Additional Preliminary Comments from Dr. Douglas Burns on EPA's Integrated Science Assessment for Oxides of Nitrogen, Oxides of Sulfur, and Particulate Matter – Ecological Criteria (First External Review Draft)

Burns Comments on Preface to EPA Draft ISA

We did not discuss or formally review the Preface, which provides a history of the Clean Air Act and pertinent secondary standards. I wanted to note that on page l (50) of the Preface there is a brief two sentence paragraph on NAPAP that describes it as a 10-year program that issued a final report in 1991. This is incorrect as NAPAP was re-authorized in Title IX of the 1990 Clean Air Act Amendments. The program issued 3 more reports after 1991, in 1998, 2005, and a final report in 2011. Below, I have provided a brief history of NAPAP that could be consulted to correct the information in the Preface.

The National Acid Precipitation Assessment Program (NAPAP) is a cooperative federal program first authorized was authorized by Congress under the Acid Precipitation Act of 1980 (P.L. 96-294, Title VII) to coordinate acid rain research and report the findings to the U.S. Congress. The research, monitoring, and assessment efforts of NAPAP and others in the 1980s culminated in Title IV of the 1990 Clean Air Act Amendments (CAAA), also known as the Acid Deposition Control Program. Title IX of the CAAA reauthorized NAPAP to conduct acid rain research and monitoring and to periodically assess the costs, benefits, and effectiveness of Title IV. The NAPAP member agencies are the U.S. Environmental Protection Agency, the U.S. Department of Energy, the U.S. Department of Agriculture, the U.S. Department of Interior, the National Aeronautics and Space Administration, and the National Oceanic and Atmospheric Administration.

The NAPAP published a total of four reports in 1991 (multiple volumes), 1998, 2005, and 2011. The Program had six directors during this time, Christopher Bernabo, Lawrence Kulp, James Mahoney, Derek Winstanley, Michael Uhardt, and Douglas Burns. The Program was able to describe and document strong reductions in sulfur dioxide and nitrogen oxide emissions and resulting atmospheric deposition during 1980 to 2010 as various elements of the CAAA were implemented. The NAPAP officially ended with publication of the last report in 2011.

Burns Response to Charge Question #5

Chapter 5 characterizes the scientific evidence on the terrestrial biological responses to acidifying deposition, including effects on physiology, productivity, and community composition, as well as a discussion of critical loads for these effects. Please comment on the accuracy, clarity, level of detail, and relevance of the discussion regarding terrestrial biological responses to acidifying deposition and the critical loads for these effects.

The application of Ca:Al ratios as an indicator of soil acidification effects on forest vegetation is discussed in Section 5.2.1. This section cites Cronan and Grigal, 1995 and several other papers on this topic. However, there was a review paper published in 2007 (Vanguelova et al., 2007, Plant Biosystems, 141: 460-480) that showed that Ca:Al in fine roots is not a reliable indicator based on field studies. I think that it's important to cite this study and to raise the point that Ca:Al ratios may not be a reliable indicator of acidification effects in many field settings.

Burns Response to Charge Question #9

Charge Question #9. Review of Chapter 9 – Biological effects associated with N deposition to freshwater systems. Lead discussants are: Drs. Elizabeth Boyer, Douglas Burns, James Galloway, and Hans Paerl.

Chapter 9 summarizes the biological effects associated with N deposition to freshwater systems. Please comment on the accuracy, clarity, level of detail, and relevance of the discussion of biological change associated with atmospheric deposition to lakes and streams.

Overall, this chapter does a very good job of providing an up-to-date perspective on this topic. I agree with the causal statement on page 9-2 that the body of evidence is sufficient to infer a causal relationship between N deposition and changes in biota including altered growth, species richness, community composition, and biodiversity due to N enrichment in freshwater ecosystems. The chapter provides an accurate updated perspective that there has been increasing recognition that nitrogen plays an important role as a limiting nutrient in many freshwaters.

- The chapter indicates the role of both nitrogen and phosphorus and how N:P stoichiometery can change through time. In particular increasing or sustained atmospheric of nitrogen can cause aquatic ecosystems to shift from N to P limitation. I would posit that atmospheric P deposition may also affect N vs. P limitation in aquatic ecosystems. So, I would suggest that discussion of atmospheric P deposition could be a topic of discussion in this chapter and in other sections of the report. I understand that atmospheric P deposition is perhaps not considered to be part of the Clean Air Act, but scientifically a discussion of atmospheric P deposition is justified. There have been some recent papers on this topic that could be discussed, Stoddard et al., 2016, Environ. Sci. Technol. 2016, 50, 3409−3415, Tipping et al., 2014, DOI: 10.1039/c3em00641g, Brahney et al., (2015), Global Biogeochem. Cycles, 29, 1369–1383, doi:10.1002/2015GB005137, and Zhu et al., (2016), J. Geophys. Res. Biogeosci., 121, 1605–1616, doi:10.1002/2016JG003393.
- I question the need for a separate section 9.1.5, Inconclusive Studies on Nutrient Limitation Shift in High Alpine Lakes. I assume that this section was created because some studies do not support the conclusions in the previous section 9.1.4. But I don't see a precedent in other parts of the report for following this type of format. For almost any topic discussed in this

report there are studies that provide some inconclusive or conflicting results because of complexities in natural systems. So, I would recommend that section 9.1.5 be folded into the previous section with some context.

- Page 9-35 – in the discussion of Baron et al., 2011b, it would be helpful to provide the highest nitrate concentrations as well if available to allow a more comprehensive assessment.
- Page 9-36 – for the LC50 concentrations listed here, it would be helpful to indicate whether these are nitrate or nitrate-N concentrations.