Responses to Significant Comments on the 2011 Proposed Rule on the Secondary National Ambient Air Quality Standards for Oxides of Nitrogen and Oxides of Sulfur

(August 1, 2011; 76 FR 46084)

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Responses to Significant Comments on the 2011 Proposed Rule on the Secondary National Ambient Air Quality Standards for Oxides of Nitrogen and Sulfur

I. INTRODUCTION

This document, together with the preamble to the final rule on the review of the secondary national ambient air quality standards (NAAQS) for oxides of nitrogen and oxides of sulfur, presents the responses of the Environmental Protection Agency (EPA) to the significant public comments received on the 2011 proposed rule for secondary NAAQS for oxides of nitrogen and sulfur (76 FR 46094). All significant issues raised in the public comments have been addressed.

This response-to-comments document does not generally cross-reference each response to the commenter(s) who raised the particular issue involved, although commenters are identified in some cases where they provided particularly detailed comments that were used to frame the overall response on an issue. Comments were received about thirty commenters, including several industry groups, a few individual companies, several environmental groups, one federal agency, one organization of state and local air agencies, five individual states, a local government agency, and two tribes.

The comments addressed in this document include comments that are addressed in the preamble to the final rule as well as other comments that were not discussed in the preamble. As such, this document incorporates and augments the discussion of public comments, and the EPA's responses to those comments, that appear in the preamble to the final rule. Although portions of the preamble to the final rule are paraphrased in this document where useful to add clarity to responses, the preamble itself remains the definitive statement of the rationale for the decisions presented in the final rule.

Accordingly, this Response to Comments document, together with the preamble to the final rule on the review of the secondary NAAQS for oxides of nitrogen and sulfur and the information contained in the Integrated Science Assessment (ISA) (U.S. EPA, 2008), the Risk and Exposure Assessment (REA) (U.S. EPA, 2009), the Policy Assessment (PA) (U.S. EPA, 2011), and the preamble to the 2011 proposed rule should be considered collectively as the EPA's response to all of the significant comments submitted on the 2011 proposed rule.

Comments related to the proposed rule on the secondary NAAQS for oxides of nitrogen and sulfur, as discussed in sections I through III of the proposed rule, are addressed below in section II. Comments on the field pilot program and monitoring methods development, as discussed in section IV of the proposed rule, are addressed below in section III. Comments related to legal, administrative, and procedural issues, as well as misplaced comments related to issues that are not germane to the setting of the NAAQS, are addressed below in section IV.

II. RESPONSES TO SIGNIFICANT COMMENTS ON PROPOSED RULE ON THE SECONDARY NAAQS FOR OXIDES OF NITROGEN AND SULFUR

General comments related to the scope of the current review of the secondary standards for oxides of nitrogen and sulfur are addressed in section I.E.2 of the preamble to the final rule and in section II.A in this document. Comments related to the adequacy of the current secondary standards for oxides of nitrogen and sulfur are addressed in section II.C.2 of the final rule and in section II.B of this document. Comments related to the multi-pollutant standard based on an aquatic acidification index (AAI) discussed in the proposal are addressed in section III.D.1 of the final rule and in sections II.C-E of this document. Comments related to setting new secondary standards identical to the existing primary 1-hour nitrogen dioxide (NO_2) and sulfur dioxide (SO_2) standards are addressed in section III.D.2 of the final rule and in section II.F below.

A. Comments on Scope of the Review

Comments related to the scope of the review are addressed in this section. These comments primarily questioned the EPA's legal authority under Section 109 of the Clean Air Act (CAA) to set NAAQS that address deposition-related effects, focusing in particular on effects resulting from acidifying deposition to ecosystems (section II.A.1). Other comments related to the scope of the review raised the following issues (section II.A.2): (1) the authority of the EPA to consider pollutants jointly and develop joint standards and (2) issues related to the role of the secondary NAAQS in not only reducing pollution but in improving existing ecological conditions.

1. Authority of the EPA to Address Deposition-related Effects

Comments: While environmental organizations and some other commenters urged the EPA to establish a NAAQS that would protect against the impacts on sensitive ecosystems associated with the acidifying deposition of nitrogen and sulfur, several industry commenters argued that the enactment of Title IV of the CAA in 1990 displaced the EPA's authority to address acidification through the setting of NAAQS. These commenters contend that the existence of a specific regulatory program to address the acidification effects of oxides of nitrogen and sulfur supplants the EPA's general authority under the Clean Air Act. According to industry comments, this is demonstrated by the legislative history and a close reading of § 404, which required the EPA to report to Congress on the feasibility of developing an acid deposition standard and the actions that would be required to integrate such a program into the CAA. The required study described in §404, commenters argue, demonstrates that Congress had concluded that the EPA lacked the authority under section 109 of the CAA to establish a secondary NAAQS to address acid deposition. Commenters also claimed that until this review, the EPA had similarly interpreted the CAA to limit its authority to address acidification through the NAAQS process.

Response: Although the EPA is not in this rulemaking adopting a secondary standard designed to protect the public welfare from the effects associated with the acidifying deposition of nitrogen and sulfur, the EPA does not agree that the enactment of Title IV displaced the EPA's authority under §109 of the CAA to adopt such a NAAQS. We note that the purpose of Title IV "is to reduce the adverse effects of acid deposition," CAA § 401(b), while section 109 directs the Administrator to go beyond this to set a standard that is "requisite to protect public welfare from

any known or anticipated adverse effects," CAA § 109(b) (2). These provisions are not accordingly in conflict, but represent the often typical interlinked approach of Congress to address the frequently complex problems of air pollution.

In adding Title IV to the CAA, Congress created a new program to reduce the emissions of SO_2 and NO_x from electric generating units, the most significant sources of acidifying pollution in 1990. Nothing in the text or the legislative history of Title IV of the Act indicates that in creating additional authority Congress intended to foreclose the EPA's authority to address acid deposition through the NAAQS process. Indeed, to the extent that Congress addressed the impact of Title IV on other provisions of the CAA, it made clear that Title IV had no impact on the compliance obligations of covered sources under other CAA provisions. CAA § 413. The legislative history of the Title IV program makes clear that Congress was acting in the face of the EPA's apparent inability to effectively address the problem of acidification through the NAAQS and other CAA programs, given the significant uncertainties associated with possible regulatory regimes to address acidification. See, e.g., S. Rep. No.101-228, at 289-291(1989). Congress did not conclude that the EPA lacked the regulatory authority to address acidification but rather concluded that "a major acid deposition control program [was] warranted …because of the evidence of damage that had already occurred as well the likelihood of further damage in the absence of Congressional action." H.R. Rep. No 101-490, at 360 (1990). The Senate Report made it clear that while the EPA envisioned section 109 as providing authority to adopt a secondary NAAQS to address the effects of acid deposition, the EPA remained concerned about the effectiveness of this and other regulatory approaches. S.Rep. No. 101-228, at 290-291. Congress addressed these issues by adding the new authorities found in Title IV, but made no mention of supplanting the EPA's authority under section 109 to address acidification effects.

There is no discussion in the legislative history of Title IV of curtailing the EPA's authority under the NAAQS program. As such, the requirement in § 404 of the 1990 CAA Amendments that the EPA send to Congress "a report on the feasibility and effectiveness of an acid deposition standard or standards" does not demonstrate that Congress concluded that an amendment to the CAA would be necessary to give the EPA the authority to issue regulations addressing acidification. See CAA § 401. The significance of the report required by § 404 can be understood in the overall context of the history of Congress' and the EPA's attempts to understand and to address the causes and effects of acid deposition and the EPA's proposed conclusion in 1988 that the scientific uncertainties associated with acid deposition were too great to allow the Agency to establish a secondary NAAQS at that time to address those effects. In the proposed rule, the EPA noted that it was clear at the time of the 1990 CAA Amendments that a program to address acid deposition was needed and that the primary and most important of these provisions is Title IV of the Act, establishing the Acid Rain Program. The Report required under section 404 of the Amendments reflects this concern, and requires an evaluation of an acid deposition standard and a comparison of its effectiveness to various regulatory authorities under the Act, including the authority for a secondary NAAQS under section 109. CAA § 404 (note) (Pub.L. 101-549, §404 (6)). This indicates the existence of an ongoing authority under section 109.

In assessing the import of § 404, the EPA has noted in the past and in the proposed rule at 46087, that "Congress reserved judgment as to whether further action might be necessary or

appropriate in the longer term" to address any problems remaining after implementation of the Title IV program, and "if so, what form it should take." See 58 Fed Reg. 21351, 21356 (April 21, 1993). Such reservation of judgment by Congress concerned whether Congress should adopt additional statutory provisions to address the effects of acid deposition, as it did in 1990. It does not indicate a view that the EPA lacked authority under section 109 to establish a secondary NAAQS to address acid deposition, but a recognition that the uncertainties associated with such a standard may be too significant to allow the Administrator to reach a reasoned conclusion to adopt such a standard, as in the 1988 proposal. The EPA's decision in that rulemaking reflects the view that there is ongoing authority to address acid deposition under section 109 of the Act, and did not indicate that Title IV impliedly amended the CAA and removed all such regulatory authority outside of Title IV. As the EPA noted in its 1993 rulemaking addressing the question of whether to revise the secondary NAAQS for SO_2, the EPA decided not to revise the standard at that time because of scientific uncertainty. The EPA noted the consistency of this decision with Congress' actions in the 1990 amendments, but nowhere indicated that Congress' actions meant the EPA no longer had the authority to adopt a secondary NAAQS to address acid deposition. Instead the EPA stated it would not adopt a secondary NAAQS at that time and based on further studies and research would determine in the future what further action to take under section 109. The EPA stated that:

> In reaching a decision that revisions to the secondary standard for oxides of sulfur to address acidic deposition and related SO_2 welfare effects are not appropriate at this time, the EPA has taken into account the significant reductions in SO_2 emissions, ambient SO_2 concentrations, and ultimately the deposition of sulfur that will result from implementation of the title IV program. … The EPA recognizes that the Congress left open the question whether further action to address acidic deposition might be necessary in the longer term. The EPA is concerned, however, as was Congress, that a number of important scientific and implementation issues must be addressed through further research and study before a more informed decision can be made on whether such action is needed; if needed, what form it should take; and whether and how a given approach could be effectively integrated with the existing title IV program. Moreover, as discussed previously, setting either a secondary NAAQS or an acidic deposition standard would involve significant difficulties, especially as compared with the total-loading approach adopted in title IV. In the EPA's judgment, the prudent course of action is to await the results of the studies and research programs that are currently under way … and then to determine whether additional control measures should be adopted or recommended to Congress. … For these reasons, the EPA concludes that, under section 109(d)(1) of the Act, revision of the secondary standard for SO_X to provide increased protection against acidic deposition and related welfare effects is not appropriate at this time. As provided for under the Act, the EPA will continue to assess the scientific information on acidic deposition and related SO_2 welfare effects as it emerges from the ongoing research and monitoring programs, and [EPA]will update the air quality criteria for SO_X accordingly. These revised criteria should provide more informed bases for reaching a decision on whether additional measures are needed to augment the title IV program. 58 FR 21351, 21357-8 (April 21, 1993) (emphasis added).

Nearly twenty years later, we have made substantial progress toward the development of a NAAQS to protect against acidification, however we find ourselves in a position

where the Administrator has concluded again that the uncertainties associated with setting a NAAQS to address acidification are too substantial to allow her to set a standard that in her judgment would be requisite to protect the public welfare from such effects. The EPA does not agree that the Administrator lacks the authority to set such a standard were it possible to do so with sufficient confidence that it would be requisite to protect public welfare.

2. Other Comments Related to the Scope of the Review

(1) Comment: Several commenters argued that the Clean Air Act requires that secondary standards must specify a single air pollutant concentration that applies to each individual criteria pollutant. One commenter argued that the language in section 109(b) requiring the EPA to set a standard to protect the public welfare from the adverse effects associated with the presence of "such air pollutant" in the ambient air means that the EPA cannot set a NAAQS for more than one criteria pollutant. Another commenter stated that the Clean Air likely would not allow the EPA to set a standard that allows for tradeoffs between two pollutants but must specify a single air pollution concentration that applies to each individual criteria air pollutant.

Response: Section 109 of the CAA states than a secondary NAAQS must "protect the public welfare from known or anticipated adverse effects associated with the presence of such air pollutant in the ambient air." The term "associated with…such air pollutant" describes the category of adverse affects to be associated with the air pollutant at issue, not the standard. The EPA does not agree with the commenter that this language limits our ability to set a standard that allows for tradeoffs between these two pollutants. For further discussion see section II. D (4).

(2) Comment: One commenter stated that public welfare does not include remediating previous damage to ecosystems but only preventing further damage. This commenter stated that the development of such a standard as discussed in this review, one which looked at improving current conditions as well as preventing future degradation, was beyond the requirements for in the Clean Air Act for protection of public welfare.

Response: In setting primary and secondary NAAQS, the EPA takes into account the effect of a pollutant in the ambient air on public health and public welfare, respectively, by assessing the effects of criteria pollutants given the current state of public health and public welfare. In other words, in determining the level of air quality requisite to protect public health or welfare, the EPA takes into account existing conditions. The ambient levels of oxides of nitrogen and sulfur have a relationship to what the future degree of aquatic acidification will be, given current conditions, the EPA looks at what future conditions will be like given current conditions and varying ambient levels of oxides of nitrogen and sulfur. This future harm is what the EPA addresses, looking at whether current conditions continue on in to the future or change. The EPA does not believe that taking the approach suggested by commenter would allow the EPA to set standards that would provide requisite protection of public health or welfare, as they would call for the EPA to ignore current conditions, which are a relevant factor in determining what impact ambient levels of oxides of nitrogen and sulfur will have on aquatic acidification in the future.

B. Comments on the Adequacy of the Current Secondary Standards

This section discusses the comments received from the public regarding the adequacy of the current secondary standards with regard to both direct and deposition-related effects.

1. Adequacy of the Current Standards to Address Direct Effects

The current secondary NO_2 and SO_2 secondary standards were set in 1971 to protect against direct effects of gaseous oxides of nitrogen and sulfur. For oxides of nitrogen, the current secondary NO_2 standard is an annual standard set to protect against adverse effects on vegetation from direct exposure to ambient oxides of nitrogen. For oxides of sulfur, the current secondary standard is a 3-hour standard intended to provide protection for plants from the direct foliar damage associated with atmospheric concentrations of SO_2. As discussed in section II.B.1 of the preamble, the Administrator proposed to conclude that the current secondary standards are adequate to protect against direct phytotoxic effects on vegetation, and proposed to retain the current standards for that purpose.

Many commenters supported the EPA's proposed decision to retain the current secondary standards for various reasons related to their comments on alternative standards (as discussed in section III.D of the final rule and sections II.C and II. D below), a few commenters (Alliance of Automobile Manufacturers (AAM), Pennsylvania Dept. of Environmental Protection) specifically expressed the view that the current standards provide requisite protection from the direct effects on vegetation from exposures to gaseous oxides of nitrogen and sulfur, and no commenters opposed retention of the current secondary standards.

2. Adequacy of the Current Standards to Address Deposition-related Effects

As discussed in section II.B.2 of the final rule, with regard to deposition-related effects, the Administrator proposed to conclude that the elements of the current secondary standards are not ecologically relevant, and thus not appropriate to provide protection of ecosystems, and that they do not provide adequate protection from such acidification and nutrient enrichment effects in both aquatic and terrestrial ecosystems. Having reached these proposed conclusions, she determined that it was appropriate to consider alternative standards that are ecologically relevant.

(1) Comments: One group of commenters that addressed the adequacy of the current standards with regard to deposition-related effects included environmental organizations (Earthjustice, on behalf of the Appalachian Mountain Club, National Parks Conservation Association, Sierra Club, and Clean Air Council; the Center for Biological Diversity; the Nature Conservancy; Adirondack Council; Chesapeake Bay Foundation), the U.S. Department of the Interior, NESCAUM, New York Dept. of Environmental Conservation, and two tribes. These commenters generally expressed the view that the current secondary standards do not provide adequate protection from deposition-related effects. More specifically, some of these commenters stated that there was overwhelming evidence of adversity to sensitive aquatic ecosystems from acidifying deposition. These commenters cited a broad range of scientific evidence that aquatic acidification was ongoing under current conditions allowed by the current secondary standards, and that this acidification represented an adverse effect on public welfare. Several commenters noted that the

Clean Air Scientific Advisory Committee (CASAC) had agreed that deposition-related effects were ongoing and harmful and that current standards were not adequate to prevent these effects.

Among these commenters, some also expressed the view that current standards were not adequate to protect against terrestrial acidification or nutrient enrichment. The Department of the Interior as well as Earthjustice noted that the current standards were not sufficient for these additional endpoints and cited ongoing harm under current conditions. Two tribes and the Center for Biological Diversity expressed the view that there was sufficient information to judge that the current standards were not adequate to protect against the adverse welfare effect of mercury methylation, contrary to the EPA's proposed conclusion that the available evidence was not sufficient to reach such a judgment. For example, The Forest County Potawatomi Community provided several citations regarding the relationships between aquatic acidification and mercury methylation and stated that there was sufficient evidence to find that the current standards were not adequate.

Response: With regard to the adequacy of the current secondary standards for NO_2 and SO_2, the EPA concurs with commenters' assertions that the current standards do not provide adequate protection for ecosystems that are sensitive to aquatic acidification and that effects to these ecosystems are ongoing from ambient deposition of oxides of nitrogen and oxides of sulfur. The EPA also agrees that there is sufficient evidence to conclude that ambient deposition under the current secondary standards is causing or contributing to terrestrial acidification as well as nutrient enrichment in sensitive ecosystems. A complete discussion of considerations with regard to adequacy can be found in section II.B of the final rule. In short, the ISA has established that the major effects of concern for this review of the oxides of nitrogen and sulfur standards are associated with deposition of nitrogen and sulfur caused by atmospheric concentrations of oxides of nitrogen and sulfur. The current standards are not directed toward depositional effects, and none of the elements of the current NAAQS – indicator, form, averaging time, and level – are suited for addressing the effects of nitrogen and sulfur deposition. Additionally, although the proportion of total nitrogen loadings associated with atmospheric deposition of nitrogen varies across locations, the ISA indicates that atmospheric nitrogen deposition is the main source of new anthropogenic nitrogen to most headwater streams, high elevation lakes, and low-order streams. Atmospheric nitrogen deposition contributes to the total nitrogen load in terrestrial, wetland, freshwater and estuarine ecosystems that receive nitrogen through multiple pathways.

There are expansive data to indicate that the levels of deposition under the current standards are not sufficient to prevent adverse effects in ecosystems. With regard to aquatic acidification, recent data indicate that in the Adirondacks and Shenandoah areas, rates of acidifying deposition of oxides of nitrogen and sulfur are still well above pre-acidification (1860) conditions. Forty-four percent of Adirondack lakes and 85 percent of Shenandoah streams evaluated exceed the critical load for an acid neutralizing capacity (ANC) of 50 microequivalents per liter (μeq/L), and have suffered loss of sensitive fish species. With regard to terrestrial acidification, the REA evaluated a small number of sensitive areas as case studies and showed the potential for reduced growth. When the methodology was extended to a 27-state region, similar results were found to indicate the potential for growth effects in sensitive forests. Nitrogen deposition can alter species composition and cause eutrophication in freshwater systems. In the Rocky Mountains, for example, current deposition levels, which are within the range associated with ambient nitrogen oxide levels meeting the current standard, are known to

cause changes in species composition in diatom communities indicating impaired water quality. With regard to terrestrial nutrient enrichment, most terrestrial ecosystems in the United States are nitrogen-limited, and therefore they are sensitive to perturbation caused by nitrogen additions. Under recent conditions, nearly all of the known sensitive mixed conifer forest ecosystems receive total nitrogen deposition levels above the ecological benchmark for changes in lichen species. In addition, in Coastal Sage Scrub ecosystems in California, nitrogen deposition exceeds the benchmark above which nitrogen is no longer a limiting nutrient, leading to potential alterations in ecosystem composition. Therefore, the EPA concludes that the current standards are not adequate for these effects.

The EPA, however, while agreeing that there is a causal effect between deposition of sulfur and mercury methylation disagrees that there is sufficient evidence to make the quantitative associations that would be necessary to determine that the current standards were not adequate to protect against mercury methylation. The ISA concluded that evidence is sufficient to infer a casual relationship between sulfur deposition and increased mercury methylation in wetlands and aquatic environments. Since the rate of mercury methylation varies according to several spatial and biogeochemical factors whose influence has not been fully quantified, the correlation between sulfur deposition and methylmercury could not be quantified for the purpose of interpolating the association across waterbodies or regions. Therefore, since we are unable to quantify the relationship between atmospherically deposited oxides of sulfur and mercury methylation we cannot we cannot assess adequacy of protection. This subject is discussed more fully in section 6.2 of the REA (EPA 2009).

(2) Comments: Another group of commenters, (e.g. Utility Air Regulatory Group (UARG), Electric Power Research Institute (EPRI), American Petroleum Institute (API), AAM, and American Road and Transportation Builders Association (ARTBA)) generally took the position that the currently available information was not sufficient to make informed judgments about the adequacy of the current standards to address aquatic acidification effects. These commenters generally based this view on the complex nature of the interactions between pollutants and ecosystems and uncertainties in the models and analyses considered in this review. Several commenters asserted that there was not sufficient data available to determine the relationship between acidifying deposition of oxides of nitrogen and sulfur and adverse effects on aquatic ecosystems, such that there was not sufficient information to allow for the assessment of the adequacy of the current standards to provide appropriate protection from this effect. For example, AAM noted the uncertainties in models relating to dry deposition and questioned the linkages between ambient concentrations of oxides of nitrogen and sulfur and the amount of nitrogen and sulfur deposition. In addition to commenting on data limitations, UARG also expressed the view that the ecosystem services analyses included in the proposal were insufficient to make judgments about adversity to aquatic ecosystems resulting from acidifying deposition and that there is a lack of evidence demonstrating that quantifiable changes in public welfare would result from reductions in acidifying deposition. Many commenters within this group did not directly comment on the adequacy of the current standards to protect against aquatic acidification or other deposition-related effects, but instead expressed the view that the EPA did not have the authority to consider deposition-related effects in general or aquatic acidification in particular through the NAAQS. This comment and the EPA's response are discussed above in section I.E of the final rule.

Response: With regard to the adequacy of the current standards to protect against aquatic acidification, the EPA disagrees with commenters' assertion that there is insufficient data to make linkages between deposition from the atmosphere and aquatic acidification effects. To the contrary, the EPA is confident that there is sufficient robust science to conclude that aquatic acidification is ongoing in sensitive ecosystems, that ambient deposition of oxides of nitrogen and oxides of sulfur are causative in many ecosystems nationwide and that the current standards are neither appropriate in form nor adequate in level to protect against such effects. The ISA concluded that there was a causal relationship between deposition of oxides of nitrogen and sulfur and reduced forms of nitrogen (NH_x) and acidification of ecosystems. In addition, the ISA found that effects of acidifying deposition on ecosystems have been well studied over the past several decades, that vulnerable areas have been identified for the United States and that the wealth of available data has led to the development of robust ecological models used for predicting soil and surface water acidification. With regard to the scope of effects, the REA also concluded that the available data are robust and considered high quality. There is high confidence about the use of these data and their value for extrapolating to larger spatial areas. The EPA Temporally Integrated Monitoring of Ecosystems and Long-Term Monitoring (TIME/LTM) network represents a source of long-term, representative sampling. Data on sulfate concentrations, nitrate concentrations and ANC from 1990 to 2006 used for this analysis as well as the EPA Environmental Monitoring and Assessment Program (EMAP) and Regional Environmental Monitoring and Assessment Program (REMAP) surveys, provide considerable data on surface water trends.

The EPA also disagrees with commenters' assessment of limitations in wet and dry deposition modeling. Further discussion of characterizing deposition with models can be found in section IV.C of the final rule. Additionally, while the EPA recognizes that there are limitations associated with modeled deposition values, the linkages between model estimates of deposition and areas exhibiting aquatic acidification effects are consistent and persuasive in considering adequacy of the current standard. Section 2.3 of the PA and sections 2.8 and 2.10 of the ISA provide additional detailed discussions of deposition modeling and spatial resolution for deposition. CASAC concurred with the EPA's conclusion on this matter and encouraged the EPA to move forward in developing a new form of a standard which would address aquatic acidification. Thus, while the EPA is fully mindful of the limitations and uncertainties associated with the data and models, the EPA concludes that the available evidence provides strong scientific support for the view that harm from aquatic acidification is ongoing and attributable in large part to atmospheric deposition of reactive nitrogen and sulfur.

With regard to the commenters' reliance on ecosystem services analyses included in the proposal to make judgments about adversity and public welfare, the EPA disagrees that comprehensive ecosystems services analyses are necessary to determine adversity. Ecosystem services analyses are used in this review to inform the decisions made with regard to adequacy and as such are used in conjunction with other considerations in the discussion of adversity to public welfare. Section 4 of the PA further refines this discussion of adversity to public welfare. Additionally, the paradigm of adversity to public welfare as deriving from disruptions in ecosystem structure and function has been used broadly by the EPA to categorize effects of pollutants from the cellular to the ecosystem level. An evaluation of adversity to public welfare might consider the likelihood, type, magnitude, and spatial scale of the effect as well as the potential for recovery and any uncertainties relating to these considerations. Within this context,

ecosystems services analyses are one of many tools used in this review to help inform the Administrator's decision on adversity. The EPA concludes that the analyses performed as part of this review are sufficient to support the decisions made by the Administrator with regard to the adequacy of the current standards.

C. Comments on Setting an AAI-based Standard

General comments that either supported or opposed the proposed decision not to set an AAI-based standard in this review are addressed in this section. Comments related specifically to the nature and degree of the uncertainties surrounding the setting of an AAI-based standard are also addressed in this section. Two groups of commenters offered sharply divergent views on whether it is appropriate for the EPA to set or even consider an AAI-based standard to protect against the effects in aquatic ecosystems from acidifying deposition associated with ambient concentrations of oxides of nitrogen and sulfur. These groups provided strongly contrasting views on the strength and limitations in the underlying scientific information upon which such a standard could be based, as well as on the legal authority and requirements in the CAA for the EPA to set such a standard. These comments are discussed in section III.D of the final rule, and build in part on the overarching issue raised by some commenters as to the EPA's authority under the CAA to include deposition-related effects within the scope of a NAAQS review, which is discussed in section I.E of the final rule. Some commenters also expressed views about specific aspects of an AAI-based approach, as discussed in section III.D of the final rule and are included in section II.D of this document. Comments on more technical elements of the AAI approach are included in section II.E of this document.

Comments: The first group of commenters, including several industry groups (e.g., EPRI, UARG, and API), individual companies (e.g., East Kentucky Power Cooperative), and two states (TX, SD), strongly supported the EPA's proposed decision not to set an AAI-based standard in this review. These commenters generally focused on the limitations and uncertainties in the scientific evidence used by the EPA as a basis for its consideration of an AAI-based standard, expressing the view that these limitations and uncertainties were so great as to preclude setting such a standard at this time. Several industry commenters felt the uncertainties were of sufficient magnitude as to invalidate the AAI approach for use in the NAAQS, while others agreed with the EPA's finding that further information and analysis is needed, and further noted that this work should be completed before the EPA could propose a new multi-pollutant standard. More fundamentally, some commenters in this group expressed the view that any consideration of such a standard is inconsistent with various provisions of the CAA and thus unlawful.

With regard to their views on the underlying scientific information, many of these commenters focused on what they asserted were areas of substantial uncertainty in the AAI approach including uncertainties in the individual F factors of the AAI, air deposition modeling, critical loads modeling, and available water quality and watershed data. Several commenters felt a more rigorous uncertainty and variability analysis of the AAI, beyond the analyses that the EPA presented in the PA, would be needed if the EPA were to consider such a standard in the future.

Some commenters expressed concerns with specific aspects of the AAI, such as the adequacy of the Omernik ecoregion approach as a method of waterbody aggregation for critical

load calculations and whether ANC was an appropriate ecological indicator. The commenters asserted that the EPA needed to explore different methods for calculating critical loads, collect essential data, and employ mechanistic water chemistry models. The commenters also felt that the EPA was arbitrary in choosing its criteria for sensitive ecoregions and percent waterbodies, and that there was a bias in the field data toward sensitive areas. Several commenters felt a more comprehensive research program was needed to improve characterization of the biogeochemical and deposition processes incorporated into the AAI.

Some industry groups commented on uncertainties in the Community Multi-scale Air Quality (CMAQ) modeling, including high levels of uncertainty surrounding measurement and modeling of chemically reduced forms of nitrogen (NHx). Other commenters were also critical of the reliance of the AAI on modeling, and expressed the view that CMAQ would require intensive deposition-focused evaluation.

A second group of commenters, including several environmental groups (e.g., Center for Biological Diversity, Earthjustice, and Adirondack Council), the U.S. Department of Interior and the National Park Service, the New York Department of Environmental Conservation, and two tribes (Fond du Lac Band and Potawatomi) strongly disagreed with the EPA's proposed decision not to set an AAI-based standard in this review. These commenters generally focused on the strengths of the evidence of deposition-related effects, the extent to which analyses presented in the PA addressed uncertainties and limitations in the evidence, and on information regarding the adversity of such effects as a basis for their views that such a standard was warranted at this time. Many of these commenters pointed to CASAC's review of the underlying scientific evidence and its support for moving forward with an AAI-based standard at this time as support for their views.

In general, the environmental group commenters expressed the view that the current standards are clearly not adequate and that a combined oxides of nitrogen and sulfur standard that links ambient air quality to an ecosystem indicator is appropriate, founded in science, and necessary for protection of public welfare. The commenters stated the current standards are neither sufficiently protective nor appropriate to address deposition-related effects. They also noted that the EPA has worked for decades to solve the acid deposition problem and that in their view the AAI represents an elegant solution to that problem.

With regard to their views on the underlying scientific information, these commenters generally agreed with the EPA's proposed conclusions that there are well-established water quality and biological indicators of aquatic deposition and well-established models that address air deposition, water quality impacts, and effects on biota. Many of these commenters expressed the view that the uncertainties and limitations in the scientific evidence were adequately addressed in the PA, which was reviewed by CASAC. Many of these commenters pointed to CASAC's support for adopting an AAI-based standard in this review while concurrently conducting additional field monitoring and longer-term research that might reduce uncertainties in future reviews of secondary NAAQS for oxides of nitrogen and sulfur.

With regard to their views on the uncertainties and limitations in the scientific evidence, these commenters generally disagreed that there was sufficient uncertainty to preclude setting an AAI-based standard and pointed to several analyses and conclusions presented in the PA to

support their position. For example, Earthjustice and the Center for Biological Diversity specifically cited the PA in presenting their views including the following points:

- that the PA concluded that "the confidence level in the information and processes associated with the linkages from ecological effects to atmospheric conditions through deposition and ecosystem modeling that is very high" (PA at 7-67);
- that the AAI performed well in the cumulative analysis of uncertainty cited in the PA, and specifically that mean results were "very close" to the observed values in the two regions analyzed (PA at 7-68), and that there was "no apparent directional bias in the [un]certainty regarding the biological, chemical and physical processes incorporated in the AAI" (PA at 7-69);
- that the PA lays out alternative levels and percentages of an AAI that would be appropriate to consider in setting a new AAI-based standard, while recognizing that selection from among alternative standards will necessarily reflect consideration of uncertainties, noting that nowhere does the PA suggest that this cannot be reasonably accomplished, and instead proposes specific ranges for levels of the standard and discusses in detail criteria to weigh in setting the standard within that range (PA at 7-78 to -80); and
- that there is an apparent disconnect between the assessment of uncertainty in the PA and the claim in the proposed rule that there is "no reasoned way" to choose a specific AAI-based standard.

Some governmental agency commenters were strongly supportive of an AAI-based standard and clearly felt such a standard should be adopted now. They also noted that the current ambient concentrations of oxides of nitrogen and sulfur are causing adverse ecological impacts and they believe that ongoing damage due to acidic deposition and the risks to ecosystems far outweigh the risk of setting an AAI-based standard while some uncertainties remain. They assert that deposition of oxides of nitrogen and sulfur is causing adversity to public welfare and that the scientific uncertainties do not preclude setting an AAI-based standard, and point to CASAC as generally supporting this view. The commenters believe that the EPA has ample evidence to support a new ecologically based standard and that the AAI is reasonable and scientifically defensible. NY specifically recommended an AAI of 50 with some flexibility built into the F factors.

Some of these agency and environmental group commenters also referenced CASAC's support for specific elements of the AAI-based standard developed in the PA, including 1) the use of ANC as an appropriate ecological indicator for such a standard, 2) the use of total reactive oxidized nitrogen (NO_y) and SO_x as well-justified indicators of atmospheric concentrations of oxides of nitrogen and sulfur, 3) the use of Omernik Level III ecoregions, 4) the division of ecoregions into sensitive and non-sensitive categories, 5) the use of a 3 to 5 year averaging time, and 6) the appropriateness of an AAI level between 20 to 75 µeq/L.

With regard to their views on the requirements of the CAA, several environmental group commenters stated that given the large body of evidence supporting significant ongoing harm to the public welfare and the EPA's finding the current standards are neither sufficiently protective nor appropriate to address deposition-related effects, the EPA's reliance on uncertainty as

grounds for failing to propose protective standards is irrational, arbitrary, and legally flawed. They believe that the EPA cannot lawfully reject a new AAI-based standard while continuing to rely solely on a form of the standard that is inadequate and allows serious harms to the public welfare to continue. When confronted with scientific uncertainties and incomplete data, they feel the EPA must act in a precautionary manner that errs toward stronger protections. Further, they believe that the EPA's reliance on scientific uncertainty as a basis for its inaction is unsupportable in light of CASAC's advice and the EPA staff's conclusions in the ISA, REA and PA.

In addition to the two broad groups of commenters discussed above, other commenters offered more general views on an AAI-based standard. For example, some state commenters (NC and PA) expressed support for the concept of developing a multi-pollutant, AAI-based standard, but felt that it would be important to gather additional information before proposing any such standard.

Response: The EPA has carefully considered these comments on whether or not an AAI-based secondary standard for oxides of nitrogen and sulfur is appropriate at this time. The EPA agrees with the second group of commenters and CASAC's advice (outlined in section III.B of the final rule) that there is a strong scientific basis for development of the structure of such a standard, specifically with regard to a standard that would provide protection from deposition-related aquatic acidification in sensitive ecosystems across the country. As discussed in section II.A of the final rule and supported by several commenters, the available scientific evidence is sufficient to infer a causal relationship between acidifying deposition of nitrogen and sulfur and potential adverse effects to aquatic ecosystems, and that the deposition of oxides of nitrogen and sulfur both cause such acidification under current conditions that are allowed by the current secondary standards (U.S. EPA, 2008, chapter 3). The EPA agrees with commenters that there are well-established water quality and biological indicators of aquatic acidification as well as well-established models that address deposition, water quality, and effects on ecosystem biota, and that ecosystem sensitivity to acidification varies across the country (U.S. EPA, 2011, chapter 7).

The EPA also agrees with the second group of commenters and CASAC that ANC would be an appropriate ecological indicator, reflecting the acidifying effects of deposition of nitrogen and sulfur (U.S. EPA, 2011, chapter 7.2 and Russell and Samet, 2011a). Further, the EPA agrees that the structure of an AAI-based standard is well-grounded in science and would address the combined effects of deposition from oxides of nitrogen and sulfur by characterizing the linkages between ambient concentrations, deposition, and aquatic acidification, and that the structure of the standard takes into account relevant variations in these linkages across the country (section III.B. of the final rule and U.S. EPA, 2011, chapter 7).

The EPA disagrees with the first group of commenters that the use of Omernik ecoregions would be inadequate. A full explanation of the EPA's rationale for selecting the Omernik ecoregion scheme for spatial aggregation is found in section 7.2.5 of the PA. Omernik ecoregions include consideration of geology, physiology, vegetation, climate, soils, land use, wildlife, and hydrology. These factors also relate well to sensitivity to acidification. The EPA also evaluated the National Ecological Observatory Network (NEON) and Bailey's ecoregions developed for the US Forest Service and concluded that the Omernik ecoregion classification would be the most appropriate for an AAI-based standard. It offers several levels of spatial

delineation, has undergone extensive scientific peer review, and has explicitly been applied to delineating acid sensitive areas of the US.

Nonetheless, the EPA agrees with the first group of commenters that there are important remaining scientific uncertainties within the derivation of the AAI, with the data used to specify the factors within the AAI equation, and with the models themselves. These uncertainties are more fully discussed in Appendix F and G of the PA and in section III.A.5 of the final rule. These uncertainties have been reviewed by CASAC, and the EPA recognizes that further research would help to reduce the uncertainties. In general, the EPA also recognizes that the AAI would depend on atmospheric and ecological modeling, with inherent uncertainties, to specify the terms of an AAI equation that incorporate the linkages between ambient concentrations, deposition, and aquatic acidification.

The EPA agrees with the first group of commenters that there are several important limitations in the available data upon which elements of the AAI are based (U.S. EPA, 2011, Chapter 7). For example, existing monitors for NO_y are generally not located in areas that are representative of sensitive aquatic ecosystems, and there is relatively sparse water quality data coverage in sensitive mountainous western areas. Further, even in areas where relevant data are available, small sample sizes impede efforts to characterize the representativeness of the available data for some ecoregions, which was noted by CASAC as being of particular concern (Russell and Samet, 2011a). Also, measurements of reduced forms of nitrogen are available from only a small number of monitoring sites, and emission inventories for reduced forms of nitrogen used in atmospheric modeling are subject to considerable uncertainty.

The EPA agrees with the first group of commenters that uncertainties related to the use of ecological and atmospheric models are difficult to evaluate due to a lack of relevant observational data. For example, relatively large uncertainties are introduced by a lack of data with regard to pre-industrial environmental conditions and other parameters that are necessary inputs to critical load models that are the basis for factor F1 in the AAI equation. Also, observational data are not generally available to evaluate the modeled relationships between nitrogen and sulfur in the ambient air and associated deposition, which are the basis for the other factors (i.e., F2, F3, and F4) in the AAI equation.

The EPA agrees that these data limitations and model uncertainties create a number of inherent uncertainties and complexities in the quantification of the F factors of the AAI and the representativeness of the F factors at an ecoregion scale (U.S. EPA, 2011, Appendix F). These uncertainties and complexities currently lead to large uncertainty in characterizing the degree of protectiveness that would be afforded by an AAI-based standard with quantified F factors derived as discussed in the final rule, within the ranges of levels and forms identified in section III.A of the final rule.

The EPA disagrees with the first set of commenters that the selection of sensitive ecoregions and percentile waterbodies would be arbitrary. The EPA fully discussed its rationale and selection of sensitive ecoregions and the range of percentiles used in section 7.2.5 of the PA. The EPA relied on available alkalinity and ANC data to draw distinctions between sensitive and non-sensitive ecoregions. The EPA used its judgment in selecting the range of percentiles for

sensitive and non-sensitive ecoregions, attempting to be neither over-protective nor under-protective of the set of waterbodies in each ecoregion.

In general, the first set of commenters tends to treat all aspects of the AAI as subject to a high to very high degree of uncertainty. The EPA disagrees with this view, and instead views some parts of the AAI as based on more certain scientific information than others. For example, the EPA believes there is a solid scientific basis for the general framework of the AAI and for the relationship between ANC and effects on aquatic life. There is a strong basis for selection of ANC as an ecological indicator, for selection of NO_y and SO_x as ambient air indicators, for selection of the annual and 3- to5-year averaging time frame, and for selection of the range of ANC and percentile of water bodies for consideration. Likewise, the EPA believes there is a solid scientific basis for selection of Omernik ecoregions as the geographic basis for development of the AAI F factors. The EPA believes that for many areas there is a strong basis for determining whether an ecoregion is acid sensitive or not acid sensitive, while recognizing there is some uncertainty in some areas as to which category the area should fall in. The EPA's decision not to adopt an AAI-based standard at this time is not driven by uncertainty in these elements of the AAI, but instead in the elements needed to derive the quantified F factors for ecoregions across the country and our ability to evaluate the representativeness of those F factors for an entire ecoregion. The greatest uncertainties concern the F1 and F2 factors, which relate to development of a single critical load to represent a specified percentile of all of the waterbodies in an ecoregion and development of the value for deposition of reduced nitrogen. In addition, there are also important uncertainties related to development of the F3 and F4 factors, which concern the quantified relationship between ambient levels of NO_y and SO_x and deposition rates of nitrogen and sulfur. The bases for these uncertainties are discussed in more detail in sections III.A.5 and section III.E of the final rule. Thus, while the EPA agrees in part with the first group of commenters, in general they paint with too broad a brush. The EPA's decision is based instead on taking into account the areas where there is less scientific uncertainty as well as the areas where there remain significant scientific uncertainties.

In general, the second set of commenters does not contest the scientific evidence as discussed by the EPA or the scientific conclusions the EPA draws. They do not contest the existence of scientific uncertainty or the causes of it, and do not present scientific or technical arguments to contest the nature or magnitude of the uncertainty. Instead, they disagree with the conclusions or judgments to draw from the uncertainty. In the view of these commenters, the degree of uncertainty is low enough to warrant setting an AAI standard at this time. They disagree with the Administrator's policy judgment that the nature and magnitude of uncertainty warrants not setting an AAI standard at this time. Their primary disagreement is with this judgment, not with the EPA's underlying views on the science and its uncertainties. As discussed in the proposal and below, however, the Administrator's reasoned judgment is that it is not appropriate to establish an AAI-based secondary standard at this time. The uncertainties discussed above prevent an understanding of the degree of protectiveness that would be afforded to various ecoregions across the country by a new standard defined in terms of a specific nationwide target ANC level and a specific percentile of water bodies for acid-sensitive ecoregions. Therefore, the Administrator is unable to identify an appropriate standard.

The EPA recognizes that the AAI equation, with factors quantified in the ranges discussed in section III.A of the final rule and described more fully in chapter 7 of the PA,

generally performs well in identifying areas of the country that are sensitive to such acidifying deposition and indicates, as expected, that lower ambient levels of oxides of nitrogen and sulfur would lead to higher calculated AAI values (PA, chapter 7). However, the various uncertainties discussed above are critical for determining with any degree of confidence the actual degree of protection that would be afforded such areas by any specific target ANC level and percentile of water bodies that would be chosen in setting a new AAI-based standard with quantified F factors, and thus for determining an appropriate AAI-based standard that meets the requirements of Section 109 of the CAA. The EPA recognizes that these limitations and uncertainties result in a considerable degree of uncertainty as to how well the quantified elements of the AAI standard would predict the actual relationship between varying ambient concentrations of oxides of nitrogen and sulfur and steady-state ANC levels across the distribution of water bodies within the various ecoregions in the United States. Because of this, there is considerable uncertainty as to the actual degree of protectiveness that such a standard would provide, especially for acid-sensitive ecoregions.

With regard to the specific comments raised by Earthjustice and the Center for Biological Diversity noted above, that the uncertainties are not so great as to preclude setting an AAI-based standard, the EPA disagrees. As an initial matter, the EPA agrees that staff did reach the conclusions in the PA noted in the first three points raised by Earthjustice, however EPA does not agree with the implications of those conclusions drawn by the commenter. First, while staff did conclude that the "confidence level in the information and processes associated with the linkages from ecological effects to atmospheric conditions through deposition and ecosystem modeling is very high," (PA, p. 7-67), that conclusion refers to the *structure* of the AAI, not to the quantification of the F factors that ultimately determine the degree of protectiveness afforded by any specific combination of level and form. While the scientific bases for the linkages between these factors of the AAI as presented in the PA are strongly supported, it is the quantification of these factors and the use of ecological and atmospheric modeling at an ecoregion scale that is necessary to specify the terms of the AAI equation and to determine the degree of protectiveness that any specific AAI-based standard would afford. Further, the appropriateness of these factors depends upon an understanding of the representativeness of the available distributions of critical load values at an ecoregion scale.

Second, while staff concluded that the AAI generally did perform well in the cumulative uncertainty analysis,[1] we note that analysis was limited to two ecoregions, only one of which was an acid-sensitive region. Further, the PA observed that these results indicate "that there is no systematic bias in the results despite what can be relatively high levels of uncertainty in the input parameters" (PA at 7-68). It is important to recognize that bias and uncertainty are not the same, and that a result indicative of minimal directional bias based on a very limited analysis does not negate conclusions with regard to the degree of uncertainty present in the various elements of the AAI. For example, the PA found that uncertainties in various elements of the AAI can be as high as 100% as was found for the transference ratios used in the AAI equation, as discussed in Appendix G of the PA. Extension of such results, which is inherent in drawing upon results from

[1] The cited PA text in this comment includes the phrase: "that mean results were 'very close' to the observed values" (PA at 7-68). For clarification, we note that the term "observed values" does not refer to *measured* values, but rather to the entire distribution of *calculated* values using the AAI equation, to which the mean values were compared.

only two areas as a basis for setting a national standard, likely results in potentially large and unquantifiable uncertainties.

Third, in considering the last two points raised by Earthjustice and the Center for Biological Diversity, we first observe that there is a substantive difference in the nature of the questions addressed in the PA and the nature of the policy judgment that needs to be made by the Administrator in determining if the available information is sufficient to provide an adequate basis for setting an AAI-based standard. The questions addressed in the PA focus on determining a range of alternative standards that would be appropriate for the Administrator to consider, and characterizing the uncertainties associated with such a standard. This is clearly not the same as reaching a judgment as to whether the uncertainties, aggregated across all the various elements of the AAI, allow for sufficient confidence in determining a specific AAI-based standard that would provide requisite protection. The EPA agrees that the PA lays out staff views on alternative levels and forms (in terms of percentiles of water bodies) of an AAI that would be appropriate to consider in setting a new AAI-based standard. While this is a reasonable conclusion to be drawn in the PA, it does not address the broader question of the overall uncertainty associated with the degree of protection afforded by specifying a level and percentile form.

As noted above, there is a considerable degree of uncertainty as to how well the quantified elements of the AAI standard would predict the actual relationship between varying ambient concentrations of oxides of nitrogen and sulfur and steady-state ANC levels across the distribution of water bodies at an ecoregion scale. In particular, defining percentile values for acid-sensitive and non-acid sensitive ecoregions, incorporated within factor F1 of the AAI equation, relies upon an understanding of the extent to which the available critical load distributions are representative of the set of water bodies within an ecoregion. Both EPA and CASAC have reflected concern with the degree of uncertainty that exists in our understanding of the representativeness of the available critical load distributions at this time. The CASAC expressly noted in its advice to the Administrator that "[a]s EPA moves forward in the regulatory process, we recommend some attention be given to our residual concern that the available data may reflect the more sensitive water bodies and thus, the selection of percentiles of water bodies to be protected could be conservatively biased" (Russell and Samet, 2011a). In EPA's view, a better understanding of this issue is central to characterizing the degree of protectiveness that an AAI-based standard would afford, and the extent of our understanding at this time is not sufficient to allow for a reasoned characterization of the degree of protectiveness that any specific AAI-based standard would afford. In light of these considerations, the EPA does not agree that there is a disconnect between the assessment of uncertainty in the PA and the policy judgment made by the Administrator that the nature and degree of uncertainties that are uniquely present in this rulemaking are such as to preclude reaching a reasoned decision that a new AAI-based standard would be requisite to protect public welfare from deposition-related effects from aquatic acidification.

With regard to comments that the EPA cannot lawfully reject a new AAI-based standard, the EPA disagrees with the second group of commenters that the Administrator is required to set an AAI-based standard at this time. Although the Administrator has concluded that the current secondary standards are neither appropriate nor adequate to protect against potentially adverse deposition-related effects associated with ambient concentrations of oxides of nitrogen and

sulfur, such a conclusion does not require the EPA to adopt a new NAAQS where the Administrator cannot reasonably judge that it would meet the criteria for a secondary NAAQS.

The Administrator judges that the current limitations in relevant data and the uncertainties associated with specifying the elements of a new AAI-based NAAQS defined in terms of modeled factors are of such nature and degree as to prevent her from reaching a reasoned decision as to what level and form (in terms of a selected percentile) of such a standard would provide any particular intended degree of protection of public welfare that the Administrator determined satisfied the requirements to set an appropriate standard under Section 109 of the CAA. As a result, the Administrator has determined that she cannot establish an AAI-based standard that is requisite to protect public welfare. The Administrator has made a similar judgment in deciding not to adopt new secondary NAAQS in the form of 1-hour standards identical to the primary NO_2 and SO_2 standards, as discussed below. No other NAAQS revisions to address the effects of acid deposition associated with oxides of nitrogen and sulfur in the ambient air have been suggested or considered by the EPA, CASAC, or commenters in this review.[2] As such, all possible revisions to the secondary NAAQS to address the effects of acid deposition would involve adoption of new secondary standards that are judged by the Administrator to have such a high degree of uncertainty that she cannot make a reasoned decision that a new standard would satisfy the criteria of Section 109(b) of the CAA.

Commenters have pointed to the requirement in Section 109(b)(2) of the CAA that any secondary NAAQS "must specify a level of air quality the attainment and maintenance of which …is requisite to protect the public welfare from any know or anticipated adverse effects…" in support of the argument that the EPA must adopt a new standard that provides requisite protection, having concluded that the current secondary standards are not sufficient to protect against adverse effects. In considering this comment, the EPA has taken into account the statutory language, as well as the bases for the EPA's conclusion that the current standards for oxides of nitrogen and sulfur are neither appropriate nor adequate to provide protection against potentially adverse deposition-related effects and the data and model uncertainties that limit our efforts to characterize the degree of protectiveness that would be afforded by either an AAI-based standard or a 1-hour standard. We have concluded that Section 109 of the CAA does not require the EPA to adopt a new secondary standard where, as here, in the reasoned judgment of the Administrator, the uncertainties associated with such a standard would prevent her from determining whether or not such a NAAQS is requisite to protect public welfare. Section 109(b) of the CAA does not require the EPA to set a new standard under circumstances where the Administrator cannot reasonably judge that it would meet the criteria for a secondary NAAQS.

The EPA recognizes and agrees with the comment from one environmental group that the EPA is not "foreclosed from setting a standard unless it can identify …a 'perfect' standard level that is free from any noteworthy uncertainty." However, that is not the situation in this rulemaking. The Agency has concluded that it would not be appropriate to promulgate a standard to address the public welfare effects of acidifying deposition where the remaining scientific

[2] No one has suggested that EPA should revise the current 3-hour or annual secondary standards to address the effects of acidifying deposition associated with oxides of nitrogen and sulfur in the ambient air. All revisions under consideration have involved adopting new secondary NAAQS.

uncertainties are of such import that they limit the EPA's ability to make a reasoned decision on the degree of protectiveness that would be afforded by such a standard. The EPA recognizes that the result of this decision is that the current secondary standards continue in place and continue to be neither appropriate nor adequate to protect against potentially adverse deposition-related effects associated with ambient concentrations of oxides of nitrogen and sulfur. However, in the Administrator's view the proper response under the current circumstances is to continue to develop the scientific and technical basis for a future revision to the standards, and not to adopt at this time a new secondary standard that she cannot reasonably judge would comply with Section 109 of the CAA.

Further, the EPA agrees with both groups of commenters and CASAC that collecting further field data would be beneficial. A field pilot program is discussed in detail in section IV of the final rule. However, the EPA disagrees with the first group of commenters' assertions that these uncertainties should invalidate or preclude the further development of an AAI-based standard.

D. Comments on Specific Aspects of the AAI Approach

This section discusses comments on the following four specific aspects of an AAI-based approach to setting a secondary standard for oxides of nitrogen and sulfur: (1) the inclusion of chemically reduced nitrogen (NH_x), in addition to oxides of nitrogen, in the AAI equation; (2) whether such a standard would be appropriately construed as a national standard versus a regional standard; (3) whether such a standard would be appropriately construed as an ambient air quality standard versus a water quality standard; and (4) whether the EPA has authority under the CAA to set a multi-pollutant NAAQS.

(1) Comments: As described in section III.A of the final rule, the AAI equation contains a separate factor that accounts for the acidifying potential of NH_x, in addition to the factor that accounts for the acidifying potential of oxides of nitrogen. Several industry commenters addressed this issue explicitly, with some expressing the view that NH_x should be treated the same as NO_x in the AAI, while others felt it should not be included at all in the AAI. Several commenters expressed the view that accounting for NH_x in the AAI equation represents a de facto regulation of ammonia, which they assert is unlawful since reduced nitrogen is not a listed air pollutant under Section 108 of the CAA.

Other commenters, including environmental groups and governmental agency commenters, did not explicitly comment on the inclusion of NH_x in the AAI equation; however several commenters made note of CASAC's advice on this issue. CASAC advised that it is necessary to include a factor for NH_x in the AAI equation, even though it is not a listed pollutant, since aquatic ecosystems respond to inputs of NH_x to create acidity just like they do with inputs of NO_x and SO_x.

Response: The EPA has included NH_x deposition explicitly as part of factor F2 in the AAI expression to account for the acidifying potential afforded by ammonia gas and ammonium ion. Inclusion of NH_x deposition, in addition to deposition of oxides of nitrogen, is necessary to account for potential effects of all reactive nitrogen species which, in turn, allows for determining the contributions of oxides of N and S to aquatic acidification. This approach is

consistent with the requirement in the CAA that where the state of the science provides a basis for considering such effects, the review of the air quality criteria for a pollutant should encompass the ways in which other air pollutants may interact with the criteria pollutant to produce adverse effects. See CAA Section 108(a)(2). In effect, the inclusion of NH_x deposition can be viewed as a necessary component consistent with our scientific understanding that links deposition of all nitrogen species to ecological effects.

The EPA recognizes that the NAAQS is established to address the pollutants oxides of nitrogen and oxides of sulfur. Consequently, the ambient concentrations of oxides of sulfur (as SO_x) and nitrogen (as NO_y) are accounted for separately from the deposition of NH_x in the AAI equation, thus defining the standard specifically in terms of the acidifying potential of levels of oxides of nitrogen and sulfur in the ambient air. More specifically, compliance with an AAI-based standard would be based on using federal reference or equivalent monitoring methods to measure ambient concentrations of NO_y and SO_x to determine an area's attainment status. Conversely, there would be no requirement to measure concentrations of NH_x to determine compliance with an AAI-based standard. Rather, ecoregion-specific values of NH_x deposition would be determined by modeling and would be specified by the EPA in conjunction with setting such a standard, and would not be a variable in the AAI equation as would SO_x and NO_y. The contribution of reduced forms of nitrogen to total nitrogen deposition would represent an ecosystem-specific environmental factor that plays a necessary background role in characterizing the relationship between the measured, variable levels of the ambient air indicators of oxides of nitrogen and sulfur (NO_y and SO_x) and the associated degree of aquatic acidification. Section 108 requires the air quality criteria to evaluate to the extent practicable the variable factors such as atmospheric conditions that affect the impact of the ambient air pollutant (in this case oxides of nitrogen and sulfur) on the public welfare. In this review, such variable factors include the deposition of reduced nitrogen in an ecoregion, as well as all of the other elements reflected in the factors F1 to F4, and the designation of an area as acid-sensitive or not acid-sensitive. Section 109 calls for the EPA to base the NAAQS on the air quality criteria, and accounting for the role of reduced nitrogen deposition in the AAI reflects this.

In considering this aspect of an AAI-based standard, the EPA took into account that in applying the AAI equation, all factors, including NH_x deposition, would be updated as appropriate as part of the periodic reviews of the NAAQS, called for at five-year intervals by the CAA, to account for changing environmental conditions and new data. In determining an ecoregion's status with regard to meeting a particular AAI-based standard, NH_x deposition reflected in the F2 factor would be treated just as all of the other environmental terms – e.g. critical loads and transference ratios -- which influence factors F1, F3 and F4. To the extent that changes in NH_x deposition occur from one review to the next, the ecoregion-specific F2 factors would be updated to reflect such changes. To the extent that NH_x deposition decreased from one review to the next, an AAI-based standard updated during a periodic review to reflect this change would allow for potentially higher levels of NO_y and SO_x that would meet a specific AAI-based standard; conversely, increased levels of NH_x deposition would allow for potentially lower levels of NO_y and SO_x. Meeting a specific AAI-based standard would only require that the combined levels of NO_y and SO_x be such that a calculated AAI value meet or exceed the AAI value set as the level of the standard. Consequently, while the contribution of NH_x deposition would be accounted for, NH_x emissions would not be regulated through the implementation of an AAI-based standard. NH_x deposition would be treated as an ecologically relevant background value

that could be updated over time to reflect changes in circumstances, but accounting for such changes would not be required for purposes of determining compliance with an AAI-based standard. Thus, the incorporation of NH_x in the AAI equation would not result in de facto regulation of NH_x emissions.

(2) Comments: Some commenters raised the issue of whether an AAI-based standard would be a national standard, as required by Section 109 of the CAA, or whether it is in essence a regional standard. One group of commenters (the Center for Biological Diversity and the National Park Service) generally expressed the view that an AAI-based standard would be a national standard, whereas another group, including industry commenters, asserted that an AAI-based standard would be a regional standard and thus not consistent with the requirements of the CAA.

The first group of commenters supported the use of a national ANC indicator, recognizing that an AAI approach would account for regional differences in sensitivity and relevant environmental factors while providing a nationally consistent degree of protection across sensitive ecoregions. For example, the National Park Service stated that the AAI approach provides a uniform level of protection to sensitive ecosystems while appropriately taking into account the variability in deposition, meteorology, and other relevant environmental factors across ecoregions.

The second group of commenters noted that application of the AAI equation in different areas of the country produced different allowable concentrations of NO_y and SO_x, asserting as a result that an AAI-based standard would be a regional standard. These commenters asserted that the EPA lacks authority under the CAA to set such a regional NAAQS. For example, UARG states that the AAI is applied differently in different regions of the country (e.g., sensitive vs. non-sensitive ecoregions). The Alliance of Automobile Manufacturers commented that both the EPA and Congress historically have decided that secondary national air quality standards are not an appropriate approach to address regionally variable welfare effects.

Response: The EPA believes that a secondary NAAQS based on the AAI approach could be a national standard, consistent with the CAA. An AAI-based standard would apply all across the country. It would be defined in part by a single level of the AAI – that is, every part of the country would be expected to meet or exceed a specified AAI level. The scientific basis for setting a national AAI level is rooted in the similarity between AAI and acid neutralizing capacity (ANC), which is a widely accepted ecological health indicator for aquatic acidification. The rationale underlying the use of ANC is that the ecosystem health reflected by an ANC value in one part of the country is generally similar to that in another location, irrespective of regional differences in biogeochemistry and atmospheric conditions. The EPA recognizes that allowable concentrations of the ambient air pollutant indicators for oxides of nitrogen and sulfur in the AAI equation can vary from one location to another and result in the same calculated AAI. The difference between an AAI-based standard and the existing primary standards is that the level of the standard is defined directly in terms of the measured ambient air pollutant indicator. That is, the health-based indicator and the measured ambient air indicator are based on the same chemical entity. In an AAI-based standard, the level of the standard, reflecting a nationally consistent degree of protection, would be defined in terms of an ecological indicator, ANC, and compliance would be determined based on concentrations of the ambient air indicators, NO_y and SO_x. From an ecosystem health perspective, it is most relevant to use the ecological indicator,

ANC, to establish a single level that, in the context of an AAI, leads to a similar degree of protection across the country. The allowable levels of NO_y and SO_x could vary across the country, while the specified AAI level and the corresponding degree of protection, would not. This would facilitate ensuring that such a NAAQS would provide sufficient protection, but not more than was necessary. It should be noted that in the 2006 particulate matter (PM) NAAQS decision the EPA set a NAAQS that envisions variation in allowable ambient levels of certain kinds of PM. The EPA set a PM_{10} standard with a single numerical level, which then allowed varying levels of coarse PM, a subset of PM_{10}. The PM_{10} standard was designed to allow lower levels of coarse PM in urban areas and higher levels of coarse PM in non-urban, rural areas. The EPA's goal was to target protection at urban areas, where the evidence showed coarse particles presented a greater risk to public health. The single numerical standard for PM_{10} allowed variable levels of coarse PM, with higher allowable levels where there was less evidence of risk and lower allowable levels where the evidence of risk was greater. This approach was upheld in American Farm Bur. Fed. v. EPA, 559 F.3d 512, 533- 536 (D.C. Cir. 2009).

In conjunction with consideration of an AAI-based standard, the EPA has recognized that the nation includes some relatively acid-sensitive and some relatively non-acid sensitive ecoregions. This delineation allows for an appropriate application of the AAI equation that increases its relevancy from a national perspective as it avoids creating more than requisite protection in areas that are not acid sensitive. The AAI equation and the selected level of such a standard would be applicable everywhere; however, factors in the AAI equation are appropriately dependent on the sensitive and non-sensitive ecoregion classification. Therefore, the delineation of sensitive and non-sensitive regions allows for a nationally consistent application of the AAI equation as it targets protection on those areas most likely to benefit from reductions in acidifying deposition of oxides of nitrogen and sulfur, and avoids more than requisite protection in areas that would not benefit from such reductions.

(3) Comments: Some commenters expressed the view that an AAI-based standard would essentially be a water quality standard, since it would use ANC, a water quality property, as the ecological indicator. For example, UARG expressed this view by noting that an AAI standard would be defined in terms of a single water quality level with multiple allowable air quality concentrations of oxides of nitrogen and sulfur.

Response: The EPA notes that the AAI relates aquatic acidification to ambient air concentrations of oxides of nitrogen and sulfur. An AAI-based standard would be set at a level such that ambient air concentrations would not cause harmful acidification effects to water quality resources, which is within the scope of welfare effects that secondary NAAQS are to address (i.e., welfare effects include, but are not limited to, "effects on soils, water, ..."). Accordingly, while an AAI-based standard would address effects on water quality, it would do so by defining the allowable ambient air concentrations of oxides of nitrogen and sulfur that would provide appropriate protection against such effects. Compliance with such a standard would be determined by measuring ambient air concentrations of NO_y and SO_x, not by measuring the water quality property of ANC. The actual water quality of any body of water would not be used to determine compliance with the air quality standard, and no body of water would be considered in "non-compliance" with an AAI air quality standard. Thus, an AAI-based standard is appropriately construed as an air quality standard, not a water quality standard.

(4) Comments: Some commenters questioned whether the EPA has the authority to establish a NAAQS that jointly addresses ambient concentrations of oxides of nitrogen and oxides of sulfur. Pointing to language in Section 109(b)(2) that a NAAQS must address "adverse effects associated with the presence of *such air pollutant* in the ambient air," these commenters took the position that the EPA may not allow for tradeoffs between two pollutants in setting a NAAQS. See Section109 (b)(2)(emphasis added). These commenters suggest the NAAQS must be set for "such air pollutant" only.

Response: The EPA disagrees that the phrase "such air pollutant" in Section109 (b) (2) would prohibit the Agency from setting a multi-pollutant NAAQS in the form of an AAI. When the Administrator sets a NAAQS, the standard must be "requisite to protect the public welfare from any known or anticipated adverse effects associated with the presence of such air pollutant." CAA Section109 (b)(2). The term "associated with…such air pollutant" describes the category of adverse affects to be associated with the air pollutant at issue, not the standard.

Oxides of nitrogen and sulfur, pollutants for which the EPA has issued air quality criteria, both cause acidification of aquatic ecosystems, effects that could be considered adverse to public welfare. As such, aquatic acidification is a "known or anticipated adverse effect associated with the presence of [oxides of nitrogen] in the ambient air." This known or anticipated adverse effect is also associated with the presence of oxides of sulfur in the ambient air. Given the scientific links between ambient air concentrations of oxides of nitrogen and sulfur, the related deposition of nitrogen and sulfur, and the associated ecological responses, the EPA appropriately considered a multi-pollutant NAAQS in the form of an AAI to protect against the effects of acidifying deposition to aquatic ecosystems that took into account these linkages. Rather than limiting the EPA's authority, the language cited by the commenters goes to the breadth of the EPA's obligation and authority to set standards to protect against "any known or anticipated adverse effects." In addition, the NAAQS are to be based on the air quality criteria, which under Section 108 (a)(2) are required to consider the kind of multi-pollutant linkage evident in this review. The EPA does not read the language of Section 109(b) as prohibiting the Administrator from setting a multi-pollutant NAAQS such as the AAI where such an approach would be judged as the appropriate way to satisfy Section 109(b)'s requirements for each of the pollutants involved.

E. Comments on Technical Elements of the AAI Approach

This section summarizes comments received on specific technical elements of the AAI approach that are not fully addressed above. Since the EPA is not promulgating an AAI-based standard in this review, these technical comments are noted for their value to the next review of the secondary NAAQS for oxides of nitrogen and sulfur. Accordingly, the EPA recognizes the comments and will consider them in the context of the next review progresses.

Comments: Some commenters (e.g., EPRI, UARG, ASARCO, AAM, Tri-State Generation and Transmission Association) provided in-depth technical comments and analysis of the AAI approach. In some cases, the commenters disagreed with the models and indicators that the EPA had considered. In other cases, the commenters provided additional information that in their view would help inform an expanded uncertainty analysis. Other commenters (e.g., Center for Biological Diversity, Earthjustice, Adirondack Council and the National Park Service) expressed support for the models and indicators that EPA had considered, noting that the EPA used well-

established water quality and biological indicators and well-established models that address air deposition, water quality impacts, and effects on biota.

With regard to the EPA's consideration of ANC as an ecological indicator for effects related to aquatic acidification, some commenters expressed concerns that ANC was not the best indicator of NO_x and SO_x depositional effects on aquatic biota. These commenters expressed the view that in certain areas of the country, ANC does not act as a good predictor of aquatic health as measured by fish species diversity. Some such commenters provided references to studies not reviewed in the ISA and discussed the interactions of ANC with the presence of dissolved organic carbon and inorganic monomeric aluminum and its contribution to pH. These commenters noted that inorganic monomeric aluminum and pH are more directly causally associated with the toxic mechanisms of impaired species richness and fish mortality; hence, in their view, are better ecological indicators than ANC.

On the other hand, other commenters supported EPA's consideration of ANC as an appropriate ecological indicator, referencing CASAC's support of ANC as an appropriate ecological indicator for an AAI-based standard and support for focusing on target ANC levels as the basis for defining the degree of protection that an AAI-based standard would afford.

With regard to EPA's consideration of the Omernik ecoregion scheme, some commenters expressed reservations over the choice of the Omernik ecoregion scheme and felt that the EPA had not fully evaluated the relationship to sensitive waterbodies. They felt a more thorough analysis was warranted including distribution of sensitive lakes and underlying watershed characteristics. They felt data representativeness had not been adequately analyzed and that the acid sensitivity classification was flawed. They submitted in-depth evaluations and suggestions for additional data. They also felt that the current approach did not adequately account for naturally acidic areas and anthropogenic non-emission sources of acidity. In addition, they felt that the EPA needs to evaluate areas of the country that are more representative, including non-sensitive regions. They recommended that the EPA should develop a national database, including key water quality parameters, aquatic biota at several trophic levels, soil chemistry variables, and watershed characteristics.

Other commenters expressed support for the use of the Omernik ecoregion scheme by way of referencing CASAC's review and support of the EPA rationale for selecting the Omernik Level III ecoregions over other regionalization schemes discussed in the PA (U.S. EPA, 2011).

While several commenters called for more data to be generated in relatively unstudied areas, one commenter wanted the EPA to further study the Appalachian Mountain region to explain why it is a heavily impacted outlier, showing the largest relative exceedances of estimated critical loads by current deposition of nitrogen and sulfur (see chapter 7, U.S. EPA, 2011). This commenter urged the EPA to further explore whether the AAI is accurately assessing and identifying areas of concern based on atmospheric and water conditions, including the influence of fertilizer deposition. Another commenter recommended that the EPA select the Chesapeake Bay watershed for further study, noting that additional data would help with the nitrogen total maximum daily load (TMDL) that is being implemented.

With regard to critical load models, some commenters questioned the EPA's choice of acidification models for the critical load calculations used to develop the AAI equation. They expressed concern with the use of steady-state assumptions and simple aquatic models, and expressed the view that the Steady-State Water Chemistry model considered by EPA did not adequately capture the complex processes involved in acidification of waterbodies. They expressed concerns with how base cation weathering was determined and how base cation deposition is handled within the AAI. Some commenters suggested the EPA engage in further development and testing of mechanistic models that include key physical and chemical processes, e.g., ion uptake, ion exchange, and weathering rates. They provided detailed discussion of alternative models and approaches. Some commenters also expressed concerns about how the AAI treats nitrogen uptake by terrestrial plants, expressing the view that it provides insufficient consideration of soil sulfur retention.

Other commenters supported the EPA's choice of critical load models and recommended extending the approach to other ecosystem effects in addition to aquatic acidification, such as terrestrial acidification, terrestrial nutrient enrichment, and aquatic eutrophication. They recommended that the EPA fully consider research and policy decisions that have occurred in parts of Europe in the area of terrestrial nutrient enrichment from nitrogen deposition.

With regard to the transference ratios used in the AAI, some commenters expressed concerns that there is no unique link between ground-level NO_x and SO_x concentrations and the deposition that may lead to effects. In their view, there is a lack of deposition data and the models are inadequate for deposition predictions. They expressed concerns with the transference ratio as a method to link ambient air concentrations to deposition. One commenter submitted analyses of the variability in the transference ratios using various air deposition models and argued that the transference ratios were unstable and thus created great uncertainty within the AAI. Another commenter felt that emissions of NO_x and SO_x, instead of ambient concentrations, were better predictors of aquatic acidification effects; therefore an air quality standard was inappropriate. These commenters included detailed analyses and rationales for their positions.

Other commenters supported the EPA's overall approach to an AAI-based standard, including the use of transference ratios in the AAI equation for an ecoregion. These commenters noted CASAC's review of the PA and support for such an approach.

Response: The EPA has carefully considered these technical comments and analyses and believes that the issues raised in the comments are appropriately considered in the next review. The information presented in these comment will help inform EPA's consideration of the scientific aspects of developing an ecologically relevant, multi-pollutant standard in the next review.

F. Comments on 1-Hour NO_2 and SO_2 Secondary Standards

Comments: Comments received on the proposal related to setting new 1-hour NO_2 and SO_2 secondary standards are addressed in this section. Most generally, there was broad and strong opposition to the EPA's proposed decision to set 1-hour NO_2 and SO_2 secondary standards identical to the 1-hour NO_2 and SO_2 primary standards. For example, strong opposition to this proposed decision was expressed by a diverse set of commenters, including some environmental

groups (e.g., Environmental Justice, the Adirondack Council) and industry groups (e.g., UARG, AAM, ASARCO, API, Portland Cement Association, Tri-State Generation and Transmission Association, Louisiana Chemical Association, East Kentucky Power Cooperative, FMMI, Rio Tinto), the U.S. Department of the Interior, and some states (e.g., NY, PA, TX). These commenters offered various arguments in support of their views that the proposed decision is unlawful, arbitrary, and not supported by the record of this rulemaking, as outlined below. One commenter (NC) supported setting secondary standards identical to the 1-hour NO_2 and SO_2 primary standards, while also supporting the EPA's decision to take additional time to develop a multi-pollutant AAI-based secondary standard. Another commenter (SD) simply supported setting secondary standards that are no more stringent than the primary standards.

In proposing the 1-hour secondary standards, the EPA recognized that such standards would not be ecologically relevant, but concluded that they would nonetheless "directionally provide some degree of additional protection" by reducing deposition to sensitive ecosystems. The EPA also noted that this was consistent with the view that the current secondary standards are neither sufficiently protective nor appropriate in form, but that it is not appropriate to propose to set a new, ecologically relevant multi-pollutant secondary standard at this time.

In arguing that the proposed decision to set 1-hour NO_2 and SO_2 secondary standards identical to the 1-hour NO_2 and SO_2 primary standards is unlawful, commenters asserted that the EPA's rationale is not consistent with the requirements of Section 109 of the CAA. Commenters argue that this rationale is not consistent with the CAA requirement that the EPA set secondary NAAQS that are "requisite to protect public welfare;" that is, a standard that is neither more nor less stringent than necessary for this purpose. More specifically, these commenters argue that a standard that is based solely on "directionally" improving the environment, without any evidence or judgment that it would provide "requisite" protection, is not consistent with the requirements of the CAA and is thus unlawful. Some commenters also note that the CAA requires that the EPA revise previously adopted NAAQS as "appropriate" to provide such protection. These commenters assert that since the EPA's proposal concludes that the 1-hour NO_2 and SO_2 standards are not ecologically relevant to address deposition-related effects on sensitive ecosystems, adding such standards cannot be considered to be an appropriate revision to the NAAQS for the purpose of addressing adverse ecological effects.

Commenters also raised a number of issues in support of their views that the proposed decision is arbitrary and unsupported by the available information in the record of this rulemaking. Some commenters noted that there is no evidence or analysis in the record that addresses the degree of protection that would likely be afforded by 1-hour NO_2 and SO_2 standards, and, further, that the EPA does not claim otherwise. In the absence of such information, commenters argue that the EPA cannot make a reasoned judgment as to what levels of such 1-hour NO_2 and SO_2 standards would be requisite to protect public welfare; in particular, some commenters emphasized that the EPA cannot demonstrate that such standards would not be more stringent than necessary to protect against adverse deposition-related effects to sensitive ecosystems. Thus, in the commenters' view, any such 1-hour standards would be arbitrary.

One commenter also expressed the view that the EPA's proposed decision to set new 1-hour NO_2 and SO_2 secondary standards is inconsistent with the reasoning the EPA used as a basis for proposing not to set a new ecologically relevant AAI-based secondary standard at this

time. As summarized above, the EPA based its proposed decision not to set an AAI-based standard, which is expressly designed to address important differences in ecosystem sensitivities, in part on uncertainties and limitations in relevant information that were of such nature and degree as to prevent the Administrator from reaching a reasoned decision at this time as to what level and form of such a standard would provide a particular degree of protection. This commenter asserts that the proposed decision to set new 1-hour NO_2 and SO_2 secondary standards completely ignores such uncertainties inherent in 1-hour standards, which are not even structured to account for differences in ecosystem sensitivities.

Some commenters asserted not only that the EPA has failed to provide any information on the degree of protection that would likely be afforded by the proposed 1-hour NO_2 and SO_2 standards, but that such an analysis cannot be done since there is no rational connection between any of the elements of the proposed 1-hour secondary standards – including the averaging time and level – and the ecological effects the proposed standards are intended to address. In particular, commenters noted that the EPA has not presented any rational basis for concluding that standards designed to reduce human health risks associated with short-term peak concentrations of NO_2 and SO_2 have any connection whatsoever to addressing long-term deposition of oxides of nitrogen and sulfur and associated impacts on sensitive ecosystems.

Further, commenters argued that there is no evidence in the record that demonstrates the proposed 1-hour secondary standards would provide any environmental benefit. For example, commenters noted that such standards do not take into account ecosystem sensitivity; they may not result in reductions to long-term deposition that is the relevant time frame for deposition-related effects on sensitive ecosystems; and they would not provide any benefit beyond that which might accrue from the identical primary standards that are already in effect. Some commenters have also noted that many other environmental regulations are already in place that will provide reductions in ambient oxides of nitrogen and sulfur, and that the EPA has not demonstrated that any additional reductions are needed to provide requisite protection.

Response: The EPA agrees that the Agency has not presented evidence or analysis in the record that addresses the degree of protection that would likely be afforded by secondary standards set identical to the current 1-hour NO_2 and SO_2 primary standards. The EPA further agrees that such an analysis cannot be done since there is no demonstrable linkage between peak 1-hour average concentrations of NO_2 and SO_2 in the ambient air and the impact of deposition-related acidification associated with oxides of nitrogen and sulfur on sensitive aquatic ecosystems that the proposed standards were intended to address. As a result, the EPA agrees that there is no factual basis to make a reasoned judgment as to what levels of 1-hour NO_2 and SO_2 standards would provide a desired degree of protection of the public welfare, such that the EPA cannot demonstrate or judge that the proposed standards would not be more or less stringent than necessary to provide the desired degree of protection against potentially adverse deposition-related effects to sensitive ecosystems.

As to whether the proposed standards would provide any environmental benefit, it is the EPA's view that it is reasonable to conclude that any standard that would lead to reductions in NO_2 and SO_2 emissions would likely result in some environmental benefit for some acid-sensitive areas. Nonetheless, the EPA recognizes that any such environmental benefit that would result from reductions in NO_2 and SO_2 emissions sufficient to attain the 1-hour standards cannot

be specifically quantified or linked to reductions in aquatic acidification in specific ecoregions. In addition, unlike an AAI-based standard, the 1-hour standards would tend to provide more protection than is warranted in areas that are not acid-sensitive.

Further, the EPA recognizes that any such benefits would accrue from the 1-hour NO_2 and SO_2 primary standards that are in effect, regardless of whether identical secondary standards are adopted. The EPA does not agree, however, that the Agency needs to consider future reductions that may accrue from other environmental regulations in the context of reaching a judgment as to what NAAQS is requisite to protect public welfare.

The EPA notes that the strongly held view of the commenters with respect to the proposed 1-hour standards is that the EPA should reject and not adopt a standard where there is not an adequate scientific or technical basis for judging the degree of protection which such a standard would provide. The EPA agrees with that general point. According to commenters, the 1-hour standards should be rejected because they do not have such a basis, and, as discussed below, the EPA agrees. This is consistent with the reasoning that the EPA has applied to consideration of an AAI-based standard, as discussed above in response to comments related to an AAI-based standard. As noted above, the limitations and uncertainties in the scientific and technical basis for developing a specific AAI-based standard result in a great degree of uncertainty as to how well the quantified elements of the AAI would predict the actual relationship between varying ambient concentrations of oxides of nitrogen and sulfur and steady-state ANC levels across the distribution of water bodies within the various ecoregions in the United States. Because of this, there is great uncertainty as to the actual degree of protectiveness that such a standard would provide, especially for acid-sensitive ecoregions. The Administrator judges that the uncertainties are of such a nature and magnitude that there is no reasoned way to choose a specific AAI-based standard, in terms of a specific nationwide target ANC level or percentile of water bodies that would appropriately account for the uncertainties, since neither the direction nor the magnitude of change from the target level and percentile that would otherwise be chosen can reasonably be ascertained at this time.[3]

The EPA has also considered, in light of the public comments, whether it is necessary or appropriate under Section 109 of the CAA to make any revision to the current secondary standards for oxides of nitrogen and sulfur, having concluded that the current standards are neither adequate nor appropriate. As discussed in section III.D.1.a of the final rule, with regard to comments on the EPA's proposed decision not to set a new multi-pollutant AAI-based standard at this time, some commenters argued that the EPA cannot lawfully use uncertainty as a basis to decline to set an ecologically relevant standard, having concluded that the current secondary standards are neither adequately protective nor appropriate to provide protection to ecosystems. In response, the EPA disagrees, stating that data limitations and uncertainties in key elements of a standard, which are of such nature and degree as to prevent the Administrator from reaching a reasoned decision as to what specific standard would be appropriate to provide requisite

[3] Thus, as discussed above, EPA's disagreement with commenters concerning adoption of an AAI-based standard at this time appears to stem from differing views on whether or not there is an adequate scientific or technical basis for judging the degree of protection which an AAI-based standard would afford. There does not appear to be a disagreement with the view that EPA should not adopt a standard absent such a scientific or technical basis.

protection, are an appropriate basis for deciding not to set such a standard, even one that is of an ecologically relevant form. The EPA concludes that it is appropriate to apply the same reasoning in reaching a decision as to whether to set new 1-hour NO_2 and SO_2 secondary standards. In this case, the uncertainties are arguably greater than with an AAI-based standard, since as noted above there is no demonstrable linkage between the elements of such standards and impacts on sensitive ecosystems that the standards would be intended to address.

III. RESPONSES TO SIGNIFICANT COMMENTS RELATED TO THE FIELD PILOT PROGRAM AND MONITORING METHODS EVALUATION

Public comments on EPA's proposed plans for a field pilot program and related evaluation of monitoring methods generally fell into the following four topic areas: goals, objectives, and scope; monitoring network and site selection; complementary measurements and instrumentation; and collaboration and stakeholder participation. An overview of these comments and EPA's responses are discussed in section of IV.D of the final rule and in sections III.A-D below.

In addition, many commenters generally requested that EPA provide clarification of its plans regarding the field pilot program. As outlined below as part of section III.D, EPA is developing a draft white paper that will reflect input from EPA's ongoing consultation with its partners on the National Association of Clean Air Agencies (NACAA) monitor steering committee as well as EPA's consideration of the public comments made on the proposal. The draft white paper in intended to provide further clarity regarding the purpose, scope, program elements, and process for participation in the development and implementation of a field pilot program. The EPA plans to make this draft white paper available for additional public comment later this year. After taking into consideration further input from the public, the EPA plans to prepare a final white paper that will serve as a work plan for the field pilot program.

A. Goals, Objectives, and Scope

Comments: There was a mix of comments regarding the need for and the overall purpose and scope of the field pilot program. In general commenters that supported the AAI approach ((e.g., U.S. Department of Interior (DOI)/National Park Service (NPS), Nature Conservancy, Adirondack Council, NESCAUM, NY, PA, NC) also supported the concept of deploying a field pilot program as well the proposed goals and objectives, while offering specific comments on the scope of the proposed monitoring effort. Other commenters supporting the AAI approach, including Earthjustice and the Center for Biological Diversity expressed the view that a field pilot program was not needed to support adoption of such a standard in this review. A variety of commenters expressed the view that a field pilot program in 3 to 5 ecoregions was too limited to adequately capture differences in concentrations and deposition patterns across the nation.

Commenters that did not support the adoption or future development of an AAI-based secondary NAAQS (e.g., EPRI, UARG, AAM, NCBA, Aluminum Association, and TX) expressed the view that a field pilot program was therefore not needed. However, these commenters nonetheless expressed the view that if EPA intended to consider such a standard in future reviews, the field pilot program would need to expand in coverage and incorporate a much

more comprehensive research program to address data gaps and uncertainties inherent in such an approach. These commenters suggested that the field pilot program should be more responsive to the issues raised by the members of the CASAC review panel. One commenter (API) expressed the view that even if EPA intended to consider such a standard in the future, a field study was not appropriate at this time on the basis that the AAI-based approach was still only very preliminary in nature.

These commenters not supporting the AAI and the field pilot program as proposed contended that the proposed program fails to address key scientific uncertainties and data needs with regard to a methodology based on the AAI, and cannot meaningfully reduce the uncertainties that would be associated with such a standard. Some of these commenters offered specific recommendations for areas of research, noted below, that in their view would be necessary to support any further consideration of such a standard. For example, these commenters contended that it was necessary to conduct research in the following areas before further consideration of an AAI-based standard: (1) the effect of other sources, including wastewater pollution from permitted or unpermitted sources and fertilization of farm lands, on aquatic acidification; (2) relationships between measured air quality and deposition rates and related model performance evaluations; (3) improved methods for measuring dry deposition; and (4) characterization of NH_x concentrations that are representative of specific ecoregions for all ecoregions based on a model performance evaluation. More specific suggestions regarding long-term research activities include:

- Exploration of several alternate methods to measure concentrations of SO_x, NO_y and NH_x in the atmosphere, including methods with high-time resolution and methods that target specific components of these three families of chemical compounds; and target methods that can differentiate between organic and inorganic constituents of gases and particles.
- Development of instruments to measure actual dry deposition fluxes of these species instead of relying on a combination of ambient concentrations and modeled deposition velocities. An emphasis should be given to methods that would be amenable to operation in routine networks; these methods should be robust, relatively low-cost, and provide continuous data on the flux of SO_x, NO_y and NH_x. Consideration should be given to the use of Leaf Areas Indices (LAI) in combination with flux measurements to better develop algorithms for estimating dry deposition fluxes that accurately represent the role of the forest canopy.
- Collection of actual deposition data in addition to concentrations in order to test the suitability of the transference ratio concept, given the role of atmospheric models in defining the AAI. In doing so, data should be collected at different locations of any regionalization schemes being considered in order to evaluate the spatial variability of these ratios across different geospatial classification methods. These data should then be compared to model simulations as part of a rigorous model evaluation study, which should include more than one atmospheric model and various model configurations.
- Continued development of atmospheric models such that they include missing emissions sources (such as emissions or organic reduced-nitrogen gases) and the accurate temporal and spatial distribution of emissions. In addition, atmospheric models should simulate the bi-directional flux of NO_y and NH_x species, which would require better land-use and characterization data for use within the modeling systems. Atmospheric models should also accurately represent the gas-particle partitioning of chemical compounds, in

particular the formation of ammonium nitrate under different meteorological and air quality conditions.

Additional views were expressed by various commenters in regard to implementation, site selection and data availability. Many commenters from State agencies and industry agreed with the EPA that implementation challenges should be addressed during the course of the field pilot program. For example, commenters expressed the view that guidance should emerge for monitoring network design accounting for the influence of variability of air concentration and deposition patterns within specific ecoregions. Some commenters also noted that much of the underlying information for the AAI was based on the Adirondacks and Shenandoah regions which are relatively rich data sources and the field pilot program should consider under-sampled areas in other parts of country such as the mountainous West. Also, some commenters requested that relatively non-acid sensitive areas be included in the field pilot program in the interest of broader national applicability or, as one state agency suggested, the availability of a rich data base in the Chesapeake Bay region. Some commenters also expressed the view that results from the field pilot program would not be available for the next periodic review of the secondary standards for oxides of nitrogen and sulfur.

Response: Having considered these comments contending that the scope of the field pilot program is too limited spatially and not sufficiently comprehensive, EPA maintains that the purpose and scope of the pilot studies program as presented in the proposal remain appropriate, with further clarification provided in IV.D of the final rule. As summarized in section IV.A of the final rule, the primary goal of the field pilot program is to collect and analyze data so as to enhance the Agency's understanding of the degree of protectiveness that would likely be afforded by an AAI-based standard. EPA also intends that data generated by this program would support development of an appropriate monitoring network for such a standard. This field pilot program is not intended to be a research program, but rather to be a more targeted data collection and analysis effort, which will be done in conjunction with ongoing research efforts that are better suited to address some of the issues raised by commenters on the breadth of the field pilot program.

EPA largely agrees that the scope of the field pilot program is not adequate to address many of the issues raised by the commenters regarding either the ability to adequately capture air quality and deposition patterns in all ecoregions or fully addressing scientific uncertainties related to numerous investigations into measurement development methods and biogeochemical and atmospheric deposition processes. However, as noted earlier, a field pilot program by definition is limited in scope and intended to guide future broader applications. Toward that end, the field pilot program is intended to provide an intermediate link between initial conceptual design and potential future development and adoption of a standard, where the breadth and depth of spatial coverage would explicitly be addressed through monitoring network rules and implementation guidance.

The relevant ongoing programs addressing underlying atmospheric deposition uncertainties and development of critical load models include EPA's atmospheric deposition research program and the multi-agency National Critical Load Data Base (NCLDB) program, respectively. In addition, the NAAQS review process of iterative science review and assessment

provides a framework for evaluating newly available information that may address current data gaps and scientific uncertainties. These research programs are appropriate venues for addressing comments, including relevant CASAC recommendations, regarding desired improvements in the science underlying an AAI-based standard. In light of these ongoing research programs, it is not appropriate to duplicate these efforts through an expanded scope of the field pilot program. Rather, the most efficient approach is to increase the coordination between the field pilot program and these existing efforts, an important theme of the field pilot program white paper (section IV.D of the final rule). For example, EPA will explore co-locating planned dry deposition studies at field pilot program sites that would result in mutually beneficial data enhancements that support both pilot program and research program objectives.

With regard to views regarding the importance of water quality monitoring, the EPA agrees with comments recommending increased coordination with water quality sampling and critical load modeling programs. In addition to working closely with the NCLDB, EPA will factor in availability of water quality monitoring data in selecting field pilot program sites. The field pilot program has the potential to spur increased water quality monitoring in under-sampled areas which would improve confidence in generating ecoregion representative critical loads, as well as enhancing longer-term assessment of progress.

In addressing the last group of comments concerning implementation, site selection and data availability, EPA offers the following views. The field pilot program does provide an opportunity to assist in answering a number of implementation challenges, including the design of a future network that could support an AAI-based secondary standard. Toward that end, EPA will work closely with its state and local agency partners in utilizing the field pilot program as a test case for implementation-based issues. In optimizing the design of a field pilot program, emphasis will be placed on relatively acid-sensitive areas given that those are areas an AAI-based standard would be intended to protect. Nevertheless, EPA will consider ecoregions that may offer advantages in having multiple deposition-based effects beyond aquatic acidification that potentially could support future reviews that consider multiple ecological effects. In addition, nearly all ecoregions have a mix of acid-sensitive and non-acid sensitive water bodies which will allow for assessing some of the AAI applicability to different aquatic systems. EPA also notes that the field pilot program will provide data and analyses that will help inform consideration of an AAI-based standard in the next review. For example, data and analyses generated as part of the field pilot program will be incorporated into EPA's characterization of environmental factors and evaluations of alternative approaches to specifying the terms of an AAI that would be included in the exposure/risk assessment and policy assessment prepared as part of the next review.

B. Monitoring Network and Site Selection

Comments: Most commenters expressed the view that the Clean Air Status and Trends Network (CASTNET) was an appropriate program to support the field pilot program and a potential AAI-based standard. While government agencies generally supported the use of CASTNET, some State organizations suggested that the NCore monitoring network may be more efficient given that the costs of adding CASTNET filter packs (CFPs) to NCore locations is less than that of adding NOy instruments, which exist at NCore locations, to CASTNET locations. Support also

was expressed by New York State and NESCAUM for the use of rural NCore monitoring stations, where appropriate, in combination with CASTNET sites. Some states requested that access to the sampling methods and laboratory analyses used in the program and all data results be made through a national contract for States and local agencies, a concern related to CASTNET operations being managed by EPA. Environmental groups also supported the use of CASTNET and encouraged EPA to adopt the multiple stakeholder process of the NCLDB program and to align CASTNET sites with the Temporally Integrated Monitoring of Ecosystems and Long-Term Monitoring (TIME/LTM) water sampling programs. These water sampling programs should also be extended to other under-sampled areas of the country that are acid sensitive. Some industry commenters (e.g., API) raised concerns regarding the CFPs as they have measurement artifacts associated with both mass loss and gain.

Some state agencies commented that states should not be required to fund or implement the pilot monitoring studies, and funding should arise from sources other than State and Territorial Air Grant (STAG) funds. In related comments, the NPS and environmental groups encouraged EPA to make this effort a priority for funding.

Some commenters, including some industry groups, were less supportive in their comments, with some expressing the view that there are very significant data gaps that a field monitoring program should be designed to fill. Some of these commenters noted that the field program described in the proposal is limited to measuring ambient concentrations with very coarse technologies. In the view of these commenters, complementary measurements beyond the atmospheric indicators that had been considered by EPA should be included, along with collocation of multiple measurements at all site locations. Some of these commenters supported the selection of monitoring sites that include locations with extreme temperature and relative humidity conditions. One commenter suggested that a minimum of three ecoregions in the eastern United States should be included in the field pilot program.

Response: The EPA has considered all available monitoring networks in the interest of locating the most suitable sites for a pilot study and to effectively leverage resources. The CASTNET monitoring program offers substantially more available platforms in acid-sensitive ecoregions relative to rural NCore sites and CASTNET sites already include the CFP method for measurements of key atmospheric species. Consequently, the financial burden on states, tribes and local air monitoring agencies would be less using this existing infrastructure instead of expanding measurements at or relocating rural NCore sites. The CASTNET siting design originally was intended to discern contributions of acidifying deposition of NO_x and SO_x to sensitive ecosystems, which is especially relevant for the AAI applications. NCore was designed as a more generalized network to collect measurements in a variety of geographical areas, with no specific focus on acid-sensitive ecosystems. Moreover, CASTNET has established a track record over the last two decades of providing quality measurements, whereas NCore is a relatively new network that has been fully deployed for less than two years and therefore not been subjected to review and analysis commensurate with the CASTNET program. Nevertheless, as some states suggested, this pilot program should afford an opportunity to explore the use of existing rural NCore sites in acid-sensitive ecoregions. EPA welcomes the inclusion of rural NCore sites into the pilot study in cases where there are clear advantages of using such sites, and especially where such sites provide additional information likely resulting in more conclusive

data findings. The development of site selection criteria and site selection will be conducted in partnership with other federal, state and local agencies. Although CASTNET is managed by EPA, the agency has aggressively supported the user community management approach adopted in the National Atmospheric Deposition Program (NADP) and views the field pilot program as an opportunity to expand ownership of CASTNET analysis and data products, which currently can be accessed by the public.

While the field pilot program resources are focused on atmospheric measurements, as noted above EPA will try to leverage existing water quality monitoring programs such as TIME/LTM in selecting field pilot program site locations. EPA would rely heavily on the NCLDB critical load work for generating AAI values at monitoring locations as part of the field pilot program. In regard to issues raised by commenters regarding artifacts in the CFP, which would be the basis for SO_x data in the field pilot program, EPA notes that these methods have been extensively deployed and evaluated and have exhibited generally excellent performance. As part of the CASAC review on measurement methods, CASAC pointed out that the CFPs are preferred methods for measuring SO_x in rural, low concentration environments due to the sensitivity of the CFP method.

C. Complementary Measurements and Instrumentation

Comments: In general, commenters across government agencies, environmental groups and industry supported the use of complementary measurements that would be deployed in addition to the CFP and NO_y instruments used to measure the indicators, NO_y and SO_x. Comments regarding these measurements were provided in different contexts. For example, industry views reflected a position that complementary measurements were necessary to address information gaps, whereas state agencies and environmental groups expressed more general support in the interest of adding additional useful data, but not as a required component of the field pilot program.

Commenters expressed support for including trace gas continuous SO_2 and speciated $PM_{2.5}$ measurements in the field pilot program to provide test data for determining the suitability of continuous SO_2 measurements as a Federal Equivalent Method (FEM) for secondary standards and to characterize the relationship between CFP-based particulate sulfate and the national network of speciation samplers used throughout the state and local air quality networks. Industry commenters suggested that dry deposition flux measurements be conducted at the field pilot program sites, while also indicating that having sites in only 3 to 5 ecoregions would be inadequate. Industry commenters also suggested deploying multiple co-located methods measuring the same species as a quality assurance step and advocated measuring individual NO_y species. Several commenters suggested adding NADP wet deposition samplers.

There were several comments from industry and government organizations supporting the development of a Federal Reference Method (FRM) for NO_y and CFP-based SO_2 and sulfate measurements. Greater attention was addressed to NO_y measurements as the technology has only recently been used in routine monitoring applications. Some commenters supported EPA's approach of using EPA's research office to conduct instrument evaluation as a related but

separate program from the field pilot program. Some commenters also recommended testing NO_y at locations with extreme temperature and relative humidity regimes.

Response: The EPA appreciates the support expressed by commenters regarding the use of complementary measurements. While EPA agrees with views expressing the importance of additional measurements, complementary measurements will not have the same funding priority as indictor measurements for NO_y and SO_x. Nevertheless, it is reasonable to expect that all field pilot program sites will also include NADP precipitation samplers and NADP passive ammonia samplers, both of which are located in roughly half of all CASTNET sites. EPA agrees that the formal NO_y FRM development should be decoupled from the pilot studies, while recognizing that separate NO_y measurements are an important component of the pilot study. Although NO_y measurement technology is relatively mature, the effort to develop FRM certification will promote more confidence in the data due to standardized operational and quality assurance protocols.

D. Collaboration and Stakeholder Participation

Comments: Most commenters agreed with EPA's intention to broaden review and participation in the field pilot program, given that the AAI approach cuts across multiple organizations and technical disciplines. Both industry and state governments suggested that some level of initial and ongoing external peer review is needed for evaluating design of the field pilot program and subsequent data analyses, with one state suggesting using NACAA's Monitoring Steering Committee. Some state commenters also reasoned that an agency's participation in the pilot program should be optional, because some states cannot support additional monitoring even if it were to be fully funded. The NPS in particular indicated a desire to participate with EPA in the field pilot program. Clearly, many of the comments described above suggesting added emphasis on water quality monitoring and research collectively emphasize strengthening the collaborative aspects of this field pilot program.

Response: EPA is encouraged by commenters' interest in the field pilot program. While EPA's Office of Air and Radiation (OAR) will assume primary leadership of this program, EPA OAR will take several actions to promote collaboration across internal EPA research programs and other government agencies as described in section IV.D of the final rule. Paralleling this effort, EPA will solicit comment on a draft white paper to enable ongoing review and input from the public. Taking into consideration comments received on the draft white paper, EPA will prepare a final white paper that will serve as a program management and communication document. Key topics areas that will be addressed in the draft white paper are described briefly below.

(1) Background, purpose and products. An introductory section will include a statement of program objectives. Since the field pilot program emphasizes atmospheric measurements in 3 to 5 ecoregions, the role and leveraging opportunities of the field pilot program in relation to ongoing water quality modeling, critical load work and atmospheric deposition research will be introduced here and expanded upon in later sections. A brief description of intended data and analysis products from this effort – highlighting the types of AAI calculations and variability analyses of NO_y and SO_x concentrations and deposition rates -- will be introduced here and expanded upon in more depth in the data analysis section. The introductory section

will also describe the process for broader public engagement and review. The EPA intends to work closely with two existing venues – the NADP critical load and total deposition science committees and the NACAA monitoring subcommittee. Background technical information will include an overview of the AAI equation.

(2) Site selection. Factors to be considered in selecting ecoregions for inclusion in the field pilot program will be discussed and initial thoughts on recommended locations will be presented. Site location considerations include available infrastructure resources (e.g., air monitoring site platforms, nearby water quality monitoring, forest/ecosystem experimental studies), location in acid-sensitive ecoregions, geographic/ecosystem diversity (e.g., east and west locations) and partnership opportunities. To assist in site selection, a series of resource-based maps will be available illustrating infrastructure assets and partnership opportunities. A paring down of the 22 acid-sensitive ecoregions to less than 10 will be accompanied by discussion of the merits of each area, and initial thoughts on groupings of 3, 4 and 5 ecoregions will be provided. This site selection discussion is particularly important as it is initiates broader discussion to enlist interest from potential partners.

(3) Linking atmospheric measurements to the AAI. A suite of atmospheric measurements to be made at the field pilot program sites will be discussed, with a focus on measurements of indicators for oxides of nitrogen and sulfur based on the CFPs and commercial NO_y instruments. Complementary measurements such as ammonia gas, precipitation chemistry and other monitoring methods under consideration (e.g., speciated NO_y samplers and continuous SO_2) will also be discussed, and information on the potential benefits and costs associated with gathering such data will be presented to help inform the program planning effort.

(4) Linking water quality data and critical load calculations to the AAI. The biogeochemical components which support the determination of representative critical loads are an important complement to atmospheric measurements as both biogeochemical and atmospheric processes work together in the calculation of area-specific AAI values. In parallel with the atmospheric measurements, a revised set of critical load estimates will be developed under the umbrella of the NCLDB, which is addressed by the NADP critical loads science committee. In addition to revising critical load estimates, this effort will help inform ongoing critical load model evaluation and development efforts. Topic areas to be considered for inclusion in the program include evaluating the F-factor approach, implications of sulfate retention on steady-state critical load modeling, the role of dynamic models as evaluation tools for generating national critical load data and assessment of Neco characterization approaches. These critical load model evaluation efforts will focus on field pilot program sites contingent on the ability to leverage water quality and soil sampling efforts underway, or new efforts that may be spurred by the pilot program. As part of this effort, attention will be given to characterizing the critical load representativeness at the ecoregion level using existing water quality surveys, which is an important aspect of the AAI equation.

(5) AAI proof-of-concept. Based on newly assembled atmospheric measurements and critical load data, as discussed above, AAI calculations will be performed. As there will be air quality measurements in selected ecoregions for the indicators, SO_x and NO_y, observation-

based AAI values can be calculated for those ecoregions in a manner that would be illustrative of the implementation of a potential future AAI-based standard. Further, based on related national-level efforts to expand the critical load data base and to update CMAQ air quality model simulations, a national set of AAI values will be calculated using approaches similar to those presented in the PA. In addition, the availability of both site-specific measurements and national-scale modeling will allow for assessments that can support monitoring network design.

(6) Coordination with atmospheric deposition research. The field pilot program presents an opportunity to leverage planned EPA dry deposition flux studies and a window of time to more fully explore atmospheric deposition characterization approaches. These research efforts are not part of the field pilot program, but the pilot program provides an opportunity for mutual leveraging between EPA air management and research efforts. The field pilot program offers an extended suite of atmospheric measurements in locations useful for diagnosing model (air quality and deposition focused) behavior. Leveraging refers to locating planned deposition flux studies at field pilot program locations. In addition, the time window afforded by the pilot program allows for continued efforts at improving deposition characterizations in general. Examples of improved characterization approaches include the use of the Parameter-elevation Regressions on Independent Slopes Model (PRISM) gridded precipitation data to improve wet deposition characterization and the merging of modeled and observed data in generating the best available deposition estimates. As part of these research elements, further evaluation of transference ratios can be addressed and the pilot program will include at least one mountainous west ecoregion enabling insights into deposition and transference ratio variability in western regions.

(7) Role of the field pilot program and implementation. As discussed in section IV.A above, the field pilot program provides an opportunity to further explore the issues that would be associated with implementing an AAI-based secondary standard. The field pilot program provides a reasonable time period for EPA and states to become familiar with the AAI approach and develop practical approaches related to implementation issues. For example, such issues are associated with the use of ecoregion boundaries as a planning basis, a focus on rural environments, and the myriad reporting and analysis requirements that are inherent in implementing any such standard. The draft white paper will outline a process for addressing such issues that will involve creating appropriate forums for bringing together EPA and state government experts in technical and air management disciplines.

(8) Data Analysis Products. The atmospheric and biogeochemical measurements to be made as part of the field pilot program, together with updated model simulations that become available during the course of the pilot program, will be used to support analyses that can help inform further development and evaluation of the AAI. Such analyses will be identified and described in terms of how they could advance our understanding and characterization of the degree of protectiveness that would likely be afforded by AAI-based standards that could be considered in the next review of the NAAQS for oxides of nitrogen and sulfur.

The field pilot program affords an excellent opportunity to coordinate air quality monitoring and related critical load and water quality assessment activities (modeling and measurements). As part of the planning effort for this program, EPA will engage other federal

agencies (U.S. Geological Survey, NPS, U.S. Forest Service) and state and local agencies primarily through existing NADP and NACAA committee structures.

IV. RESPONSES TO LEGAL, ADMINISTRATIVE AND PROCEDURAL ISSUES AND MISPLACED COMMENTS

This section is intended to address those comments received regarding legal, administrative, and procedural issues as well as issues raised in public comments that are not considered when setting a NAAQS. Many legal comments are presented in previous sections of this document and throughout the rule. Comments included here address issues related to interactions with CASAC, the EPA's authority to define a new indicator of ambient air quality, and responsibility of the EPA under tribal trust agreements. Additionally, a number of comments were submitted related to implementation issues and regulatory impact analyses. As the EPA is not permitted to consider implementation-related issues or the cost associated with meeting a standard when developing NAAQS, these comments are considered misplaced as they are not relevant to determining the appropriate secondary NAAQS for oxides of nitrogen and sulfur. We note that some implementation issues are generally addressed for informational purposes only in section I.C of the preamble to the final rule.

A. Legal, Administrative and Procedural Issues

(1) Comment: One commenter (NESCAUM) expressed concern that the proposal was not consistent with CASAC's recommendation to apply an ecologically relevant level and form in this review.

Response: In considering CASAC's advice and recommendations, the EPA pays close attention to the content of the advice and weighs it carefully, whether it is advice on the science or advice on policy matters related to new or revised NAAQS. The EPA in fact has done this in this review, as seen in the many and varied revisions made to the draft documents CASAC has reviewed and commented on, such as the ISA, the Risk and Exposure Assessment and the Policy Assessment. It can also be seen in the careful attention paid by the Administrator to CASAC's advice in both the proposed rule and in the final rule. The Administrator has carefully explained where she has accepted CASAC's advice and where she has not, and explained in detail her reasoning. We acknowledge that in previous comments on the Policy Assessment, CASAC expressed support for setting ecologically relevant standards but also identified areas of concern with regard to uncertainty in modeling and data. The EPA is not, however, required to follow CASAC's recommendations where the Administrator explains the reasons for such differences where she differs in important respects from CASAC's advice (CAA section 307(d) (3), (d) (6)).

(2) Comment: Some commenters asserted that the consideration of NOy as the indicator for oxides of nitrogen in the AAI is contrary to the EPA's statutory authority. One such commenter asserted that NOy was a broader indicator than had been defined in listing oxides of nitrogen as a criteria pollutant and as such the EPA was prevented from modifying the scope of the criteria pollutant addressed in this review.

Response: While this issue will be addressed more fully in future reviews, the EPA disagrees that NOy, as considered in this review, is beyond what is permissible in conjunction with the listed criteria pollutant for oxides of nitrogen. In the primary standards, NO_2 is used as the indicator of oxides of nitrogen because it is relevant to the exposures of concern to public health. Similarly, in this review NO_y is considered as the indicator of oxides of nitrogen in that it is considered to be the most relevant indicator of exposures of concern to aquatic ecosystems with regard to acidifying deposition.

(2) Comment: Two tribes, the Forest County Potawatomi Community and the Fond du Lac Reservation, commented that failure of the EPA to implement standards and determine adequacy with regard to mercury methylation and deposition of oxides of sulfur represents a violation of tribal trust responsibilities. The commenters explained that methylation of mercury from sulfur deposition continues to be a significant adverse effect on tribal lands and that the EPA has the responsibility to prevent such effects.

Response: The adequacy of the current standards to address mercury methylation is discussed in section II.B.2. above and in greater detail in the final rule section II.B. With regard to tribal trust, the EPA agrees with the commenters that the definition of "tribal implications" can also include rule impacts to tribal resources, whether occurring on reservations or on lands managed by federal agencies under the federal Trust Responsibility. These resources include tribes' lands, waters, and natural, religious and cultural resources. NAAQS are intended to provide additional protection, as warranted, to adversely impacted systems and as such are expected to also provide additional protection to such resources that fall on tribal lands or lands held in trust by federal agencies. On August 3, 2011, the EPA sent letters to all Tribal leaders offering to consult with the tribes on the proposed rule. On October 6, 2011 the EPA held a call consultation call with the Forest County Potawatomi Community and 5 other tribes participated for informational purposes.

With respect to EO 13175, the EPA has determined however, that this rule does not have tribal implications. The rule concerns the establishment of a secondary Oxides of Nitrogen and Oxides of Sulfur NAAQS. The Tribal Authority Rule gives Tribes the opportunity to develop and implement CAA programs such as the PM NAAQS, but it leaves to the discretion of the Tribe whether to develop these programs and which programs, or appropriate elements of a program, they will adopt. Thus, the rule does not have substantial direct effects on Tribes, which means it does not have tribal implications and is not subject to EO 13175. Nevertheless, the Agency has, as explained in section x, worked to obtain timely and meaningful input from Indian Tribes and their leaders.

B. Misplaced Comments

Comment: Several commenters stated that additional implementation language should have been included in the proposal both with regard how the EPA would implement an AAI-based standard in the future and with regard to the proposed decision to set the secondary NAAQS for oxides of nitrogen and sulfur equal to the primary NAAQS for NO_2 and SO_2. Some commenters also noted that further regulatory analyses such as regulatory impact analyses and regulatory flexibility analyses should have been conducted.

Response: Comments concerning implementation of a NAAQS are legally irrelevant in determining which standards are requisite to protect public welfare. (API v. Costle, 665 F. 2d at 1185-86). The Clean Air Act also specifically prohibits the EPA from considering costs associated with implementation or setting of NAAQS. The EPA therefore did not consider these comments in its decision making process on the NAAQS standard.

V. REFERENCES

Russell, A and J. M. Samet, 2011a. Review of the Policy Assessment for the Review of the Secondary National Ambient Air Quality Standard for NO_x and SO_x: FINAL. EPA-CASAC-11-005.

U.S. EPA 2008. Integrated Science Assessment (ISA) for Oxides of Nitrogen and Sulfur Ecological Criteria (Final Report). U.S. Environmental Protection Agency, Washington, D.C., EPA/600/R-08/082F, 2008.

U.S. EPA 2009. Risk and Exposure Assessment for Review of the Secondary National Ambient Air Quality Standards for Oxides of Nitrogen and Oxides of Sulfur-Main Content - Final Report. U.S. Environmental Protection Agency, Washington, D.C., EPA-452/R-09-008a.

U.S. EPA 2011. Policy Assessment for the Review of the Secondary National Ambient Air Quality Standards for Oxides of Nitrogen and Oxides of Sulfur. U.S. Environmental Protection Agency, Washington, D.C., EPA-452/R-11-005a.