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MEMORANDUM

SUBJECT: Calpuff Visibility Modeling Protocol for Regulatory Analysis

FROM: Kevin Golden, Lead Regional Modeler

Carl Daly, Chief Air Permitting, Monitoring, and Modeling Unit

TO: Tyler Fox, Leader
Air Quality Modeling Group, OAQPS

This memo seeks your concurrence with Region 8's intent to reject certain aspects of a BART analysis proposed by Otter Tail Power for the Big Stone Unit 1 EGU in eastern South Dakota. The Calmet-related issues with Big Stone have also been raised by commenter's at recent EPA/State/Local modeling workshops and in the technical literature. A long term fix of the interface between Calmet/MM5/Calpuff needs to be developed to provide consistency and accuracy in Calpuff applications. In the interim, EPA guidance is needed on how to address these issues in regulatory applications. In the absence of a refined model evaluation data set that would allow a definitive resolution to these issues, Region 8 is seeking an approach that will provide a reasonably conservative estimate of Big Stone's impact on visibility in Class 1 areas.

BACKGROUND

Region 8 has been working with the Federal Land Managers and South Dakota to develop an acceptable Calpuff modeling demonstration to determine whether the Big Stone Unit 1 power plant in eastern South Dakota is subject-to-BART. Big Stone Unit 1 is a large uncontrolled coal-fired facility that is approximately 400 km from the nearest Class 1 areas in MN. We have attempted to develop a modeling protocol with the company/FLMs/SD, however the company's consultant (Otter Tail Power's consultant is TRC) has not been responsive to Region 8's, SD's, and the FLM's comments. We are concerned about the continuing delay in resolving this issue since the December 2007 regulatory deadline for States to submit Regional Haze SIPs has passed and EPA has issued a finding of failure to submit to SD. In addition, the company has proposed another unit at the Big Stone facility that would rely, in part, on SO2 and NOx emission reductions from the existing Unit 1 to avoid the PSD process for the new unit. There has been considerable interest in the media, at the political level, and in the environmental community on

the Big Stone new unit issue.

Big Stone 1 has previously been modeled for BART visibility impacts by Region 7 as part of work being conducted for Nebraska using the particulate source apportionment (PSAT) capability of CAMx. That "screening" analysis showed impacts exceeding 0.5dv at Class 1 parks in both SD and MN. In addition, TRC applied the Calpuff model in their September 2008 submittal in the absence of an approved protocol. That analysis showed an impact of 0.489 dv on the Boundary Waters Class 1 area.

## SPECIFIC ISSUES AND REGION 8 POSITION

### Modeling grid

TRC has proposed to use three CALMET modeling domains developed with 1 km resolution and an overlaying 36 km MM5 grid (see Figure 3-1 in TRC attachment). Region 8 has accepted 1 km and smaller grids in modeling applications in Colorado and Montana where complex terrain is in close proximity to the source because we believe that the higher resolution at these distances will better characterize terrain effects and local scale meteorology. However, at a distance of 400 km in relatively flat terrain it does not seem reasonable that, in the absence of additional data, a 1 km resolution would provide a more accurate estimate of source impacts. This is particularly true when the MM5 data is only at a 36 km resolution. We are concerned that the proposed 1 km grid resolution in Calpuff/Calmet will not necessarily enhance and may even degrade model performance. We are not aware of a model evaluation data base that would allow us to test model performance at these distances using various grid resolutions. Region 8 believes that a 4 km resolution in Calmet / Calpuff would likely provide a conservative estimate of impacts in this application.

### Calmet Non-default settings

TRC is proposing to use the non-default "no-obs" setting in Calmet, which would make this a non-guideline modeling demonstration. TRC argues that inclusion of the upper air data directly into Calmet is likely to degrade the quality of the wind fields, and that these observations are not dense enough, thus they propose to use model settings noobs=1 and itwprog=2. These switches remove the need for upper air observations both with regard to winds and temperature. TRC's arguments are not supported by data showing degraded wind fields. Appendix W (paragraph 8.3.1.2(d)) requires that mesoscale meteorological fields be used in conjunction with NWS or comparable observations, not in place of such observations. Region 8 believes that upper air observations and temperature profiles should use the default settings. (noobs-0 and itwprog=0).

### Ammonia issues

Initially TRC would assume a constant background ammonia concentration of 1 parts per billion (ppb) as recommended in the 2006 WRAP Protocol, However, TRC proposes to use data from a CMAQ 2002 modeling application in the ammonia limiting method (ALM) analysis. This would

result in ammonia concentrations lower than values that have recently been measured in the MN Class 1 areas, and significantly lower than those measured in southwestern MN closer to the location of the Big Stone facility (Caughey, 2008). Region 8 has more confidence in the measured ammonia levels which suggest that a value of at least 1 ppb is appropriate for use in Calpuff and any ammonia limiting analysis.

In their September 2008 submittal TRC utilized a specific version of ammonia limiting (referred to as ALM) during the POSTUTIL step that was specifically developed as part of the VISTAS BART process and was reviewed and rejected by FWS/NPS. VISTAS subsequently did not pursue or incorporate that method further into VISTAS work. In that case, EarthTech (now TRC) was the consultant for VISTAS. However, FWS/NPS has accepted a similar ammonia limiting process through the use of POSTUTIL's "MNITRATE=1" switch. Region 8 proposes to accept this approach, which is consistent with the VISTAS RPO process.

Source Emissions

In response to our previous request, TRC's latest protocol documents the emissions that would be used in the modeling. TRC proposes to model only SO2, NOx, and PM2.5 emissions from the facility. In visibility modeling Region 8 has required sources to provide more detailed speciation of particulates and condensable particulate emissions in Calpuff BART applicability modeling. This should include primary SO4, SOA (organic carbon particles), elemental carbon (EC), PM fine, and PM coarse particulates as per NPS recommendations.

Reference:

Caughey, M.,et al, April 30, 2008 Ambient Gaseous Ammonia Monitoring at the Fernberg, MN Air Monitoring Site Using Passive Diffusion Monitoring. Illinois State Water Survey, University of Illinois