



September 15, 2010

MEMORANDUM

SUBJECT: CASAC Review of *Policy Assessment for the Review of the Secondary National Ambient Air Quality Standards for NO_x and SO_x: Second External Review Draft*

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TO: Angela Nugent
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Attached is the draft document, *Policy Assessment for the Review of the Secondary National Ambient Air Quality Standards for NO_x and SO_x: Second External Review Draft* (September 2010), prepared by the Environmental Protection Agency's (EPA) Office of Air Quality Planning and Standards (OAQPS) staff as part of EPA's ongoing review of the secondary (welfare-based) national ambient air quality standards (NAAQS) for oxides of nitrogen (NO_x) and sulfur (SO_x). This document will be the focus of a review by the Clean Air Scientific Advisory Committee (CASAC) Oxides of Nitrogen (NO_x) and Sulfur Oxides (SO_x) Secondary Review Panel (the CASAC NO_x SO_x Secondary Panel) at a public meeting to be held in Durham NC on October 6-7, 2010. I am requesting that you forward these draft documents to the CASAC NO_x SO_x Secondary Panel to prepare for the October meeting.

As part of the review of the current secondary (welfare-based) NAAQS for NO_x and SO_x, EPA's OAQPS staff has prepared a second draft Policy Assessment. This draft Policy Assessment evaluates the policy implications of the key scientific information contained in the document Integrated Science Assessment for Oxides of Nitrogen and Sulfur-Ecological Criteria, prepared by EPA's National Center for Environmental Assessment (NCEA) and the results from the analyses contained in the Risk and Exposure Assessment for Review of the Secondary National Ambient Air Quality Standards for Oxides of Nitrogen and Oxides of Sulfur. These documents, along with EPA's Integrated Review Plan, can be found at <http://www.epa.gov/ttn/naaqs/standards/no2so2sec/index.html>.

The second draft Policy Assessment reflects consideration of comments from the Panel, as well as public comments, on the first draft Policy Assessment, which was reviewed by the Panel on April 1-2 and May 3, 2010. The main comments from the Panel on the first draft Policy

Assessment were provided to us in a June 22, 2010 letter (Russell and Samet, 2010)¹. These comments, and the changes made in the second draft Policy Assessment in response to them, are summarized in Attachment 1. Note that the structure of the Policy Assessment has changed somewhat from the first draft. While there are still 9 chapters, Chapters 5 and 6 in the first draft have been combined into Chapter 5 in the current draft; Chapter 7 in the first draft is now Chapter 6 in the current draft, Chapter 7 in the current draft is a new chapter on uncertainty, variability and sensitivity analyses, and Chapter 8 in the current draft is a new chapter on monitoring issues.

The current draft contains several placeholders indicating missing tables or discussions. We expect to provide the Panel with these tables and discussions in a separate submission two weeks prior to the October 6-7 Panel meeting. These will include a table in Chapter 9 summarizing the options for elements of the standards, a table in Chapter 7 summarizing key uncertainties, and a discussion in Chapter 5 of the implications of a range of choices of the target percent of lakes and streams to protect for alternative target ANC levels. This discussion will also cover the various spatial aggregation choices and resulting implications on the target percentages. We recognize that there are some formatting issues in several chapters, and these will be addressed in the final PA.

The CASAC and public comments on the draft Policy Assessment will be taken into consideration in making revisions to the draft document. A final Policy Assessment will be released in December of 2010. Following completion of the final Policy Assessment, EPA will conduct a rulemaking with regard to its review of the secondary NO_x and SO_x NAAQS. Consistent with the terms of a consent decree, the EPA Administrator will sign a notice of proposed rulemaking by July 12, 2011 and a final rulemaking notice by March 20, 2012. Draft documents are being made available to the CASAC NO_x SO_x Secondary Panel in the form of attached electronic files. The documents are also available from the EPA website at <http://www.epa.gov/ttn/naaqs/standards/no2so2sec/index.html>. Printed copies of these documents will be sent to CASAC NO_x SO_x Secondary Panel members via UPS. A set of charge questions related to the draft Policy Assessment will be submitted separately.

We look forward to discussing the second draft Policy Assessment with the CASAC NO_x SO_x Secondary Panel at our upcoming meeting. Should you have any questions regarding the first draft NO_x SO_x Secondary NAAQS Policy Assessment, please contact me (919-541-5505; email wegman.lydia@epa.gov) or Dr. Bryan Hubbell (919-541-0621; email hubbell.bryan@epa.gov).

Attachments

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¹ Russell, A. and Samet, J. (2010). Letter from Clean Air Scientific Advisory Committee to the Honorable Lisa P. Jackson, Administrator, US EPA. Review of the Policy Assessment for the Review of the Secondary National Ambient Air Quality Standards for NO_x and SO_x: First Draft (March 2010). June 22, 2010.

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Attachment 1

CASAC comments on first draft PM Policy Assessment and responses to those comments

The CASAC Panel's comments and recommendations on the first draft of the NO_x and SO_x Secondary NAAQS Policy Assessment, as well as changes made in the second draft in response to those comments, are summarized below. Overarching comments and recommendations are summarized below, followed by comments and recommendations on chapters 2 through 9.

Overarching comments and recommendations

The Panel made several overarching comments and recommendations, including:

- The second draft should include in a separate chapter a more comprehensive sensitivity and uncertainty analyses of the proposed approach. This chapter should provide more reasoning to support EPA's assessment of the relative values of the uncertainties. The sensitivity analyses should include the sensitivity of the AAPI to component terms. The chapter should provide a more thorough evaluation of the ability of CMAQ to simulate the ambient concentrations and wet and dry deposition fluxes of the SO_x, NO_x and NH_x species used in determining the AAPI.
- The second draft should include a succinct discussion of other potential impacts of NO_x deposition to N-limited ecosystems, including potential production increases that may be either beneficial or adverse depending on the system and management goals.
- The second draft should ensure the use of a consistent set of units in its presentation of data, results and equations.

In response to these comments, we have made extensive edits throughout the second draft Policy Assessment to ensure consistent units are used, and have included a table in Chapter 1 which clearly identifies units and conversions used in the document (Table 1-1, Section 1.1). We have added a new chapter (Chapter 7) which provides a more extensive discussion of uncertainties and variability in the science, data, and models which inform our considerations of the standards. This chapter also provides assessments of the sensitivity of models and the AAPI to inputs. We have added additional discussions of the broader set of potential impacts of NO_x deposition, while continuing to focus the overall review on the effects of NO_x and SO_x deposition on sensitive aquatic ecosystems, and protection against adverse effects of NO_x additions (ES-4, Section 1.6, Section 4.5.2, Section 2.2.2, and Section 3.4).

Chapter 2 (Known or Anticipated Ecological Effects)

The panel was generally supportive of the review of effects provided in the chapter. The panel asked primarily for clarifications of the text and additional references. The panel asked for a summary of the assumptions and limitations of the steady-state models used in the ecological effects studies. The panel requested that we clarify that ecological effects due to deposition of N and S occur in a relatively small set of sensitive ecosystems, rather than throughout all

ecosystems. The panel also asked for a more thorough discussion of uncertainties, with justifications for rankings of uncertainties, and sensitivity analyses for the different models used for aquatic acidification.

Changes made in chapter 2 in the second draft Policy Assessment were primarily focused on streamlining the chapter as well as on improving and clarifying the approach for characterizing uncertainty. In addition, we included a new table (Table 2-2) that summarizes the assumptions and limitations of the ecological effects models.

Chapter 3 (Considerations of Adversity to Public Welfare)

The panel asked for a more focused discussion on how and why the current effects of SO_x/NO_y deposition on sensitive ecosystems matter in terms of services and functions of ecosystems that are important to people, emphasizing that effects occur only in a limited set of sensitive areas. The panel asked for more explanation of the policy implications of the monetary values of ecosystem services discussed in the chapter. The panel also asked for a table summarizing the monetary valuation associated with various ecosystem services estimates. The panel asked for more focus on the effects that are likely occurring due to NO_x and SO_x deposition and less on those that potentially could be affected. The panel also asked for greater acknowledgement of the potential beneficial effects of nitrogen inputs to nutrient limited ecosystems.

Change made in chapter 3 in the second draft Policy Assessment were focused on describing those ecosystem services that were likely impacted by current NO_x and SO_x deposition. In addition, we have expanded the discussion of insights that can be gained by evaluating public decisionmaking regarding protection of aquatic resources (Section 3.1.2.4.3), and through evaluation of programs in Europe that have established targets for ecosystem protection as part of critical loads policies (Section 3.1.2.4.4). We have modified Figures 3.4 and 3.5 to include deposition levels in a wider range of public lands, including Federal Class I Areas, as well as state and local parks and wilderness areas. We have added an additional assessment of the value of decreases in acidification in the Adirondacks based on the Banzhaf et al (2006) valuation survey of NY residents (Section 3.4.2). We have added a number of additional tables, including a summary of values of ecosystem services affected by current N deposition (Table 3-7 and 3-8). We have included a discussion of the potential beneficial effects of N deposition in nitrogen-limited areas in Chapter 4, and have added a clarification to this chapter acknowledging these effects and reiterating our focus on adverse effects (Section 3.4.5).

Chapter 4 (Addressing the Adequacy of the Current Standards)

The panel was generally supportive of the information provided demonstrating that current NO_x and SO_x secondary standards are not adequate to protect against effects of deposition of NO_x and SO_x to sensitive ecosystems. While the panel agreed that steady state models are appropriate to evaluate the adequacy of the standards, they note that approach could be enhanced by also applying dynamic acidification modeling techniques to “hindcast” changes in ANC. The panel recommended that the evaluation of adequacy should consider the extent to which and rates at which some less sensitive systems may continue to recover at current S + N deposition, while other more sensitive systems will not recover or may experience further deterioration. The

panel also asked for additional plots showing the relationship of NO_y to NO_x, compared with NO₂ to NO_x. The panel also asked that a summary of the performance assessment of CMAQ be included.

The performance assessment of CMAQ has been incorporated in the new Chapter 7 addressing uncertainty, variability, and sensitivity. Much of the monitoring discussion has been moved to a separate Chapter 8 on monitoring issues, and that chapter also provides more discussion on the ambient concentration to deposition relationship of individual sulfur and nitrogen species. New plots of NO_y to NO_x and NO₂ to NO_x have been added to chapter 4.

While the panel recognized that the current review was focused on sensitive, non-managed ecosystems, the panel requested more discussion of fertilization effects. In response to these comments an additional discussion has been added to Chapter 4 (Section 4.5.2) regarding nutrient enrichment effects in both managed and non-managed systems. In addition, language has been added in several other chapters highlighting the range of potential responses to nitrogen nutrient enrichment in different types of ecosystems, especially in N-limited ecosystems.

Chapters 5 (Conceptual Design of an Ecologically Relevant Multi-pollutant Standard) and 6 (Options for Elements of a Standard to Protect Against Effects from Aquatic Acidification)

Note: We have combined Chapters 5 and 6 from the first draft Policy Assessment into a single Chapter 5 in the second draft Policy Assessment to reduce redundancy and improve the flow of the document.

The panel was generally supportive of both the conceptual framework developed to address effects associated with deposition of NO_x and SO_x, and the Atmospheric Acidification Protection Index introduced as a new form of the standards. The panel agreed with selection of NO_y and SO_x as atmospheric indicators, and with the selection of ANC as the ecological indicator. The panel agreed that a multi-year averaging time from 3 to 5 years was appropriate. The panel also agreed that a multipollutant standard is appropriate to protect aquatic ecosystems from acid deposition.

The panel asked that reduced nitrogen be treated as a variable component of the AAPI standard that can be updated. The panel asked that the underlying assumption of steady state behavior should be evaluated with a parallel effort using sensitivity analysis and dynamic modeling. The panel asked that the AAPI equation for the proposed standard should include the geographical extent and numerical range of its applicability. The panel recommended that the mass balance approach to determining Neco be used over the dynamic modeling approach. The panel recommended that in evaluating methods for aggregating catchment scale critical loads, consideration be given to approaches by which the water bodies within any specified area could be first stratified to include only those which were considered potentially susceptible to acidification, based on estimates of preindustrial ANC, or acid sensitivity class. The panel advised EPA to focus on an AAPI standard driven by aquatic effects concerns, given both the availability of data, and the likelihood that such a standard would decrease N and S inputs to ecosystems, which would provide protection against additional effects. The panel recommended

that EPA conduct a sensitivity study to characterize uncertainty associated with different components of the conceptual framework and propagate the resulting uncertainty at every step to arrive at an ensemble of SO_x and NO_y response surfaces to meet a given standard. The panel asked for inclusion of a separate conceptual diagram which shows the important contributing factors for each term in the AAPI equation.

The panel noted a number of challenges in specifying the AAPI form. The panel highlighted a number of areas of uncertainty, including

- Uncertainty in pre-industrial levels of ANC
- Uncertainty in the use of steady state models
- Uncertainty in the atmospheric deposition transformation ratios
- Uncertainty in modeled estimates of reduced nitrogen deposition

In addition, the panel recommended that close attention be given to the issue of matching temporal and spatial scales in various components of the AAPI.

The panel recommended disaggregating the $g(\cdot)$ term in the AAPI equation, and include a term to account for naturally occurring organic acids. The panel recommends that consideration of chronically acidic or highly acid sensitive surface waters that would not be recoverable at a given ANC limit should be given.

The panel recommended that the CMAQ modeling that is used to develop the atmospheric deposition transformation ratios be evaluated for sensitivity to emissions and chemistry, and that characterization of the uncertainties in precipitation and wet deposition be included. The panel recommended several specific evaluations of CMAQ, including:

- Model performance for nitric oxide, nitrogen dioxide, sulfur dioxide, nitrate, ammonium and aerosol nitrate, ammonium, and sulfate for different networks for which the data are routinely available
- Model performance for wet deposition of sulfate, nitrate, and ammonium using the National Atmospheric Deposition Program (NADP) network
- A regional model evaluation using the continuous measurements of nitric oxide, nitrogen dioxide, nitric acid and NO_y from the SEARCH network in the southeastern U.S.

The panel expressed support for the use of NO_x/SO_x tradeoff curves, but recommended that these curves include the impact of reduced nitrogen.

In response to the comments from the panel, Chapter 5 has been revised in the following ways:

- We have added a section comparing critical loads calculated using steady-state versus dynamic modeling has been added (5.3.2.3).
- The mass balance approach to determining Neco has been used (5.3.2).
- The tradeoff curves now show the impact of NH_x, based on a range of NH_x deposition values which are modeled to occur across the U.S. (5.3.9).
- Criteria have been identified to only consider critical loads from catchments that are susceptible to acidification from atmospheric deposition, while excluding those

catchments in which acidification results from high organic acid content, acid mine drainage or naturally low base cation weathering (5.3.2.6).

- The focus of the conceptual design is on aquatic acidification (5.3.1) with co-protection to other effects presented in Chapter 6.
- A new conceptual diagram has been added that outlines each step to develop the tradeoff curves and the AAPI (5.3.1)
- The $g(\cdot)$ term from the first draft PA has been disaggregated so that each component is represented in the AAPI equation (5.3.4). As stated above, the critical load dataset is screened to exclude those catchments which would not be able to recover based on pre-industrial ANC values (5.3.2.6).

Chapter 7 (Co-protection)

Note: The chapter on co-protection is now Chapter 6.

The panel supported evaluation of co-protection provided by an aquatic acidification based standard for terrestrial acidification endpoints and terrestrial and aquatic nutrient enrichment endpoints. The panel recommended that the chapter be expanded to better explain the potential interrelationships between aquatic and related terrestrial responses to acidification. The panel recommended that further consideration not be given to developing a single standard addressing both acidification and nutrient enrichment.

Chapter 9 (Conclusions)

The panel generally supported the preliminary staff conclusions regarding the adequacy of existing standards, and options for the indicators, averaging times, and form of additional standards to protect against the effects of NO_x and SO_x deposition to sensitive aquatic ecosystems. The panel reiterated the request for a separate uncertainty chapter. They also asked that discussions of future research needs be linked to the identification of critical uncertainties.

Chapter 9 has been expanded to include a discussion of staff conclusions regarding the options for elements of the standard. We have included discussions of how critical uncertainties might influence the AAPI, with references to the broader uncertainty discussions in Chapter 7. Research needs are discussed briefly in the new Chapter 7, but will need to be more fully developed in the final PA.