Health benefits from large scale ozone reduction in the United States

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Rationale

Tropospheric ozone is one of six "criteria" air pollutants for which the United States Environmental Protection Agency (EPA) sets a health-based National Ambient Air Quality Standard (NAAQS). The EPA monitors ozone levels across the United States (US) through a network of air quality monitors. Increased levels of ozone have been correlated with increased risk of adverse health effects, including premature mortality and related cardiopulmonary and respiratory morbidity. In 2008, the US Environmental Protection Agency (EPA) lowered the ozone NAAQS from 84 ppb to 75ppb, expressed as the maximum 8-hr average over a 24-hr period. Based on current monitoring data, ozone levels in numerous locations across the U.S. exceed this standard.

Methods

The avoided potential adverse health impacts were quantified among the U.S. population associated with attaining the current and two alternative ozone NAAQS levels. We estimated the avoided health impacts occurring after "rolling back" ozone values to meet three 8-hr ozone NAAQS: 75, 70, and 60 ppb (a range under current consideration for a revised ozone standard). The two lower alternatives reflect the upper and lower-bound range of EPA Clean Air Scientific Advisory Committee recommended values. The EPA Environmental Benefits Mapping and Analysis Program (BenMAP) was used to project the number of avoided cases of premature mortality and morbidity for an analysis year of 2007.

Results/Conclusions

Using a suite of short-term ozone mortality studies (Bell et al, 2005 and Levy et al, 2005) the avoided incidences from current ozone-related all-cause premature mortality range from 290-410 at 75ppb, 580-820 at 70ppb, and 1,890-2,660 at 60ppb (Table 1). We also found that attaining the 75ppb standard results in prevention of 290 emergency room visits (respiratory) and 250 hospital admissions (respiratory), with a reduction of 550,250 acute respiratory symptoms and 237,100 lost school days. Attainment of the 70 and 60 ppb 8-hr maximum levels yielded substantial additional health benefits, with about 1.1 and 3.5 million acute respiratory symptoms and 510 and 1,680 hospital admissions (respiratory) prevented at the 70 and 60ppb rollbacks, respectively. Mapping of all scenario results display regional variation in health benefits (Figure 1), and reporting by metropolitan statistical areas (MSAs) show the greatest health benefits to be in the New York, Los Angeles, Philadelphia, and Riverside, California MSAs.

All Cause Mortalities Prevented by Ozone Rollbacks



Figure 1. The geographic distribution of prevented all cause mortalities (using Bell et al.
05) following ozone rollbacks to the 75ppb standard, and further rollbacks to 70 and
60ppb.

Table 1. Nationwide reductions in mortality and morbidities resulting from ozone rollbacks to the75ppb standard, and further rollbacks to 70 and 60ppb.					
Endpoint	Author	75ppb Rollback	70ppb Rollback	60ppb Rollback	
Mortality (Non-Accidental)	Ito et al (2005)	280	560	1,810	
	Schwartz (2005)	140	270	890	
	Bell et al (2004)	90	180	580	
Mortality (All Causes)	Levy et al (2005)	410	820	2,660	
	Bell et al (2005)	290	580	1,890	
Mortality (Cardiopulmonary)	Huang et al (2005)	150	300	970	
Emergency Room Visits	3 pooled studies	290	590	1,920	
Hospital Admissions (Respiratory)	6 pooled studies	250	510	1,680	
School Loss Days	2 pooled studies	207,790	410,220	1,299,790	
Acute Respiratory Symptoms	Ostro and Rothschild (1989)	550,250	1,090,690	3,469,640	