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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue
Seattle, Washington 98101

March 26, 1997

REPLY TO
ATTENTION OF: OEA-095

Mr. Jim Baumgartner
Department of Environmental Conservation
State of Alaska
410 Willoughby Avenue, Suite 105
Juneau, Alaska 99801-1795

Dear Mr. Baumgartner:

This is in response to your letter of March 4, 1997, to Wayne Elson of our office, requesting EPA approval of the use of the Ozone Limiting Method (OLM), an air modeling method that is no longer recommended in EPA's Guideline on Air Quality Models (40 CFR 51, Appendix W)[1]. Based on the following discussion, the State of Alaska may use OLM in any situation where the sources and predicted impacts of concern are located in a rural area, as defined in Section 8.2.8 of the Guideline. This generic approval is valid until EPA updates the recommended method for modeling nitrogen dioxide (NO_2) concentrations in Section 6.2.3 of the Guideline, or until rescinded by EPA Region 10. OLM may be applied using either the "Second Level" - annual approach, or the "Third Level" - hourly approach, as was recommended in the Guideline prior to August 1995. It is important that the ambient O_3 data be adequately representative of (i.e., not under-estimate the ambient O_3 concentrations associated with) the source-receptor situation to which the OLM is being applied.

In the OLM[2], the NO_2 emissions of a typical combustion source are assumed to be 10 percent of the total oxides of nitrogen (NO_x) emissions. The remaining 90 percent of NO_x emissions are assumed to be nitric oxide (NO). NO is assumed to be immediately converted to NO_2 in proportion to the concentration of ozone (O_3) present.

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[1] During the last revision of the Guideline on Air Quality Models (40 CFR 51, Appendix W), EPA's Office of Air Quality Planning and Standards (OAQPS) replaced the recommendations for use of the OLM with a recommendation to use the Ambient Ratio Method (ARM). Thus, the mention of the OLM was removed from Section 6.2.3 of the Guideline. However, a reference to the OLM was inadvertently retained in Section 8.2.6 of the Guideline. Based on our understanding of the intent of OAQPS to no longer recommend the OLM in the Guideline, we are treating the OLM as a non-Guideline method, notwithstanding its mention in Section 8.2.6.

[2] Cole, H. S., and J. E. Summerhays, "A Review of Techniques Available for Estimating Short-Term NO_2 Concentrations," *Journal of the Air Pollution Control Association*, Volume 29, Number 8, August 1979, pp. 812-817.

The OLM was intended to be applied to the plume of a single source, rather than in multiple source situations. Therefore, to ensure the potential NO_2 impacts are not under-estimated in multiple source situations, the OLM should be applied to each individual plume in the modeling analysis. This approach assumes that the full ambient concentration of O_3 is available to each and every plume. Please note that this "plume-by-plume" approach is different from the "combined plume" approach that was typically used in the past.

The OLM does not account for the conversion of NO to NO_2 through reactions between NO and organic radicals. Thus, depending on the significance of this method of forming NO_2, the OLM may tend to under-estimate the resultant NO_2 concentration. For example, in urban atmospheres, concentrations of organic radicals may be relatively high, and the NO_2-forming potential of reactions of NO with organic radicals may be significant. In such a case, the application of OLM may under-estimate the NO_2 concentration. In rural atmospheres, concentrations of organic radicals may be relatively low, so that the reactions of NO with organic radicals to form NO_2 may not be important. Consequently, the reaction of O_3 with NO to form NO_2 may be the only important NO_2-forming reaction in rural areas, and, in this case, the OLM should not under-estimate NO_2 concentrations.

As a first approximation, we can use the objective urban/rural classification scheme in the Guideline (Section 8.2.8) as a surrogate to determine areas where the formation of NO_2 through reactions of NO with organic radicals is important. Where the sources and impacts of concern are located in an urban area, application of the OLM may have the potential to under-predict NO_2 concentrations. On the other hand, where the sources and impacts of concern are in a rural area, the application of OLM should not tend to under-predict NO_2. This surrogate should not be employed, however, in situations where ambient monitoring or emission estimates of organic radicals suggest that reactions of organic radicals with NO to form NO_2 may be significant.

Two other factors are important in providing some confidence that OLM should not under-estimate NO_2 concentrations. First, the OLM inherently assumes that the chemical reaction of O_3 with NO to form NO_2 occurs immediately upon emission of the exhaust from the stack, ignoring that fact that it takes time for the plume to mix with the ambient air. Secondly, the OLM ignores the photo-dissociation of NO_2, which would tend to reduce the NO_2 concentrations.

In conclusion, it appears that application of the OLM to NO_x point sources will produce reasonably conservative results, if the sources are treated on an individual plume basis, and if the sources and their impacts are located in rural areas. In urban areas, we cannot have the same confidence in OLM's conservatism unless it can be shown that ambient concentrations of organic radicals are inconsequential relative to NO_2 formation.

Please contact me if you have any questions.

Sincerely,

Robert B. Wilson
Regional Meteorologist

cc: W. Elson, OAQ
J. Tikvart, OAQPS