold established for the CAL3QHC model (Reference; page 29 of CAL3QHC Users Manual, EPA-454/R-92-006. Also see Guideline on Air Quality Models, Section 9.3.4.2 recommendation for use of CALMPRO in treatment of calms). Given that meteorological conditions were outside the stated limits of the model, the results are not considered sufficiently reliable to be used for analysis of intersection concentrations.

2) There are also concerns with the hourly CAL3QHC concentrations calculated at the CAMP intersection due to calm winds for a number of hours during both episodes. However, it is important to note two facts, one; application of EPA's suggested treatment for calm winds would actually reduce the predicted CAL3QHC intersection-related concentration at CAMP for both the 1988 base year and the 2000 attainment year projections, and, second; since the CAMP intersection component accounts for less than 10 percent of the total concentration, the performance evaluation results and the attainment year projections would not

change significantly from those submitted by the State.

3) Saturation monitoring studies conducted during the winter of 1993/1994 do not support the modeled predictions of significantly higher concentrations at Speer/Auraria and Broadway/Colfax intersections. While the data indicates that significant concentration gradients can occur in the vicinity of Speer and Auraria (see figure 1), these data also show that carbon monoxide concentrations at these two intersections were very similar to those observed at the CAMP station during moderate CO episode conditions (see figure 2). In fact, in nearly all cases when CO levels exceeded 6 ppm, concentrations were higher at CAMP than were recorded at either intersection. The State is conducting additional CO sampling this winter (1994/1995), however, the final results are not yet available. From informal discussions with the State we understand that preliminary 1994/1995 monitoring data continues to support use of CAMP as the downtown maximum concentration monitoring site. For both the December 23, 1994 and January 5, 1995 episodes, concentrations at CAMP were nearly 1 ppm higher than at Speer/Auraria (No monitoring data are available from the Broadway/Colfax intersection during these episodes).

4) There is a high degree of uncertainty in estimating vehicle emissions at the Speer/Auraria and Broadway/Colfax intersections. A major problem is in estimating the fraction of vehicles operating in "cold start" mode. During the first few minutes of operation vehicles emit carbon monoxide at much higher rates than when operating at normal temperature. Intuitively, we would expect a higher proportion of "cold start" vehicles in the evening rush hour near the CAMP monitor given the extensive parking lots in the area. Conversely, for intersections containing major arterial roadways (such as Speer Blvd and Colfax Ave.) a lower proportion of vehicles operating in cold start mode would be expected. The specific values for these parameters used by the State in modeling the Speer/Auraria and Broadway/Colfax intersection may not fully take these differences into account, hence these emissions estimates have a high level of uncertainty.

For these reasons the Region believes that the concentrations at the Speer/Auraria and Broadway/Colfax intersections are indeterminate. Immediate promulgation of a control strategy based on the State's preliminary CAL3QHC modeling results at these intersections is not technically or legally defensible at this time. Application of EPA's suggested calms processing method would slightly reduce predicted CO concentrations at the CAMP monitor, however, this change is not expected to significantly affect the final attainment demonstration results. However, to ensure that the NAAQS is protected, Region 8 is requiring the State to continue saturation monitoring at these intersections during the 1994/1995 winter season. If the monitoring data indicate that the SIP will not

protect the NAAQS, then the State would be required to develop appropriate measures to mitigate these higher CO levels.

REQUESTED ACTION

Region 8 is requesting that OAQPS determine if our position on this SIP modeling issue is consistent with the national modeling policy and the goals and requirements of the CAA. As always, we would appreciate it if you coordinate OAQPS response to this issue with appropriate staff in the SIP and the air quality monitoring groups. If you have any questions or need additional information on this subject, please contact either Kevin Golden at 303 293-0955, or Larry Svoboda at 303 293-0962.