

# Final Revisions to the Primary National Ambient Air Quality Standard for Nitrogen Dioxide (NO<sub>2</sub>)



## *General Overview*

Office of Air and Radiation  
Office of Air Quality Planning and Standards  
January 2010

## Overview of the Final Rule

- On January 22, 2010 EPA strengthened the primary national ambient air quality standard (NAAQS) for nitrogen dioxide (NO<sub>2</sub>) to increase protection of public health by:
  - adding a *1-hour* NO<sub>2</sub> standard at 100 parts per billion (ppb); and
  - retaining the *annual* average NO<sub>2</sub> standard at a level of 53 ppb
- To determine compliance with the revised NO<sub>2</sub> standard, EPA also is making changes to the NO<sub>2</sub> air quality monitoring network requirements.
  - Monitoring is needed to measure:
    - Peak, short-term concentrations – primarily near major roads in urban areas
    - Highest concentrations of NO<sub>2</sub> that occur over wider community areas, and
    - Concentrations impacting susceptible and vulnerable groups

## Overview of the Final Rule (cont.)

- These revisions are consistent with recommendations of the majority of the Clean Air Scientific Advisory Committee (CASAC) panel.
- This action does **not** impact the secondary NO<sub>2</sub> standard, set to protect public welfare.
  - It is an annual average standard set at 53 ppb
  - Under a separate review, EPA is considering the need for changes to the secondary NO<sub>2</sub> standard
- For more information go to <http://www.epa.gov/air/nitrogenoxides>

## Final NO<sub>2</sub> Standards

- EPA determined that the existing primary annual average NO<sub>2</sub> standard of 53 ppb alone is not sufficient to protect public health with an adequate margin of safety
- EPA is setting a new 1-hour NO<sub>2</sub> that defines the maximum allowable concentration anywhere in an area - primarily near major roads
  - Set at a level of 100 ppb
  - Expressed as the 3-year average of the 98th percentile of the annual distribution of daily maximum 1-hour average concentrations
- EPA is retaining the current annual average NO<sub>2</sub> standard of 53 ppb
- This suite of primary standards will:
  - Limit short-term exposures to peak NO<sub>2</sub> concentrations, which often occur near major roads and could worsen asthma symptoms
  - Maintain community-wide NO<sub>2</sub> concentrations below levels associated with respiratory-related emergency department visits and hospital admissions

# Updating the Monitoring Network

- The monitoring networks for NAAQS pollutants focus on monitoring in locations of **maximum concentrations**
- EPA is requiring changes to the monitoring network that will capture short-term NO<sub>2</sub> concentrations such as those that occur near roads, community-wide NO<sub>2</sub> concentrations, and low income or minority at-risk communities
  - **Near Road**
    - At least one monitor would be located near a major road in any urban area with a population greater than or equal to 500,000 people.
    - A second monitor would be required near a major road in areas with either:
      - population greater than or equal to 2.5 million people, or
      - one or more road segments with an annual average daily traffic count greater than or equal to 250,000 vehicles
  - **Community-Wide**
    - A minimum of one monitor would be placed in any urban area with a population greater than or equal to 1 million people to assess community-wide concentrations
  - **Susceptible and Vulnerable Communities**
    - Working with the states, EPA Regional Administrators will site at least 40 additional NO<sub>2</sub> monitors to help protect communities that are susceptible and vulnerable to NO<sub>2</sub>-related health effects

# Updating the Monitoring Network

- EPA is requiring all new NO<sub>2</sub> monitors to begin operating no later than January 1, 2013
- EPA estimates the revised NO<sub>2</sub> monitoring requirements will lead to:
  - 126 NO<sub>2</sub> monitoring sites near major roads in 102 urban areas.
  - 53 additional monitoring sites to assess community-wide levels across wider urban areas.
  - 40 monitors in low income or minority at-risk communities.

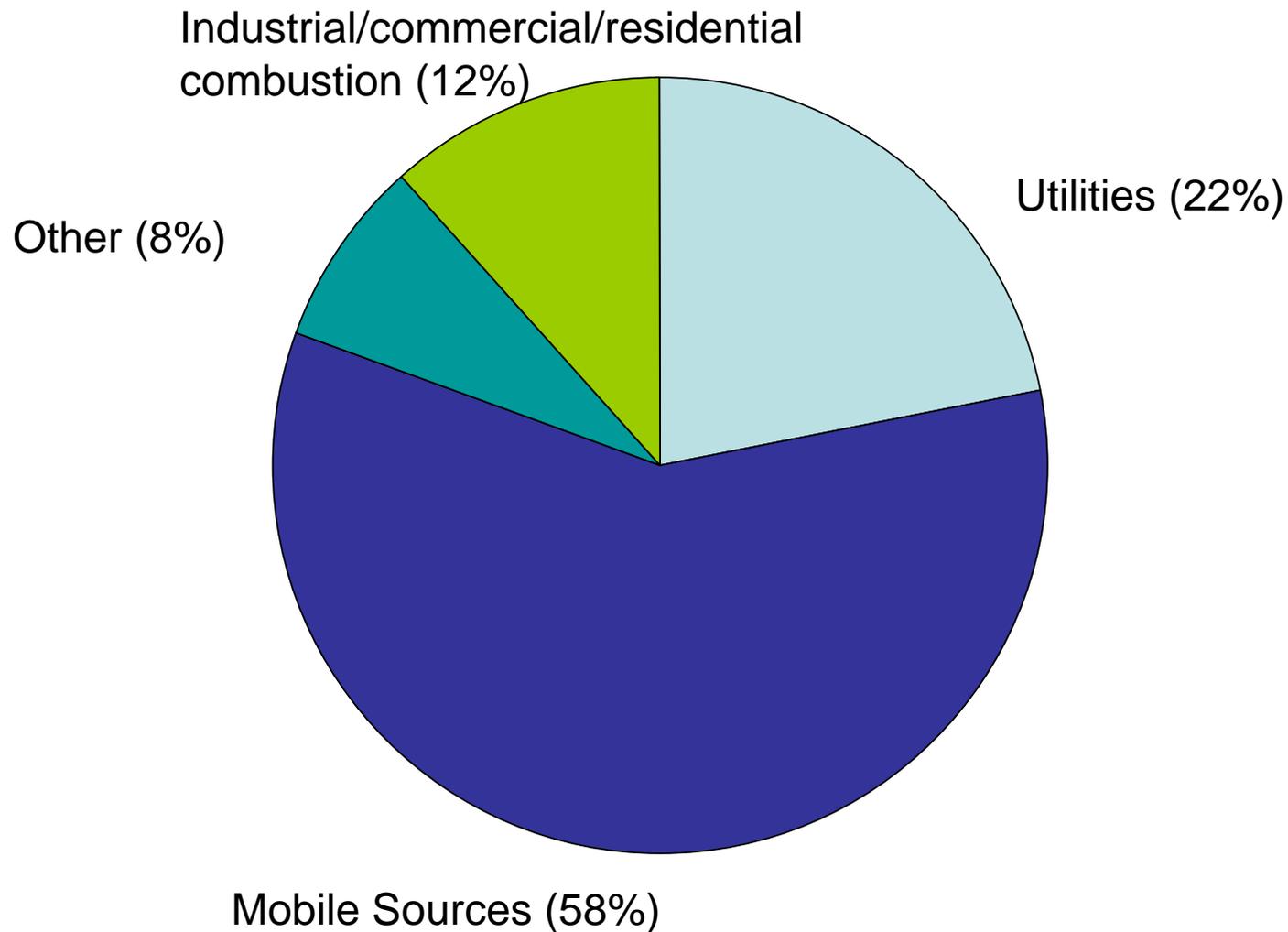
## Setting the Air Quality Standard for NO<sub>2</sub>

- The Clean Air Act requires EPA to set two types of national ambient air quality standards (NAAQS) for “criteria” air pollutants:
  - *Primary standards* to protect public health with an adequate margin of safety
  - *Secondary standards* to protect public welfare (visibility, wildlife, crops, vegetation, national monuments and buildings)
- EPA has set NAAQS for six common air pollutants:
  - Nitrogen dioxide
  - Carbon monoxide
  - Lead
  - Particulate matter
  - Ground-level ozone (smog)
  - Sulfur dioxide
- The law requires EPA to review the scientific information and the standards for each pollutant every five years, and to obtain advice from the Clean Air Scientific Advisory Committee (CASAC) on each review
- Different considerations apply to setting NAAQS than to achieving them
  - **Setting NAAQS:** based on scientific evidence of health and environmental effects
  - **Achieving NAAQS:** account for cost, technical feasibility, time needed to attain
- EPA set the annual average NO<sub>2</sub> standard of 53 ppb in 1971
  - EPA reviewed the NO<sub>2</sub> standard in 1985 and 1996 and decided to retain the 53 ppb annual average standard

## NO<sub>2</sub> is the Indicator for Entire NO<sub>x</sub> Group of Gases

- NO<sub>2</sub> is one of a group of highly reactive gasses known as oxides of nitrogen (NO<sub>x</sub>)
  - Other oxides of nitrogen include nitrous acid and nitric acid
- NO<sub>2</sub> is the component of NO<sub>x</sub> of greatest interest and serves as the indicator for the entire NO<sub>x</sub> family
- NO<sub>x</sub> forms when fuel is burned at high temperatures
- Control measures that reduce NO<sub>2</sub> can generally be expected to reduce population exposures to all NO<sub>x</sub> gases
  - This may have the important co-benefit of reducing the formation of ozone and fine particles both of which pose significant public health threats

# Sources of NO<sub>x</sub> Pollution



## Reducing NO<sub>x</sub> Pollution in the U.S.

- All areas in the U.S. comply with the current (1971) NO<sub>2</sub> standards
  - Annual average ambient NO<sub>2</sub> concentrations, as measured at community-wide monitors, have decreased by more than 40% since 1980
  - The range of current annual average NO<sub>2</sub> concentrations is approximately 10-20 ppb
- EPA, states and tribes have been working together since the 1970's to reduce emissions of NO<sub>x</sub> from a range of sources. Key efforts include:
  - Emission Standards for Motor Vehicles and Power Plants
  - Regulating Regional Transport of NO<sub>x</sub>
- EPA anticipates NO<sub>x</sub> concentrations will continue to decrease as a result of mobile source regulations
  - Tier 2 standards for light-duty vehicles began phasing in in 2004, and new NO<sub>x</sub> standards for heavy-duty engines are phasing in between 2007 and 2010 model years
  - As these standards continue to be phased in, NO<sub>x</sub> from motor vehicles are expected to be lower

## New Health Evidence in this Review

- Current scientific evidence links short-term NO<sub>2</sub> exposures, ranging from 30 minutes to 24 hours, with an array of adverse respiratory effects including increased asthma symptoms, worsened control of asthma, and an increase in respiratory illnesses and symptoms.
  - These health effects have been associated with exposure to the range of NO<sub>2</sub> levels across an area, which includes both the higher short-term exposures than can occur on or near major roadways, and the lower concentrations that can occur away from such roadways.
- Studies also show a connection between short-term exposure and increased visits to emergency departments and hospital admissions for respiratory illnesses, particularly in at-risk populations including children, the elderly, and asthmatics.

## Near and On Roadway NO<sub>2</sub> Exposures

- NO<sub>2</sub> concentrations on or near major roads are appreciably higher than those measured at monitors in the current network
  - In-vehicle concentrations can be 2-3 times higher than measured at nearby community-wide monitors
  - Near-roadway concentrations have been measured to be approximately 30 to 100% higher than those measured away from major roads
- Individuals who spend time on or near major roads can experience short-term NO<sub>2</sub> exposures considerably higher than measured by the current network, which are of particular concern for at-risk populations, including people with asthma, children, and the elderly.

## CASAC Recommendations

- The Clean Air Scientific Advisory Committee (CASAC) provides independent advice to the EPA Administrator on the NAAQS
- The majority of the CASAC panel supported EPA's proposal to:
  - Focus on protecting against short-term maximum concentrations in an area
  - Set a 1-hour standard at a level no higher than 100 ppb
- In light of evidence suggesting an association between *long-term exposures* to NO<sub>2</sub> and adverse health effects, CASAC also recommended retaining the current annual standard of 53 ppb
  - Evidence is too limited to suggest any change to the level of the annual average standard

## Nitrogen Oxides Also Contribute to the Formation of Fine Particle Pollution and Ozone

- NO<sub>x</sub> react with ammonia, moisture, and other compounds to form small particles, exposure to which results in health effects including:
  - Premature death
  - Effects on breathing and the respiratory system,
  - Damage to lung tissue,
  - Small particles that penetrate deeply into sensitive parts of the lungs and can cause or worsen respiratory disease, such as emphysema and bronchitis, and aggravate existing heart disease
- NO<sub>x</sub> is also a precursor of ground-level ozone
  - Ozone is formed when NO<sub>x</sub> and volatile organic compounds (VOC) react in the presence of heat and sunlight
  - Children, the elderly, people with lung diseases such as asthma, and people who work or exercise outside are susceptible to adverse effects of ozone such as damage to lung tissue and reduction in lung function

## Implementation Schedule

Milestone	Date
State Designation Recommendations to EPA	January 2011: One year following promulgation (Based on existing network data)
Designations	January 2012: EPA designates all/most areas as "unclassifiable" (because near road monitors not in place)
New NO <sub>2</sub> Monitoring Network	January 1, 2013: All monitors operating
Next NO <sub>2</sub> NAAQS Review Completed	January 2015: Anticipated time frame
Nonattainment Re- Designations (discretionary)	January 2016/2017 (depending on date that sites become operational)
Attainment Date	January 2021/2022 (5 years after date of nonattainment designations)