February 8, 2001

REPLY TO
ATTENTION OF: OEA-095

Mr. John Kuterbach
Air Permits Program Manager
Alaska Department of Environmental Conservation
410 Willoughby Avenue, Suite 105
Juneau, Alaska 99801-1795

Subject: Permission to Use PVMRM to Estimate Ambient NO_2 Concentrations

Dear Mr. Kuterbach:

Last year, in a letter dated March 17, 2000, from John M. Stone of your office, to Bonnie Thie in our Office of Air Quality, your agency requested permission to use the Plume Volume Molar Ratio Method (PVMRM) to refine modeled nitrogen dioxide (NO_2) concentrations in ambient analyses conducted under your New Source Review programs, including Prevention of Significant Deterioration. This request was referred to me. Although the method appears to show promise for regulatory use in the future, for reasons discussed below, we are not able at this time to approve, on a generic or case-specific basis, the use of PVMRM as an acceptable alternative to models/methods recommended in EPA's *Guideline on Air Quality Models* [40 CFR 51, Appendix W].

I reviewed the materials you submitted with your request, including the two papers in the *Journal of the Air and Waste Management Association* (November 1999), authored by Pat Hanrahan, describing the development and evaluation of PVMRM, and also including some comments of Ned Meyer of OAQPS. In addition, I obtained some comments on PVMRM from John Summerhays of EPA Region 5, and co-author of the Ozone Limiting Method (OLM). Lastly, I had discussions with the PVMRM developer, Pat Hanrahan, and with Alan Schuler of your staff.

As you mentioned in your agency's request, PVMRM clearly has advantages over methods currently in use for estimating maximum NO_2 impacts from point sources of oxides of nitrogen (NO_x). PVMRM is relatively simple, it handles multiple sources, and it appears to be less conservative at near-field receptors (without significant under-prediction) when compared to OLM, the Ambient Ratio Method, and Full Conversion. From a theoretical standpoint, PVMRM appears to be a simple, but reasonable attempt to account for the oxidation of a NO_x plume to NO_2. While there is some uncertainty about the effects of some of the simplifying assumptions in PVMRM, many of these assumptions appear to bias the results towards conservatism (i.e., an over-prediction of NO_2 impacts). The performance evaluations of PVMRM, described in one of the AWMA journal articles mentioned above, are limited in scope, but provide some evidence that PVMRM predictions are reasonable, or

conservative, when compared to measurements.

There are some reasons, however, that we cannot approve the use of PVMRM at this time. First, the code for PVMRM has not been standardized, and is not currently in a form for distribution in the public domain. To be approved as an alternative model, it is critical that the method be publicly available in a commonly used computer code (e.g., Fortran) to allow the method to be consistently applied in regulatory applications, and to facilitate evaluation and testing of the method. It would be best if the PVMRM option was made available in the AERMOD modeling system and the Calpuff modeling system.

Second, there is very limited sensitivity testing of PVMRM. While the existing applications of PVMRM are encouraging in that they indicate reasonable model behavior, PVMRM needs to be tested on a much wider variety of NO_x sources. This additional sensitivity testing can be more easily accomplished when the PVMRM method is installed in a model such as AERMOD.

Finally, I offer a couple of recommendations (stemming from my discussions with Alan Schuler and Pat Hanrahan) for improving the practicality of the method for routine regulatory applications. Currently, the method can only be applied as a post-processor to the ISCST3 model, and it can only treat a single receptor at a time. When the method is installed in a modeling system such as AERMOD, it can be made applicable to multiple receptors. Also, for each source analyzed, the percentage of NO_x emitted as NO_2 should be an input variable, rather than being 'hard-wired' as 10%. For instance, some combustion sources emit a much higher or lower percentage of NO_x as NO_2 in their exhaust. This variability in actual NO_2/NO_x emission ratios can and will have some palpable effect on simulated impacts.

In conclusion, the PVMRM method shows promise as a relatively simple regulatory tool for improved assessment of NO_2 impacts of point sources of NO_x. Once the method is installed in a regulatory modeling system, and it has received thorough sensitivity testing, perhaps PVMRM will be acceptable as an alternative model.

Sincerely,

Robert B. Wilson
Regional Meteorologist

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