DTE-498-91

COMMONWEALTH of VIRGINIA

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December 12, 1991

Ms. Marcia Spink, Chief
Air Programs Branch
U.S. EPA - Region III
841 Chestnut Building
Philadelphia, PA 19107

Dear Ms. Spink:

The department has received a modeling analysis which involves the use of an approach that we believe to be non-guideline. We request that an opinion on the approach be issued by EPA Region III in order to assist us in our evaluation of the analysis. The situation is briefly described below and supporting documentation has been enclosed with this letter.

Air quality modeling conducted by department staff of an existing gas pipeline compressor station near Unionville (Orange County), Virginia predicted violations of the NO_2 NAAQS. The modeling was conducted assuming that all NO_x emissions were composed of NO_2. When the source was advised of the existence of potential problems, they opted to remodel the station using refined emissions data as well as refined building dimension and source configuration data. Additional refinements were incorporated into the approach regarding the initial ratio of NO/NO_2 in the stack and regarding the chemical interactions occurring outside of the stack. Specifically, an exponential decay method designed to approximate the conversion of NO to NO_2 was used to show that, at receptors where appreciable amounts of NO had converted to NO_2, considerable dispersion of the plume had occurred, diluting the concentrations to levels below the NO_2 NAAQS.

Along these lines the department had previously approved use of the ozone limiting method as described in section 6.2.3 of the **EPA Guideline on Air Quality Models** (excerpt enclosed). However, the department had not approved the exponential decay approach which is described in the enclosed Cole and Summerhays paper and in the air quality analysis report submitted by the source. Note that the Cole and Summerhays paper is also the original reference for the ozone limiting method.

Since the department had not previously approved the exponential decay method and since it was judged to be a non-guideline method, the source was asked to thoroughly justify the conservatism of their approach. Subsequently, documentation was supplied by the source which supported their contention that:

(1) the initial concentration of NO_2 in the stack gas is approximately 1/10 of the total NO_x emitted and

(2) a half-life of 5 minutes is appropriate for modeling the conversion of NO to NO_2 according to an exponential decay function.

During our evaluation of the air quality analysis, a resident of the Unionville area raised significant questions about the appropriateness of the initial NO/NO_2 ratio and pollutant half-life used in the analysis submitted by the source. In addition, the resident expressed concerns about the appropriateness of the exponential decay method from a theoretical perspective. A copy of one letter submitted by the resident is enclosed. Essentially, his argument regarding the exponential decay method is that the approach (which assumes a first-order kinetic process) is inappropriate for application to a higher order reaction of the type that is believed to occur in the conversion of NO to NO_2. He has further observed that the variability in reported half-lives for the conversion of NO to NO_2 can be partially attributed to the inappropriateness of using the exponential decay method (which involves the application of half-lives) to explain the conversion process.

The department believes that valid questions about the appropriateness of the approach have been raised. The concerns that we believe to be the most significant are as follows:

(1) The initial NO/NO_2 ratio used in the analysis may not be conservative. This question can be resolved by stack tests which we understand are being planned for the facility.

(2) The exponential decay method may not be theoretically appropriate to adequately address the conversion of NO to NO_2.

(3) If the exponential decay method is not theoretically appropriate for this situation, it is still possible that it could be used in a sufficiently conservative manner such that it clearly overpredicts NO_2 impacts. However, assuming that such an approach is reasonable, the department is concerned that the proposed half-life of 5 minutes is not sufficiently conservative due to the fact that a wide range of values has been reported in the literature. Some of the reported values are more conservative (i.e., shorter) than 5 minutes.

While the first concern above will be resolved by additional stack tests, the second and third concerns remain. Due to the existence of these concerns, it is the preliminary opinion of the department that the exponential decay approach should either be disallowed or used with the most conservative half-life reported in the literature. However, in order to fairly and completely evaluate all sides of the issue, the department is requesting an opinion from EPA Region III regarding the appropriateness of the exponential decay approach and the associated pollutant half-life used in this modeling analysis.

Please note in your review of the enclosed material that there are certain other clear deficiencies regarding the treatment of intermediate terrain and the use of National Weather Service meteorological data in the COMPLEX I model. The approach used in the analysis to address intermediate terrain and complex terrain impacts was not approved by the department. It is recognized that these deficiencies must be corrected. Also please note that in the correspondence you will find references to an earlier modeling report submitted by the source. This report was later revised and only the revised version has been included with this letter.

We request that your review be carried out as expeditiously as possible. If you or your staff should have any questions regarding this matter please feel free to contact Jim Browder of my staff at (804) 786-0176 or me at (804) 786-7764.

Sincerely,

Kenneth L. McBee
Chief, DTE Modeling Section

Enclosures

cc: G. Clayton, Director, Region IV
J. Browder, Division of Technical Evaluation
K. Bonds, Division of Technical Evaluation
L. Parcell, Unionville, VA

LIST OF ENCLOSURES

(1) Letter from VDAPC to W. H. Hammons (Transco) - 11/30/90

(2) Letter from VDAPC to W. H. Hammons (Transco) - 5/22/91

(3) Excerpt from EPA Guideline on Air Quality Models

(4) Cole and Summerhays paper outlining ozone limiting method and exponential decay method (JAPCA, August 1979)

(5) Letter from L. J. Parcell to G. L. Clayton (VDAPC) - 8/20/91

(6) Additional documentation supplied by Transco regarding the exponential decay method - 6/27/91

(7) Revised dispersion modeling report submitted by Transco - 7/30/91