

**Testimony of Gregory Wellenius, ScD**

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**Hearing on**

**“Oversight Hearing: EPA’s Proposed National Ambient Air Quality Standards for  
Ozone”**

**Subcommittee on Clean Air and Nuclear Safety  
Committee on Environment and Public Works  
U.S. Senate**

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Mr. Chairman, Members of the Committee, thank you for the opportunity to testify today. I am Dr. Gregory Wellenius, Associate Professor of Epidemiology at the Brown University School of Public Health and Associate Director of the Brown University Center for Environmental Health and Technology. I earned my doctorate in Environmental Health and Epidemiology from the Harvard School of Public Health and previously served on the faculty at Harvard Medical School. I have been conducting research on the health effects of air pollution for more than 15 years, have authored or coauthored more than three dozen original studies in this area, and contributed as an author for the EPA’s 2009 Integrated Science Assessment for Particulate Matter. My research has focused on the human health effects of ambient air pollutants and it is my pleasure to provide testimony in this area.

As we’ve heard, the EPA is proposing to revise the primary standard for ozone from the current level of 75 ppb to a level in the range on 65-70 ppb, and is accepting comments

on revising the standard to as low as 60 ppb. There is scientific and medical consensus that the current standard of 75 ppb is outdated and that a protective standard should fall within the range of 60-70 ppb. Reducing ozone pollution will save lives and improve air quality for everyone, especially vulnerable populations like children with asthma and others with respiratory diseases. For the reasons I explain in my testimony, I encourage the EPA to give full consideration to setting a 60 ppb standard and to finalize a standard that will protect public health.

There is broad consensus in the scientific and medical communities that ambient ozone is harmful to human health. For example, the American Lung Association states that “ozone air pollution threatens the health of infants, children, seniors, and people with asthma and other lung diseases.” They further urge EPA to “set the final standard where it provides the greatest safeguards to the most people.”<sup>1</sup> This sentiment has been echoed by a number of medical and professional societies including the American Academy of Pediatrics, the American Heart Association, the American Public Health Association, and the American Thoracic Society, among others. On August 3, 2011, fourteen leading medical and public health organizations cosigned a letter to the White House stating the following:

“The ozone health standard must protect those who are most vulnerable from the dangerous health impacts of ozone, including infants, children, older adults, and those with chronic diseases. To safeguard the health of the American people, help to save lives, and reduce health care spending, we support the most protective standard under consideration: 60 parts per billion (ppb) averaged over eight hours.”<sup>2</sup>

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<sup>1</sup> <http://www.lung.org/associations/states/colorado/clean-air/ozone.html>.

<sup>2</sup> The organizations signing this letter were the American Academy of Pediatrics, American Association of Cardiovascular and Pulmonary Rehabilitation, American College of Preventive Medicine, American Heart Association, American Lung Association, American Public Health Association, American Thoracic Society, Asthma and Allergy Foundation of America, National Association for Medical Direction of Respiratory Care, National Association of County and City Health Officials, National Environmental Health Association, National Home Oxygen Patients Association, Physicians for Social Responsibility, and Trust for America's Health.  
[http://c.ymcdn.com/sites/www.acpm.org/resource/resmgr/policy-files/2011\\_ltr\\_presidentozone.pdf](http://c.ymcdn.com/sites/www.acpm.org/resource/resmgr/policy-files/2011_ltr_presidentozone.pdf).

The external panel of independent scientists that make up the Clean Air Scientific Advisory Committee (CASAC) and EPA scientists have also concluded that there is a “causal relationship between short-term O<sub>3</sub> [ozone] exposure and respiratory health effects.”<sup>3</sup> This conclusion is based on the findings from more than a thousand epidemiologic, clinical, and toxicologic studies carried out over decades and consistently demonstrating adverse effects of ozone exposure on respiratory morbidity and mortality, including increased risk of respiratory deaths, hospital admissions, and emergency department visits, increased respiratory symptoms and medication use, decrements in lung function, increased airway reactivity, and evidence of increased pulmonary inflammation and injury. As one example, a 2010 study by scientists at Emory and the Georgia Institute of Technology found that in the Atlanta metropolitan area a 30 ppb increase in 8-hour maximum ozone levels was associated with approximately a 6% higher rate of pediatric emergency department visits for asthma.<sup>4</sup> In this study, the investigators found that the dose-response curve was approximately linear with adverse health effects evident at ozone levels well below the current ozone standard of 75 ppb.

The physiologic mechanisms underlying these effects include: (1) activation of neural reflexes, (2) initiation of inflammation, (3) alteration of epithelial barrier function, (4) sensitization of bronchial smooth muscle, (5) changes in immunity, and (6) airway remodeling. These downstream consequences of exposure to ozone lead not only to the respiratory and pulmonary effects described above, but also to adverse effects on other organs beyond the lungs.

Recent evidence also suggests that short-term exposure to ozone likely increases both total mortality and cardiovascular mortality, with supporting evidence provided by several large studies conducted in the US, Canada, and Western Europe. Further

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<sup>3</sup> U.S. Environmental Protection Agency. (2013). Integrated Science Assessment for Ozone and Related Photochemical Oxidants (Final Report). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-10/076F.

<sup>4</sup> Strickland MJ, Darrow LA, Klein M, Flanders WD, Sarnat JA, Waller LA, Sarnat SE, Mulholland JA, Tolbert PE. Short-term associations between ambient air pollutants and pediatric asthma emergency department visits. *Am J Respir Crit Care Med.* 2010;182:307-316.

support for these findings is provided by a growing number of epidemiologic, clinical and animal toxicologic studies that have found a connection between ozone exposure and subclinical changes in cardiovascular physiology.

Many of the available studies indicate measureable adverse health effects at levels below the current standard of 75 ppb. For example, meaningful and statistically significant reductions in lung function have been observed in young, healthy adults exposed to ozone levels as low as 60 ppb.<sup>5, 6</sup> Other studies have found increased respiratory symptoms during controlled exposure to ozone at levels of 70 ppb.<sup>7</sup> Of note, these controlled exposure studies have been conducted in healthy adults. It is expected that people with asthma, including asthmatic children, are even more sensitive to these effects. Epidemiologic studies also support the presence of adverse respiratory health effects at ozone levels well below the current standard. For example, the study of pediatric emergency department visits for asthma that I mentioned earlier provided evidence of effects at ambient ozone levels as low as 30 ppb.<sup>8</sup>

Results from these studies indicate that the current standard for ozone is inadequate to protect the public's health. Based on the existing evidence, CASAC's review of the EPA's second draft policy assessment for the review of the ozone standard concluded that "there is clear scientific support for the need to revise the standard" and that "there is adequate scientific evidence to recommend a range of levels for a revised primary ozone standard from 70 ppb to 60 ppb."<sup>9</sup>

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<sup>5</sup> Brown JS, Bateson TF, McDonnell WF. Effects of exposure to 0.06 ppm ozone on FEV1 in humans: a secondary analysis of existing data. *Environ Health Perspect.* 2008;116:1023-1026.

<sup>6</sup> Kim CS, Alexis NE, Rappold AG, Kehrl H, Hazucha MJ, Lay JC, Schmitt MT, Case M, Devlin RB, Peden DB, Diaz-Sanchez D. Lung function and inflammatory responses in healthy young adults exposed to 0.06 ppm ozone for 6.6 hours. *Am J Respir Crit Care Med.* 2011;183:1215-1221.

<sup>7</sup> Schelegle ES, Morales CA, Walby WF, Marion S, Allen RP. 6.6-hour inhalation of ozone concentrations from 60 to 87 parts per billion in healthy humans. *Am J Respir Crit Care Med.* 2009;180:265-272.

<sup>8</sup> Strickland MJ, Darrow LA, Klein M, Flanders WD, Sarnat JA, Waller LA, Sarnat SE, Mulholland JA, Tolbert PE. Short-term associations between ambient air pollutants and pediatric asthma emergency department visits. *Am J Respir Crit Care Med.* 2010;182:307-316.

<sup>9</sup>[http://yosemite.epa.gov/sab/sabproduct.nsf/264cb1227d55e02c85257402007446a4/5EFA320CCAD326E885257D030071531C/\\$File/EPA-CASAC-14-004+unsigned.pdf](http://yosemite.epa.gov/sab/sabproduct.nsf/264cb1227d55e02c85257402007446a4/5EFA320CCAD326E885257D030071531C/$File/EPA-CASAC-14-004+unsigned.pdf).

Scientific evidence supports a causal link between short-term exposures to ozone and increased respiratory morbidity and mortality at levels below the current standard. Lowering the primary ozone standard would have significant public health benefits including fewer deaths, fewer hospital admissions and emergency room visits for respiratory diseases, fewer respiratory symptoms, and improved lung function, especially among the most vulnerable members of the population.

In Rhode Island, the state Senator Whitehouse represents and where I work at Brown University, asthma rates in adults and children are above the national average. Ensuring ozone pollution is at safe levels will save lives and improve the quality of life for people in Rhode Island and across the country.

Rising temperatures from climate change could further exacerbate the health effects of ozone. Research has shown that the formation of ground-level ozone is affected by weather and climate, and that there is a strong link between higher temperatures and increased ozone levels. Ozone itself is also a major greenhouse gas and an important contributor to global climate change. According to the Intergovernmental Panel on Climate Change (IPCC), ozone in the troposphere is the third most important greenhouse gas contributing to climate change (after carbon dioxide and methane). Models estimate that average global ozone levels in the troposphere have increased by 30-70% since the pre-industrial era, but levels have increased by 4 or 5 fold in some regions. Thus, reductions in ozone pollution are expected to slow the pace of future climate change, in addition to the immediate public health benefits of reducing ozone pollution. At the same time, addressing climate change could help reduce ozone pollution.

EPA's proposal is based on scientific and medical consensus and supported by extensive scientific evidence. I encourage the EPA to give full consideration to setting the primary ozone standard at the health-protective level of 60 ppb. Thank you for your attention. I would be happy to answer any questions you might have.