

**Review comments on the Risk and Exposure Assessment for Review of the  
Secondary National Ambient Air Quality Standards for Oxides of Nitrogen and  
Oxides of Sulfur**

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I am charged primarily with Scope of the Review, and so my comments are primarily on that issue. The specific Charge Question addressed is:

“Scope of the Review: Chapters 1 and 2 provide the background, history and framework for this review, including a discussion of our focus on the four ecological effect areas (aquatic acidification, terrestrial acidification, aquatic nutrient enrichment, terrestrial nutrient enrichment). Is this review appropriately focused in terms of characterizing the important atmospheric and ecologic variables that influence the deposition and ultimately the ecologic impacts of nitrogen and sulphur? Does the panel have any further suggested refinements at this time?”

This review also considers Chapters 7 and 8, as these are the core of the document in regards to an eventual regulatory decision.

As with my review of the ISA, my conclusion here is that the REA does in fact satisfy the goal in the Charge Question, subject to the comments below. The correct effects are considered (there may be more effects one could note, but the ones considered here are the most significant and are likely to bound the areas of concern adequately), and the correct relationships to atmospheric and ecologic variables are considered (again to the extent these are needed to draw the primary conclusions). The document is well written, being easy to follow and nicely organized, although the wheels fall off a bit – or are not even present - in Chapters 7 and 8). The authors have culled the most important conclusions from an immense literature, focusing the reader properly onto the key findings. A theme that will emerge below, however, is my feeling that the available data and analyses may support the need for considering a reduced NAAQS for NO<sub>x</sub> and SO<sub>x</sub>, but is insufficient to suggest the actual ambient levels needed to avoid demonstrably adverse effects (which I contrast with effects alone, which may or may not be sufficient to deem adverse).

This document would benefit greatly from an Executive Summary similar to the one in the ISA. There is a large amount of information here, but it can be boiled down to a few key conclusions. My fear is that failing to do that, the authors may find specific parts of the document picked in the policy process because they support a desired conclusion and policy solution. There needs to be a concise and unambiguous statement of the key scientific conclusions, and an Executive Summary is exactly the place to put these.

I found Chapter 1 very well written. The document lays out the relevant policy questions and even relates these (in contrast to past documents) clearly to the task of deciding whether the NAAQS needs to be revised and, if so, how the information would be used to do that.

Figure 1.4-1 is quite interesting, but it also lays clear the one glaring problem with a secondary NAAQS, since the key element is the Ecological Effect Function. I don't see where such a function is sufficiently well established to allow use in setting a secondary standard, other than perhaps as an analogue to an effects threshold in non-cancer human health risk assessment, probably with some margin of safety inherent in it due to the inability to draw a proper line between effect and adverse effect.

Chapter 2 begins by listing the appropriate effects, and I agree with the selection of these based on the information in the ISA. Table 2.1-1 is particularly useful in providing a road map to the material in the entire document. In the previous draft, I was unclear as to the purpose of the case studies. In the present draft, this point is clearer, and I agree with the idea that given the very large inhomogeneity in both exposure conditions and species across different geographic areas, the best that can be done is to select a few representative but sensitive regions and determine where the ambient levels would need to be to protect these. The one thing missing is a clear statement as to how unique these case study areas are. One can't set national standards based on a few outliers in the national distribution, and I believe a better case can be made in the document as to why these particular areas studied are not in the extremes of the tail of inter-site distributions of sensitivity.

I particularly like the structure of the assessment outlined in the seven steps. While the committee may have disagreements over specific methodological issues, these seem to me the appropriate steps and an innovative way to get at the issue of a secondary NAAQS that relies maximally on available data. I fully support the EPA staff in this choice of framework, even if in the end they must execute it somewhat more qualitatively than might be desired. The point is that it is the right way to be thinking about the NAAQS.

The ecosystem services discussion in Chapter 2 was interesting to read. It presented the subject well, and it is evident to me that ecosystem services is one lens through which to view a secondary NAAQS (although it doesn't capture issues such as inherent rights of other species). My problem lies in a disconnect between the detailed discussion of ecosystem services and the specific Ecological Effect Functions in Figure 1.4-1. I don't believe the document, or even the current state of the science, allows for development of such a Function needed to determine how much a specific ecosystem service is impacted by a given N or S loading, or how adverse is a given decline in ecosystem service. I wouldn't be inclined to support a position that says any decline is automatically adverse; the same applies to my position on human health impacts. Due to this methodological and computational gap, the Ecosystem Services discussion in Chapter 2 comes off as more interesting than truly informative – a good idea that can't quite be pulled off when the data are analyzed.

The uncertainty discussion, as in almost all of the REAs we have reviewed, is quite generic and qualitative. But given the nature of this exercise, I am not sure a more quantitative approach to uncertainty would inform the final decision. This is because, while there are quantitative uncertainties having to do with the data and modelling, an equally important uncertainty is the conceptual relationship between the case studies and any sort of statement about the impact of a national standard.

As Chapters 3, 4 and 5 are outside my area of expertise, especially with respect to specifying where the staff should look for representative but sensitive case study areas, I don't provide comments here, other than to note that Chapters 4 and 5 are of little use given their sketchy nature.

The heart of the REA is found in Chapters 7 and 8. Table 7.1-1 agrees with the information provided in Chapter 1, so at least the methodology is consistent on this point. The framework of thinking laid out in this Chapter is appropriate, although provided here in much too sketchy a form for me to agree or disagree with how it is being executed. There remain two areas in which substantial disagreement can arise between individuals reviewing the document: (1) the methodological steps in calculating impacts on a given case study site and (2) drawing summary conclusions across sites. At the moment, the document does not fully clarify the first, and the second issue is dealt with more through aspirations than any clear approach. But I must withhold judgment until the final report is prepared. The staff is at least headed in the right direction, have a proper roadmap in front of them and have the expertise on hand to carry out these tasks.

In Chapter 8, the phrase “uniform level of ecosystem protection” occurs, and seems to become a key idea in how a NAAQS might be considered. This idea really needs more of an explanation. Given the high levels of inhomogeneity, and the fact that the conclusions rest ultimately on case studies of sensitive areas, and the quite diverse kinds of effects being considered, I don’t understand what is meant by a “uniform level of ecosystem protection”. It surely doesn’t mean that the level of effect will be the same across all ecosystems in the country, or even that the same ambient level will produce the same level of effect everywhere, or that the effects will be equally adverse in some deeper sense. And there is no common metric to which all these diverse effects can be reduced. So, just what does it mean?

Again, Figure 8.1-1 is the right kind of structure, but I don’t see how the Ecological Effect Function will be developed as anything other than a threshold model. And I don’t see where a margin of safety is recognized or introduced. But it is still the right conceptual approach if it can be pulled off methodologically.

Much of the discussion in Section 8.2 seems to me of a policy nature, belonging in a much earlier chapter. It almost comes across as being filler here while the staff tries to figure out exactly how they will execute the ambitious steps in Figure 8.1-1. I recommend moving it to the front of the REA in either Chapter 1 or 2.

The rest of the Chapter 8 strikes me as a lot of scientific detail with little to connect it all to the final calculations. I can't comment on many of the equations proposed, because they relate more to environmental transport and fate than to effects. But it is evident to me that there is still a large gap between methodologies to estimate deposition and methodologies to relate these loadings to any specific effect that will drive a NAAQS. This seems like a rich area for discussion in the CASAC meeting.