Science Policy Decision-Making Within a Multi-Pollutant Framework

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Overview

- Background: Multi-pollutant air quality management and planning
- Multi-pollutant within the context of…
  - Standard setting
  - Designing control strategies (e.g., standard implementation)
- Incorporating climate

Background: A Program Perspective

- **Our motivation:** Multi-pollutant air quality management and planning could improve protection of public health and ecosystems while also being more cost-effective than traditional strategies
- What we mean by "multi-pollutant" depends on the context
  - **Setting ambient standards:** Ambient concentrations, exposures, effects
  - **Developing control strategies** (e.g., NAAQS implementation): Sources of emissions and control efficiencies
- For now, the specific pollutants encompassed by the term "multi-pollutant" are defined by Agency programs
  - Criteria pollutants
  - Stationary and mobile source air toxics
  - Pollutants with climate impacts

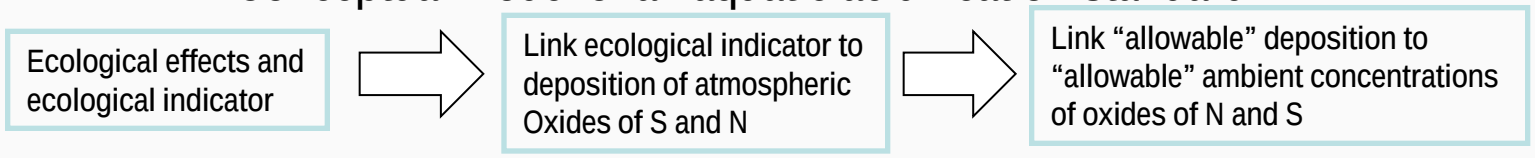
Standard Setting for the NAAQS

- **Currently**, we set health-based NAAQS using available evidence for the unique contributions to health effects of individual pollutants, though uncertainties and limitations can confound attempts to attribute risks reliably
  - Single pollutant and co-pollutant models in epidemiological studies
  - Human clinical and animal toxicology studies, typically focused on single pollutants
- In the **near future**, if sufficient evidence were available, we could consider how that unique contribution changes in the presence of other pollutants
  - Consider multi-pollutant evidence to inform single-pollutant standard setting
- In the **longer term**, if sufficient evidence were available, we could…
  - Coordinate standard setting across multiple NAAQS, considering the public health protection provided by the suite of standards
  - Define a multi-pollutant standard in terms of a common indicator of toxicity

Standard Setting for the NAAQS (Continued)

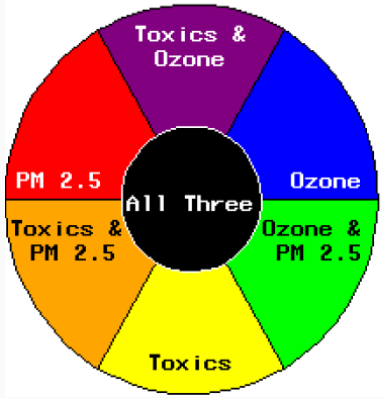
- EPA staff has developed multi-pollutant options for a welfare-based standard that would protect against aquatic acidification caused by oxides of nitrogen and sulfur
- There is a **well-developed body of scientific evidence** linking the deposition of ambient oxides of nitrogen and sulfur to acidification in sensitive aquatic ecosystems

Conceptual model of an aquatic acidification standard



- Something analogous could be considered for a primary NAAQS if sufficient evidence were available

What About Other Pollutants?



- Support for **multi-pollutant considerations when implementing standards**

Counties with ozone and/or annual PM2.5 concentrations above the NAAQS for 2006-2008 and counties in the top 10% of modeled risk from NATA 2002

Developing Control Strategies

- **Detroit Multi-Pollutant Pilot Project:** Case study comparing traditional air quality management strategy to a multi-pollutant, risk-based approach
  - **Traditional single pollutant strategy:** Separate strategies for O_3 and $PM_{2.5}$, based on least cost approach
  - **Multi-pollutant strategy:** Focused on controls that would offer co-benefits for multiple pollutants and controls in the most heavily populated areas
  - **Results:** Multi-pollutant risk-based strategy resulted in larger monetized health benefits, was more cost-effective, provided the greatest benefits in locations with large susceptible and vulnerable populations, and more effectively reduced non-cancer risks from air toxics
- **Multi-pollutant air quality management plan pilot projects:** EPA and volunteer states (NY, NC, MO/IL) developed pollution reduction strategies with multi-pollutant goals, including…
  - Attainment/maintenance of NAAQS; risk reductions from air toxics; improvements in visibility and ecosystems; and integrated land use, transportation, energy and climate plans
- **Sector-based emissions standards:** Apply multi-pollutant strategies to stationary source regulation in order to achieve greater benefits while reducing regulatory and administrative burdens and leveraging federal, state, and local resources more efficiently

Incorporating Climate into the Mix

- Direct impacts of climate on air quality
  - Increased ozone concentrations while effects on PM more variable
- Indirect impacts of climate change on air quality
  - Increase in wildfires, changes in residential energy demand, increase temperature-dependent evaporative emissions (e.g., biogenic), changes in locations of emissions (e.g., as people migrate)
- Impacts of climate on susceptibility
  - Elevated temperature can worsen air quality-related health effects and climate affects aeroallergens
- Climate change mitigation and air quality
  - Many mitigation strategies for GHG will have air quality co-benefits while others could have unintended negative consequences for air pollution
- Impacts of air pollution on climate
  - Many conventional air pollutants are climate forcers

Climate in the Context of Multi-Pollutant Air Quality Management

- **Benefit-cost analyses:** Where sufficient data are available, we estimate…
  - Climate impacts of rules focused on traditional air pollutants (e.g., proposed Utility emissions standards)
  - Air quality-related health impacts of greenhouse gas rules (e.g., light duty vehicle standards)
- **Implementing standards, designing control strategies, or setting technology-based standards:** Develop tools and technical information to support **multi-pollutant air quality planning** strategies that incorporate consideration of climate impacts
- **Setting health-based ambient standards(?):** If sufficient scientific information were available, interactions between climate, air quality, and health effects could potentially be considered

Areas for Continued Research to Inform Multi-Pollutant Air Quality Management

- Better understand the contribution of individual pollutants, including PM components, and groups of pollutants to adverse effects
- Link effects to pollution sources
- Improve exposure estimates for individual pollutants and mixtures
- Evaluate the impacts of climate on susceptibility to the health effects that are linked to air pollution exposures
- Improved characterization of source emissions and develop/enhance emissions monitoring technologies
- Improved characterization of the impacts of control strategies
- Develop/enhance ambient monitoring techniques for criteria pollutants and air toxics
- Develop/improve modeling tools to allow coupled assessment of climate and air quality impacts and by improving the treatment of key chemical and physical processes

For Additional Information

- NO_x/SO_x secondary NAAQS: http://www.epa.gov/ttn/naaqs/standards/no2so2sec/index.html
- Detroit multi-pollutant pilot: http://www.epa.gov/scram001/reports/Detroitpres_final09.pdf
- Multi-pollutant air quality management planning pilots: http://www.epa.gov/oar/aqmp/index.html
- Information on Light-Duty Vehicle Greenhouse Gas Emissions Standards: http://www.epa.gov/oms/climate/regulations.htm
- Information on proposed Utility emissions standards: http://www.epa.gov/airquality/powerplanttoxics/actions.html