UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
841 Chestnut Building
Philadelphia, Pennsylvania 19107

SUBJECT: Request for Review of Kammer Wind Tunnel Study Report

DATE: AUG 22 1986
(originally E-mailed 8/5/86)

FROM: James E. Sydnor, Chief
Air Programs Branch (3AM10)

TO: Joseph A. Tikvart, Chief
Source Receptor Analysis Branch (MD-10)

This is to request your review and concurrence with our analysis of some recent information submitted by West Virginia regarding the wind tunnel study carried out for the Kammer power plant (see Attachment 1, consisting of West Virginia's letter and the submittal from the American Electric Power Service Corporation (AEP)). As you know, this study was one of the first to be conducted under Section 123 of the Clean Air Act. The study was carried out to justify a 900-ft stack that was built in 1978, in conjunction with the installation of particulate pollution control equipment, to replace two 600-ft stacks. The study was accepted by EPA, by letter, in 1981 as justifying the full height of the new stack.

The stack height regulations of 7/8/85 have caused us to re-examine this study to determine its acceptability under the revised regs. The most significant issues are: 1) whether merging two flues into one is creditable and 2) the NSPS presumption.

The merged flue issue is being dealt with separately. If credit is not granted, then clearly the study must be re-done. The NSPS presumption would appear also to automatically invalidate the study, since an actual emission rate of 6.8 lb/MMBtu was utilized in the NAAQS portion of the excessive concentration determination. If the NSPS presumption is successfully rebutted by the company and a lowest feasible emission rate established (also a question being dealt with separately), AEP contends that the results of the original study can be scaled to determine creditable height. Wind tunnel results were reported for 600 ft and in 50 ft increments up to 900 ft.

Whether or not the previous results can be scaled depends on the technical merits of the previous study and whether it satisfies today's guidance on how to conduct a fluid modeling study for terrain downwash. While there are some unknowns at this point (merged flue credit and emission rate), we believe that it is important to make a decision now regarding the study's acceptability. If it is not acceptable, work needs to be initiated soon to start the study over from the beginning.

Our review of the original basis for the acceptance of the study and the information provided by AEP have led us to the conclusion that the study results can be used, assuming that merged flue credit is granted. This means the following for Kammer:

1. The 40% criterion has been met for the 900-ft stack;

2. Wind tunnel results can be scaled, once an emission limit is established, to determine what part of the stack is creditable based on the NAAQS portion of the excessive concentration determination.

Your concurrence is requested on these two specific conclusions; the rest of this memo discusses our review in more detail.

ORIGINAL BASIS FOR ACCEPTANCE

The Kammer wind-tunnel study was coordinated closely with OAQPS and ORD. The final fluid modeling guidelines, published in 1981, were in fact influenced by the experience with the Kammer study. Bill Belanger's memo of 3/13/81 summarizes the key points in EPA's review and acceptance. The memo is still quite relevant to the issue and is included as Attachment 2. The memo points out that some aspects of the study did not conform to the letter of the (then draft) guidelines, but the deviations did not contribute to granting too much stack height credit. A summary of the major issues and conclusions follows:

- o Treatment of nearby terrain: Although the terrain examined in the study is creditable under the 7/8/85 definition of nearby, all of the terrain was removed in the "upwind terrain out" case and replaced with roughness elements. Current guidance would require that only the terrain within 10Ht be removed and the surface sloped smoothly to plant base. The memorandum acknowleged that this approach was not consistent with guidance even then, but concluded that, due to the characteristics of the rest of the upwind terrain, the procedure followed gave results that were essentially the same as if the guidance were strictly followed.

- o Concentrations falling beyond the end of the tunnel: With the upwind terrain out, virtually no concentrations were observed in the tunnel. A Gaussian dispersion modeling technique was employed to define the denominator for the 40% criterion. A detailed discussion of this is contained in the memo, the conclusion being that the Gaussian results are sufficiently conservative to ensure that the 40% criterion has been easily met at 900 ft.

Our opinion is that these conclusions are still valid. Several other aspects of the Kammer wind tunnel study are discussed in the memo. These include two points of clarification: first, on the selection of the test wind speed and second, on the Reynolds number independence test results. Furthermore, shear stress profiles were not measured, and the results of the Atmospheric Dispersion Comparability tests indicated that tunnel dispersion was between D and E stability, rather than between C and D stability. These last two points also represent deviation from guidance requirements (then and now). While shear stress profiles are important, their absence in our opinion does not justify rejection of this study. Other measurements supported the wind tunnel's ability to make a realistic simulation. Finally, as the memo points out, the lower stability representation does not impact the results of the 40% test in this case.

COMPARISON TO CURRENT GUIDANCE

When the fluid modeling guidelines were finalized in 1981, a significant requirement was dropped; namely, the requirement to match the buoyancy length scale in the model. The effect of this is that wind tunnel studies can now be conducted at higher tunnel speeds, and the problems associated with lower tunnel speeds can be more easily brought under control. At the same time, however, it is likely that a study conducted at higher speeds would result in a plume rise lower than that of the full-scale stack, for highly buoyant sources such as Kammer. Thus the NAAQS showing is likely to be easier and the 40% criterion more difficult to meet than a study in which plume buoyancy and plume rise are more properly simulated.

Today's guidance would therefore probably result in a different experimental design than was used for Kammer. It is our belief that the results from a new study would not be significantly different than the current results. This belief is supported by examining the results of the "example" study performed by Snyder and Lawson for the Clinch River power plant. This study was published in 1985 and serves as a benchmark for complex terrain downwash studies. As discussed in detail in AEP's report, the similarity of the Clinch River plant and terrain to the Kammer plant and terrain, and the fact that the Clinch River creditable height is 1070 feet, lends credence to the argument that a study conducted at higher tunnel speeds would result in similar stack height credit for Kammer.

The comparison to Clinch River is not completely valid in that the study by Snyder and Lawson did not consider the NAAQS part of the excessive concentration definition. However, since the 40% criterion is likely the more difficult one to meet with a high tunnel speed study, and the Clinch River 1070 ft height is based on meeting the 40% criterion, the absence of a NAAQS comparison is not important when making this comparison.

In AEP's report tunnel concentrations are converted to 24-hour averages by the use of a factor of 0.4. This factor comes directly from Volume 10, the guidance for screening models. It is important to note that in the case of making a showing of a NAAQS violation in a wind tunnel study the concept of "conservatism" is reversed: a factor that gives a lower concentration will result in less stack height credit, hence a more conservative emission limit. In the case of a dispersion study, a higher factor leads to a more conservative emission limit. For this reason we support the use of the lower end of the range of factors that are suggested as an initial screen; namely, 0.8 for the 3-hour and 0.2 for the 24-hour conversions. As with dispersion screening, the opportunity is always available to make a case for a less conservative number, and AEP would have that opportunity as well. The case would be based on examining on-site meteorological data and developing a factor based on wind direction persistence. The initial screen would however be based on 0.8 and 0.2.

Attachment 1 contains a detailed description of the differences between the "old" and "new" fluid modeling guidance. The report makes no mention of scaling wind tunnel results based on the emission limit determined through the NSPS rebuttal process, and makes no mention of the merged flue issue. Although these questions will have to be answered, we believe that the report generally supports our two major conclusions noted above.

We would appreciate a response on this issue by August 22. If you have any technical questions, please contact Mark Garrison at 597-4553; otherwise, please contact me at 597-9075.

Attachments

cc: A. Huber ASRL w/attachments
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