

July 2011 Proposed Revisions to the Secondary National Ambient Air Quality Standards for Oxides of Nitrogen and Oxides of Sulfur

Overview





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- On July 12, 2011, EPA issued a proposed decision in its review of the secondary National Ambient Air Quality Standards (NAAQS) for oxides of nitrogen and sulfur.
 - EPA conducted a separate, integrated review of the secondary (welfare-based) standards for these pollutants, recognizing they have interrelated impacts on a range of important ecosystems.
- EPA is proposing to retain the existing secondary NAAQS for oxides of nitrogen and sulfur to protect plants from the direct effects of these pollutants in ambient air. These secondary standards are:
 - For NO₂: 0.053 ppm (parts per million) averaged over a year; and
 - For SO₂: 0.5 ppm averaged over three hours, not to be exceeded more than once per year
- EPA also is proposing to establish an additional set of secondary standards identical to the new health-based primary standards the Agency set in 2010. These standards are:
 - For NO₂: 100 ppb (parts per billion) averaged over one hour; and
 - For SO₂: 75 ppb averaged over one hour
- For more information, go to: <http://www.epa.gov/air/nitrogenoxides/actions.html> or <http://www.epa.gov/air/sulfurdioxide/actions.html>



Background

- EPA first established standards for oxides of nitrogen and sulfur in 1971, using nitrogen dioxide (NO₂) and sulfur dioxide (SO₂) as indicators.
 - EPA updated the primary (health-based) standards for both NO₂ and SO₂ in 2010.
- This is the first time EPA reviewed secondary NAAQS separately from the primary standards. It is also the first time the Agency has examined the effects of multiple pollutants in one NAAQS review process.
 - EPA explored the possibility of developing a multi-pollutant standard that would address the indirect effects SO_x and NO_x have on sensitive ecosystems.
 - Due to substantial uncertainties, EPA is proposing not to set a new multi-pollutant secondary standard to address deposition-related effects at this time. Instead, EPA is presenting plans for a field pilot program to collect additional data.
- EPA is working under a court-ordered schedule, which requires the Agency to issue a proposed rule by July 12, 2011 and a final rule by March 20, 2012.



What are Oxides of Nitrogen and Sulfur?

- Oxides of nitrogen and sulfur are common pollutants that come from combustion of fossil fuels and from certain industrial processes.
- In the atmosphere, oxides of nitrogen and sulfur are linked through complex chemical processes. Key pollutants involved in these processes are:
 - Total reactive nitrogen, which includes:
 - All oxides of nitrogen (NO_y), including nitrogen dioxide (NO₂) and other NO_x. NO₂ is the indicator for the current secondary standard for oxides of nitrogen.
 - Nitrogen transformation products: compounds produced from the oxidation of NO_x in the atmosphere, particularly nitric acid and peroxy acetyl nitrate (PAN).
 - Reduced nitrogen (NH_x): forms of nitrogen including ammonia that are not criteria pollutants, but contribute to nitrogen deposition.
 - Oxides of sulfur (SO_x), which include:
 - SO₂, the indicator for the current secondary standard for oxides of sulfur
 - Particulate sulfate (SO₄)



Ecological Effects of Oxides of Nitrogen and Sulfur

- Oxides of nitrogen and sulfur in ambient air (i.e., gaseous NO_2 and SO_2) have direct toxic effects on vegetation
- When deposited on land and in lakes and streams, oxides of nitrogen and sulfur affect soils, water quality, and fish and wildlife. Key deposition-related effects include:
 - *Nutrient enrichment*: over-fertilization of ecosystems through the addition of excess nitrogen, leading to adverse impacts such as algal blooms, decreases in dissolved oxygen, and changes in species diversity
 - *Aquatic and terrestrial acidification*: both dry and wet deposition of nitrogen and sulfur increase acidity of soils and surface waters, leading to decreased tree growth and fish mortality. Wet deposition is known as “acid rain”.
- In addition, oxides of nitrogen and sulfur both contribute to adverse health effects and to the formation of ground-level ozone and fine particle pollution.



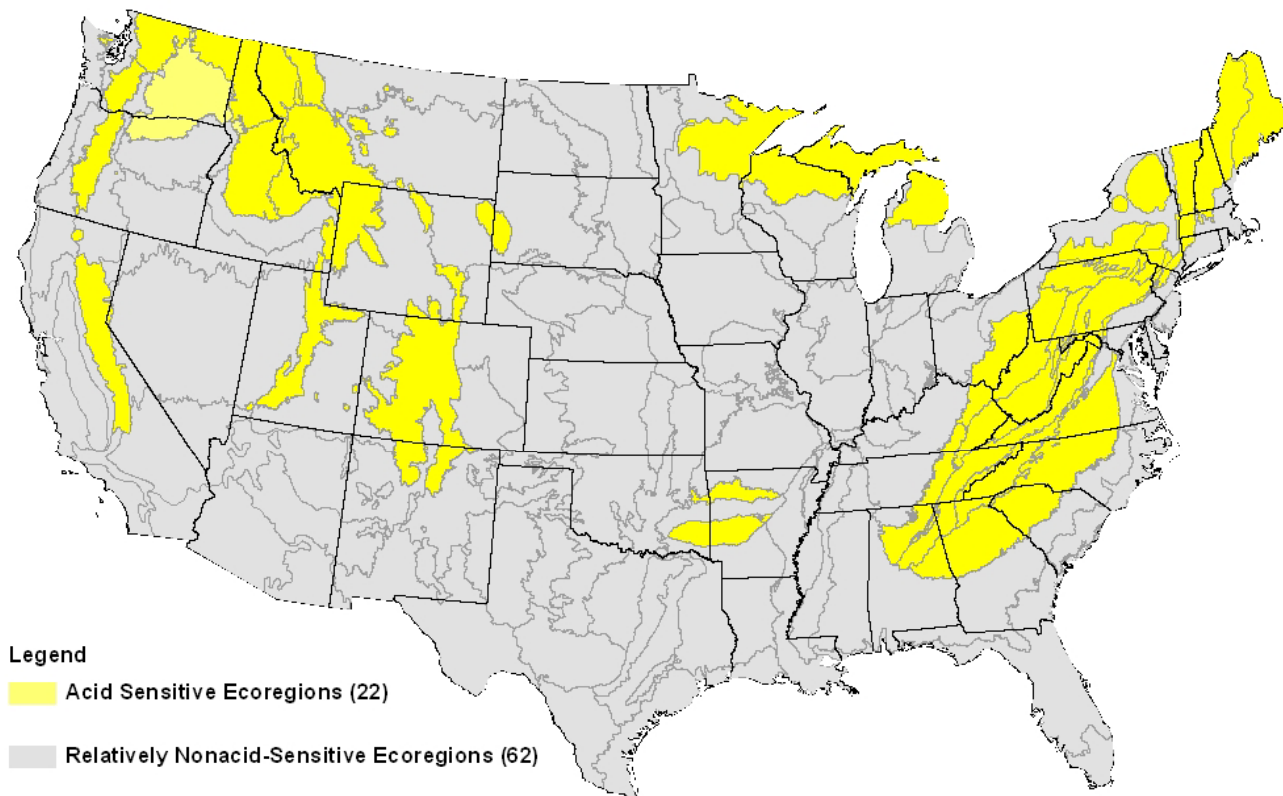
Aquatic Acidification

- In evaluating deposition-related effects in this review, EPA focused mainly on aquatic acidification.
 - Science is more complete than for other deposition-related effects.
 - NO_x and SO_x in the air contribute significantly to this effect.
- EPA's Acid Rain Program has reduced emissions of SO₂ and NO_x from utilities, but was not designed to fully address aquatic acidification in sensitive ecosystems across the country.
 - Despite improvement in many lakes and streams, studies have found evidence of continuing adverse effects in many acid-sensitive areas at current levels of emissions.
- The extent to which emissions of oxides of nitrogen and sulfur lead to aquatic acidification in particular water bodies depends on:
 - *Acid neutralizing capacity (ANC)*: ability of the water body to buffer acidifying inputs.
 - *Critical load*: the amount of acidifying deposition that a water body can handle to maintain a specified ANC level. Critical loads vary among ecosystems, based on each ecosystem's ability to neutralize acid inputs.



Acid Sensitive Ecoregions

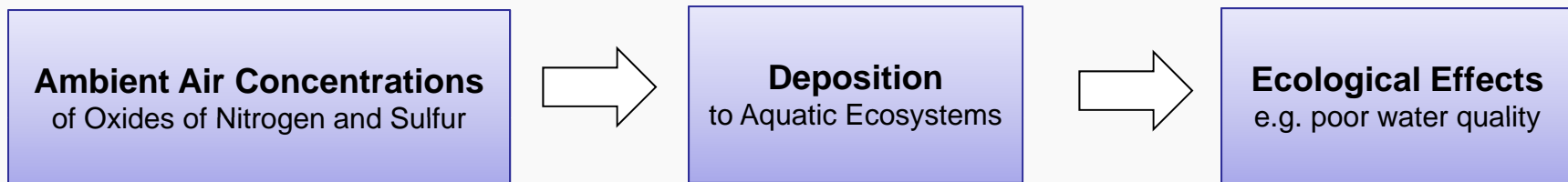
- Lakes and streams in some regions of the country are more sensitive to acid deposition, depending on the underlying geologic material (bedrock and soils) that buffers acidifying deposition.





Key issues

- To set a multi-pollutant standard for aquatic acidification effects, EPA must consider multiple, complex linkages:

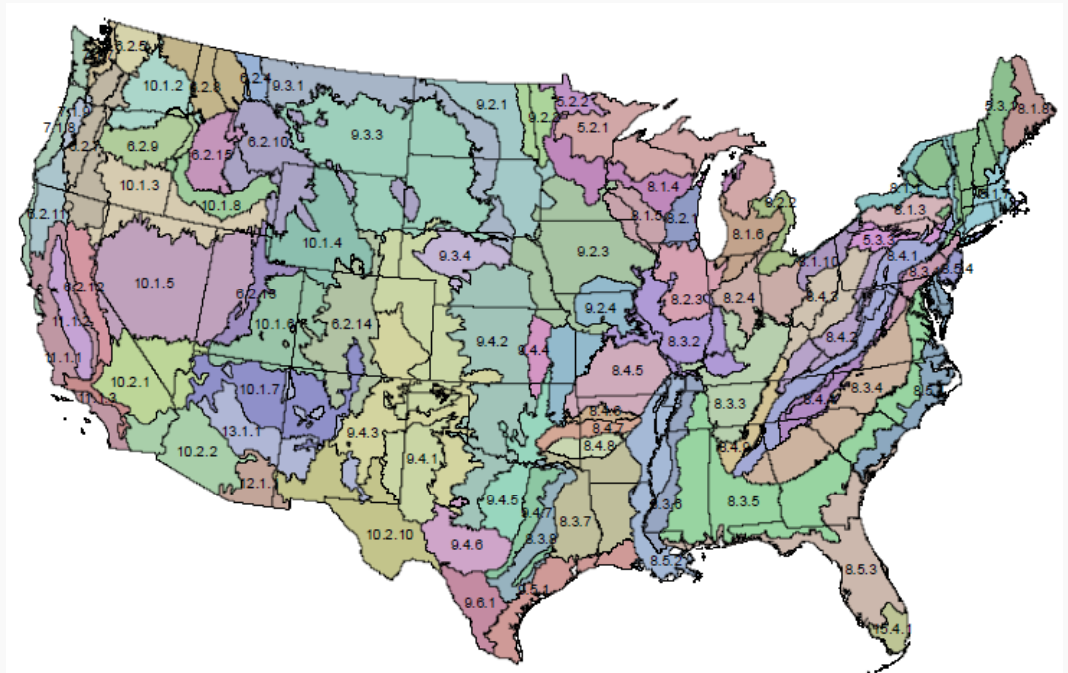


- This is different than other NAAQS, which are based on the direct relationship between pollutant concentrations in the air and effects on health or welfare.
- Because different ecosystems vary in the amount of acid deposition they can tolerate, EPA staff developed a formula called the “Aquatic Acidification Index” (AAI) that could be used to relate levels of NO_x and SO_x in the air to water quality
 - While the elements of the AAI would be the same everywhere, the values of the factors in the formula would vary on an area-specific basis, because ecosystem sensitivity varies across the nation due to variable geologic, hydrologic, and environmental factors
 - The significant challenge is to translate spatially variable effects into a national standard, including limitations on available monitoring data



Illustrating the Complexity: Significant Variation among Ecoregions

- Omernik Ecoregion III classification scheme (developed in the 1980s by EPA) divides the continental U.S. into 84 ecologically relevant regions, based on common vegetation, geology, soils, and hydrological characteristics
- A multi-pollutant standard for oxides of nitrogen and sulfur must account for these differences to provide the appropriate degree of protection against aquatic acidification in different regions





CASAC Review

- The Clean Air Scientific Advisory Committee (CASAC) provides independent advice to the EPA Administrator on the technical bases for EPA's national ambient air quality standards.
- For this review, CASAC:
 - Recommended retaining the current secondary standards to protect against the direct effects on vegetation from NO_x and SO_x
 - Supported the development of a new, multi-pollutant standard to help protect lakes and streams from acidifying deposition of NO_x and SO_x
 - Noted important uncertainties should be considered in this review and addressed in future analyses and reviews



Proposed Decision

- With regard to direct effects on vegetation, EPA is proposing to retain the existing secondary NAAQS for oxides of nitrogen and oxides of sulfur.
 - The Administrator has proposed to conclude that these standards are adequate to protect plants from the direct effects of oxides of nitrogen and sulfur in the ambient air.
 - These standards are:
 - For NO₂: 0.053 ppm (parts per million) averaged over a year; and
 - For SO₂: 0.5 ppm averaged over three hours, not to be exceeded more than once per year
- In addition, EPA is proposing to establish an additional set of secondary standards identical to the new health-based primary standards the Agency set in 2010.
 - While these standards are not designed to protect ecosystems, they will reduce SO_x and NO_x pollution and the harmful effects the pollutants have on sensitive lakes and streams.
 - These standards are:
 - For NO₂: 100 ppb (parts per billion) averaged over one hour; and
 - For SO₂: 75 ppb averaged over one hour



Proposed Decision (cont.)

- The proposal also recognizes that the current secondary standards for oxides of nitrogen and sulfur do not provide adequate protection from the harmful effects resulting from the deposition of oxides of nitrogen and sulfur to sensitive aquatic and terrestrial ecosystems.
- However, because of remaining complexities and uncertainties, EPA cannot currently judge whether a new, multi-pollutant standard would provide the appropriate degree of protection.
 - In particular, the Agency is not able to adequately quantify the various elements of the Aquatic Acidification Index (AAI).
 - This leads to substantial uncertainty about whether such a standard could provide the appropriate degree of protectiveness in different parts of the country, based on significant ecological differences among regions.
- As a result, the Administrator is proposing not to set a new, multi-pollutant standard to address the deposition of oxides of nitrogen and sulfur to sensitive aquatic and terrestrial ecosystems until key remaining complexities and uncertainties can be addressed.



Field Pilot Program

- To aid in considering an appropriate multi pollutant standard, EPA is planning a 5-year field pilot program to collect and analyze data designed to inform the next review of the NAAQS for oxides of nitrogen and sulfur.
- The field pilot program will be conducted in 3-5 locations in selected acid-sensitive ecoregions, beginning in 2013.
 - EPA is planning to use existing CASTNET monitoring sites as the platform for this pilot program. Measurements taken at CASTNET monitors would be supplemented with additional data from other instruments to help EPA refine the information needed to quantify elements of the AAI.
- Data generated by this field program would also support development of an appropriate monitoring network that could help ensure that a multi-pollutant standard would provide the intended degree of protection in all regions.
- EPA will work with states to address additional implementation-related issues in parallel with the pilot program



Public Comment

- EPA is seeking comment on all aspects of this proposed decision, including:
 - The framework and elements of a multi-pollutant standard;
 - The uncertainties and complexities associated with the development of such a standard at this time; and
 - The field pilot program and related monitoring methods.
- EPA will accept comments on the proposal for 60 days after publication of the proposed rule in the Federal Register.