

Health Update: Nitrogen Dioxide Exposure Increases Allergic Responses in Asthmatics

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California Air Resources Board

California Environmental Protection Agency

Nitrogen Dioxide (NO₂) Standard

- Ambient air quality standards
- Define maximum safe exposures
- Protect vulnerable sub-populations
- NO₂ standard last reviewed in 1992
 - 0.25 ppm, one-hour average
- Asthmatics identified as vulnerable

Background

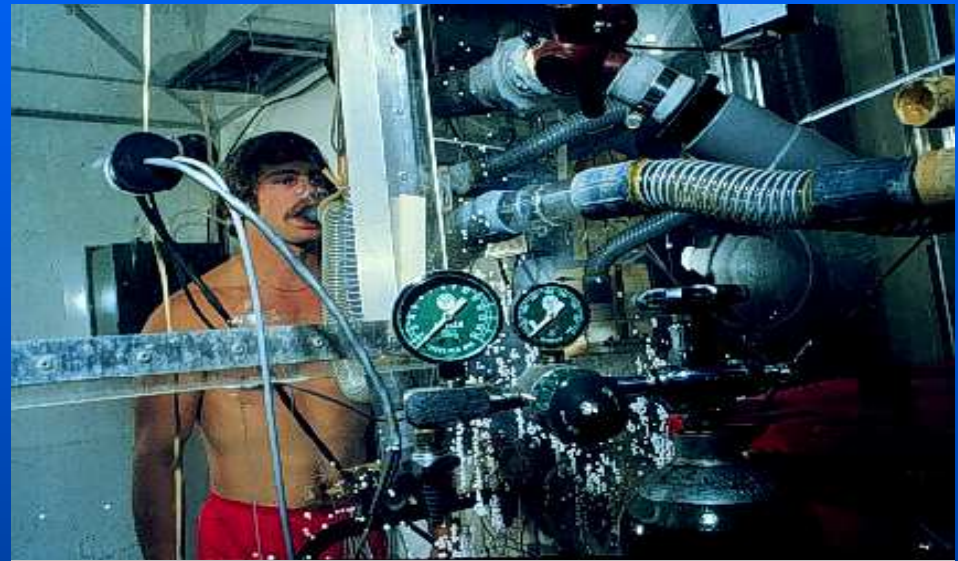
- Controlled exposure and epidemiologic studies do not agree
- Controlled human studies
 - Clinical effects of NO₂ – above 0.5 ppm
 - Reduced lung function
 - Symptoms: cough, chest tightness
 - No effects at level of standard
- Epidemiologic studies – acute effects at concentrations <0.25 ppm
 - Asthma exacerbation
 - Increased asthma medication use
 - Hospitalization and emergency room visits
 - Premature mortality

How Does NO₂ Exacerbate Asthma?

- Sub-clinical effects of NO₂ – below 0.3 ppm
 - Increased airway reactivity
 - Increased airway inflammation
 - Increased response to allergen in asthmatics
- Sub-clinical effects may explain epidemiologic findings

The Question

Does NO_2 exposure lead to increased allergic inflammation in the airways of asthmatics?



Barck, C., J. Lundahl, G. Hallden, and G. Bylin. Brief exposures to NO_2 augment the allergic inflammation in asthmatics. *Environmental Research*. 97: 58-66, 2005

Methods

- Subjects: 18 mild, allergic asthmatics (timothy grass or birch tree pollen)
- Exposures: NO₂ (0.26 ppm) or clean air
 - Three-day protocol
 - 15-minute exposures
- Endpoints (pre- and post-exposure)
 - Symptoms (i.e., cough, chest tightness)
 - Lung function
 - Inflammatory cells in sputum and blood
 - Inflammatory mediators in sputum and blood

Results

- No changes in:
 - Lung function, symptoms, or number of inflammatory cells
- Enhanced allergic response with NO₂ exposure – sub-clinical effect
 - Evidence for allergic cell activation (eosinophils)
 - Activation marker increased 6-fold in sputum and 2-fold in blood

Conclusions and Implications

- Short NO₂ exposures can amplify allergic responses in asthmatics
- Plausible explanation for asthma exacerbation with NO₂ exposure
- Current CA ambient air quality standard for NO₂ has no margin of safety