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Review EPA SAB Report

Reactive Nitrogen in the United States: An analysis of Inputs, Flows, Consequences, and Management Options

The subject report is well organized and well written. It contains excellent background material on the nitrogen cascade, sources of reactive nitrogen, and the flows and inventories of reactive nitrogen in the environment. The analysis appears sound and the recommendations appear to be scientifically robust. As my expertise is in the atmospheric science and combustion related fields, my review and comments largely focused on these components of the report. I do have several comments that should be addressed before the report is finalized and distributed. These comments are as follows:

General Comments

- 1) The framework for discussing the transport and inventory of reactive nitrogen across environmental compartments is somewhat deceptive in terms of the atmosphere. Due to the timescale of mixing across the global troposphere, it is not reasonable to view the US atmosphere as a well defined entity. It appears that the export of reactive nitrogen from the US via the atmosphere is considered in the analysis and mass balance but that the import of reactive nitrogen to the US via the atmosphere is not considered. I think the reader would greatly benefit from a clearer presentation of the atmosphere as only a global atmosphere, which provides a transport mechanism for deposition in other areas and transport to the stratosphere.
- 2) The inclusion of N₂O in reactive nitrogen is understandable from a chemistry perspective but clearly the role of N₂O in the context of the nitrogen cascade is very different from other species included in the report. N₂O is basically inert until it reaches the largely isolated stratosphere, where it is an important species in stratospheric ozone depletion. The integration of N₂O with all other reactive nitrogen species will be confusing to many readers. I think a separate section on N₂O is needed to clearly explain N₂O in the context of the nitrogen cascade and the report. This is particularly important in Figure 2 and 3, which implies that N₂O has similar biogeochemistry to other species discussed in the report. As shown in Figure 2, the fate of NO_y and NH₃ are the same as N₂O, which is not correct. It is unclear how the recommendations on page 18 related to N₂O.
- 3) Throughout the report, one of the impacts of the nitrogen cascade is “global warming.” I would strongly recommend to not use the term “global warming” as the impacts of the nitrogen cascade have important impacts on climate forcing that are positive and negative forcings. I would recommend the use of the term “climate change.” As written, the report seems to use the

term global warming with little explanation and some discussion of direct and indirect effects should be briefly discussed.

3) The discussion of mobile sources is a very stagnant perspective on emissions. The discussion of recommended reductions from mobile sources, and which feed into the overall recommendations, do not properly address the growth in mobile source VMT (Vehicles Miles Traveled) and already existing diesel engine emissions regulations that will go into place in 2010 for on-road engines and they are being phased in for off-road engines. The recommendations need to be placed into context of expected growth in emissions and existing regulations that are currently being implemented.

Specific Comments

1) Page 11 lines 5-7 and Page 12 lines 1-3 – The text does not seem consistent with Figure 1. According to the Figure 1, Cultivated BNF seems to be the second largest sources and Fossil Fuel Combustion is the third largest source. This figure and associated text would gain from a clear discussion of the contributions by sector and process.

2) Page 17, line 1 – I am not sure what is meant by “more efficient diesel engines” but I think this should be engines with lower emissions or after-treatment controls. Engine efficiency usually does not mean the degree of NOX emissions.

3) Page 19, line 31 – The term “passenger cars” needs to be checked. I assume that this is on-road vehicles or mobile sources.

4) Page 58, lines 10-12 - Recommendation 5 is really not a feasible recommendation. It is not really possible to measure trends in fugitive or areas sources. Networks like NADP are used as an assessment tool to study trends in emissions. A better recommendation may to be expand the locations or measurements of the NADP and STN networks.