United States Environmental Protection Agency

Review of the National Ambient Air Quality Standards for Ozone:

Policy Assessment of Scientific and Technical Information

Appendices to OAQPS Staff Paper

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REVIEW OF THE NATIONAL AMBIENT AIR QUALITY STANDARDS FOR OZONE:

POLICY ASSESSMENT OF SCIENTIFIC AND TECHNICAL INFORMATION

Appendices to OAQPS STAFF PAPER

U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina

APPENDICES

APPENDIX 2A. PLOTS OF DIURNAL POLICY RELEVANT BACKGROUND OZONE PATTERNS FOR 12 URBAN AREAS BASED ON RUNS OF THE GEOS-CHEM MODEL FOR APRIL-OCTOBER 2001

Figure 2A-1. Atlanta CSA: Diurnal Policy Relevant Background Ozone Patterns.

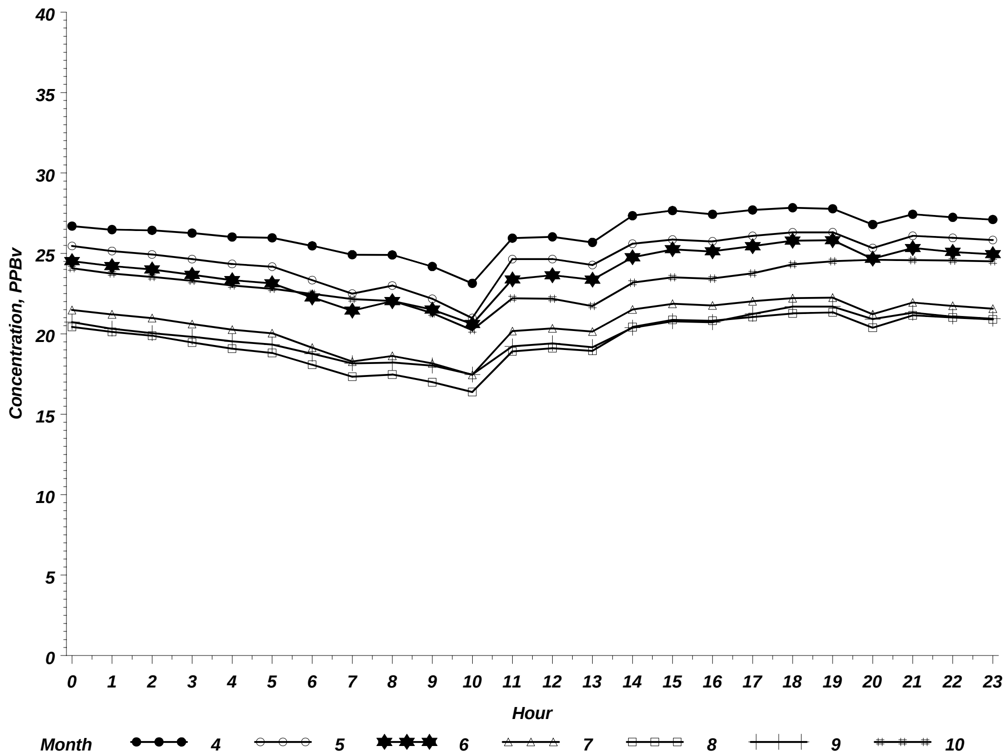


Figure 2A-2. Boston CSA: Diurnal Policy Relevant Background Ozone Patterns.

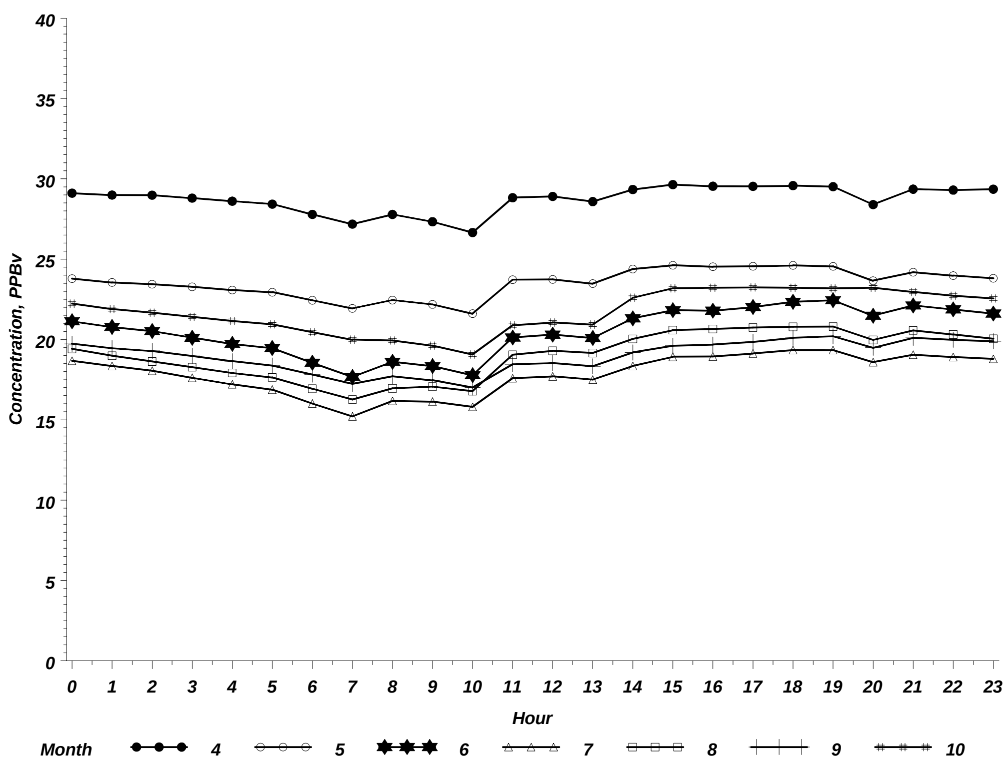


Figure 2A-3. Chicago CSA: Diurnal Policy Relevant Background Ozone Patterns.

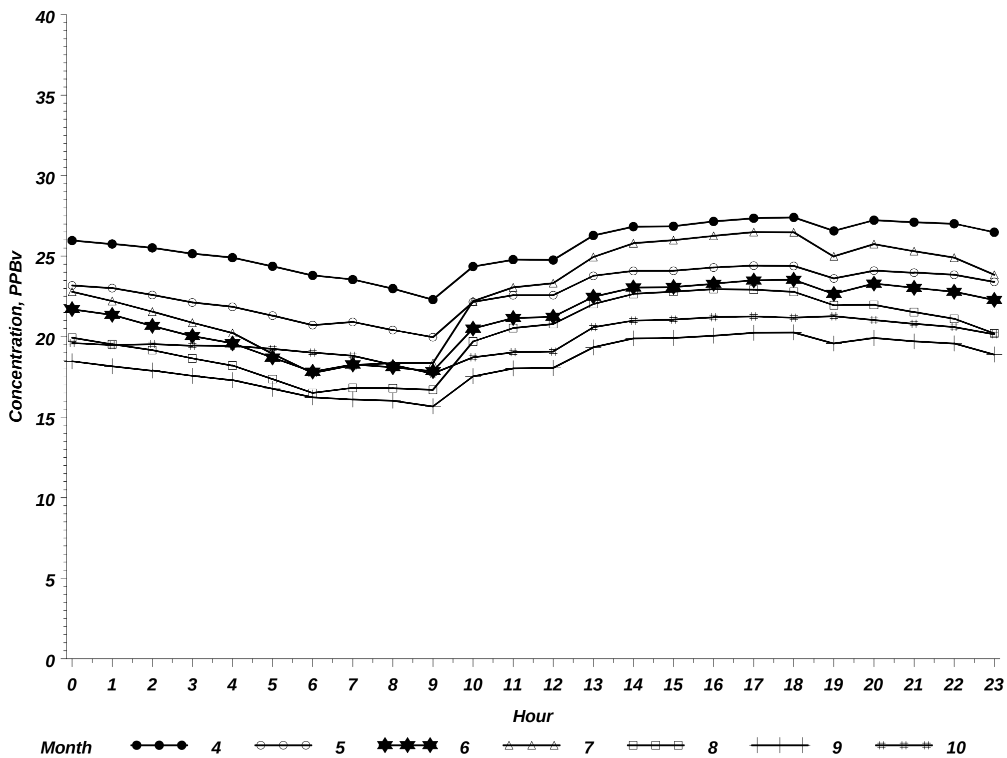


Figure 2A-4. Cleveland CSA: Diurnal Policy Relevant Background Ozone Patterns.

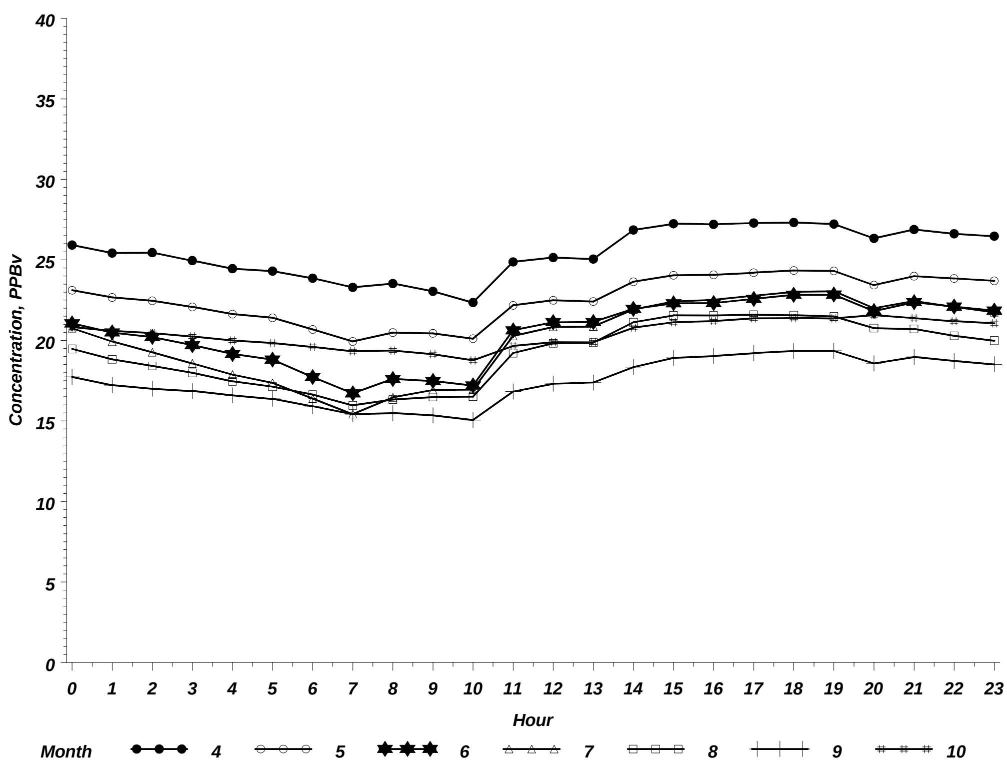


Figure 2A-5. Detroit CSA: Diurnal Policy Relevant Background Ozone Patterns.

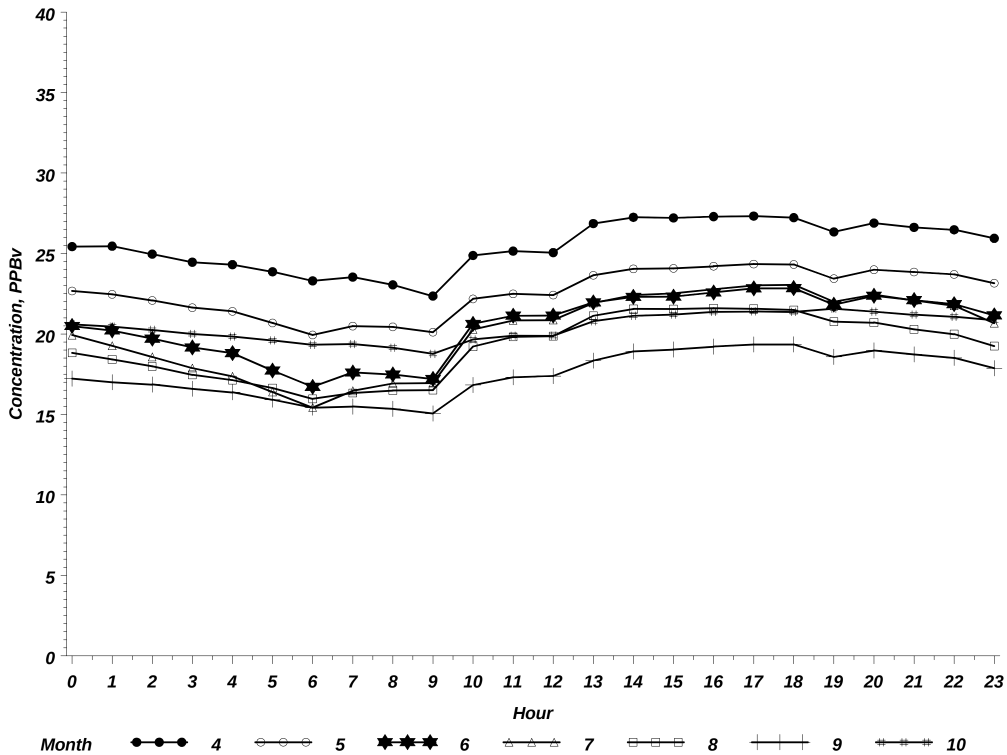


Figure 2A-6. Houston CSA: Diurnal Policy Relevant Background Ozone Patterns.

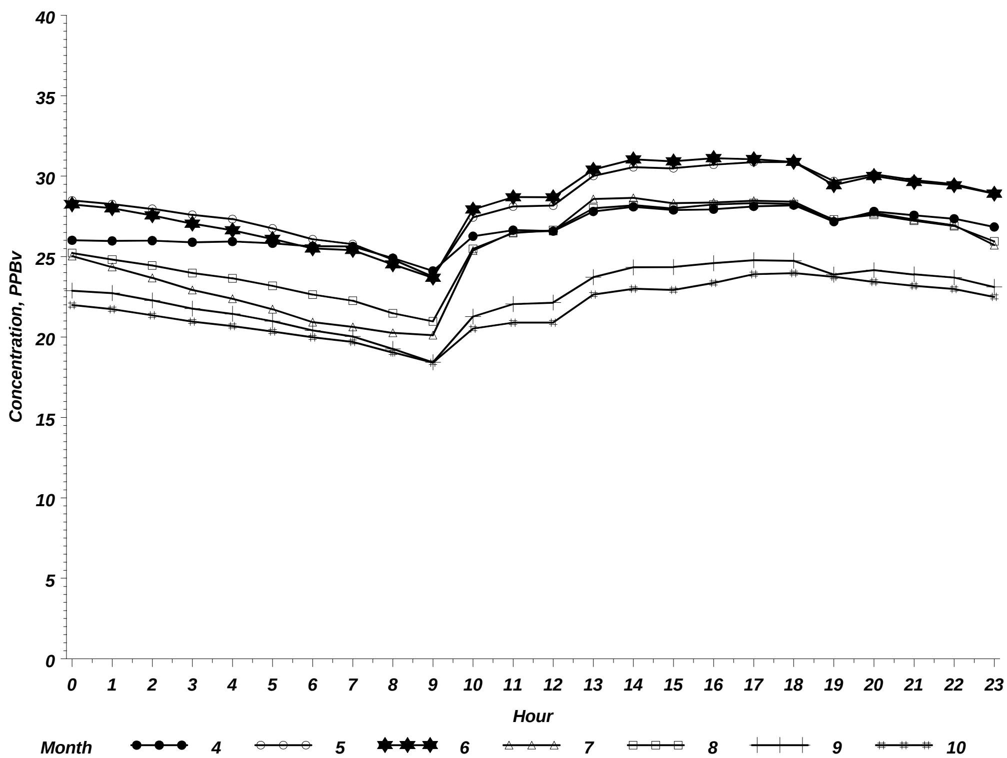


Figure 2A-7. Los Angeles CSA: Diurnal Policy Relevant Background Ozone Patterns.

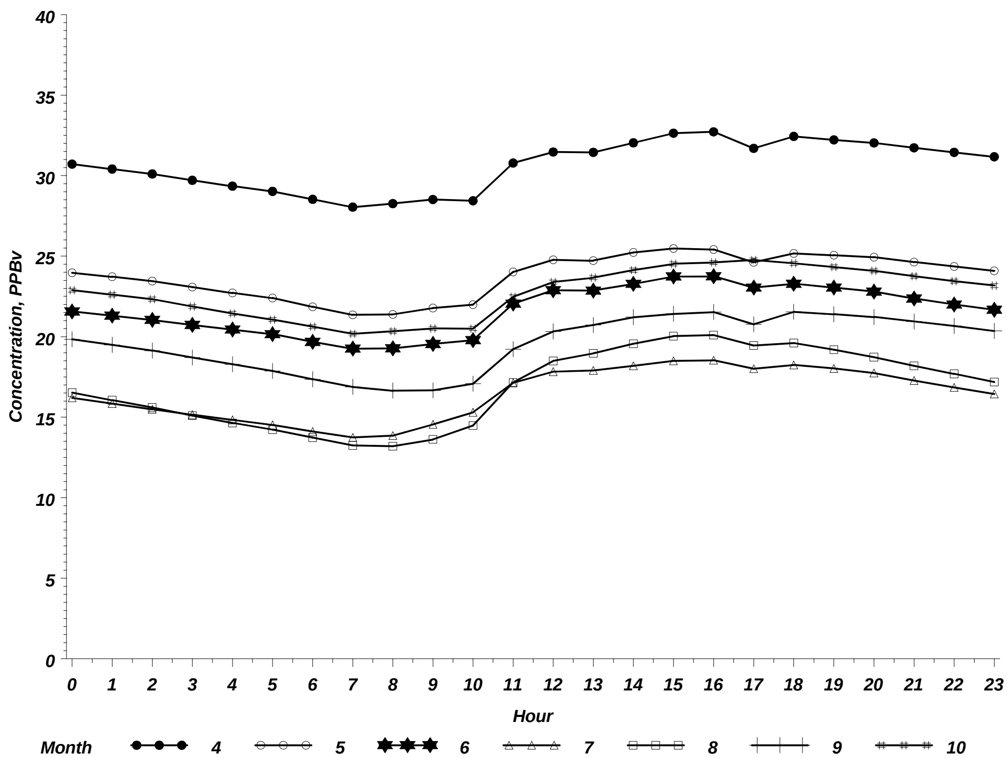


Figure 2A-8. New York CSA: Diurnal Policy Relevant Background Ozone Patterns.

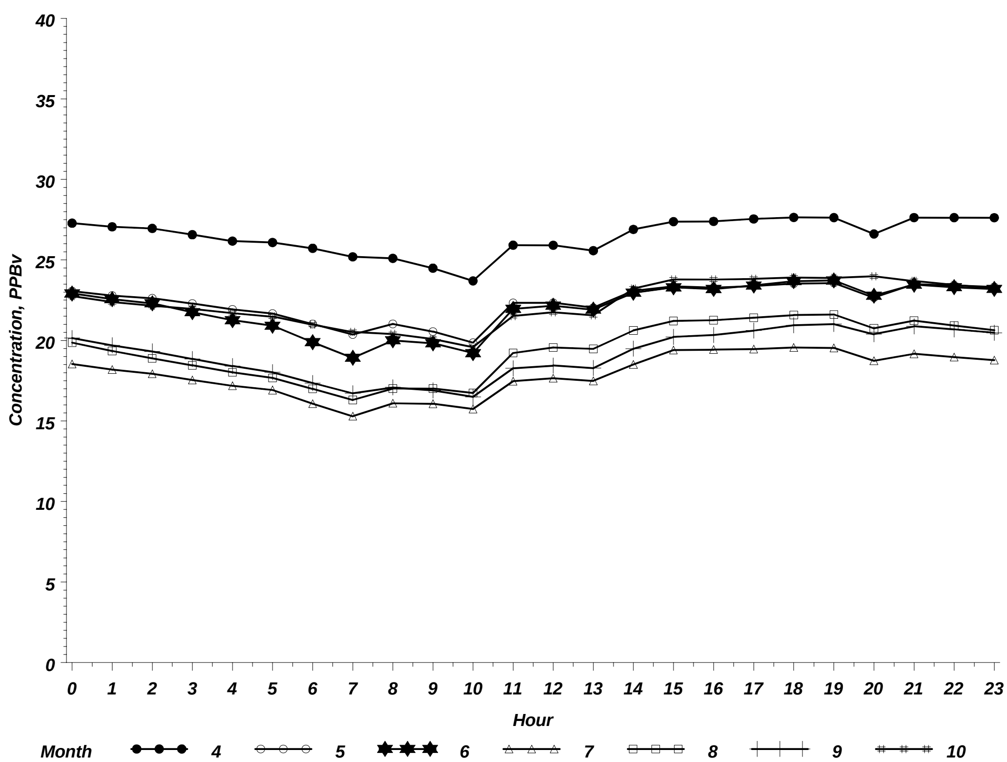


Figure 2A-9. Philadelphia CSA: Diurnal Policy Relevant Background Ozone Patterns.

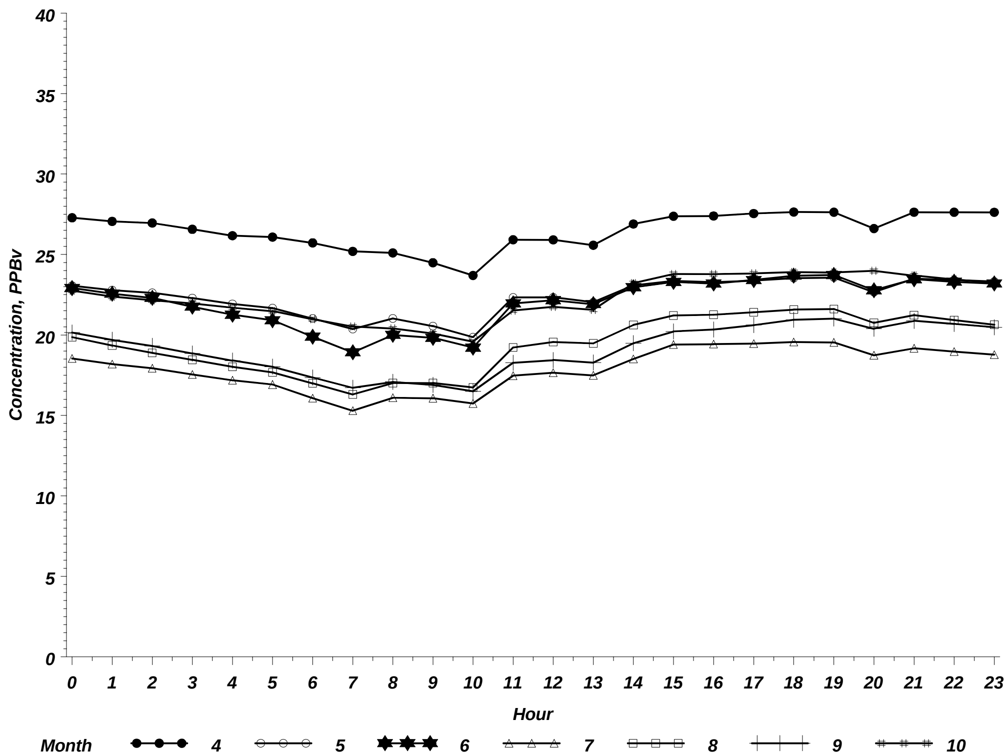


Figure 2A-10. Sacramento CSA: Diurnal Policy Relevant Background Ozone Patterns.

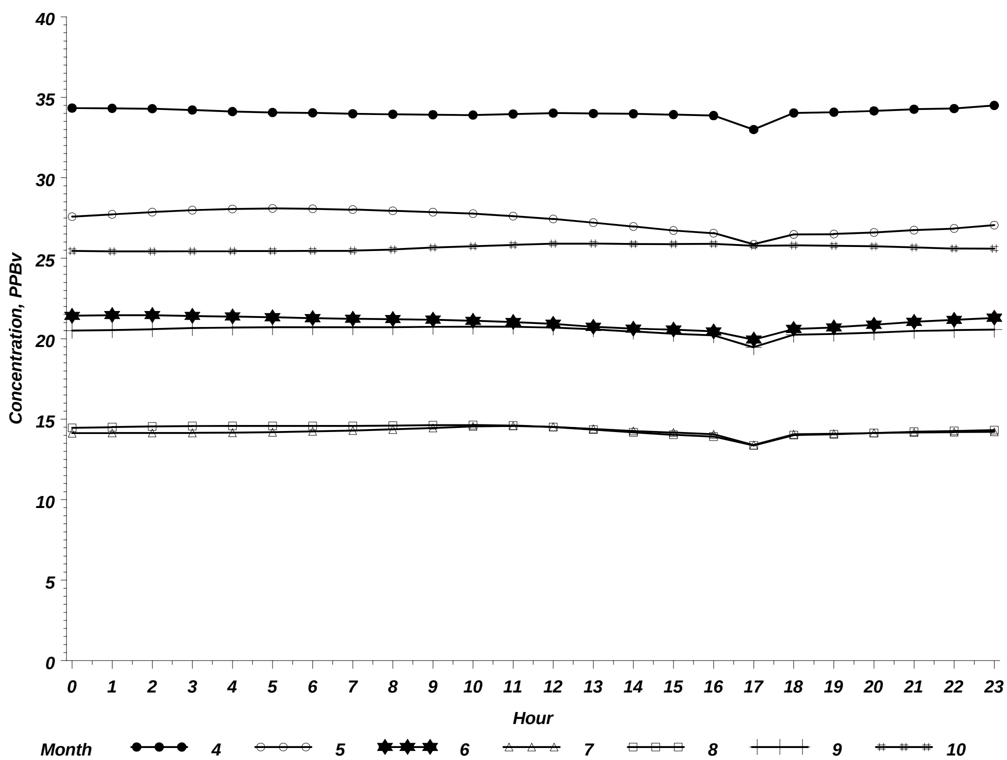


Figure 2A-11. St. Louis CSA: Diurnal Policy Relevant Background Ozone Patterns.

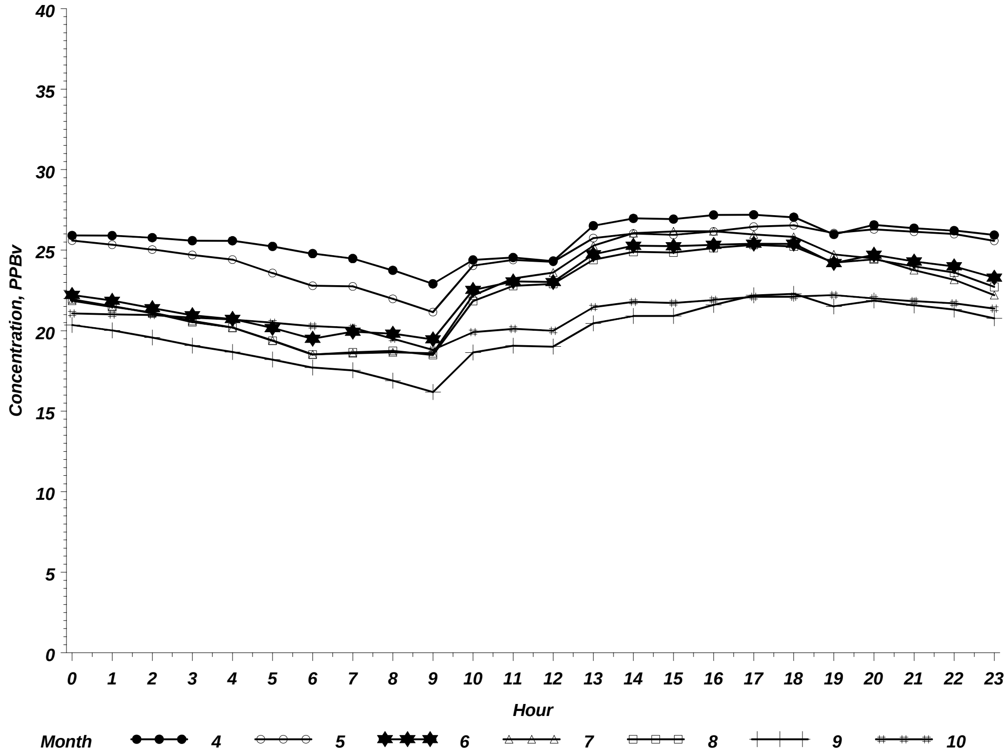
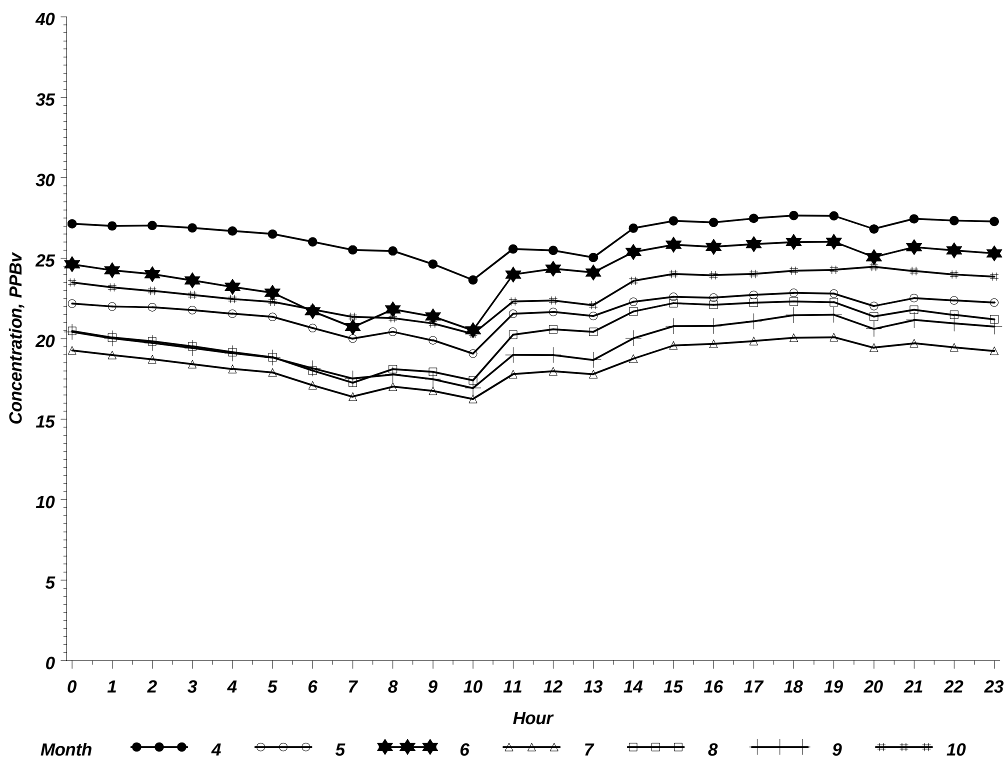


Figure 2A-12. Washington CSA: Diurnal Policy Relevant Background Ozone Patterns.



APPENDIX 3A: MECHANISMS OF TOXICITY

This Appendix provides an overview of evidence covered in Chapters 5 and 6 of the CD on possible mechanisms by which exposure to O_3 may result in acute and chronic health effects.

Pulmonary Function Responses

The direct pulmonary effects of O_3 include changes in breathing pattern, symptoms of breathing discomfort, lung function changes, and airway hyperreactivity. Subjects who engage in physical activity for several hours while exposed to O_3 may experience respiratory tract symptoms and acute physiological changes. Airway irritation is consistently the most typical symptomatic response reported in studies and can be accompanied by several physiological changes. These physiological changes include alteration in breathing pattern, airway hyperresponsiveness, airway inflammation, immune system activation, and epithelial injury. Severity of symptoms and magnitude of response depend on dose of inhaled O_3, individual sensitivity to O_3, and the extent of tolerance resulting from previous O_3 exposures. Development of effects is time-dependent with a substantial degree of overlap of increasing and receding effects. Time sequences, magnitudes, and types of responses of this series of events, in terms of development and recovery, indicate that several mechanisms, activated at different times, must contribute to the overall lung function response. For the full discussion of the mechanisms of pulmonary function responses, see section 6.2.5 of the CD.

Breathing Pattern Changes

Human controlled-exposure studies have consistently found that inhalation of O_3 alters the breathing pattern without significantly affecting minute ventilation. A progressive decrease in tidal volume and an increase in frequency of breathing to maintain steady ventilation during exposure of human subjects indicates a direct impact on ventilation. These changes are similar to responses in many animal species exposed to O_3 and other respiratory irritants. Bronchial C-fibers and rapidly adapting receptors appear to be the primary modulators of O_3-induced changes in ventilatory rate and O_3 penetration in both humans and animals (CD, section 6.2.5.1).

Symptoms and Lung Function Changes

In addition to changes in ventilatory control, O_3 inhalation by humans induces a variety of symptoms (e.g., cough, pain on deep inspiration), reduces inspiratory capacity (IC) and vital capacity (VC) and related functional measures, and increases airway resistance. The reduction in VC caused by exposure to O_3 is a reflex action and not a voluntary early termination of inspiration resulting from discomfort. An inhaled topical anesthetic substantially reduces O_3-induced symptom responses (mediated in part by bronchial C-fibers) while having only minor and irregular effect on pulmonary function decrements and rapid, shallow breathing. Since respiratory symptom responses were largely abolished by anesthetic, these findings support reflex inhibition of VC due to stimulation by both bronchial and pulmonary C-fibers. Intersubject variability in FEV_1 responses is not explained by differences in O_3 doses between similarly exposed individuals (CD, section 6.2.5.1).

Airway Hyperresponsiveness

Bronchial or airway hyperresponsiveness (AHR) refers to a condition in which the propensity for the airways to bronchoconstrict, due to a variety of specific (e.g., allergens and antigens) or nonspecific (e.g., histamine and cold air) stimuli, becomes increased. Despite a common mechanism, post- O_3 exposure pulmonary function changes and AHR (either early or late phase) are poorly correlated either in time or magnitude. Neither does post-O_3 exposure AHR seem to be related to baseline airway responsiveness. These findings imply that the mechanisms are either not related or are activated independently in time. Animal studies (with limited support from human studies) have suggested that stimulation of C-fibers can lead to increased responsiveness of bronchial smooth muscle independently of systemic and inflammatory changes which may be absent. A characteristic of O_3-induced inflammatory airway neutrophilia, which at one time was considered a leading AHR mechanism, has been found to be only coincidentally associated with AHR, i.e., there was no cause and effect relationship. This observation does not rule out involvement of other cells in AHR modulation. However, there is some evidence that release of inflammatory mediators can sustain AHR and bronchoconstriction. Late AHR observed in some studies is plausibly due to sustained damage of the airway epithelium and continual release of inflammatory mediators. In conclusion, O_3-induced AHR appears to be a product of many mechanisms acting at different time periods and levels of the bronchial smooth muscle signaling pathways (CD, section 6.2.5.1)..

Extrapulmonary Effects

Ozone reacts rapidly on contact with lipids and antioxidants in the epithelial lining fluid (ELF) and the epithelial cell layer and is not absorbed or transported to extrapulmonary sites to any significant degree. Laboratory animal studies suggest that reaction products formed by the interaction of O_3 with respiratory system fluids or tissues may produce effects measured outside the respiratory tract. Studies of the effects on hematological parameters and blood chemistry in rats have shown that erythrocytes are a target of O_3. Exposures to 1.0 ppm O_3 for 3 hr have been found to decrease heart rate (HR), mean arterial pressure (MAP), and core temperature (T_{CO}) and to induce arrhythmias with some exposures in rats. These effects are more pronounced in adult and awake rats than in younger or sleeping animals. Exposures of 0.2 ppm for 48 hr have been shown to cause bradycardia, while exposures of 0.1 ppm O_3 for 3 days have been shown to cause bradyarrhythmia in these animals (CD, Section 5.3.3).

More recent studies of rats have consistently demonstrated effects on heart rate, T_{CO} and activity levels. One study exposed rats to FA for 6 hr, followed 2 days later by a 5 hr exposure to 0.1 ppm O_3, 5 days later by a 5 hr exposure to 0.3 ppm O_3, and 10 days later by a 5 hr exposure to 0.5 ppm O_3 (Arito et al., 1997). Each of the O_3 exposures was preceded by a 1 hr exposure to FA. Transient rapid, shallow breathing with slightly increased HR appeared 1 to 2 min after the start of O_3 exposures and was attributed to an olfactory response. Persistent rapid, shallow breathing with a progressive decrease in HR occurred with a latent period of 12 hr. During the last 90-min of exposure, averaged values for relative $V0_E$ tended to decrease with the increase in O_3 concentration for young (4 to 6 months) but not old (20 to 22 months) rats.

Studies by Watkinson et al. (1995, 2001) and Highfill and Watkinson (1996) demonstrated that when HR was reduced during a 5-day, 0.5 ppm O_3 exposure, T_{CO} and activity levels also decreased. The decreases in T_{CO} and BP reported in these studies and by Arito et al. (1997) suggest that the changes in ventilation and HR are mediated through physiological and behavioral defense mechanisms in an attempt to minimize the irritant effects of O_3 inhalation.

Similar cardiovascular and thermoregulatory responses in rats to O_3 were reported by Iwasaki et al. (1998). Repeated exposure to 0.1, 0.3, and 0.5 ppm O_3 8 hr/day for 4 consecutive days caused disruption of circadian rhythms of HR and T_{CO} on the first and second exposure days that was concentration-dependent. The decreased HR and T_{CO} recovered to control values on the third and fourth days of O_3 exposure.

The thermoregulatory response to O_3 was further characterized by Watkinson et al. (2003). Rats were either exposed to 0.0 ppm for 24 hr/day (air), 0.5 ppm for 6 hr/day (intermittent), or to 0.5 ppm for 23 hr/day (continuous) at 3 temperatures, 10 °C (cold), 22 °C (room), or 34 °C (warm). Another protocol examined the effects of O_3 exposure (0.5 ppm) and exercise (described as rest, moderate, or heavy) or CO_2-stimulated ventilation. Both intermittent and continuous O_3 exposure caused decreases in HR and T_{CO} and increases in BALF inflammatory markers. Exercise in FA caused increases in HR and T_{CO} while exercise in O_3 caused decreases in those parameters. Several factors were suggested that may modulate the hypothermic response, including dose, animal mass, and environmental stress.

One of the major postulated molecular mechanisms of action of O_3 is peroxidation of mono- and polyunsaturated fatty acids and unsaturated neutral lipids in the lung, resulting in lipid ozonation products. Ozone can penetrate only a short distance into the ELF; and, therefore, it reacts with epithelial cell membranes only in regions of distal lung where ELF is very thin or absent. The inflammatory cascade initiated by O_3 generates a mix of secondary reactants which then are likely to oxidize lipids and proteins in cell membranes (CD Section 5.1.2.4).

Recent in vitro studies of O_3 reactions with cholesterol in lung surfactant found consequent generation of highly reactive products such as oxysterols and β-epoxide in BALF isolated from rats exposed to 2.0 ppm O_3 for 4 hr (Pulfer and Murphy, 2004). Additionally, both 5β,6β- epoxycholesterol and its most abundant metabolite, cholestan-6-oxo-3β,5α-diol, were shown to be cytotoxic to human lung epithelial (16-HBE) cells and to inhibit cholesterol synthesis. Studies (Pulfer et al., 2005) of mice exposed to 0.5, 1.0, 2.0, or 3.0 ppm O_3 for 3 hr also demonstrated that these oxysterols were produced in vivo. These results suggest that this may be an additional mechanism of O_3 toxicity, including a pathway by which O_3 may play a possible role in the development of atherosclerosis and other cardiovascular effects.

The presence of oxysterols in human atherosclerotic lesions implicates the oxidation of cholesterol in the pathogenesis of atherosclerosis, a well-known contributor to development of cardiovascular disease. Oxysterols may arise from different cholesterol oxidation mechanisms, (including free radical-mediated oxidations), and their unabated accumulation in macrophages and smooth muscle cells of arterial walls lead to formation of fatty streaks in advanced lesions. The presence of one of the O_3-induced oxysterols, secosterol, in endogenously formed arterial plaques (Wentworth et al., 2003) suggests that the oxysterols produced in the lung either due to direct O_3 interaction with surfactant cholesterol or with oxidant radicals at the O_3-induced inflammation site may have potential involvement in the development of cardiovascular and myocardial diseases. In addition, the recent in vitro observation (Sathishkumar et al., 2005) of increased apoptosis (programmed cell death) induced by secosterol in H9c2 cardiomyocytes (heart cells) supports possible involvement of such biologically active oxysterols in O_3-induced cardiovascular effects observed in the epidemiologic studies. Also, the detection of oxysterols in the BALF of rats exposed to O_3 suggests their potential to be used as biomarkers of O_3 exposure. Demonstration of relationships between oxysterols of the type generated in lung surfactant with O_3 exposure and cardiovascular disease outcomes in clinical settings or epidemiologic studies would add considerable value to the experimental observations thus for reported in the animal toxicology studies.

Other potential mechanisms by which O_3 exposure may be associated with cardiovascular disease outcomes have been described. Laboratory animals exposed to relatively high O_3 concentrations (≥ 0.5 ppm) demonstrate tissue edema in the heart and lungs. This may be due to increased circulating levels of atrial natriuretic factor (ANF), which is known to mediate capillary permeability, vasodilation, and BP (Daly et al., 2002). Ozone-induced changes in heart rate, edema of heart tissue, and increased tissue and serum levels of ANF found with 8-hr 0.5 ppm O_3 exposure in animal toxicology studies (Vesely et al., 1994a,b,c) raise the possibility of potential cardiovascular effects of acute O_3 exposures.

Earlier work demonstrated O_3-induced release of functionally active platelet activating factor (PAF) from rodent epithelial cells and the presence of PAF receptors on AMs. New work examining lipid metabolism (CD, Section 5.2.1.4) and mediators of inflammatory response and injury (CD, Section 5.2.3.4) confirm earlier findings indicating that PAF (Kafoury et al., 1999) and PAF receptors (Longphre et al., 1999) are involved in responses to O_3. In addition to the role of PAF in pulmonary inflammation and hyperpermeability, this potent inflammatory mediator may have clotting and thrombolytic effects, though this has not been demonstrated experimentally. This cardiovascular effect may help explain, in part, some limited epidemiologic findings suggestive of possible association of heart attack and stroke with ambient O_3 exposure described in section 3.3.1.3 of this Staff Paper. As indicated by the studies described above, an emerging body of animal toxicology evidence is beginning to suggest mechanisms by which O_3 can affect the cardiovascular system.

In a controlled human exposure study described in the CD in Chapter 6, Gong et al. (1998) exposed 10 hypertensive and 6 healthy adult males, 41 to 78 years of age, to 0.3 ppm O_3 for 3 hr while at intermittent exercise, at 30 L/min. For all subjects combined (no significant group differences), there was an O_3-induced decrement of 7% in FEV_1 and a statistically significant increase (70%) in the alveolar-arterial oxygen tension gradient. The overall results did not indicate any major acute cardiovascular effects of O_3 in either the hypertensive or normal subjects. Foster et al. (1993) demonstrated that even in relatively young healthy adults (26.7 ± 7 yrs old), O_3 exposure can cause ventilation to shift away from the well perfused basal lung. This effect of O_3 on ventilation distribution (and, by association, the small airways) may persist beyond 24-hr postexposure (Foster et al., 1997). Gong et al. (1998) suggested that by impairing alveolar-arterial oxygen transfer, the O_3 exposure could potentially lead to adverse cardiac events by decreasing oxygen supply to the myocardium. However, the subjects in their study apparently had sufficient functional reserve so as to not experience significant ECG changes or myocardial ischemia and/or injury. Information about the impact of O_3 exposure on the cardiovascular system from epidemiologic studies is discussed in section 3.3.1.

Appendix 3B. Ozone Epidemiological Study Results: Summary of effect estimates and air quality data reported in studies, distribution statistics for 8-hr daily maximum ozone concentrations for the study period and location, and information about monitoring data used in study.

Study; Location	Effect Estimate (lower CL, upper CL)	Air Quality Data from Study *		Statistics for 8-hr daily max air quality data **			Study period; Monitoring information
		Ave time; Lag	Mean	98th %	99th %	Range	
Respiratory Symptoms:							
Mortimer et al., 2002 8 U.S. cities morning symptoms	1.35 (1.06, 1.71)	8h	48	64.3	66	28.8-66	6/1/93 - 8/31/93 AQS, all monitors in corresponding county, averaged for 10am to 6pm
Gent et al., 2003 New England cities chest tightness	1.19 (1.05, 1.34)	8h 1d	51.3	95.2	91.8	27.1-99.6	4/1/01 - 9/30/01 10 sites in CT and 4 in Springfield MA
Gent et al., 2003 New England cities shortness of breath	1.17 (1.03, 1.33)	8h 1d	51.3	95.2	91.8	27.1-99.6	4/1/01 - 9/30/01 10 sites in CT and 4 in Springfield MA
Ostro et al., 2001 2 S Cal counties Asthma med use	1.15 (1.12, 1.19)	1h	59.5/ 95.8 (57.2)	121	122	14-122	Aug-Nov 1993 2 sites - downtown LA and Pasadena, individuals matched to closest site
Ostro et al., 2001 2 S Cal counties shortness of breath	1.01 (0.92, 1.10)	1h 3d	59.5/ 95.8 (57.2)	121	122	14-122	Aug-Nov 1993 2 sites - downtown LA and Pasadena, individuals matched to closest site
Ostro et al., 2001 2 S Cal counties Wheeze	0.94 (0.88, 1.00)	1h 3d	59.5/ 95.8 (57.2)	121	122	14-122	Aug-Nov 1993 2 sites - downtown LA and Pasadena, individuals matched to closest site
Ostro et al., 2001 2 S Cal counties Cough	0.93 (0.87, 0.99)	1h 3d	59.5/ 95.8 (57.2)	121	122	14-122	Aug-Nov 1993 2 sites - downtown LA and Pasadena, individuals matched to closest site

Study; Location	Effect Estimate (lower CL, upper CL)	Air Quality Data from Study *		Statistics for 8-hr daily max air quality data **			Study period; Monitoring information
		Ave time; Lag	Mean	98th %	99th %	Range	
Neas et al., 1995 Uniontown PA pm cough	1.36 (0.86, 2.14)	12h 0d	37.2 (56.1)	85.3	98	15-98	6/10/90 - 8/23/90 1 site near Laurel Highlands HS
Delfino et al., 2003 San Diego, CA Symptom score>1	0.75 (0.24, 2.33)	8h 0d	17.1	34.8	35.2	5.8-35.2	Nov 99 - Jan 00 Huntington Park central site
Delfino et al., 2003 San Diego, CA Symptom score>1	1.55 (0.52, 4.63)	8h 1d	17.1	34.8	35.2	5.8-35.2	Nov 99 - Jan 00 Huntington Park central site
Delfino et al., 2003 San Diego, CA Symptom score>2	6.67 (1.09, 40.88)	8h 0d	17.1	34.8	35.2	5.8-35.2	Nov 99 - Jan 00 Huntington Park central site
Delfino et al., 2003 San Diego, CA Symptom score>2	1.15 (0.41, 3.17)	8h 1d	17.1	34.8	35.2	5.8-35.2	Nov 99 - Jan 00 Huntington Park central site
Delfino et al., 1998 San Diego, CA Asthma symptoms	1.26 (1.00, 1.58)	8h 0d	73	107	109	43-109	8/1/95 - 10/30/95 SDAPCD site
Schwartz et al., 1994 6 US cities Cough	1.15 (0.99, 1.33)	24h 1d	36.9				Harvard 6 cities sites; school year period for each, from 1985/6 to 1987/8
Schwartz et al., 1994 6 U.S. cities lower respiratory symptoms	1.22 (1.00, 1.50)	24h 1d	36.9				Harvard 6 cities sites; school year period for each, from 1985/6 to 1987/8

Study; Location	Effect Estimate (lower CL, upper CL)	Air Quality Data from Study *		Statistics for 8-hr daily max air quality data **			Study period; Monitoring information
		Ave time; Lag	Mean	98th %	99th %	Range	
Ross et al., 2002 East Moline, IL morning symptoms	1.12 (1.05, 1.20)	8h 3d ave	41.5	68.8	75	8.9-78.3	Apr-Oct 1994 AQS data - East Moline sites
Ross et al., 2002 East Moline, IL Evening symptoms	1.12 (1.06, 1.19)	8h 3d ave	41.5	68.8	75	8.9-78.3	Apr-Oct 1994 AQS data - East Moline sites
Ross et al., 2002 East Moline, IL Asthma med use	1.08 (0.99, 1.17)	8h 3d ave	41.5	68.8	75	8.9-78.3	Apr-Oct 1994 AQS data - East Moline sites
Thurston et al., 1997 Connecticut chest symptoms	1.21 (1.12, 1.31)	1h 0d	83.6	NA	NA	NA	last wk of June 1991-93 on-site monitor
Thurston 1997 Connecticut Asthma med use	1.19 (1.08, 1.32)	1h 0d	83.6	NA	NA	NA	last wk of June 1991-93 on-site monitor
Lung Function Changes:							
Mortimer et al., 2002 8 U.S. cities am PEF (%)	-0.59% (-1.05, -0.13)	8h	48	64.3	66	28.8-66	6/1/93 - 8/31/93 AQS, all monitors in corresponding county, averaged for 10am to 6pm
Linn et al., 1996 Los Angeles FEV1 (ml)	-0.26 (SE 0.25) (am) -0.18 (SE 0.20) (pm)	24h 0d	23	150	164	2.5-192.5	Jan 91-Dec 92 SCAQMD sites in 3 communities: Upland, Rubidoux, Torrance

Study; Location	Effect Estimate (lower CL, upper CL)	Air Quality Data from Study *		Statistics for 8-hr daily max air quality data **			Study period; Monitoring information
		Ave time; Lag	Mean	98th %	99th %	Range	
Newhouse et al., 2004 Tulsa, OK am PEF (L/min)	-0.274 (p<0.05) (mean O_3) -0.289 (p<0.05) (max O_3)	24h 1d	30	92.7	104.7	17.3-104.7	9/1/00 - 10/31/00 OK DEQ site about 1 km from U Tulsa
Ross et al., 2002 East Moline, IL PEF (L/min)	-2.29 (-4.26, -0.33) (am) -2.58 (-4.26, -0.89) (pm)	8h 0-1d 1d	41.5	68.8	75	8.9-78.3	Apr-Oct 1994 AQS data - East Moline sites
Neas et al., 1995 Uniontown PA PEF (L/min)	-2.79 (-6.7, -1.1) (pm)	12h 0d	37.2 (56.1)	85.3	98	15-98	6/10/90 - 8/23/90 1 site near Laurel Highlands HS
Neas et al., 1999 Philadelphia PA PEF (L/min)	-1.38 (-2.81, 0.04) (am) -2.58 (-4.91, -0.35) (pm)	12h 0d 1-5d ave	56	96.9	104.5	17.7-104.5	7/8/93 - 9/3/93 2 sites: Airport and Presbyterian Nursing Home (58th and Greenway)
Korrick et al., 1998 Mt. Washington NH FEV1 (%)	-2.6 (-4.1, -0.4)	1h 0d	40	87	89	24 – 91	summers 1991, 92 2 sites: Mt. Washington Observatory and mountain base at Auto Rd
Thurston et al., 1997 Connecticut summer camp PEF (L/min)	-0.096 (p<0.05)	1h 0d	83.6	NA	NA	NA	last wk of June, 1991-1993 on-site monitor
Naeher et al., 1999 SW Virginia PEF (L/min)	-7.65 (-13.0, -2.25) (pm)	24h 1-5d ave	34.87	74	79	13-87	summers 1995-1996 1 site in Vinton VA

Study; Location	Effect Estimate (lower CL, upper CL)	Air Quality Data from Study *		Statistics for 8-hr daily max air quality data **			Study period; Monitoring information
		Ave time; Lag	Mean	98th %	99th %	Range	
Brauer et al., 1996 Fraser Valley, BC FEV1 (mL)	-3.8 (SE 0.4) (end shift) -4.5 (SE 0.6) (next day)	1h 0d	40.3	55	55	3-55	June-August 1993 BC Ministry of Environment sites
Emergency Department Visits: Respiratory Diseases							
Peel et al., 2005 Atlanta	2.89 (1.03, 4.77)	8h 3d ave	55.6	127	140	3-152	1/1/93 to 12/21/02 AQS Confederate Ave monitor
Delfino et al., 1997 Montreal (>64yo)	28.93 (11.98, 45.88)	8h 1d	34.7	57.5	64.9	7-64.9	May-Aug 1988 and 1989 AQS data, 5 sites
Delfino et al., 1997 Montreal (>64yo)	31.61 (12.91, 50.31)	1h 1d	34.7 (28.9)	57.5	64.9	7-64.9	May-Aug 1988 and 1989 AQS data, 5 sites
Jones et al., 1995 Baton Rouge, LA (1-17 yo)	-13.00 (-32.82, 12.66)	24h 0d	28.2 (56.4)	111.8	118	21-119	6/1/90 - 8/31/90 DEQ 3 sites
Jones et al., 1995 Baton Rouge, LA (18-60 yo)	20.00 (2.29, 40.78)	24h 0d	28.2 (56.4)	111.8	118	21-119	6/1/90 - 8/31/90 DEQ 3 sites
Jones et al., 1995 Baton Rouge, LA (>60 yo)	27.00 (-3.48, 67.10)	24h 0d	28.2 (56.4)	111.8	118	21-119	6/1/90 - 8/31/90 DEQ 3 sites
Wilson et al., 2005 Portland NH,	-3.00 (-8.49, 2.82)	8h 0d	43.1	108	121	15-142	Apr-Oct 1998-2000 AQS data, single monitor in each city
Wilson et al., 2005 Manchester NH	-3.00 (-8.53, 2.87)	8h 0d		85	93	5-121	Apr-Oct 1998-2000 AQS data, single monitor in each city

Study; Location	Effect Estimate (lower CL, upper CL)	Air Quality Data from Study *		Statistics for 8-hr daily max air quality data **			Study period; Monitoring information
		Ave time; Lag	Mean	98^{th} %	99^{th} %	Range	
Stieb et al., 1996 St. John, Canada	9.33 (-0.07, 18.74)	1h 2d	41.6 (36.1)	83	91	5-140.5	May-Sept 1984-1992 EC data averaged across sites
Emergency Department Visits: Asthma							
Peel et al., 2005 Atlanta, GA	2.65 (-0.50, 5.89)	8h 3d ave	55.6	127	140	3-152	1/1/93 to 12/21/02 AQS Confederate Ave monitor
Wilson et al., 2005 Manchester NH	-3.00 (-8.91, 3.29)	8h 0d	NA	108	121	15-142	Apr-Oct 1998-2000 AQS data, single monitor in each city
Wilson et al., 2005 Portland NH	9.40 (10.26, 8.55)	8h 0d	NA	85	93	5-121	Apr-Oct 1998-2000 AQS data, single monitor in each city
Friedman et al., 2001 Atlanta GA (1-16 yo)	30.89 (5.34, 62.64)	1h 0-1d	77.2 (60.7)	85.8	85.8	20-85.8	7/19/96 - 8/4/96 3 sites in Atlanta
Tolbert et al., 2000 Atlanta, GA	6.37 (2.53, 10.34)	8h 1d	59.3 (60.7)	92.4	112.6	16.2-135.8	AQS, GA and Fulton Co., SOS, USGS; 7 sites in Atlanta MSA
Zhu et al., 2003 Atlanta, GA (0-16 yo)	2.41 (-2.39, 7.44)	8h 0d					
Jaffe et al., 2003 3 Ohio cities	9.27 (0.13, 19.25)	8h 2-3d	(66.1)	104	108	24-124	7/1/91 to 6/30/96 all data from active monitors
Jaffe et al., 2003 Cincinnati	15.76 (-1.01, 35.38)	8h 2d	60	106	116	24-124	7/1/91 to 6/30/96 all data from active monitors
Jaffe et al., 2003 Cleveland	3.03 (-8.52, 16.04)	8h 2d	50	104	107	27-111	7/1/91 to 6/30/96 all data from active monitors
Jaffe et al., 2003 Columbus	15.76 (-2.49, 37.44)	8h 3d	57	98	106	25-117	7/1/91 to 6/30/96 all data from active monitors

Study; Location	Effect Estimate (lower CL, upper CL)	Air Quality Data from Study *		Statistics for 8-hr daily max air quality data **			Study period; Monitoring information
		Ave time; Lag	Mean	98th %	99th %	Range	
Cassino et al., 1999 NYC (in heavy smokers)	-5.42 (-8.38, -2.36)	24h 0d	17.5 (32.6)	83.3	88.8	3-114.6	1/1/89 - 12/31/93 data from sites throughout NYC
Cassino et al., 1999 NYC (in heavy smokers)	2.74 (-3.00, 8.83)	24h 1d	17.5 (32.6)	83.3	88.8	3-114.6	1/1/89 - 12/31/93 data from sites throughout NYC
Cassino et al., 1999 NYC (in heavy smokers)	9.69 (3.93, 15.76)	24h 2d	17.5 (32.6)	83.3	88.8	3-114.6	1/1/89 - 12/31/93 data from sites throughout NYCl
Cassino et al., 1999 NYC (in heavy smokers)	-1.62 (-7.01, 4.08)	24h 3d	17.5 (32.6)	83.3	88.8	3-114.6	1/1/89 - 12/31/93 data from sites throughout NYC
Emergency Department Visits: Other respiratory diseases:							
Peel et al., 2005 Atlanta, GA Pneumonia	1.80 (-2.27, 6.04)	8h 3d ave	55.6	127	140	3-152	1/1/93 to 12/21/02 AQS Confederate Ave monitor
Peel et al., 2005 Atlanta, GA COPD	3.49 (-2.77,10.15)	8h 3d ave	55.6	127	140	3-152	1/1/93 to 12/21/02 AQS Confederate Ave monitor
Peel et al., 2005 Atlanta, GA upper respiratory infection	3.25 (1.10, 5.44)	8h 3d ave	55.6	127	140	3-152	1/1/93 to 12/21/02 AQS Confederate Ave monitor
Cardiovascular outcomes, biomarkers, and physiological changes:							

Study; Location	Effect Estimate (lower CL, upper CL)	Air Quality Data from Study *		Statistics for 8-hr daily max air quality data **			Study period; Monitoring information
		Ave time; Lag	Mean	98th %	99th %	Range	
Liao et al., 2004 3 US cities HRV (high frequency power)	-0.010 (SE 0.016)	8h 1d	41				1996-1998 AQS data
Liao et al., 2004 3 US cities SD of normal RR intervals	-0.336 (SE 0.290)	8h 1d	41				1996-1998 AQS data
Peters et al., 2000 Boston Defibrillator discharge	OR 0.96 (0.47, 1.98) (patients with 1+ event) OR 1.23 (0.53, 2.87) (patients with 10+ events)	24h 0d	18.6	75.2	78.1	15.7-102.7	Jan 95 - Dec 97 1 site
Peters et al., 2001 Boston Myocardial infarction	OR 1.31 (0.85, 2.03) (2h O_3) OR 0.94 (0.60, 1.49) (24h O_3)	24h and 2h 1d and 1h	19.9	75.8	81.5	17.7-102.7	Jan 95 - May 96 1 site (case-crossover)
Park et al., 2004 Boston HRV (low frequency power)	-11.5% (-21.3, -0.4)	4h	23	81.8	92	10-122.6	Nov 2000- Oct 2003 Mass Dept. Environ. Protection sites
Gold et al., 2000 Boston HRV (r-MSSD) (ms)	-3.0 (SE 1.9) (first rest period) -5.8 (SE 2.4) (slow breathing period)	1h	34	77.3	92.5	21.8-100	June-Sept 1997 1 site, MA Dept. Environ. Protection

Study; Location	Effect Estimate (lower CL, upper CL)	Air Quality Data from Study *		Statistics for 8-hr daily max air quality data **			Study period; Monitoring information
		Ave time; Lag	Mean	98th %	99th %	Range	
Dockery et al., 2005 Boston Ventricular arrhythmia	OR 1.09 (0.93, 1.29) (all events)	48h	22.9	75	82.1	2–102.7	7/11/95 - 7/11/02 6 sites, Mass Dept. Envir. Protection
Rich et al., 2005 Boston Ventricular arrhythmia	OR 1.21 (1.00, 1.45) (all events)	24h	22.6	74	81.5	2-102.7	Aug 1995 - June 2002 6 sites, Mass Dept. Envir. Protection
Emergency Department Visits: Cardiovascular Diseases							
Metzger et al., 2004 Atlanta, GA all CV	0.96 (-1.59, 3.58)	8h 3dave	53.9	127	140	3-152	1/1/93 to 12/21/02 AQS Confederate Ave monitor
Metzger et al., 2004 Atlanta, GA Dysrrhythmia	0.96 (-3.96, 6.13)	8h 3dave	53.9	127	140	3-152	1/1/93 to 12/21/02 AQS Confederate Ave monitor
Metzger et al., 2004 Atlanta, GA CHF	-4.19 (-9.74, 1.71)	8h 3dave	53.9	127	140	3-152	1/1/93 to 12/21/02 AQS Confederate Ave monitor
Metzger et al., 2004 Atlanta, GA IHD	2.28 (-2.30, 7.09)	8h 3dave	53.9	127	140	3-152	1/1/93 to 12/21/02 AQS Confederate Ave monitor
Metzger et al., 2004 Atlanta, GA peripheral vascular	1.68 (-1.57, 5.05)	8h 3dave	53.9	127	140	3-152	1/1/93 to 12/21/02 AQS Confederate Ave monitor
Hospital Admissions: Cardiovascular Diseases							

Study; Location	Effect Estimate (lower CL, upper CL)	Air Quality Data from Study *		Statistics for 8-hr daily max air quality data **			Study period; Monitoring information
		Ave time; Lag	Mean	98th %	99th %	Range	
Linn et al., 2000 Los Angeles CA (summer)	2.02 (-16.14, 24.11)	24h 0d	32.9 (98.7)	175	180	188	Los Angeles basin - averaged from monitors across basin
Fung et al., 2003 Windsor CV <65 yo	-0.14 (-11.79, 13.06)	1h 0d	39.3 (31.6)	78	85	0-106	4/1/95 - 12/31/00 4 sites in Winsdor
Fung et al., 2003 Windsor CV <65 yo	5.84 (-10.50, 25.16)	1h 0-2d ave	39.3 (31.6)	78	85	0-106	4/1/95 - 12/31/00 4 sites in Winsdor
Fung et al., 2003 Windsor CV 65+ yo	-3.57 (-10.35, 3.72)	1h 0d	39.3 (31.6)	78	85	0-106	4/1/95 - 12/31/00 4 sites in Winsdor
Fung et al., 2003 Windsor CV 65+ yo	1.94 (-8.01, 12.95)	1h 0-2d ave	39.3 (31.6)	78	85	0 -106	4/1/95 - 12/31/00 4 sites in Winsdor
Burnett et al., 1997 Toronto CV	20.47 (9.32, 32.76)	1h 2-4d ave	41.2 (31.6)	62	64	0-79	summers 1992, 93, 94 7-9 sites in metro Toronto
Gwynn et al., 2000 Buffalo circulatory	0.23 (-1.27, 1.74)	24h 1d	26.2 (38.7)	92.5	104	4.5-123	1988-1990 AQS data from multiple sites in Buffalo/Rochester area
Hospital Admissions: Specific Cardiovascular Diseases							
Koken et al., 2003 Denver CO myocardial infarction	-32.91 (-47.16, -14.82)	24h 0d	25 (44.2)	64.5	65.5	11-76	July-August 1993-1997 AQS sites in Denver County (2 sites)

Study; Location	Effect Estimate (lower CL, upper CL)	Air Quality Data from Study *		Statistics for 8-hr daily max air quality data **			Study period; Monitoring information
		Ave time; Lag	Mean	98th %	99th %	Range	
Koken et al., 2003 Denver Coronary Atheroschlerosis	27.02 (8.30, 48.98)	24h 2d	25 (44.2)	64.5	65.5	11-76	July-August 1993-1997 AQS sites in Denver County (2 sites)
Koken et al., 2003 Denver Pulm Heart Disease	49.16 (8.35, 105.22)	24h 1d	25 (44.2)	64.5	65.5	11-76	July-August 1993-1997 AQS sites in Denver County (2 sites
Ito, 2003 Detroit MI ischemic heart disease	0.52 (-2.27, 3.39)	24h 3d	25 (38.7)	80	85	4.3-101.3	1992-1994 AQS data, 4 ozone sites
Ito, 2003 Detroit MI dysrrhythmia	-1.04 (-5.87, 4.04)	24h 3d	25 (38.7)	80	85	4.3-101.3	1992-1994 AQS data, 4 ozone sites
Ito, 2003 Detroit MI heart failure	0.76 (-2.47, 4.09)	24h 3d	25 (38.7)	80	85	4.3-101.3	1992-1994 AQS data 4 ozone sites
Ito, 2003 Detroit MI stroke	0.50 (-3.03, 4.15)	24h 3d	25 (38.7)	80	85	4.3-101.3	1992-1994 AQS data 4 ozone sites
Hospital Admissions: Respiratory Diseases							
Luginaah et al., 2003 Windsor (males)	5.56 (-10.57, 24.59)	1h 0d	39.3 (31.6)	78	85	0-106	4/1/95 - 12/31/00 4 sites in Winsdor
Luginaah et al., 2003 Windsor (females)	-6.83 (-23.92, 14.09)	1h 0d	39.3 (31.6)	78	85	0-106	4/1/95 - 12/31/00 4 sites in Winsdor

Study; Location	Effect Estimate (lower CL, upper CL)	Air Quality Data from Study *		Statistics for 8-hr daily max air quality data **			Study period; Monitoring information
		Ave time; Lag	Mean	98^{th} %	99^{th} %	Range	
Thurston et al., 1992 Buffalo NY	4.94 (-0.23, 10.12)	1h 2d	60 (58.9)	125.5	133	24-133	June-Aug 1988-1989 NYDEC monitors
Delfino et al., 1994 Montreal	4.05 (1.00, 7.11)	8h 4d	32.1	69	73.8	8.6-82.3	Jul-Aug 1984-1988 7 sites in Montreal; 2 sites near heavy traffic areas not used
Burnett et al., 1994 Toronto	3.95 (2.50, 5.43)	1h 1d	(41.7)	79	81.5	15-104.3	1983-1988 Ont Min Environ 22 sites May-August
Burnett et al., 1997 16 Canadian city	6.72 (3.52, 10.02)	1h 1d	32.9 (25.3)	47.1	51.3	6.2-68.4	4/1/81 - 12/31/91 used Apr-Dec data, all stations in each city
Burnett et al., 1997 Toronto	17.57 (10.44, 25.15)	1h 1-3d ave	41.2 (31.6)	62	64	0-79	summers 1992, 93, 94 7-9 sites in metro Toronto
Yang et al., 2003 Vancouver (<3 yo)	50.43 (32.64, 70.61)	24h 4d	13.41 (21.3)	42.7	47.3	1.1-71.9	1/1/86 - 12/31/98 25 sites, Great Vancouver Regional District
Yang et al., 2003 Vancouver (65+yo)	28.53 (18.47, 39.43)	24h 4d	13.41 (21.3)	42.7	47.3	1.1-71.9	1/1/86 - 12/31/98 25 sites, Great Vancouver Regional District
Schwartz et al., 1996 Cleveland	3.51 (0.88, 6.20)	1h 1-2d ave	56 (55.1)	91	99	5-120.3	1988-1990 Cuyahoga county warm season only
Moolgavkar et al., 1997 Minneapolis/St. Paul	8.08 (4.47, 11.81)	24h 1d	26.2 (45.1)	83.2	87.7	4.6-101.8	1/1/86 - 12/31/91 AQS data from all monitoring stations
Gwynn et al., 2001 NYC (white)	1.08 (-0.44, 2.63)	24h 1d	22.1 (34.2)	90.6	106	6-125	1988-1990 AQS data

Study; Location	Effect Estimate (lower CL, upper CL)	Air Quality Data from Study *		Statistics for 8-hr daily max air quality data **			Study period; Monitoring information
		Ave time; Lag	Mean	98th %	99th %	Range	
Gwynn et al., 2001 NYC (nonwhite)	4.01 (2.47, 5.57)	24h 1d	22.1 (34.2)	90.6	106	6-125	1988-1990 AQS data
Gwynn et al., 2001 NYC (uninsured)	4.51 (2.80, 6.25)	24h 1d	22.1 (34.2)	90.6	106	6-125	1988-1990 AQS data
Thurston et al., 1992 NYC	0.42 (0.10, 0.74)	1h 3d	29.1				June-Aug 1988-1989 NYDEC monitors
Gwynn et al., 2000 Buffalo	3.94 (1.78, 6.15)	24h 1d	26.2 (38.7)	92.5	104	4.5-123	1988-1990 AQS data from multiple sites in Buffalo/Rochester area
Schwartz et al., 1996 Spokane	19.08 (0.17, 41.57)	1h 2d	79	NA	NA	NA	1988-1990 1 residential site
Thurston et al., 1994 Toronto	15.30 (4.11, 26.50)	1hr 0d	57.47 (45.8)	92	94	8-125	July-Aug, 1986-1988 Breadalbane site
Hospital Admissions: Asthma							
Sheppard et al., 2003 Seattle, WA	3.44 (0.58, 6.39)	8h 2d	30.4	65	73	2-100	1987-1994 1 site at Lake Sammamish
Nauenberg et al., 1999 Los Angeles (all insurance)	1.00 (-6.28, 8.84)	24h 0d	19.88 (19.1)	46.5	50.5	2-67	(11/15-3/1)1991-1994 2 SCAQMD sites in zip codes 90025 and 90012
Burnett et al., 2001 Toronto (<2 yo)	30.25 (16.87, 45.15)	1h 5d ave	45.2 (38.6)	77.7	83.7	9-110.8	1/1/80 - 12/31/94 4 sites
Thurston et al., 1992 Buffalo NY	6.59 (1.29, 11.89)	1h 3d	60 (58.9)	125.5	133	24-133	June-Aug 1988-1989 NYDEC monitors

Study; Location	Effect Estimate (lower CL, upper CL)	Air Quality Data from Study *		Statistics for 8-hr daily max air quality data **			Study period; Monitoring information
		Ave time; Lag	Mean	98th %	99th %	Range	
Burnett et al., 1999 Toronto	6.47 (3.68, 9.33)	24h 1-3d ave	19.5 (26.7)	68.4	74.8	0.1-110.8	summers 1992, 93, 94 7-9 sites in metro Toronto
Lin et al., 2003 Toronto, 6-12 yo	-7.84 (-22.02, 8.92) (female) -26.04 (-44.53, -1.39) (male)	1h 0d	28.2	68.4	74.8	0.14-110.8	1981-1993 4 sites, Ontario Ministry of Environment and Energy (case-crossover)
Thurston et al., 1992 New York City	0.95 (0.20, 1.69)	1h 1d	29.1				June-Aug 1988-1989 NYDEC monitors
Schwartz et al., 1994 Detroit	10.81 (5.13, 16.80)	24h 1d	21 (37.6)	82.8	88.5	10-122.7	1986-1989 AQS data 9 sites in 86 and 89, 8 sites in 87 and 88
Hospital Admissions: Other respiratory diseases							
Moolgavkar et al., 1997 Minneapolis/St. Paul pneumonia	8.90 (4.62, 13.34)	24h 1d	26.2 (45.1)	83.2	87.7	4.6-101.8	1/1/86 - 12/31/91 AQS data from all monitoring stations
Ito, 2003 Detroit MI pneumonia	3.10 (-1.84, 8.28)	24h 3d	25 (38.7)	80	85	4.3-101.3	1992-1994 AQS data, 4 ozone sites
Ito, 2003 Detroit MI COPD	1.25 (-3.55, 6.28)	24h 3d	25 (38.7)	80	85	4.3-101.3	1992-1994 AQS data 4 ozone sites
Burnett et al., 1999 Toronto COPD	7.49 (4.00, 11.10)	24h 2-4d ave	19.5 (26.7)	68.4	74.8	0.1-110.8	summers 1992, 93, 94 7-9 sites in metro Toronto

Study; Location	Effect Estimate (lower CL, upper CL)	Air Quality Data from Study *		Statistics for 8-hr daily max air quality data **			Study period; Monitoring information
		Ave time; Lag	Mean	98th %	99th %	Range	
Schwartz et al., 1994 Detroit COPD	11.68 (2.92, 21.19)	24h 1d	21 (37.6)	82.8	88.5	10-122.7	1986-1989 AQS data 9 sites in 86 and 89, 8 sites in 87 and 88
Moolgavkar et al., 1997 Minneapolis/St. Paul COPD	6.04 (1.22, 11.10)	24h 1d	26.2 (45.1)	83.2	87.7	4.6-101.8	1/1/86 - 12/31/91 AQS data from all monitoring stations
Burnett et al., 1999 Toronto Respiratory Infection	4.52 (2.43, 6.64)	24h 1-2d ave	19.5	68.4	74.8	0.1-110.8	summers 1992, 93, 94 7-9 sites in metro Toronto
Mortality: Total nonaccidental							
Bell et al., 2004 95 U.S. cities (warm)	0.44 (0.14, 0.74)	24h 0d	26.84				1987-2000 AQS data, 10% trimmed mean to average across monitors after correction for each monitor
Bell et al., 2004 95 U.S. cities (warm)	0.78 (0.26, 1.30)	24h 0-6d dl	26.84				1987-2000 AQS data, 10% trimmed mean to average across monitors after correction for each monitor
Schwartz et al., 2004 14 U.S. cities (warm)	1.04 (0.30, 1.79)	1h 0d	45.9				1986-1993 AQS data, May-September (case-crossover)
Ostro et al., 2003 Coachella Valley CA	-1 (-4.42, 2.55)	1h	62				1/1/89 – 12/20/98 sites in Palm Springs and Indio

Study; Location	Effect Estimate (lower CL, upper CL)	Air Quality Data from Study *		Statistics for 8-hr daily max air quality data **			Study period; Monitoring information
		Ave time; Lag	Mean	98th %	99th %	Range	
Ostro et al., 1995 2 Southern CA counties	0.80 (-0.18, 1.78)	1h 0d	140				1980-1986 4 sites in San Bernardino and Riverside counties: Upland, Rubidoux, Redlands, Perris
Moolgavkar et al., 1995 Philadelphia (summer)	2.82 (1.33, 4.33)	24h 1d	35.5				1973-1988 AQS data
Ito, 2003 Detroit MI	0.86 (-0.36, 2.09)	24h 0d	20.9 (34.3)	81.5	88.7	2-123.5	1985-1990 AQS data, 4 ozone sites
Ito, 2003 Detroit MI	1.88 (-1.69, 5.58)	24h 0d	25 (38.7)	80	85	4.3-101.3	1992-1994 AQS data, 4 ozone sites
Fairley, 2003 San Jose CA	2.81 (-0.27, 5.99)	8-h 0d	29	67	74	2-105	1989-1996 San Jose 4th St. site
Chock et al., 2000 Pittsburg PA (<75 yo)	-1.48 (-5.63, 2.85)	1h 0d	(35.4)	80	88.9	2.3-92.5	1989-1991 1 site with daily obs, used only data between 1200 and 2000 hours
Chock et al., 2000 Pittsburg PA (75+)	-1.82 (-6.03, 2.59)	1h 0d	(35.4)	80	88.9	2.3-92.5	1989-1991 1 site with daily obs, used only data between 1200 and 2000 hours
Kinney et al., 1995 Los Angeles	0.00 (-4.90, 5.15)	1h 1d	70 (53.4)	115.3	130	5.4-156.1	1985-1990 8 ozone sites
Gamble et al., 1998 Dallas TX	3.69 (0.85, 6.62)	24h 1-2d	22 (37.9)	81	86.3	2-98.7	1990-1994 TNRCC data, 2-3 sites in Dallas Co.
Dockery et al., 1992 St. Louis	0.60 (-2.46, 3.750	24h 1d	22.5				Sept 1985-August 1986 Harvard site on S side of city

Study; Location	Effect Estimate (lower CL, upper CL)	Air Quality Data from Study *		Statistics for 8-hr daily max air quality data **			Study period; Monitoring information
		Ave time; Lag	Mean	98th %	99th %	Range	
Dockery et al., 1992 E Tennesse	-1.30 (-7.91, 5.78)	24h 1d	23				Sept 1985-August 1986 Harvard site, ~50 km SW of Knoxville
Ito et al., 1996 Cook County	3.89 (2.21, 5.59)	1h 0-1d	38.1 (31.8)	76	85.6	2.7-124	1985-1990 AQS sites with at least 4 y data, 5 O3 sites
Klemm et al., 2004 Atlanta quartknot **	2.40 (-3.39, 8.54)	8h 0-1d	47.03			6.63- 124.41	ARIES database, as described in Klemm 2000
Klemm et al., 2004 Atlanta monthknot **	4.16 (-2.42, 11.19)	8h 0-1d	47.03			6.63- 124.41	ARIES database, as described in Klemm 2000
Goldberg et al., 2003 Montreal (CHFunderlying)	4.26 (-5.30, 14.78)	24h 0-2d	29				1984-1993 Environment Canada data, 9 sites
Vedal et al., 2003 Vancouver	16.63 (5.54, 28.88)	1h 0d	27.4 (21.4)	53.3	47.3	1.1-58.7	Jan 94 - Dec 96 19 sites in Greater Vancouver Regional District and EC
Villeneuve et al., 2003 Vancouver	1.31 (-0.78, 3.45)	24h 0d	13.4 (21.3)	69.3	47.3	3.1-71.9	1/1/86 - 12/31/98 13 census subdivisions
Mortality: Cardiovascular or Cardiorespiratory diseases							
Bell et al., 2004 95 U.S. cities	1.28 (0.61, 1.96)	24h 0-6d dl	26.84				1987-2000 AQS data, 10% trimmed mean to average across monitors after correction for each monitor

Study; Location	Effect Estimate (lower CL, upper CL)	Air Quality Data from Study *		Statistics for 8-hr daily max air quality data **			Study period; Monitoring information
		Ave time; Lag	Mean	98th %	99th %	Range	
Huang et al., 2004 19 U.S. cities	1.47 (0.54, 2.40)	24h 0d	18-56				June 1- Sept 30, 1987-1994 AQS data
Lipfert, et al., 2000 Philadelphia	30.19 (p<0.055)	1h 0-1dave	44.76 (39.7)	88.8	93.6	2.3-116.6	May 92 - Sept 95 1 Camden and 1 Phila site
Lipfert, et al., 2000 Philadelphia	-2.00 (p<0.055)	1h 0-1dave	44.76 (39.7)	88.8	93.6	2.3-116.6	May 92 - Sept 95 1 Camden and 1 Phila site
Ostro et al., 2003 Coachella Valley	-4 (-8.88, 1.14)	1h	62				1/1/89 – 12/20/98 sites in Palm Springs and Indio
Ito, 2003 Detroit MI	1.45 (-0.29, 3.21)	24h 0d	20.9 (34.3)	81.5	88.7	2-123.5	1985-1990 AQS data, 4 ozone sites
Ito, 2003 Detroit MI	1.79 (-3.38, 7.24)	24h 0d	25 (38.7)	80	85	4.3-101.3	1992-1994 AQS data, 4 ozone sites
Fairley, 2003 San Jose CA	2.36 (-2.12, 7.04)	8h 0d	29	67	74	2-105	1989-1996, San Jose 4th St. site
Gamble et al., 1998 Dallas TX	3.28 (-1.48, 8.27)	24h 1-2d	22 (37.9)	81	86.3	2-98.7	1990-1994 TNRCC data, 2-3 sites in Dallas Co.
Ito et al., 1996 Cook County	4.64 (2.07, 7.27)	1h 0-1d	38.1 (31.8)	76	85.6	2.7-124	1985-1990, AQS sites with at least 4 y data, 5 O3 sites
Moolgavkar et al., 2003 Cook County	0.30 (0.16, 0.44)	24h 0d	18				1987-1995 AQS data
Villeneuve et al., 2003 Vancouver	0.66 (-2.57, 3.99)	24h 0d	13.4 (21.3)	69.3	47.3	3.1-71.9	1/1/86 - 12/31/98 13 census subdivisions

Study; Location	Effect Estimate (lower CL, upper CL)	Air Quality Data from Study *		Statistics for 8-hr daily max air quality data **			Study period; Monitoring information
		Ave time; Lag	Mean	98th %	99th %	Range	
Goldberg et al., 2001 Montreal	2.81 (1.35, 4.30)	24h 0-2d	29				1984-1993 Environment Canada data, 9 sites
Vedal et al., 2003 Vancouver	16.19 (-0.67, 35.91)	1h 0d	27.4 (21.4)	53.3	47.3	1.1-58.7	Jan 94 - Dec 96 19 sites in Greater Vancouver Regional District and EC
Mortality: Respiratory Diseases							
Ostro et al., 2003 Coachella Valley	3 (-8.77, 16.29)	1h	62				1/1/89 – 12/20/98 sites in Palm Springs and Indio
Ito, 2003 Detroit MI	0.07 (-4.34, 4.68)	24h 0d	20.9 (34.3)	81.5	88.7	2-123.5	1985-1990 AQS data, 4 ozone sites
Ito, 2003 Detroit MI	7.44 (-5.37, 21.99)	24h 0d	25 (38.7)	80	85	4.3-101.3	1992-1994 AQS data, 4 ozone sites
Vedal et al., 2003 Vancouver	6.01 (-22.53, 45.06)	1h 0d	27.4 (21.4)	53.3	47.3	1.1-58.7	Jan 94 - Dec 96 19 sites in Greater Vancouver Regional District and EC
Villeneuve et al., 2003 Vancouver	1.50 (-4.24, 7.58)	24h 0d	13.4 (21.3)	69.3	47.3	3.1-71.9	1/1/86 - 12/31/98 13 census subdivisions
Moolgavkar et al., 2003 Cook County (COPD)	0.30 (-0.10, 0.71)	24h 0d	18				1987-1995 AQS data

* Includes ozone averaging period and lag period for effect estimate calculation; for example, 1h represents 1-hour maximum concentration and 0d represents a 0-day lag period. Mean values taken from study publications, for the ozone averaging period used in the study (e.g., 1h, 8h, 24h). Where 8-hour daily max ozone concentrations were used, the mean 8-hour daily max concentration is presented in parentheses.

** Using ozone data obtained for the study period in the location of the study, 8-hour daily maximum concentrations were derived and statistics calculated. The 98th and 99th percentile values for the full study period distribution are presented here, along with the range (minimum-maximum) of concentrations. Since the time periods of the studies vary in length, from several weeks to over 10 years, the 98th and 99th percentile values were selected for presentation here as a high study period concentration that roughly approximates a 4th maximum concentration, depending on the study period length. NA= data not available

Table C-1. Controlled Exposure of Healthy Humans to Ozone for 1 to 2 Hours During Exercise[a]

Ozone Concentration[b] ppm	Ozone Concentration[b] μg/m³	Exposure Duration and Activity	Exposure Conditions[c]	Number and Gender of Subjects	Subject Characteristics	Observed Effect(s)	Reference
0.0 0.4	0 784	2 h IE 4 × 15 min on bicycle, $\dot{V}_E$ = 30 L/min	NA	5 M, 4 F 6 M, 7 F	Healthy adults 25 ± 2 years old Mild atopic asthmatics 22 ± 0.7 years old	O_3-induced reductions in FVC (12%, 10%) and FEV_1 (13%, 11%) for asthmatic and healthy subjects. Significant reductions in mid-flows in both asthmatics and healthy subjects. Indomethacin pretreatment significantly decreased FVC and FEV_1 responses to O_3 in healthy but not asthmatic subjects. *See Section AX6.3.2 and Tables AX6-3 and AX6-13.*	Alexis et al. (2000)
0.0 0.2	0 392	2 h IE 4 × 15 min at $\dot{V}_E$ = 20 L/min/m² BSA	20 °C 50% RH	8 M, 5 F	Healthy NS median age 23 years	Median O_3-induced decrements of 70 mL, 190 mL, and 400 mL/s in FVC, FEV_1, and FEF_{25-75}, respectively. Spirometric responses not predicted of inflammatory responses. *See Sections AX6.2.5.2, AX6.5.6, and AX6.9.3 and Table AX6-12*.	Blomberg et al. (1999)
0.0 0.2	0 392	2 h IE 4 × 15 min at $\dot{V}_E$ = 20 L/min/m² BSA	20 °C 50% RH	10 M, 12 F	Healthy NS mean age 24 years	Significant O_3-induced decrement in FEV_1 immediately postexposure but not significantly different from baseline 2 h later. No correlation between Clara cell protein (CC16) and FEV_1 decrement. CC16 levels, elevated by O_3 exposure, remained high at 6 h postexposure, but returned to baseline by 18 h postexposure. *See Table AX6-13*.	Blomberg et al. (2003)
0.0 0.33	0 647	2 h IE 4 × 15 min on bicycle ergometer (600 kpm/min)	NA	9 M	Healthy NS 26.7 ± 7 years old	O_3-induced reductions in FVC (7%). FRC not altered by O_3 exposure. Post FA, normal gradient in ventilation which increased from apex to the base of the lung. Post O_3, ventilation shifted away from the lower-lung into middle and upper-lung regions. The post O_3 increase in ventilation to mid-lung region was correlated with decrease in midmaximal expiratory flow ($r = 0.76$, $p < 0.05$).	Foster et al. (1993)
0.0 0.35	0 690	2.2 h IE 2 × 30 min on treadmill ($\dot{V}_E \approx$ 50 L/min) Final 10 min rest	19-23 °C 48-55% RH	15 M	Healthy NS 25.4 ± 2 years old	Pre- to post-O_3, mean FVC and FEV_1 decreased by 12 and 14%, respectively. Following O_3 exposure, there was a pronounced slow phase evident in multibreath nitrogen washouts which, on average, represented a 24% decrease in the washout rate relative to pre-O_3.	Foster et al. (1997)

Table C-1 (cont'd). Controlled Exposure of Healthy Humans to Ozone for 1 to 2 Hours during Exercise[a]

Ozone Concentration[b] ppm	Ozone Concentration[b] μg/m³	Exposure Duration and Activity	Exposure Conditions[c]	Number and Gender of Subjects	Subject Characteristics	Observed Effect(s)	Reference
0.0 0.12 0.18 0.24 0.30 0.40	0 235 353 471 589 784	2 h rest or IE (4 × 15 min at $\dot{V}_E$ = 25 or 35 L/min/m² BSA)	22 °C 40% RH	485 M (each subject exposed at one activity level to one O_3 concentration)	Healthy NS 18 to 36 years old mean age 24 years	Statistical analysis of 8 experimental chamber studies conducted between 1980 and 1993 by the U.S. EPA in Chapel Hill, NC. Decrement in FEV_1 described by sigmoid-shaped curve as a function of subject age, O_3 concentration, $\dot{V}_E$, and time. Response decreased with age, was minimally affected by body size corrections, and was not more sensitive to O_3 concentration than $\dot{V}_E$. *Also see Section AX6.5.*	McDonnell et al. (1997)
0.4	784	2 h IE 20 min mild-mod. exercise, 10 min rest	NA	4 M, 5 F	Healthy NS 30 ± 3 years old	Subjects previously in Nightingale et al. (2000) study. Placebo-control: Immediately postexposure decrements in FVC (9%) and FEV_1 (14%) relative to pre-exposure values. FEV_1 decrement only 9% at 1 hr postexposure. By 3 h postexposure, recovery in FVC to 97% and FEV_1 to 98% of preexposure values. Significant increases in 8-isoprostane at 4 h postexposure. Budesonide for 2 wk prior to exposure did not affect responses.	Montuschi et al. (2002)
0.0 0.2	392	2 h IE 4 × 15 min at $\dot{V}_E$ = 20 L/min/m² BSA	20 °C 50% RH	6 M, 9 F 9 M, 6 F	Healthy adults 24 years old Mild asthmatics 29 years old	O_3-induced FEV_1 decrement (8%, healthy adults; 3% asthmatics) and PMN increase (20.6%, healthy adults; 15.2% asthmatics). Primary goal was to investigate relationship between antioxidant defenses and O_3 responses in asthmatics and healthy adults. *See Tables* AX*6-3 and AX6-13.*	Mudway et al. (2001) Stenfors et al. (2002)
0.4	784	2 h IE 20 min mild-mod. exercise, 10 min rest	NA	6 M, 9 F	Healthy NS mean age ~31 years	Placebo-control: O_3 caused significant decrements in FEV_1 (13.5%) and FVC (10%) immediately following exposure, a small increase in MCh-reactivity, and increased PMNs and myeloperoxidase in induced sputum at 4 h postexposure. FEV_1 at 96% and FVC at 97% preexposure values at 3 h postexposure. Budesonide for 2 wk prior to exposure did not affect spirometric responses. *See Section AX6.2.5 and Table AX6-13.*	Nightingale et al. (2000)

Table C-1 (cont'd). Controlled Exposure of Healthy Humans to Ozone for 1 to 2 Hours during Exercise[a]

Ozone Concentration[b] ppm	Ozone Concentration[b] μg/m³	Exposure Duration and Activity	Exposure Conditions[c]	Number and Gender of Subjects	Subject Characteristics	Observed Effect(s)	Reference
0.0 0.4	784	2 h IE 4 × 15 min at $\dot{V}_E$ =18 L/min/m^2 BSA 2 exposures: 25% subjects exposed to air-air, 75% to O_3-O_3	21 °C 40% RH	Weak responders 7 M, 13F Strong responders 21 M, 21 F	Healthy NS 20 to 59 years old	Significant O_3-induced decrements in spirometric lung function. Young adults (<35 years) were significantly more responsive than older individuals (>35 years). Sufentanil, a narcotic analgesic, largely abolished symptom responses and improved FEV_1 in strong responders. Naloxone, an opioid antagonist, did not affect O_3 effects in weak responders. *See Section AX6.2.5.1*.	Passannante et al. (1998)
0.0 0.4	784	2 h IE 4 × 15 min at $\dot{V}_E$ = 20 L/min/m^2 BSA	20 °C 40% RH	Placebo group 15 M, 1 F Antioxidant group 13 M, 2 F	Healthy NS mean age 27 years	Placebo and antioxidant groups had O_3-induced decrements in FEV_1 (20 and 14%) and FVC (13 and 10%), respectively. Percent neutrophils and IL-6 levels in BAL fluid obtained 1 h postexposure were not different in the two treatment groups. *See Table AX6-13.*	Samet et al. (2001) Steck-Scott et al. (2004)
0.0 0.25	490	1 h CE $\dot{V}_E$ = 30 L/min	NA Face mask exposure	32 M, 28 F	Healthy NS 22.6 ± 0.6 years old	Mean O_3-induced FEV_1 decrements of 15.9% in males and 9.4% in females (gender differences not significant). FEV_1 decrements ranged from −4 to 56%; decrements >15% in 20 subjects and >40% in 4 subjects. Uptake of O_3 greater in males than females, but uptake not correlated with spirometric responses.	Ultman et al. (2004)

[a]See Appendix A for abbreviations and acronyms.
[b]Listed from lowest to highest O_3 concentration.
[c]Studies conducted in exposure chamber unless otherwise indicated.

Table C-2. Pulmonary Function Effects after Prolonged Exposures to Ozone[a]

Ozone Concentration[b] ppm	Ozone Concentration[b] μg/m³	Exposure Duration and Activity	Exposure Conditions	Number and Gender of Subjects	Subject Characteristics	Observed Effect(s)	Reference
Studies with 4 hr Exposures							
0.18	353	4 h IE (4 × 50 min) $\dot{V}_E$ = 35 L/min	23 °C 50% RH	2 M, 2 F	Adults NS, 21 to 33 years old	FVC decreased 19% and FEV_1 decreased 29% in these four pre-screened sensitive subjects.	Adams (2000a)
0.0 0.20	0 392	4 h IE (4 × 50 min cycle ergometry or treadmill running [$\dot{V}_E$ = 40 L/min])	20 °C 50% RH	FA: 11 M, 3 F O_3: 9 M, 3 F	Adult NS, 19 to 41 years old	Decrease in FVC, FEV_1, V_T, and SRaw and increase in f_B with O_3 exposure compared with FA; total cell count and LDH increased in isolated left main bronchus lavage and inflammatory cell influx occurred with O_3 exposure compared to FA exposure.	Aris et al. (1993)
0.2	392	4 h IE (4 × 50 min) $\dot{V}_E$ = 25 L/min/m² BSA	20 °C 50% RH	42 M, 24 F	Adults NS, 18 to 50 years old	FEV_1 decreased by 18.6%; Pre-exposure methacholine responsiveness was weakly correlated with the functional response to O_3 exposure. Symptoms were also weakly correlated with the FEV_1 response (r = -0.31 to −0.37)	Aris et al. (1995)
0.0 0.24	0 470	4 h IE (4 × 15 min) $\dot{V}_E$ = 20 L/min	24 °C 40% RH	10 M 9 M	Healthy NS, 60 to 69 years COPD 59 to 71 years	Healthy: small, 3.3%, decline in FEV_1 (p = 0.03 [not reported in paper], paired-t on O_3 versus FA pre-post FEV_1). COPD: 8% decline in FEV_1 (p = ns, O_3 versus FA). Adjusted for exercise, ozone effects did not differ significantly between COPD patients and healthy subjects. *See Section AX6.5.1.*	Gong et al. (1997a)
Studies with >6 hr Exposures							
0.0 0.06 0.08 0.04 (mean, peak of 0.05) 0.06 (mean, peak of 0.09) 0.08 (mean, peak of 0.15)	0 118 157 78 118 157	6.6 h IE (6 × 50min) $\dot{V}_E$ = 20 L/min/m² BSA	25 °C 40-60% RH	15 M, 15 F	Healthy NS Males 23.5 ± 3.0 yrs Females 22.8 ± 1.2 yrs	FEV_1 and symptom responses after 6.6 h exposure to 0.04 and 0.06 ppm not significantly different from FA. Following exposure to 0.08 ppm, O_3-induced FEV_1 (−6.1%, square-wave; −7.0%, triangular) and symptom responses significantly greater than after 0.04 and 0.06 ppm exposures. Triangular exposure to 0.08 ppm caused peak decrement in FEV_1 at 5.6 h of exposure, whereas peak for square-wave exposure occurred at 6.6 h.	Adams (2006)
0.0 0.04 0.08 0.12	0 78 157 235	6.6 h IE (6 × 50min) $\dot{V}_E$ = 20 L/min/m² BSA	23 °C 50% RH	15 M, 15 F	Healthy NS, 22.4 ± 2.4 yrs old	FEV_1 and total symptoms after 6.6 h exposure to 0.04 ppm not significantly different from FA. FEV_1 (−6.4%) and total symptoms significant at 6.6 h exposure to 0.08 ppm. FEV_1 (−15.4%) at 6.6 h not significantly different between chamber and face mask exposure to 0.12 ppm.	Adams (2002)

Table C-2 (cont'd). Pulmonary Function Effects after Prolonged Exposures to Ozone[a]

Ozone Concentration[b]		Exposure Duration and Activity	Exposure Conditions	Number and Gender of Subjects	Subject Characteristics	Observed Effect(s)	Reference
ppm	μg/m³						
0.12	235	3 day-6.6h/day IE (6 × 50 min) $\dot{V}_E$ = 17 L/min/m², 20 L/min/m² BSA, and 23 L/min/m² BSA	23 °C 50% RH	15 M, 15 F	Healthy NS, 18 to 31 years old	FEV_1 at 6.6 h decreased significantly by 9.3%, 11.7%, and 13.9%, respectively at three different exercise $\dot{V}_E$ rates, but were not significantly different from each other. Total symptoms at the highest $\dot{V}_E$ protocol were significantly greater than for the lowest $\dot{V}_E$ protocol beginning at 4.6 h. Largest subjects (2.2 m² BSA) had significantly greater average FEV_1 decrement for the three protocols, 18.5% compared to the smallest subjects (1.4 m² BSA), 6.5%.	Adams (2000b)
(a) 0.08 (b) 0.08 (mean) varied from 0.03 to 0.15	235 235 (mean)	6.6 h IE (6 × 50 min) $\dot{V}_E$ = 20 L/min/m² BSA	23 °C 50% RH	15 M 15 F	Healthy NS, 18 to 25 years old	(a) FEV_1 decreased 6.2% after 6.6 h in square-wave exposures. Total symptoms significantly increased at 5.6 and 6.6 h. (b) FEV_1 decreased 5.6 to 6.2% after 4.6 to 6.6 h, respectively, in varied exposure; total symptoms significantly increased also after 4.6 to 6.6 h. No significant difference between face mask and chamber exposures.	Adams (2003a)
(a) 0.08	157	6.6 h IE (6 × 50 min) $\dot{V}_E$ = 20 L/min/m² BSA	23 °C 50% RH	15 M 15 F	Healthy NS, 18 to 25 years old	Significantly greater FEV_1 decrement (12.4%) for 2-h, 0.30 ppm exposure than for 6.6-h, 0.08 ppm exposure (3.6%).	Adams (2003b)
(b) 0.30	588	2 h IE (4 × 15 min) $\dot{V}_E$ = 35 L/min/m² BSA					
(a) 0.12 (b) 0.12 (mean) varied from 0.07 to 0.16 (c) 0.12 (mean) varied from 0.11 to 0.13 (d) 0.12	235 235 (mean) 235 (mean) 235	6.6 h IE (6 × 50 min) (a,b,c) $\dot{V}_E$ = 20 L/min/m² BSA (d) $\dot{V}_E$ = 12 L/min/m² BSA	23 °C 50% RH	6 M, 6 F	Healthy NS, 19 to 25 years old	(a) FEV_1 decreased 11% at 6.6 h in square-wave exposure. Total symptoms significant from 4.6 to 6.6 h. (b) FEV_1 decreased 13% at 6.6 h; not significantly different from square-wave exposure. Total symptoms significant from 4.6 to 6.6 h. (c) FEV_1 decreased 10.3% at 6.6 h; not significantly different from square-wave exposure. Total symptoms significant from 4.6 to 6.6 h. (d) FEV_1 decreased 3.6% at 6.6 h; significantly less than for 20 L/min/m² BSA protocols.	Adams and Ollison (1997)

[a]See Appendix A for abbreviations and acronyms.
[b]Listed from lowest to highest O_3 concentration.

Appendix 4A. Exposure Tables

Table 4A-1. Percent of people with 1 or more 8-hour exposures above 0.06 ppm-8hr for Children, moderate exertion for the year 2002

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	68%	53%	53%	45%	35%	29%	29%	18%	5%
Boston	66%	54%	48%	47%	44%	35%	29%	25%	11%
Chicago	69%	53%	48%	44%	37%	28%	23%	17%	3%
Cleveland	77%	66%	62%	60%	51%	48%	40%	35%	13%
Detroit	72%	61%	55%	54%	52%	39%	30%	25%	6%
Houston	58%	27%	21%	19%	11%	9%	7%	5%	1%
Los Angeles	61%	7%	6%	4%	1%	1%	1%	0%	0%
New York	74%	50%	46%	41%	23%	25%	21%	15%	3%
Philadelphia	77%	64%	60%	58%	49%	46%	41%	36%	17%
Sacramento	66%	33%	29%	24%	15%	12%	10%	6%	1%
St. Louis	70%	63%	60%	58%	50%	46%	40%	34%	14%
Washington	73%	59%	52%	51%	43%	38%	30%	28%	10%

Table 4A-2. Percent of people with 1 or more 8-hour exposures above 0.06 ppm-8hr for Children, moderate exertion for the year 2003

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	52%	33%	.	.	.	10%	.	.	1%
Boston	38%	28%	.	.	.	9%	.	.	1%
Chicago	37%	26%	.	.	.	7%	.	.	0%
Cleveland	49%	22%	.	.	.	9%	.	.	0%
Detroit	56%	26%	.	.	.	10%	.	.	0%
Houston	67%	19%	.	.	.	4%	.	.	0%
Los Angeles	71%	8%	.	.	.	2%	.	.	0%
New York	57%	24%	.	.	.	7%	.	.	0%
Philadelphia	58%	33%	.	.	.	11%	.	.	1%
Sacramento	59%	15%	.	.	.	3%	.	.	0%
St. Louis	54%	39%	.	.	.	15%	.	.	1%
Washington	47%	21%	.	.	.	8%	.	.	1%

Numbers are rounded to the nearest percent.

Table 4A-3. Percent of people with 1 or more 8-hour exposures above 0.06 ppm-8hr for Children, moderate exertion for the year 2004

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	48%	26%	25%	18%	11%	8%	8%	3%	0%
Boston	30%	13%	8%	8%	6%	2%	1%	1%	0%
Chicago	12%	1%	0%	0%	0%	0%	0%	0%	0%
Cleveland	26%	5%	3%	2%	0%	0%	0%	0%	0%
Detroit	22%	7%	4%	3%	2%	0%	0%	0%	0%
Houston	57%	25%	20%	17%	10%	9%	6%	4%	1%
Los Angeles	69%	5%	4%	3%	1%	1%	1%	0%	0%
New York	35%	6%	4%	3%	0%	0%	0%	0%	0%
Philadelphia	47%	16%	11%	9%	3%	2%	1%	0%	0%
Sacramento	43%	6%	4%	3%	1%	0%	0%	0%	0%
St. Louis	22%	8%	5%	3%	1%	0%	0%	0%	0%
Washington	48%	21%	15%	14%	7%	6%	2%	1%	0%

Table 4A-4. Percent of people with 1 or more 8-hour exposures above 0.07 ppm-8hr for Children, moderate exertion for the year 2002

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	42%	21%	19%	12%	7%	5%	5%	1%	0%
Boston	46%	28%	21%	20%	18%	10%	7%	5%	1%
Chicago	44%	20%	15%	12%	6%	3%	2%	1%	0%
Cleveland	63%	38%	29%	27%	12%	9%	3%	2%	0%
Detroit	51%	29%	20%	17%	15%	4%	1%	0%	0%
Houston	31%	7%	4%	4%	1%	1%	0%	0%	0%
Los Angeles	36%	1%	1%	0%	0%	0%	0%	0%	0%
New York	54%	16%	13%	9%	2%	3%	2%	1%	0%
Philadelphia	60%	37%	30%	28%	16%	13%	8%	5%	0%
Sacramento	39%	7%	5%	4%	2%	1%	1%	0%	0%
St. Louis	51%	37%	31%	27%	15%	11%	7%	5%	0%
Washington	53%	29%	21%	20%	12%	8%	4%	3%	0%

Numbers are rounded to the nearest percent.

Table 4A-5. Percent of people with 1 or more 8-hour exposures above 0.07 ppm-8hr for Children, moderate exertion for the year 2003

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	17%	7%	.	.	.	1%	.	.	0%
Boston	13%	7%	.	.	.	1%	.	.	0%
Chicago	10%	4%	.	.	.	0%	.	.	0%
Cleveland	25%	8%	.	.	.	1%	.	.	0%
Detroit	32%	7%	.	.	.	1%	.	.	0%
Houston	42%	3%	.	.	.	0%	.	.	0%
Los Angeles	49%	1%	.	.	.	0%	.	.	0%
New York	31%	6%	.	.	.	0%	.	.	0%
Philadelphia	32%	10%	.	.	.	2%	.	.	0%
Sacramento	28%	2%	.	.	.	0%	.	.	0%
St. Louis	24%	11%	.	.	.	2%	.	.	0%
Washington	22%	8%	.	.	.	2%	.	.	0%

Table 4A-6. Percent of people with 1 or more 8-hour exposures above 0.07 ppm-8hr for Children, moderate exertion for the year 2004

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	17%	6%	5%	3%	1%	1%	1%	0%	0%
Boston	8%	2%	1%	1%	0%	0%	0%	0%	0%
Chicago	1%	0%	0%	0%	0%	0%	0%	0%	0%
Cleveland	4%	0%	0%	0%	0%	0%	0%	0%	0%
Detroit	3%	0%	0%	0%	0%	0%	0%	0%	0%
Houston	30%	7%	4%	3%	1%	1%	0%	0%	0%
Los Angeles	38%	0%	0%	0%	0%	0%	0%	0%	0%
New York	11%	0%	0%	0%	0%	0%	0%	0%	0%
Philadelphia	15%	1%	0%	0%	0%	0%	0%	0%	0%
Sacramento	10%	0%	0%	0%	0%	0%	0%	0%	0%
St. Louis	1%	0%	0%	0%	0%	0%	0%	0%	0%
Washington	19%	5%	1%	1%	0%	0%	0%	0%	0%

Numbers are rounded to the nearest percent.

Table 4A-7. Percent of people with 1 or more 8-hour exposures above 0.08 ppm-8hr for Children, moderate exertion for the year 2002

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	15%	4%	4%	2%	1%	0%	0%	0%	0%
Boston	24%	10%	6%	6%	5%	2%	1%	0%	0%
Chicago	17%	3%	2%	1%	0%	0%	0%	0%	0%
Cleveland	38%	7%	2%	2%	0%	0%	0%	0%	0%
Detroit	20%	3%	1%	0%	0%	0%	0%	0%	0%
Houston	13%	1%	1%	0%	0%	0%	0%	0%	0%
Los Angeles	16%	0%	0%	0%	0%	0%	0%	0%	0%
New York	28%	3%	2%	1%	0%	0%	0%	0%	0%
Philadelphia	38%	11%	6%	5%	2%	1%	0%	0%	0%
Sacramento	15%	1%	0%	0%	0%	0%	0%	0%	0%
St. Louis	21%	10%	6%	4%	1%	1%	0%	0%	0%
Washington	29%	7%	4%	3%	1%	1%	0%	0%	0%

Table 4A-8. Percent of people with 1 or more 8-hour exposures above 0.08 ppm-8hr for Children, moderate exertion for the year 2003

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	4%	1%	.	.	.	0%	.	.	0%
Boston	3%	1%	.	.	.	0%	.	.	0%
Chicago	1%	0%	.	.	.	0%	.	.	0%
Cleveland	11%	1%	.	.	.	0%	.	.	0%
Detroit	16%	1%	.	.	.	0%	.	.	0%
Houston	18%	0%	.	.	.	0%	.	.	0%
Los Angeles	26%	0%	.	.	.	0%	.	.	0%
New York	13%	1%	.	.	.	0%	.	.	0%
Philadelphia	14%	3%	.	.	.	0%	.	.	0%
Sacramento	8%	0%	.	.	.	0%	.	.	0%
St. Louis	8%	2%	.	.	.	0%	.	.	0%
Washington	11%	3%	.	.	.	0%	.	.	0%

Table 4A-9. Percent of people with 1 or more 8-hour exposures above 0.08 ppm-8hr for Children, moderate exertion for the year 2004

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	4%	1%	1%	0%	0%	0%	0%	0%	0%
Boston	2%	0%	0%	0%	0%	0%	0%	0%	0%
Chicago	0%	0%	0%	0%	0%	0%	0%	0%	0%
Cleveland	0%	0%	0%	0%	0%	0%	0%	0%	0%
Detroit	0%	0%	0%	0%	0%	0%	0%	0%	0%
Houston	12%	1%	0%	0%	0%	0%	0%	0%	0%
Los Angeles	14%	0%	0%	0%	0%	0%	0%	0%	0%
New York	2%	0%	0%	0%	0%	0%	0%	0%	0%
Philadelphia	2%	0%	0%	0%	0%	0%	0%	0%	0%
Sacramento	1%	0%	0%	0%	0%	0%	0%	0%	0%
St. Louis	0%	0%	0%	0%	0%	0%	0%	0%	0%
Washington	6%	0%	0%	0%	0%	0%	0%	0%	0%

Numbers are rounded to the nearest percent.

Table 4A-10. Percent of people with 1 or more 8-hour exposures above 0.06 ppm-8hr for Asthmatic children, moderate exertion for the year 2002

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	74%	58%	58%	49%	39%	34%	34%	22%	6%
Boston	68%	57%	50%	49%	45%	37%	30%	26%	11%
Chicago	72%	55%	50%	46%	38%	29%	23%	15%	3%
Cleveland	79%	66%	60%	59%	50%	46%	38%	34%	11%
Detroit	71%	60%	54%	52%	51%	39%	29%	23%	5%
Houston	60%	27%	20%	18%	10%	9%	7%	4%	1%
Los Angeles	63%	7%	6%	4%	2%	1%	1%	0%	0%
New York	78%	52%	48%	44%	25%	27%	23%	16%	4%
Philadelphia	80%	69%	65%	63%	53%	51%	46%	41%	19%
Sacramento	69%	33%	28%	24%	13%	11%	9%	6%	1%
St. Louis	69%	63%	60%	58%	49%	45%	38%	31%	13%
Washington	77%	63%	57%	56%	47%	41%	34%	31%	10%

Table 4A-11. Percent of people with 1 or more 8-hour exposures above 0.06 ppm-8hr for Asthmatic children, moderate exertion for the year 2003

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	56%	34%	.	.	.	10%	.	.	1%
Boston	39%	30%	.	.	.	10%	.	.	1%
Chicago	37%	26%	.	.	.	7%	.	.	0%
Cleveland	47%	21%	.	.	.	8%	.	.	0%
Detroit	56%	25%	.	.	.	8%	.	.	1%
Houston	73%	21%	.	.	.	5%	.	.	0%
Los Angeles	72%	9%	.	.	.	2%	.	.	0%
New York	61%	25%	.	.	.	7%	.	.	0%
Philadelphia	64%	38%	.	.	.	14%	.	.	1%
Sacramento	61%	16%	.	.	.	3%	.	.	0%
St. Louis	54%	38%	.	.	.	14%	.	.	1%
Washington	51%	22%	.	.	.	8%	.	.	1%

Numbers are rounded to the nearest percent.

Table 4A-12. Percent of people with 1 or more 8-hour exposures above 0.06 ppm-8hr for Asthmatic children, moderate exertion for the year 2004

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	51%	28%	26%	19%	11%	8%	7%	3%	0%
Boston	31%	14%	9%	8%	6%	2%	1%	1%	0%
Chicago	11%	1%	1%	0%	0%	0%	0%	0%	0%
Cleveland	26%	5%	2%	2%	0%	0%	0%	0%	0%
Detroit	24%	8%	4%	3%	2%	0%	0%	0%	0%
Houston	61%	27%	21%	19%	11%	9%	6%	3%	1%
Los Angeles	69%	6%	5%	3%	1%	1%	1%	0%	0%
New York	38%	6%	4%	3%	0%	0%	0%	0%	0%
Philadelphia	51%	19%	14%	10%	3%	3%	1%	1%	0%
Sacramento	43%	5%	3%	2%	1%	0%	0%	0%	0%
St. Louis	22%	7%	4%	3%	1%	0%	0%	0%	0%
Washington	53%	25%	17%	15%	8%	6%	2%	2%	0%

Table 4A-13. Percent of people with 1 or more 8-hour exposures above 0.07 ppm-8hr for Asthmatic children, moderate exertion for the year 2002

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	45%	25%	24%	15%	9%	6%	6%	1%	0%
Boston	49%	30%	20%	20%	17%	11%	7%	6%	1%
Chicago	46%	20%	14%	11%	6%	2%	2%	0%	0%
Cleveland	62%	36%	28%	26%	11%	8%	3%	2%	0%
Detroit	50%	28%	19%	16%	14%	3%	1%	0%	0%
Houston	31%	7%	4%	3%	1%	1%	0%	0%	0%
Los Angeles	38%	1%	1%	0%	0%	0%	0%	0%	0%
New York	57%	18%	15%	11%	3%	4%	2%	1%	0%
Philadelphia	66%	41%	34%	31%	17%	14%	9%	6%	0%
Sacramento	38%	7%	5%	4%	2%	1%	1%	0%	0%
St. Louis	49%	35%	29%	25%	14%	10%	7%	4%	0%
Washington	58%	32%	22%	22%	13%	9%	5%	4%	0%

Numbers are rounded to the nearest percent.

Table 4A-14. Percent of people with 1 or more 8-hour exposures above 0.07 ppm-8hr for Asthmatic children, moderate exertion for the year 2003

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	17%	7%	.	.	.	1%	.	.	0%
Boston	14%	7%	.	.	.	1%	.	.	0%
Chicago	10%	4%	.	.	.	0%	.	.	0%
Cleveland	23%	7%	.	.	.	1%	.	.	0%
Detroit	31%	7%	.	.	.	1%	.	.	0%
Houston	45%	3%	.	.	.	0%	.	.	0%
Los Angeles	51%	1%	.	.	.	0%	.	.	0%
New York	32%	6%	.	.	.	0%	.	.	0%
Philadelphia	36%	12%	.	.	.	2%	.	.	0%
Sacramento	29%	2%	.	.	.	0%	.	.	0%
St. Louis	23%	11%	.	.	.	2%	.	.	0%
Washington	23%	8%	.	.	.	1%	.	.	0%

Table 4A-15. Percent of people with 1 or more 8-hour exposures above 0.07 ppm-8hr for Asthmatic children, moderate exertion for the year 2004

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	18%	5%	5%	2%	1%	1%	1%	0%	0%
Boston	9%	2%	1%	1%	0%	0%	0%	0%	0%
Chicago	1%	0%	0%	0%	0%	0%	0%	0%	0%
Cleveland	4%	0%	0%	0%	0%	0%	0%	0%	0%
Detroit	3%	0%	0%	0%	0%	0%	0%	0%	0%
Houston	31%	7%	4%	3%	1%	1%	0%	0%	0%
Los Angeles	40%	0%	0%	0%	0%	0%	0%	0%	0%
New York	12%	0%	0%	0%	0%	0%	0%	0%	0%
Philadelphia	18%	1%	1%	0%	0%	0%	0%	0%	0%
Sacramento	8%	0%	0%	0%	0%	0%	0%	0%	0%
St. Louis	1%	0%	0%	0%	0%	0%	0%	0%	0%
Washington	22%	5%	1%	1%	0%	0%	0%	0%	0%

Numbers are rounded to the nearest percent.

Table 4A-16. Percent of people with 1 or more 8-hour exposures above 0.08 ppm-8hr for Asthmatic children, moderate exertion for the year 2002

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	18%	5%	5%	2%	1%	1%	1%	0%	0%
Boston	25%	11%	7%	7%	6%	2%	1%	0%	0%
Chicago	17%	2%	1%	0%	0%	0%	0%	0%	0%
Cleveland	36%	6%	3%	2%	0%	0%	0%	0%	0%
Detroit	19%	2%	1%	0%	0%	0%	0%	0%	0%
Houston	12%	1%	1%	0%	0%	0%	0%	0%	0%
Los Angeles	17%	0%	0%	0%	0%	0%	0%	0%	0%
New York	31%	4%	2%	1%	0%	0%	0%	0%	0%
Philadelphia	42%	12%	7%	6%	2%	1%	0%	0%	0%
Sacramento	14%	1%	0%	0%	0%	0%	0%	0%	0%
St. Louis	20%	9%	6%	4%	2%	1%	0%	0%	0%
Washington	31%	8%	4%	4%	1%	1%	0%	0%	0%

Table 4A-17. Percent of people with 1 or more 8-hour exposures above 0.08 ppm-8hr for Asthmatic children, moderate exertion for the year 2003

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	4%	1%	.	.	.	0%	.	.	0%
Boston	3%	1%	.	.	.	0%	.	.	0%
Chicago	0%	0%	.	.	.	0%	.	.	0%
Cleveland	10%	1%	.	.	.	0%	.	.	0%
Detroit	14%	1%	.	.	.	0%	.	.	0%
Houston	19%	0%	.	.	.	0%	.	.	0%
Los Angeles	27%	0%	.	.	.	0%	.	.	0%
New York	13%	1%	.	.	.	0%	.	.	0%
Philadelphia	16%	4%	.	.	.	0%	.	.	0%
Sacramento	8%	0%	.	.	.	0%	.	.	0%
St. Louis	8%	2%	.	.	.	0%	.	.	0%
Washington	11%	2%	.	.	.	0%	.	.	0%

Numbers are rounded to the nearest percent.

Table 4A-18. Percent of people with 1 or more 8-hour exposures above 0.08 ppm-8hr for Asthmatic children, moderate exertion for the year 2004

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	4%	1%	1%	0%	0%	0%	0%	0%	0%
Boston	2%	0%	0%	0%	0%	0%	0%	0%	0%
Chicago	0%	0%	0%	0%	0%	0%	0%	0%	0%
Cleveland	0%	0%	0%	0%	0%	0%	0%	0%	0%
Detroit	0%	0%	0%	0%	0%	0%	0%	0%	0%
Houston	13%	1%	0%	0%	0%	0%	0%	0%	0%
Los Angeles	16%	0%	0%	0%	0%	0%	0%	0%	0%
New York	2%	0%	0%	0%	0%	0%	0%	0%	0%
Philadelphia	3%	0%	0%	0%	0%	0%	0%	0%	0%
Sacramento	1%	0%	0%	0%	0%	0%	0%	0%	0%
St. Louis	0%	0%	0%	0%	0%	0%	0%	0%	0%
Washington	6%	0%	0%	0%	0%	0%	0%	0%	0%

Numbers are rounded to the nearest percent.

Table 4A-19. Number of people with 1 or more 8-hour exposures above 0.06 ppm-8hr, Children, moderate exertion, 2002

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	642,000	503,000	497,000	423,000	334,000	276,000	271,000	171,000	49,000
Boston	718,000	592,000	522,000	514,000	481,000	381,000	316,000	278,000	117,000
Chicago	1,350,000	1,030,000	939,000	863,000	716,000	547,000	449,000	334,000	61,300
Cleveland	458,000	393,000	366,000	358,000	302,000	283,000	237,000	208,000	74,200
Detroit	799,000	681,000	616,000	601,000	581,000	438,000	336,000	276,000	61,100
Houston	627,000	292,000	233,000	209,000	115,000	101,000	72,300	50,100	10,100
Los Angeles	2,240,000	258,000	226,000	154,000	49,700	51,000	40,700	15,300	3,270
New York	3,070,000	2,070,000	1,910,000	1,720,000	940,000	1,030,000	856,000	604,000	130,000
Philadelphia	910,000	757,000	711,000	692,000	580,000	550,000	482,000	430,000	203,000
Sacramento	271,000	137,000	120,000	101,000	59,800	50,000	39,400	24,200	5,210
St. Louis	406,000	369,000	351,000	340,000	293,000	269,000	236,000	200,000	83,400
Washington	1,090,000	879,000	767,000	761,000	639,000	570,000	452,000	411,000	148,000

Table 4A-20. Number of people with 1 or more 8-hour exposures above 0.06 ppm-8hr, Children, moderate exertion, 2003

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	491,000	309,000	.	.	.	94,700	.	.	6,220
Boston	418,000	309,000	.	.	.	101,000	.	.	8,950
Chicago	726,000	504,000	.	.	.	135,000	.	.	1,710
Cleveland	292,000	133,000	.	.	.	51,200	.	.	2,060
Detroit	623,000	293,000	.	.	.	112,000	.	.	4,640
Houston	733,000	212,000	.	.	.	48,400	.	.	2,730
Los Angeles	2,620,000	295,000	.	.	.	75,000	.	.	2,460
New York	2,380,000	987,000	.	.	.	287,000	.	.	11,000
Philadelphia	692,000	397,000	.	.	.	136,000	.	.	12,700
Sacramento	242,000	62,600	.	.	.	14,200	.	.	129
St. Louis	316,000	228,000	.	.	.	88,600	.	.	6,560
Washington	696,000	312,000	.	.	.	116,000	.	.	8,450

Numbers are rounded to 3 significant digits.

Table 4A-21. Number of people with 1 or more 8-hour exposures above 0.06 ppm-8hr, Children, moderate exertion, 2004

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	452,000	246,000	235,000	168,000	101,000	76,300	71,700	29,200	3,260
Boston	326,000	142,000	90,400	82,400	65,400	24,200	14,200	7,900	0
Chicago	225,000	19,200	9,160	5,740	2,640	931	466	310	0
Cleveland	153,000	30,100	16,000	11,500	1,870	1,230	344	49	0
Detroit	249,000	80,900	41,700	31,100	22,700	3,570	268	89	0
Houston	624,000	273,000	214,000	189,000	112,000	94,800	61,500	43,700	8,830
Los Angeles	2,510,000	182,000	152,000	104,000	31,700	25,600	19,100	5,180	0
New York	1,450,000	246,000	175,000	119,000	6,760	10,300	4,270	1,070	0
Philadelphia	553,000	191,000	129,000	101,000	31,300	23,500	10,200	4,960	97
Sacramento	176,000	25,100	17,000	11,200	2,190	1,640	836	322	0
St. Louis	126,000	47,000	26,900	19,600	3,990	2,570	1,240	229	0
Washington	720,000	319,000	217,000	207,000	108,000	82,800	32,400	20,300	1,770

Table 4A-22. Number of people with 1 or more 8-hour exposures above 0.07 ppm-8hr, Children, moderate exertion, 2002

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	393,000	193,000	178,000	114,000	67,800	44,900	44,500	12,600	152
Boston	504,000	312,000	230,000	223,000	192,000	112,000	72,200	56,900	9,900
Chicago	860,000	389,000	300,000	233,000	118,000	53,100	39,300	10,200	776
Cleveland	374,000	226,000	173,000	160,000	71,200	53,900	18,000	11,300	933
Detroit	572,000	322,000	220,000	194,000	166,000	40,500	12,500	5,180	89
Houston	333,000	80,000	48,500	40,300	12,800	9,470	4,810	2,090	160
Los Angeles	1,300,000	28,100	22,400	11,200	1,360	3,000	2,460	1,360	0
New York	2,250,000	675,000	531,000	384,000	77,600	110,000	64,100	29,900	5,340
Philadelphia	716,000	439,000	359,000	330,000	185,000	151,000	96,500	64,400	5,830
Sacramento	159,000	30,200	20,900	16,100	6,400	4,410	2,250	965	32
St. Louis	295,000	214,000	178,000	154,000	88,900	66,900	43,100	26,500	1,290
Washington	792,000	435,000	305,000	300,000	175,000	123,000	64,000	48,800	3,910

Table 4A-23. Number of people with 1 or more 8-hour exposures above 0.07 ppm-8hr, Children, moderate exertion, 2003

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	156,000	63,100	.	.	.	7,580	.	.	0
Boston	146,000	78,300	.	.	.	11,500	.	.	571
Chicago	196,000	83,000	.	.	.	2,480	.	.	0
Cleveland	149,000	46,100	.	.	.	5,790	.	.	0
Detroit	359,000	82,500	.	.	.	7,230	.	.	0
Houston	457,000	28,600	.	.	.	2,410	.	.	0
Los Angeles	1,810,000	50,800	.	.	.	1,640	.	.	0
New York	1,280,000	250,000	.	.	.	14,200	.	.	0
Philadelphia	377,000	123,000	.	.	.	26,000	.	.	0
Sacramento	115,000	9,130	.	.	.	354	.	.	0
St. Louis	142,000	65,700	.	.	.	11,100	.	.	46
Washington	329,000	115,000	.	.	.	22,300	.	.	0

Table 4A-24. Number of people with 1 or more 8-hour exposures above 0.07 ppm-8hr, Children, moderate exertion, 2004

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	161,000	54,100	47,800	24,300	10,300	6,970	6,670	910	0
Boston	91,000	19,600	8,860	6,380	3,520	190	0	0	0
Chicago	12,400	1,090	621	0	0	0	0	0	0
Cleveland	26,600	785	245	0	0	0	0	0	0
Detroit	31,600	1,430	89	89	0	0	0	0	0
Houston	322,000	71,500	44,100	36,400	12,100	9,630	2,810	1,360	0
Los Angeles	1,400,000	14,700	10,900	1,910	0	0	0	0	0
New York	459,000	10,700	4,630	2,850	0	0	0	0	0
Philadelphia	181,000	12,300	5,440	3,210	194	0	0	0	0
Sacramento	41,100	708	515	225	0	0	0	0	0
St. Louis	7,480	1,510	551	46	0	0	0	0	0
Washington	289,000	68,400	20,600	20,200	4,670	3,410	1,010	631	0

Table 4A-25. Number of people with 1 or more 8-hour exposures above 0.08 ppm-8hr, Children, moderate exertion, 2002

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	144,000	41,700	38,600	16,700	7,120	3,640	3,940	455	0
Boston	261,000	112,000	70,200	67,600	52,900	17,600	8,000	4,570	571
Chicago	332,000	49,700	33,700	11,000	4,500	1,400	466	310	0
Cleveland	223,000	43,000	14,600	10,900	2,160	1,130	540	295	0
Detroit	220,000	32,100	8,040	5,540	3,390	179	0	0	0
Houston	137,000	12,800	6,420	4,730	160	642	80	0	0
Los Angeles	596,000	2,180	1,910	1,360	0	0	0	0	0
New York	1,150,000	108,000	63,400	36,300	6,050	7,480	3,920	2,140	0
Philadelphia	452,000	129,000	76,800	60,200	19,200	11,500	3,310	1,070	0
Sacramento	59,800	4,340	1,900	1,160	161	64	32	32	0
St. Louis	124,000	58,100	35,000	25,200	8,080	4,270	1,330	275	0
Washington	427,000	111,000	53,300	50,900	18,400	8,830	2,020	883	0

Table 4A-26. Number of people with 1 or more 8-hour exposures above 0.08 ppm-8hr, Children, moderate exertion, 2003

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	37,500	8,570	.	.	.	227	.	.	0
Boston	36,400	13,700	.	.	.	1,240	.	.	286
Chicago	18,800	2,950	.	.	.	0	.	.	0
Cleveland	67,200	7,510	.	.	.	0	.	.	0
Detroit	173,000	8,040	.	.	.	0	.	.	0
Houston	192,000	2,730	.	.	.	0	.	.	0
Los Angeles	965,000	1,360	.	.	.	0	.	.	0
New York	537,000	24,900	.	.	.	0	.	.	0
Philadelphia	163,000	40,300	.	.	.	97	.	.	0
Sacramento	31,900	579	.	.	.	0	.	.	0
St. Louis	47,700	13,800	.	.	.	184	.	.	0
Washington	163,000	38,700	.	.	.	379	.	.	0

Table 4A-27. Number of people with 1 or more 8-hour exposures above 0.08 ppm-8hr, Children, moderate exertion, 2004

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	42,000	7,660	7,500	1,890	152	152	152	0	0
Boston	18,300	1,330	95	0	0	0	0	0	0
Chicago	1,090	0	0	0	0	0	0	0	0
Cleveland	1,420	0	0	0	0	0	0	0	0
Detroit	446	0	0	0	0	0	0	0	0
Houston	129,000	12,000	4,980	3,130	80	80	0	0	0
Los Angeles	517,000	0	0	0	0	0	0	0	0
New York	77,200	356	0	0	0	0	0	0	0
Philadelphia	25,100	194	0	0	0	0	0	0	0
Sacramento	5,600	0	0	0	0	0	0	0	0
St. Louis	46	0	0	0	0	0	0	0	0
Washington	88,100	4,540	1,640	1,640	505	126	0	0	0

Table 4A-28. Number of people with 1 or more 8-hour exposures above 0.06 ppm-8hr, Asthmatic children, moderate exertion, 2002

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	86,800	68,200	67,400	57,100	45,600	39,400	39,900	26,200	6,820
Boston	125,000	104,000	90,800	88,900	82,200	67,200	54,600	47,000	20,700
Chicago	200,000	155,000	141,000	130,000	107,000	81,200	63,800	43,300	7,600
Cleveland	69,600	58,200	53,600	52,400	44,000	40,800	33,600	29,800	9,960
Detroit	115,000	97,700	87,500	84,300	82,600	63,300	46,200	37,800	7,680
Houston	80,900	37,000	27,700	24,300	13,500	12,200	9,150	5,860	1,770
Los Angeles	289,000	33,000	29,500	19,900	7,370	6,000	4,910	1,640	273
New York	500,000	337,000	310,000	280,000	161,000	175,000	148,000	105,000	25,300
Philadelphia	154,000	133,000	125,000	122,000	103,000	99,100	87,800	79,300	36,100
Sacramento	35,200	17,100	14,400	12,200	6,850	5,600	4,470	3,090	547
St. Louis	57,100	51,900	49,800	47,700	40,200	36,800	31,600	25,900	11,200
Washington	143,000	118,000	106,000	105,000	87,300	75,600	62,800	57,500	19,600

Table 4A-29. Number of people with 1 or more 8-hour exposures above 0.06 ppm-8hr, Asthmatic children, moderate exertion, 2003

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	65,700	40,200	.	.	.	12,100	.	.	1,060
Boston	72,000	53,900	.	.	.	17,500	.	.	2,000
Chicago	104,000	72,900	.	.	.	19,600	.	.	155
Cleveland	41,900	18,600	.	.	.	6,730	.	.	245
Detroit	89,900	41,100	.	.	.	13,700	.	.	893
Houston	98,600	28,200	.	.	.	6,420	.	.	241
Los Angeles	330,000	39,000	.	.	.	9,000	.	.	273
New York	390,000	163,000	.	.	.	43,400	.	.	1,780
Philadelphia	123,000	73,300	.	.	.	26,100	.	.	2,240
Sacramento	31,200	8,170	.	.	.	1,770	.	.	0
St. Louis	44,700	31,400	.	.	.	11,500	.	.	1,100
Washington	95,500	40,500	.	.	.	14,400	.	.	1,010

Table 4A-30. Number of people with 1 or more 8-hour exposures above 0.06 ppm-8hr, Asthmatic children, moderate exertion, 2004

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	59,900	32,100	30,500	22,300	13,100	9,470	8,720	3,110	303
Boston	56,700	25,400	16,000	14,700	11,700	4,290	2,670	1,330	0
Chicago	32,000	3,570	2,020	1,090	310	0	0	0	0
Cleveland	22,900	4,270	2,160	1,870	295	147	0	0	0
Detroit	38,300	12,200	6,430	4,460	3,840	625	0	0	0
Houston	82,500	36,400	28,500	25,800	15,200	12,600	7,540	4,730	802
Los Angeles	317,000	27,300	24,300	15,800	4,910	4,370	2,460	546	0
New York	241,000	40,200	26,700	17,100	1,070	1,070	712	356	0
Philadelphia	98,100	36,600	26,100	19,300	6,420	4,860	2,240	1,070	0
Sacramento	22,200	2,510	1,700	1,060	257	161	64	32	0
St. Louis	18,300	5,780	3,170	2,160	459	229	184	0	0
Washington	98,900	46,100	30,900	28,900	14,400	11,600	4,160	3,150	379

Table 4A-31. Number of people with 1 or more 8-hour exposures above 0.07 ppm-8hr, Asthmatic children, moderate exertion, 2002

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	52,700	28,800	27,400	17,800	10,400	6,750	6,520	1,590	0
Boston	89,200	55,000	37,300	36,900	31,900	19,700	13,000	10,500	2,290
Chicago	130,000	55,200	38,800	30,600	15,700	6,980	4,350	776	155
Cleveland	54,900	32,000	25,200	23,300	9,720	6,920	2,600	1,670	147
Detroit	81,200	45,200	30,500	26,200	22,900	5,270	1,700	446	0
Houston	42,600	10,100	6,100	4,730	1,440	1,520	481	401	0
Los Angeles	174,000	3,550	3,000	1,360	273	273	273	273	0
New York	364,000	119,000	95,400	70,100	16,400	23,100	12,500	7,830	1,780
Philadelphia	126,000	79,500	65,200	59,800	33,400	27,400	17,900	11,500	486
Sacramento	19,700	3,470	2,700	2,030	965	482	322	161	0
St. Louis	40,200	29,000	23,800	20,400	11,800	8,580	5,830	3,720	275
Washington	107,000	59,200	41,400	40,600	23,700	16,700	9,090	7,190	379

Table 4A-32. Number of people with 1 or more 8-hour exposures above 0.07 ppm-8hr, Asthmatic children, moderate exertion, 2003

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	19,600	8,190	.	.	.	1,360	.	.	0
Boston	26,100	13,600	.	.	.	2,190	.	.	95
Chicago	27,600	11,200	.	.	.	155	.	.	0
Cleveland	20,500	5,890	.	.	.	835	.	.	0
Detroit	51,000	10,500	.	.	.	1,340	.	.	0
Houston	60,500	3,850	.	.	.	241	.	.	0
Los Angeles	231,000	6,550	.	.	.	0	.	.	0
New York	206,000	40,200	.	.	.	2,490	.	.	0
Philadelphia	69,600	23,800	.	.	.	3,990	.	.	0
Sacramento	15,100	1,160	.	.	.	32	.	.	0
St. Louis	18,900	8,720	.	.	.	1,510	.	.	0
Washington	43,300	14,300	.	.	.	2,150	.	.	0

Table 4A-33. Number of people with 1 or more 8-hour exposures above 0.07 ppm-8hr, Asthmatic children, moderate exertion, 2004

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	21,100	5,990	5,460	2,650	1,440	910	834	76	0
Boston	16,600	3,900	1,330	1,140	667	95	0	0	0
Chicago	2,330	155	0	0	0	0	0	0	0
Cleveland	3,680	0	0	0	0	0	0	0	0
Detroit	4,820	357	0	0	0	0	0	0	0
Houston	42,400	9,070	4,980	4,090	963	963	321	160	0
Los Angeles	184,000	2,180	1,360	273	0	0	0	0	0
New York	79,000	1,420	712	356	0	0	0	0	0
Philadelphia	34,300	2,720	1,260	875	97	0	0	0	0
Sacramento	4,340	64	32	32	0	0	0	0	0
St. Louis	872	184	46	0	0	0	0	0	0
Washington	41,500	9,840	2,780	2,400	883	757	379	126	0

Table 4A-34. Number of people with 1 or more 8-hour exposures above 0.08 ppm-8hr, Asthmatic children, moderate exertion, 2002

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	21,500	6,370	5,910	2,050	1,210	606	606	0	0
Boston	45,400	19,600	12,900	12,100	10,200	3,520	1,520	476	95
Chicago	47,300	6,360	3,410	931	310	155	155	0	0
Cleveland	31,900	5,690	2,260	1,520	295	196	98	49	0
Detroit	30,300	4,020	1,070	536	89	0	0	0	0
Houston	16,900	2,010	802	642	0	160	0	0	0
Los Angeles	75,600	273	273	273	0	0	0	0	0
New York	199,000	22,800	12,800	8,900	2,140	2,490	1,420	712	0
Philadelphia	81,300	23,400	14,200	11,100	3,310	1,260	486	292	0
Sacramento	7,010	515	225	161	32	0	0	0	0
St. Louis	16,200	7,530	4,870	3,400	1,560	872	321	92	0
Washington	57,700	15,300	7,950	7,950	2,650	1,390	379	0	0

Table 4A-35. Number of people with 1 or more 8-hour exposures above 0.08 ppm-8hr, Asthmatic children, moderate exertion, 2003

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	5,080	1,520	.	.	.	0	.	.	0
Boston	5,900	2,480	.	.	.	286	.	.	95
Chicago	1,240	155	.	.	.	0	.	.	0
Cleveland	8,840	884	.	.	.	0	.	.	0
Detroit	22,800	1,430	.	.	.	0	.	.	0
Houston	25,800	241	.	.	.	0	.	.	0
Los Angeles	122,000	0	.	.	.	0	.	.	0
New York	82,200	4,980	.	.	.	0	.	.	0
Philadelphia	29,900	7,100	.	.	.	0	.	.	0
Sacramento	4,340	64	.	.	.	0	.	.	0
St. Louis	6,240	1,790	.	.	.	46	.	.	0
Washington	20,900	3,910	.	.	.	0	.	.	0

Table 4A-36. Number of people with 1 or more 8-hour exposures above 0.08 ppm-8hr, Asthmatic children, moderate exertion, 2004

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	4,780	985	985	76	0	0	0	0	0
Boston	3,520	286	95	0	0	0	0	0	0
Chicago	155	0	0	0	0	0	0	0	0
Cleveland	295	0	0	0	0	0	0	0	0
Detroit	0	0	0	0	0	0	0	0	0
Houston	17,600	1,440	642	321	0	0	0	0	0
Los Angeles	72,600	0	0	0	0	0	0	0	0
New York	11,000	356	0	0	0	0	0	0	0
Philadelphia	5,250	97	0	0	0	0	0	0	0
Sacramento	611	0	0	0	0	0	0	0	0
St. Louis	0	0	0	0	0	0	0	0	0
Washington	12,000	757	379	379	126	0	0	0	0

Table 4A-37. Number of person-days with 8-hour exposures above 0.06 ppm-8hr, Children, moderate exertion, 2002

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	2,210,000	1,170,000	1,130,000	832,000	571,000	430,000	424,000	229,000	54,200
Boston	2,310,000	1,380,000	1,090,000	1,060,000	940,000	639,000	483,000	403,000	145,000
Chicago	4,160,000	2,070,000	1,720,000	1,490,000	1,140,000	799,000	617,000	432,000	68,300
Cleveland	2,270,000	1,210,000	977,000	928,000	631,000	561,000	417,000	346,000	94,500
Detroit	2,860,000	1,700,000	1,330,000	1,260,000	1,170,000	712,000	484,000	375,000	67,900
Houston	1,470,000	403,000	299,000	263,000	133,000	114,000	80,800	55,100	10,400
Los Angeles	8,260,000	349,000	299,000	194,000	53,800	57,600	45,300	15,800	3,270
New York	12,600,000	4,420,000	3,740,000	3,140,000	1,360,000	1,520,000	1,210,000	787,000	151,000
Philadelphia	4,880,000	2,470,000	2,030,000	1,880,000	1,270,000	1,150,000	906,000	755,000	274,000
Sacramento	1,000,000	263,000	214,000	168,000	85,700	68,800	52,200	30,900	5,850
St. Louis	1,480,000	1,070,000	924,000	844,000	614,000	523,000	419,000	325,000	103,000
Washington	4,500,000	2,270,000	1,710,000	1,680,000	1,210,000	988,000	713,000	620,000	184,000

Table 4A-38. Number of person-days with 8-hour exposures above 0.06 ppm-8hr, Children, moderate exertion, 2003

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	999,000	466,000	.	.	.	113,000	.	.	6,220
Boston	683,000	427,000	.	.	.	111,000	.	.	9,430
Chicago	1,190,000	709,000	.	.	.	153,000	.	.	1,860
Cleveland	602,000	178,000	.	.	.	57,000	.	.	2,110
Detroit	1,430,000	396,000	.	.	.	126,000	.	.	4,730
Houston	2,230,000	275,000	.	.	.	52,400	.	.	2,730
Los Angeles	12,500,000	453,000	.	.	.	88,400	.	.	2,460
New York	5,450,000	1,350,000	.	.	.	321,000	.	.	11,400
Philadelphia	1,800,000	626,000	.	.	.	160,000	.	.	12,900
Sacramento	739,000	95,600	.	.	.	16,900	.	.	129
St. Louis	721,000	378,000	.	.	.	106,000	.	.	6,790
Washington	1,310,000	394,000	.	.	.	127,000	.	.	8,580

Table 4A-39. Number of person-days with 8-hour exposures above 0.06 ppm-8hr, Children, moderate exertion, 2004

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	846,000	335,000	315,000	209,000	115,000	84,100	78,900	30,600	3,490
Boston	481,000	170,000	105,000	93,600	74,100	25,900	15,000	8,190	0
Chicago	249,000	19,700	9,160	5,740	2,640	931	466	310	0
Cleveland	221,000	32,800	16,800	11,900	1,870	1,230	344	49	0
Detroit	309,000	85,400	42,700	31,700	23,000	3,570	268	89	0
Houston	1,530,000	403,000	286,000	246,000	132,000	109,000	68,500	47,800	9,230
Los Angeles	10,300,000	236,000	192,000	119,000	33,800	26,500	19,700	5,180	0
New York	2,320,000	272,000	189,000	128,000	6,760	10,300	4,270	1,070	0
Philadelphia	1,140,000	239,000	154,000	119,000	33,500	24,900	10,500	4,960	97
Sacramento	371,000	30,300	20,100	12,700	2,280	1,670	868	322	0
St. Louis	165,000	54,200	29,600	20,800	4,090	2,570	1,240	230	0
Washington	1,380,000	418,000	255,000	241,000	118,000	88,800	33,100	20,800	1,890

Table 4A-40. Number of person-days with 8-hour exposures above 0.07 ppm-8hr, Children, moderate exertion, 2002

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	723,000	261,000	237,000	136,000	75,700	48,400	48,000	13,000	152
Boston	978,000	461,000	309,000	297,000	245,000	133,000	81,300	63,000	10,300
Chicago	1,490,000	516,000	371,000	275,000	132,000	57,100	42,100	11,300	776
Cleveland	1,020,000	380,000	259,000	232,000	89,000	64,800	19,900	12,500	1,030
Detroit	1,120,000	458,000	279,000	239,000	200,000	44,400	12,900	5,360	89
Houston	470,000	88,000	51,400	42,100	13,100	9,630	4,820	2,090	161
Los Angeles	2,860,000	30,300	23,700	11,500	1,360	3,000	2,460	1,360	0
New York	5,080,000	880,000	656,000	461,000	86,900	122,000	72,300	34,900	6,050
Philadelphia	2,050,000	768,000	563,000	499,000	240,000	186,000	113,000	71,800	6,030
Sacramento	315,000	38,200	25,300	19,000	6,920	4,730	2,350	965	32
St. Louis	607,000	352,000	267,000	220,000	108,000	78,000	48,700	28,500	1,290
Washington	1,770,000	649,000	413,000	405,000	215,000	147,000	72,200	53,400	3,910

Table 4A-41. Number of person-days with 8-hour exposures above 0.07 ppm-8hr, Children, moderate exertion, 2003

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	195,000	69,800	.	.	.	7,660	.	.	0
Boston	166,000	83,000	.	.	.	11,800	.	.	571
Chicago	227,000	91,100	.	.	.	2,640	.	.	0
Cleveland	203,000	51,100	.	.	.	5,940	.	.	0
Detroit	521,000	88,600	.	.	.	7,230	.	.	0
Houston	803,000	30,000	.	.	.	2,410	.	.	0
Los Angeles	5,020,000	57,300	.	.	.	1,640	.	.	0
New York	1,880,000	273,000	.	.	.	14,200	.	.	0
Philadelphia	563,000	137,000	.	.	.	26,500	.	.	0
Sacramento	200,000	10,100	.	.	.	354	.	.	0
St. Louis	187,000	73,500	.	.	.	11,400	.	.	46
Washington	411,000	124,000	.	.	.	22,700	.	.	0

Table 4A-42. Number of person-days with 8-hour exposures above 0.07 ppm-8hr, Children, moderate exertion, 2004

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	197,000	57,700	50,400	25,300	10,500	7,130	6,750	910	0
Boston	104,000	21,100	9,330	6,670	3,810	191	0	0	0
Chicago	12,600	1,090	621	0	0	0	0	0	0
Cleveland	28,600	785	245	0	0	0	0	0	0
Detroit	32,200	1,430	89	89	0	0	0	0	0
Houston	486,000	77,500	47,300	39,100	12,800	10,000	2,810	1,360	0
Los Angeles	2,990,000	15,000	10,900	1,910	0	0	0	0	0
New York	527,000	10,700	4,630	2,850	0	0	0	0	0
Philadelphia	223,000	12,400	5,440	3,210	194	0	0	0	0
Sacramento	53,100	708	515	225	0	0	0	0	0
St. Louis	7,620	1,520	551	46	0	0	0	0	0
Washington	358,000	71,700	21,100	20,400	4,800	3,530	1,010	631	0

Table 4A-43. Number of person-days with 8-hour exposures above 0.08 ppm-8hr, Children, moderate exertion, 2002

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	178,000	43,800	40,600	17,200	7,200	3,640	3,940	455	0
Boston	356,000	130,000	78,100	74,700	57,500	18,900	8,100	4,570	571
Chicago	416,000	53,200	35,500	12,400	4,660	1,400	466	310	0
Cleveland	372,000	49,600	15,900	11,900	2,260	1,230	540	295	0
Detroit	280,000	34,600	8,210	5,710	3,480	179	0	0	0
Houston	156,000	12,900	6,420	4,730	161	642	80	0	0
Los Angeles	902,000	2,180	1,910	1,360	0	0	0	0	0
New York	1,710,000	119,000	70,800	41,300	6,050	8,190	3,920	2,140	0
Philadelphia	794,000	154,000	86,800	66,000	20,400	11,700	3,400	1,170	0
Sacramento	81,700	4,630	1,930	1,160	161	64	32	32	0
St. Louis	163,000	66,500	38,100	27,000	8,310	4,310	1,330	275	0
Washington	627,000	130,000	58,400	55,400	19,100	8,830	2,150	883	0

Table 4A-44. Number of person-days with 8-hour exposures above 0.08 ppm-8hr, Children, moderate exertion, 2003

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	39,600	8,720	.	.	.	227	.	.	0
Boston	37,600	13,900	.	.	.	1,240	.	.	286
Chicago	19,600	3,100	.	.	.	0	.	.	0
Cleveland	76,500	7,710	.	.	.	0	.	.	0
Detroit	203,000	8,040	.	.	.	0	.	.	0
Houston	239,000	2,730	.	.	.	0	.	.	0
Los Angeles	1,810,000	1,360	.	.	.	0	.	.	0
New York	620,000	24,900	.	.	.	0	.	.	0
Philadelphia	186,000	41,600	.	.	.	97	.	.	0
Sacramento	39,200	579	.	.	.	0	.	.	0
St. Louis	51,700	14,200	.	.	.	184	.	.	0
Washington	179,000	39,600	.	.	.	379	.	.	0

Numbers are rounded to 3 significant digits.

Table 4A-45. Number of person-days with 8-hour exposures above 0.08 ppm-8hr, Children, moderate exertion, 2004

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	44,400	7,730	7,580	1,900	152	152	152	0	0
Boston	19,700	1,330	95	0	0	0	0	0	0
Chicago	1,090	0	0	0	0	0	0	0	0
Cleveland	1,420	0	0	0	0	0	0	0	0
Detroit	446	0	0	0	0	0	0	0	0
Houston	148,000	12,200	4,980	3,130	80	80	0	0	0
Los Angeles	759,000	0	0	0	0	0	0	0	0
New York	81,200	356	0	0	0	0	0	0	0
Philadelphia	26,200	194	0	0	0	0	0	0	0
Sacramento	5,890	0	0	0	0	0	0	0	0
St. Louis	46	0	0	0	0	0	0	0	0
Washington	93,400	4,670	1,640	1,640	505	126	0	0	0

Table 4A-46. Number of person-days with 8-hour exposures above 0.06 ppm-8hr, Asthmatic children, moderate exertion, 2002

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	310,000	164,000	158,000	115,000	80,400	61,900	62,700	34,900	7,130
Boston	408,000	245,000	192,000	186,000	165,000	115,000	84,600	69,100	27,500
Chicago	613,000	302,000	252,000	220,000	167,000	114,000	87,100	56,800	8,380
Cleveland	325,000	172,000	139,000	131,000	89,500	78,600	57,100	47,500	11,600
Detroit	401,000	240,000	188,000	177,000	165,000	99,000	65,500	51,100	8,120
Houston	189,000	51,500	35,400	31,100	15,500	14,000	10,100	6,580	1,850
Los Angeles	1,050,000	43,700	37,700	24,600	7,370	6,000	4,910	1,640	273
New York	2,110,000	748,000	638,000	544,000	251,000	271,000	221,000	143,000	28,500
Philadelphia	896,000	451,000	370,000	343,000	231,000	212,000	166,000	140,000	48,200
Sacramento	130,000	32,600	25,300	20,100	9,940	7,880	6,020	3,920	611
St. Louis	203,000	146,000	126,000	115,000	82,900	71,100	56,100	42,900	13,500
Washington	627,000	316,000	240,000	236,000	166,000	131,000	97,600	84,800	24,100

Table 4A-47. Number of person-days with 8-hour exposures above 0.06 ppm-8hr, Asthmatic children, moderate exertion, 2003

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	133,000	59,200	.	.	.	14,100	.	.	1,060
Boston	120,000	76,200	.	.	.	19,700	.	.	2,100
Chicago	170,000	99,800	.	.	.	21,400	.	.	155
Cleveland	84,500	24,700	.	.	.	7,360	.	.	245
Detroit	202,000	55,900	.	.	.	15,500	.	.	893
Houston	293,000	35,900	.	.	.	6,980	.	.	241
Los Angeles	1,580,000	56,800	.	.	.	9,280	.	.	273
New York	884,000	220,000	.	.	.	47,300	.	.	1,780
Philadelphia	326,000	117,000	.	.	.	29,900	.	.	2,330
Sacramento	96,300	12,400	.	.	.	2,120	.	.	0
St. Louis	97,700	51,800	.	.	.	14,000	.	.	1,100
Washington	179,000	51,400	.	.	.	15,500	.	.	1,010

Table 4A-48. Number of person-days with 8-hour exposures above 0.06 ppm-8hr, Asthmatic children, moderate exertion, 2004

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	113,000	43,700	40,500	27,700	14,900	10,500	9,630	3,260	303
Boston	82,500	30,700	18,900	17,100	13,800	4,570	2,760	1,430	0
Chicago	36,900	3,570	2,020	1,090	310	0	0	0	0
Cleveland	31,100	4,760	2,310	1,960	295	147	0	0	0
Detroit	46,800	13,000	6,610	4,550	3,930	625	0	0	0
Houston	201,000	54,300	38,800	34,100	17,900	14,600	8,190	5,300	802
Los Angeles	1,310,000	36,300	31,100	18,000	5,180	4,370	2,460	546	0
New York	392,000	43,800	28,800	18,500	1,070	1,070	712	356	0
Philadelphia	212,000	48,500	32,400	23,500	6,710	5,150	2,240	1,070	0
Sacramento	44,400	2,930	2,060	1,190	257	161	64	32	0
St. Louis	23,200	6,430	3,490	2,250	459	230	184	0	0
Washington	195,000	62,200	36,900	34,300	16,200	12,500	4,160	3,160	379

Table 4A-49. Number of person-days with 8-hour exposures above 0.07 ppm-8hr, Asthmatic children, moderate exertion, 2002

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	99,100	39,400	36,600	20,900	11,100	6,970	6,590	1,590	0
Boston	177,000	81,400	51,600	50,700	42,400	25,200	15,100	11,700	2,380
Chicago	219,000	71,500	48,600	35,400	16,900	7,450	4,660	776	155
Cleveland	147,000	52,300	35,900	31,600	11,700	7,850	2,800	1,720	147
Detroit	156,000	63,000	38,300	31,800	27,500	5,540	1,700	446	0
Houston	60,100	11,400	6,580	5,060	1,530	1,610	482	401	0
Los Angeles	374,000	3,550	3,000	1,360	273	273	273	273	0
New York	856,000	159,000	119,000	83,300	18,200	25,300	14,200	9,260	1,780
Philadelphia	378,000	143,000	102,000	89,800	43,000	33,900	20,500	12,700	681
Sacramento	39,500	4,410	3,220	2,480	1,060	515	354	161	0
St. Louis	82,000	48,700	35,400	28,500	14,400	10,000	6,700	4,090	275
Washington	244,000	88,300	56,200	55,000	29,000	19,700	10,500	8,080	379

Table 4A-50. Number of person-days with 8-hour exposures above 0.07 ppm-8hr, Asthmatic children, moderate exertion, 2003

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	24,500	8,870	.	.	.	1,360	.	.	0
Boston	30,200	14,800	.	.	.	2,290	.	.	95
Chicago	31,400	11,500	.	.	.	155	.	.	0
Cleveland	28,000	6,430	.	.	.	884	.	.	0
Detroit	73,500	11,700	.	.	.	1,340	.	.	0
Houston	105,000	4,090	.	.	.	241	.	.	0
Los Angeles	632,000	6,550	.	.	.	0	.	.	0
New York	295,000	43,100	.	.	.	2,490	.	.	0
Philadelphia	104,000	26,100	.	.	.	4,080	.	.	0
Sacramento	26,100	1,290	.	.	.	32	.	.	0
St. Louis	25,500	9,590	.	.	.	1,520	.	.	0
Washington	55,000	15,300	.	.	.	2,270	.	.	0

Table 4A-51. Number of person-days with 8-hour exposures above 0.07 ppm-8hr, Asthmatic children, moderate exertion, 2004

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	25,700	6,440	5,760	2,730	1,440	910	834	76	0
Boston	19,200	4,100	1,430	1,240	762	95	0	0	0
Chicago	2,330	155	0	0	0	0	0	0	0
Cleveland	4,030	0	0	0	0	0	0	0	0
Detroit	4,910	357	0	0	0	0	0	0	0
Houston	64,800	9,630	5,300	4,330	1,040	963	321	161	0
Los Angeles	390,000	2,180	1,360	273	0	0	0	0	0
New York	90,800	1,420	712	356	0	0	0	0	0
Philadelphia	44,700	2,720	1,260	875	97	0	0	0	0
Sacramento	5,440	64	32	32	0	0	0	0	0
St. Louis	872	184	46	0	0	0	0	0	0
Washington	53,500	10,400	2,900	2,400	883	757	379	126	0

Table 4A-52. Number of person-days with 8-hour exposures above 0.08 ppm-8hr, Asthmatic children, moderate exertion, 2002

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	26,900	6,520	6,060	2,050	1,210	606	606	0	0
Boston	62,800	24,300	14,500	13,500	11,200	3,910	1,520	476	95
Chicago	58,000	6,830	3,410	931	310	155	155	0	0
Cleveland	51,700	6,280	2,260	1,520	295	196	98	49	0
Detroit	38,200	4,200	1,070	536	89	0	0	0	0
Houston	19,400	2,090	802	642	0	161	0	0	0
Los Angeles	114,000	273	273	273	0	0	0	0	0
New York	305,000	24,200	14,200	9,970	2,140	2,490	1,420	712	0
Philadelphia	147,000	27,800	15,900	12,000	3,600	1,460	583	389	0
Sacramento	9,840	579	225	161	32	0	0	0	0
St. Louis	21,400	8,810	5,320	3,670	1,700	872	321	92	0
Washington	84,800	18,100	8,960	8,830	2,650	1,390	379	0	0

Table 4A-53. Number of person-days with 8-hour exposures above 0.08 ppm-8hr, Asthmatic children, moderate exertion, 2003

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	5,150	1,520	.	.	.	0	.	.	0
Boston	6,000	2,570	.	.	.	286	.	.	95
Chicago	1,240	155	.	.	.	0	.	.	0
Cleveland	9,970	933	.	.	.	0	.	.	0
Detroit	27,700	1,430	.	.	.	0	.	.	0
Houston	31,700	241	.	.	.	0	.	.	0
Los Angeles	231,000	0	.	.	.	0	.	.	0
New York	91,800	4,980	.	.	.	0	.	.	0
Philadelphia	33,500	7,290	.	.	.	0	.	.	0
Sacramento	5,370	64	.	.	.	0	.	.	0
St. Louis	6,700	1,790	.	.	.	46	.	.	0
Washington	23,600	4,290	.	.	.	0	.	.	0

Table 4A-54. Number of person-days with 8-hour exposures above 0.08 ppm-8hr, Asthmatic children, moderate exertion, 2004

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	5,080	985	985	76	0	0	0	0	0
Boston	3,910	286	95	0	0	0	0	0	0
Chicago	155	0	0	0	0	0	0	0	0
Cleveland	295	0	0	0	0	0	0	0	0
Detroit	0	0	0	0	0	0	0	0	0
Houston	19,900	1,440	642	321	0	0	0	0	0
Los Angeles	106,000	0	0	0	0	0	0	0	0
New York	11,400	356	0	0	0	0	0	0	0
Philadelphia	5,540	97	0	0	0	0	0	0	0
Sacramento	643	0	0	0	0	0	0	0	0
St. Louis	0	0	0	0	0	0	0	0	0
Washington	12,800	757	379	379	126	0	0	0	0

Table 4A-55. Exposure level=0.06 (ppm-8hr), Group=Asthmatic children, moderate exertion, 12-city totals

Alt std	Year	Persons (percent)	Persons	Person-days
base	2002	72%	1,860,000	7,260,000
base	2003	58%	1,490,000	4,170,000
base	2004	42%	1,090,000	2,690,000
84/4	2002	47%	1,210,000	2,910,000
84/4	2003	24%	610,000	860,000
84/4	2004	11%	270,000	350,000
84/3	2002	43%	1,100,000	2,400,000
84/3	2004	8%	200,000	240,000
80/4	2002	40%	1,020,000	2,140,000
80/4	2004	6%	150,000	180,000
74/5	2002	30%	780,000	1,430,000
74/5	2004	3%	70,000	80,000
74/4	2002	27%	700,000	1,180,000
74/4	2003	7%	180,000	200,000
74/4	2004	2%	50,000	50,000
74/3	2002	23%	590,000	920,000
74/3	2004	1%	30,000	30,000
70/4	2002	18%	460,000	680,000
70/4	2004	1%	10,000	20,000
64/4	2002	6%	150,000	180,000
64/4	2003	0%	10,000	10,000
64/4	2004	0%	0	0

Numbers smaller than 5,000 are rounded to the nearest 1,000; larger numbers are rounded to the nearest 10,000.

Table 4A-56. Exposure level=0.06 (ppm-8hr), Group=Children, moderate exertion, 12-city totals

Alt std	Year	Persons (percent)	Persons	Person-days
base	2002	69%	12,580,000	48,000,000
base	2003	56%	10,220,000	29,640,000
base	2004	41%	7,570,000	19,300,000
84/4	2002	44%	7,970,000	18,760,000
84/4	2003	22%	4,040,000	5,750,000
84/4	2004	10%	1,800,000	2,300,000
84/3	2002	40%	7,260,000	15,450,000
84/3	2004	7%	1,320,000	1,610,000
80/4	2002	37%	6,730,000	13,730,000
80/4	2004	6%	1,050,000	1,240,000
74/5	2002	28%	5,090,000	9,190,000
74/5	2004	3%	490,000	550,000
74/4	2002	25%	4,550,000	7,560,000
74/4	2003	7%	1,260,000	1,430,000
74/4	2004	2%	350,000	380,000
74/3	2002	21%	3,790,000	5,850,000
74/3	2004	1%	220,000	230,000
70/4	2002	16%	3,000,000	4,370,000
70/4	2004	1%	110,000	120,000
64/4	2002	5%	950,000	1,160,000
64/4	2003	0%	70,000	70,000
64/4	2004	0%	10,000	10,000

Numbers smaller than 5,000 are rounded to the nearest 1,000; larger numbers are rounded to the nearest 10,000.

Table 4A-57. Exposure level=0.07 (ppm-8hr), Group=Asthmatic children, moderate exertion, 12-city totals

Alt std	Year	Persons (percent)	Persons	Person-days
base	2002	50%	1,280,000	2,830,000
base	2003	31%	790,000	1,430,000
base	2004	17%	440,000	710,000
84/4	2002	20%	520,000	770,000
84/4	2003	6%	150,000	160,000
84/4	2004	1%	40,000	40,000
84/3	2002	15%	400,000	540,000
84/3	2004	1%	20,000	20,000
80/4	2002	13%	330,000	440,000
80/4	2004	0%	10,000	10,000
74/5	2002	7%	180,000	220,000
74/5	2004	0%	0	0
74/4	2002	5%	120,000	140,000
74/4	2003	1%	20,000	20,000
74/4	2004	0%	0	0
74/3	2002	3%	70,000	80,000
74/3	2004	0%	0	0
70/4	2002	2%	50,000	50,000
70/4	2004	0%	0	0
64/4	2002	0%	10,000	10,000
64/4	2003	0%	0	0
64/4	2004	0%	0	0

Numbers smaller than 5,000 are rounded to the nearest 1,000; larger numbers are rounded to the nearest 10,000.

Table 4A-58. Exposure level=0.07 (ppm-8hr), Group=Children, moderate exertion, 12-city totals

Alt std	Year	Persons (percent)	Persons	Person-days
base	2002	47%	8,550,000	18,500,000
base	2003	30%	5,510,000	10,380,000
base	2004	17%	3,020,000	5,020,000
84/4	2002	18%	3,340,000	4,880,000
84/4	2003	5%	1,000,000	1,090,000
84/4	2004	1%	260,000	270,000
84/3	2002	14%	2,570,000	3,450,000
84/3	2004	1%	140,000	150,000
80/4	2002	12%	2,160,000	2,840,000
80/4	2004	1%	100,000	100,000
74/5	2002	6%	1,160,000	1,410,000
74/5	2004	0%	30,000	30,000
74/4	2002	4%	770,000	900,000
74/4	2003	1%	110,000	110,000
74/4	2004	0%	20,000	20,000
74/3	2002	3%	460,000	520,000
74/3	2004	0%	10,000	10,000
70/4	2002	1%	270,000	300,000
70/4	2004	0%	0	0
64/4	2002	0%	30,000	30,000
64/4	2003	0%	0	0
64/4	2004	0%	0	0

Numbers smaller than 5,000 are rounded to the nearest 1,000; larger numbers are rounded to the nearest 10,000.

Table 4A-59. Exposure level=0.08 (ppm-8hr), Group=Asthmatic children, moderate exertion, 12-city totals

Alt std	Year	Persons (percent)	Persons	Person-days
base	2002	24%	630,000	940,000
base	2003	13%	340,000	470,000
base	2004	5%	130,000	170,000
84/4	2002	4%	110,000	130,000
84/4	2003	1%	20,000	30,000
84/4	2004	0%	0	0
84/3	2002	3%	70,000	70,000
84/3	2004	0%	0	0
80/4	2002	2%	50,000	50,000
80/4	2004	0%	0	0
74/5	2002	1%	20,000	20,000
74/5	2004	0%	0	0
74/4	2002	0%	10,000	10,000
74/4	2003	0%	0	0
74/4	2004	0%	0	0
74/3	2002	0%	0	10,000
74/3	2004	0%	0	0
70/4	2002	0%	0	0
70/4	2004	0%	0	0
64/4	2002	0%	0	0
64/4	2003	0%	0	0
64/4	2004	0%	0	0

Numbers smaller than 5,000 are rounded to the nearest 1,000; larger numbers are rounded to the nearest 10,000.

Table 4A-60. Exposure level=0.08 (ppm-8hr), Group=Children, moderate exertion, 12-city totals

Alt std	Year	Persons (percent)	Persons	Person-days
base	2002	23%	4,130,000	6,030,000
base	2003	13%	2,430,000	3,500,000
base	2004	5%	910,000	1,180,000
84/4	2002	4%	700,000	800,000
84/4	2003	1%	160,000	170,000
84/4	2004	0%	30,000	30,000
84/3	2002	2%	400,000	440,000
84/3	2004	0%	10,000	10,000
80/4	2002	2%	290,000	320,000
80/4	2004	0%	10,000	10,000
74/5	2002	1%	120,000	130,000
74/5	2004	0%	0	0
74/4	2002	0%	60,000	60,000
74/4	2003	0%	0	0
74/4	2004	0%	0	0
74/3	2002	0%	20,000	20,000
74/3	2004	0%	0	0
70/4	2002	0%	10,000	10,000
70/4	2004	0%	0	0
64/4	2002	0%	0	0
64/4	2003	0%	0	0
64/4	2004	0%	0	0

Numbers smaller than 5,000 are rounded to the nearest 1,000; larger numbers are rounded to the nearest 10,000.

APPENDICES FOR CHAPTER 5

5A.1. Ozone Air Quality Information for 12 Urban Areas

Table 5A-1. Monitor-Specific O_3 Air Quality Information: Atlanta, GA

AIRS Monitor ID	Fourth Daily Maximum 8-Hour Average (ppm)			Average of the 3 Year-Specific Values (ppm)
	2002	2003	2004	
1305700011	0.089			
1306700031	0.100	0.084	0.073	0.085
1307700021	0.099	0.077	0.083	0.086
1308500012	0.088	0.077	0.068	0.077
1308900021	0.095	0.080	0.084	0.086
1308930011	0.090	0.091	0.088	0.089
1309700041	0.098	0.085	0.080	0.087
1311300011	0.088	0.077	0.084	0.083
1312100551	0.100	0.091	0.089	0.093
1313500021	0.089	0.088	0.092	0.089
1315100021	0.099	0.082	0.085	0.088
1322300031	0.099	0.083	0.073	0.085
1324700011	0.099	0.078	0.087	0.088
Average:	0.095	0.083	0.082	
			Design Value*:	0.093

*The design value is the maximum of the monitor-specific averages of the annual fourth daily maximum 8-hour average over the 3 year period.

Table 5A-2. Monitor-Specific O_3 Air Quality Information: Boston, MA

AIRS Monitor ID	Fourth Daily Maximum 8-Hour Average (ppm)			Average of the 3 Year-Specific Values (ppm)
	2002	2003	2004	
2500900051	0.088			
2500920061	0.100	0.079	0.081	0.086
2500940041	0.094	0.080	0.077	0.083
2501711021	0.096	0.073	0.070	0.079
2502130031	0.107	0.088	0.078	0.091
2502500411	0.102	0.078	0.079	0.086
2502500421	0.074	0.074	0.064	0.07
2502700151	0.091	0.080	0.074	0.081
Average:	0.094	0.079	0.075	
			Design Value*:	0.091

*The design value is the maximum of the monitor-specific averages of the annual fourth daily maximum 8-hour average over the 3 year period.

Table 5A-3. Monitor-Specific O_3 Air Quality Information: Chicago, IL

AIRS Monitor ID	Fourth Daily Maximum 8-Hour Average (ppm)			Average of the 3 Year-Specific Values (ppm)
	2002	2003	2004	
1703100011	0.094	0.077	0.065	0.078
1703100321	0.096	0.080	0.067	0.081
1703100422	0.103			
1703100501	0.084	0.069		
1703100641	0.085	0.067	0.054	0.068
1703100721	0.085	0.075	0.060	0.073
1703100761			0.068	
1703110032	0.092	0.071	0.067	0.076
1703116011	0.081	0.075	0.067	0.074
1703140021	0.084	0.070	0.059	0.071
1703140071	0.093	0.073	0.064	0.076
1703142011	0.087	0.080	0.067	0.078
1703142012	0.067		0.051	
1703170021	0.091	0.082	0.071	0.081
1703180031	0.074			
1704360011	0.084	0.066	0.065	0.071
1708900051	0.082	0.076	0.069	0.075
1709710021	0.090	0.074	0.068	0.077
1709710071	0.100	0.078	0.071	0.083
1709730011	0.087			
1711100011	0.090	0.079	0.068	0.079
1719710081	0.086	0.077	0.063	0.075
1719710111	0.087	0.073	0.068	0.076
1808900221	0.094	0.076	0.064	0.078
1808900241	0.086	0.081		
1808900301			0.064	
1808920081	0.101	0.081	0.067	0.083
1809100051	0.107	0.082	0.070	0.086
1809100101	0.100	0.084		
1812700202	0.097	0.079		
1812700241	0.101	0.077	0.069	0.082
1812700261	0.100	0.082	0.072	0.084
5505900021	0.110	0.085		
5505900191	0.116	0.088	0.078	0.094
5505900221	0.096	0.088		
Average:	0.092	0.077	0.066	
			Design Value*:	0.094

*The design value is the maximum of the monitor-specific averages of the annual fourth daily maximum 8-hour average over the 3 year period.

Table 5A-4. Monitor-Specific O_3 Air Quality Information: Cleveland, OH

AIRS Monitor ID	Fourth Daily Maximum 8-Hour Average (ppm)			Average of the 3 Year-Specific Values (ppm)
	2002	2003	2004	
3900710011	0.103	0.099	0.081	0.094
3903500341	0.090	0.076	0.057	0.074
3903500641	0.090	0.079	0.063	0.077
3903550021	0.098	0.089	0.077	0.088
3905500041	0.115	0.097	0.075	0.095
3908500031	0.104	0.092	0.079	0.091
3908530021	0.088	0.080	0.076	0.081
3909300171	0.099	0.085	0.074	0.086
3910300031	0.091	0.086	0.077	0.084
3913310011	0.097	0.091	0.081	0.089
3915300201	0.103	0.089	0.077	0.089
Average:	0.098	0.088	0.074	
			Design Value*:	0.095

*The design value is the maximum of the monitor-specific averages of the annual fourth daily maximum 8-hour average over the 3 year period.

Table 5A-5. Monitor-Specific O_3 Air Quality Information: Detroit, MI

AIRS Monitor ID	Fourth Daily Maximum 8-Hour Average (ppm)			Average of the 3 Year-Specific Values (ppm)
	2002	2003	2004	
2604900211	0.088	0.087	0.075	0.083
2604920011	0.089	0.091	0.077	0.085
2609900091	0.095	0.102	0.081	0.092
2609910031	0.092	0.101	0.071	0.088
2612500012	0.093	0.090	0.075	0.086
2614700051	0.100	0.086	0.074	0.086
2616100081	0.091	0.091	0.071	0.084
2616300012	0.088	0.085	0.065	0.079
2616300161	0.092	0.084	0.066	0.08
2616300192	0.083	0.098	0.066	0.082
Average:	0.091	0.092	0.072	
			Design Value*:	0.092

*The design value is the maximum of the monitor-specific averages of the annual fourth daily maximum 8-hour average over the 3 year period.

Table 5A-6. Monitor-Specific O_3 Air Quality Information: Houston, TX

AIRS Monitor ID	Fourth Daily Maximum 8-Hour Average (ppm)			Average of the 3 Year-Specific Values (ppm)
	2002	2003	2004	
4803910032	0.095			
4803910041	0.092	0.097	0.103	0.097
4803910161			0.081	
4816700141	0.093	0.092	0.088	0.091
4816710022	0.083	0.082		
4820100242	0.096	0.095	0.096	0.095
4820100263	0.088	0.098	0.085	0.09
4820100292	0.098	0.096	0.090	0.094
4820100461	0.078	0.093	0.084	0.085
4820100472	0.072	0.082	0.083	0.079
4820100512	0.101	0.103	0.095	0.099
4820100551	0.094	0.107	0.104	0.101
4820100621	0.095	0.094	0.097	0.095
4820100661	0.084	0.081	0.097	0.087
4820100701	0.088	0.100	0.078	0.088
4820100751	0.078	0.096	0.093	0.089
4820110151		0.108	0.093	
4820110342	0.093	0.102	0.091	0.095
4820110353	0.092	0.105	0.092	0.096
4820110391	0.095	0.113	0.097	0.101
4820110411	0.090			
4820110501	0.094	0.092	0.097	0.094
4833900781	0.082	0.094	0.080	0.085
Average:	0.090	0.097	0.091	
			Design Value*:	0.101

*The design value is the maximum of the monitor-specific averages of the annual fourth daily maximum 8-hour average over the 3 year period.

Table 5A-7. Monitor-Specific O_3 Air Quality Information: Los Angeles, CA

AIRS Monitor ID	Fourth Daily Maximum 8-Hour Average (ppm)			Average of the 3 Year-Specific Values (ppm)
	2002	2003	2004	
0603700021	0.097	0.104	0.092	0.097
0603700161	0.111	0.123	0.095	0.109
0603701131	0.073	0.083	0.076	0.077
0603710021	0.091	0.096	0.089	0.092
0603711031	0.077	0.082	0.078	0.079
0603712011	0.111	0.119	0.101	0.11
0603713011	0.049	0.057	0.065	0.057
0603716011	0.074	0.082	0.079	0.078
0603717011	0.099	0.109	0.095	0.101
0603720051	0.095	0.101	0.093	0.096
0603740021	0.059	0.063	0.070	0.064
0603750011	0.064	0.070		
0603750051			0.085	
0603760121	0.131	0.137	0.107	0.125
0603790331	0.102	0.103	0.095	0.1
0605900071	0.069	0.080	0.088	0.079
0605910031	0.066	0.079	0.076	0.073
0605920221	0.081	0.095	0.085	0.087
0605950011	0.071	0.080	0.075	0.075
0606500121	0.113	0.127	0.112	0.117
0606520021	0.097	0.100	0.094	0.097
0606550011	0.109	0.105	0.099	0.104
0606560011	0.107	0.116	0.095	0.106
0606580011	0.109	0.120	0.111	0.113
0606590011	0.104	0.112	0.100	0.105
0606590031			0.060	
0607100011	0.092	0.088	0.082	0.087
0607100051	0.131	0.130	0.122	0.127
0607100121	0.115	0.103	0.097	0.105
0607100171	0.087	0.084	0.087	0.086
0607103061	0.106	0.104	0.085	0.098
0607110042	0.105	0.114	0.102	0.107
0607112341	0.089	0.087	0.082	0.086
0607120021	0.114	0.132	0.111	0.119
0607140011	0.113	0.110	0.099	0.107
0607140031	0.117	0.137	0.119	0.124
0607190021	0.101	0.111	0.102	0.104
0607190041	0.105	0.123	0.112	0.113
0611100051	0.076			
0611100071	0.080	0.087	0.086	0.084
0611100091	0.087	0.093	0.086	0.088
0611110041	0.097	0.093	0.092	0.094
0611120021	0.092	0.093	0.092	0.092
0611120031	0.064	0.074	0.069	0.069
0611130011	0.064	0.069	0.065	0.066
Average:	0.093	0.099	0.091	
			Design Value*:	0.127

*The design value is the maximum of the monitor-specific averages of the annual fourth daily maximum 8-hour average over the 3 year period.

Table 5A-8. Monitor-Specific O_3 Air Quality Information: New York, NY

AIRS Monitor ID	Fourth Daily Maximum 8-Hour Average (ppm)			Average of the 3 Year-Specific Values (ppm)
	2002	2003	2004	
3600500831	0.096	0.079	0.074	0.083
3600501101	0.089	0.082	0.069	0.08
3602700071	0.111	0.081	0.076	0.089
3607150011	0.082	0.087	0.078	0.082
3607900051	0.102	0.082	0.082	0.088
3608100981	0.082	0.072	0.064	0.072
3608101241	0.089	0.086	0.075	0.083
3608500671	0.099	0.086	0.083	0.089
3610300021	0.108	0.094	0.081	0.094
3610300041	0.090	0.082		
3610300092	0.103	0.102	0.079	0.094
3611110051	0.084	0.082	0.076	0.08
3611920041	0.102	0.091	0.078	0.09
Average:	0.095	0.085	0.076	
			Design Value*:	0.094

*The design value is the maximum of the monitor-specific averages of the annual fourth daily maximum 8-hour average over the 3 year period.

Table 5A-9. Monitor-Specific O_3 Air Quality Information: Philadelphia, PA

AIRS Monitor ID	Fourth Daily Maximum 8-Hour Average (ppm)			Average of the 3 Year-Specific Values (ppm)
	2002	2003	2004	
4201700121	0.111	0.087	0.082	0.093
4202900501	0.104	0.085		
4202901001	0.112	0.085	0.085	0.094
4204500021	0.106	0.080	0.081	0.089
4209100131	0.101	0.085	0.083	0.089
4210100041	0.082	0.069	0.054	0.068
4210100141	0.098	0.083	0.077	0.086
4210100241	0.110	0.082	0.091	0.094
4210101361	0.094	0.070	0.073	0.079
Average:	0.102	0.081	0.078	
			Design Value*:	0.094

*The design value is the maximum of the monitor-specific averages of the annual fourth daily maximum 8-hour average over the 3 year period.

Table 5A-10. Monitor-Specific O_3 Air Quality Information: Sacramento, CA

AIRS Monitor ID	Fourth Daily Maximum 8-Hour Average (ppm)			Average of the 3 Year-Specific Values (ppm)
	2002	2003	2004	
0601700101	0.098	0.096	0.089	0.094
0601700111	0.067	0.065		
0601700121	0.077	0.075	0.073	0.075
0601700201	0.111	0.106	0.089	0.102
0605700051	0.099	0.098	0.093	0.096
0605700071	0.093	0.090	0.085	0.089
0605710011	0.065			
0606100021	0.101	0.094	0.092	0.095
0606100041	0.101	0.089	0.087	0.092
0606100061	0.095	0.085	0.082	0.087
0606100071		0.068		
0606130011	0.097			
0606700021	0.095	0.086	0.076	0.085
0606700061	0.105	0.097	0.083	0.095
0606700101	0.083	0.076	0.067	0.075
0606700111	0.069	0.087	0.077	0.077
0606700121	0.104	0.098	0.087	0.096
0606700131	0.079	0.075	0.067	0.073
0606750031	0.097	0.097	0.089	0.094
0611300041	0.076	0.077	0.071	0.074
0611310031	0.088	0.082	0.069	0.079
Average:	0.090	0.086	0.081	
			Design Value*:	0.102

*The design value is the maximum of the monitor-specific averages of the annual fourth daily maximum 8-hour average over the 3 year period.

Table 5A-11. Monitor-Specific O_3 Air Quality Information: St. Louis, MO

AIRS Monitor ID	Fourth Daily Maximum 8-Hour Average (ppm)			Average of the 3 Year-Specific Values (ppm)
	2002	2003	2004	
1708310011	0.100	0.083	0.073	0.085
1711700021	0.085	0.077	0.068	0.076
1711900081	0.094	0.089	0.074	0.085
1711910091	0.090	0.088	0.078	0.085
1711920072	0.090	0.082	0.068	0.08
1711930071	0.084	0.083	0.073	0.08
1716300102	0.093	0.079	0.073	0.081
2909900121	0.093	0.082	0.070	0.081
2918310021	0.099	0.091	0.077	0.089
2918310041	0.098	0.090	0.076	0.088
2918900041	0.098	0.088	0.070	0.085
2918900061	0.094	0.086	0.067	0.082
2918930011	0.094	0.082	0.067	0.081
2918950011	0.095	0.088	0.068	0.083
2918970031	0.093	0.088	0.069	0.083
2951000071	0.090	0.084		
2951000721	0.081	0.071	0.058	0.07
2951000861	0.098	0.090	0.072	0.086
Average:	0.093	0.085	0.071	
			Design Value*:	0.089

*The design value is the maximum of the monitor-specific averages of the annual fourth daily maximum 8-hour average over the 3 year period.

Table 5A-12. Monitor-Specific O_3 Air Quality Information: Washington, D.C.

AIRS Monitor ID	Fourth Daily Maximum 8-Hour Average (ppm)			Average of the 3 Year-Specific Values (ppm)
	2002	2003	2004	
1100100251	0.097	0.079	0.080	0.085
1100100411	0.102	0.082	0.070	0.084
1100100431	0.106	0.081	0.081	0.089
Average:	0.102	0.081	0.077	
			Design Value*:	0.089

*The design value is the maximum of the monitor-specific averages of the annual fourth daily maximum 8-hour average over the 3 year period.

Table 5A-13. Composite Monitor Statistics: 2004

Urban Area	24-Hour Average (ppm)			1-Hour Maximum (ppm)			8-Hour Maximum (ppm)		
	Minimum	Mean	Maximum	Minimum	Mean	Maximum	Minimum	Mean	Maximum
Atlanta	0.0091	0.0279	0.0504	0.0170	0.0578	0.1267	0.0146	0.0499	0.1103
Boston 1*	0.0060	0.0276	0.0571	0.0185	0.0433	0.1060	0.0128	0.0379	0.0904
Boston 2*	0.0114	0.0310	0.0603	0.0218	0.0450	0.0956	0.0194	0.0411	0.0842
Chicago	0.0110	0.0270	0.0453	0.0152	0.0432	0.0758	0.0119	0.0389	0.0679
Cleveland	0.0080	0.0257	0.0445	0.0123	0.0404	0.0743	0.0090	0.0360	0.0676
Detroit	0.0074	0.0239	0.0459	0.0140	0.0430	0.0793	0.0094	0.0375	0.0730
Houston	0.0075	0.0262	0.0572	0.0155	0.0510	0.1243	0.0137	0.0443	0.1082
Los Angeles 1**	0.0204	0.0338	0.0491	0.0351	0.0634	0.1005	0.0319	0.0555	0.0867
Los Angeles 2**	0.0249	0.0398	0.0568	0.0410	0.0656	0.0992	0.0387	0.0597	0.0888
New York 1***	0.0055	0.0242	0.0494	0.0128	0.0449	0.0920	0.0085	0.0378	0.0811
New York 2***	0.0052	0.0241	0.0491	0.0115	0.0447	0.0883	0.0076	0.0378	0.0806
Philadelphia	0.0037	0.0272	0.0486	0.0090	0.0492	0.0915	0.0057	0.0426	0.0775
Sacramento	0.0164	0.0323	0.0462	0.0307	0.0593	0.0953	0.0241	0.0520	0.0806
St. Louis	0.0078	0.0248	0.0425	0.0175	0.0468	0.0890	0.0114	0.0409	0.0688
Washington, D.C.	0.0055	0.0283	0.0526	0.0140	0.0521	0.1020	0.0103	0.0450	0.0916

*"Boston 1" denotes Suffolk County; "Boston 2" denotes Essex, Middlesex, Norfolk, Suffolk, and Worcester Counties.

**"Los Angeles 1" denotes Los Angeles County; "Los Angeles 2" denotes Los Angeles, Riverside, San Bernardino, and Orange Counties.

***"New York 1" denotes the 5 boroughs of New York City -- Brooklyn, Queens, Manhattan, Bronx, and Staten Island. "New York 2" denotes the 5 boroughs plus Westchester County.

Table 5A-14. Composite Monitor Statistics: 2003

Urban Area	24-Hour Average (ppm)			1-Hour Maximum (ppm)			8-Hour Maximum (ppm)		
	Minimum	Mean	Maximum	Minimum	Mean	Maximum	Minimum	Mean	Maximum
Atlanta	0.0035	0.0265	0.0513	0.0083	0.0574	0.1133	0.0042	0.0492	0.1003
Boston 1*	0.0106	0.0305	0.0693	0.0190	0.0469	0.1110	0.0143	0.0407	0.0955
Boston 2*	0.0104	0.0339	0.0693	0.0190	0.0482	0.1089	0.0145	0.0439	0.0958
Chicago	0.0084	0.0287	0.0554	0.0158	0.0458	0.0819	0.0111	0.0410	0.0793
Cleveland	0.0073	0.0298	0.0676	0.0143	0.0483	0.1013	0.0102	0.0427	0.0919
Detroit	0.0074	0.0279	0.0550	0.0163	0.0503	0.1010	0.0150	0.0442	0.0945
Houston	0.0065	0.0270	0.0612	0.0181	0.0534	0.1161	0.0119	0.0455	0.1008
Los Angeles 1**	0.0155	0.0326	0.0537	0.0274	0.0650	0.1099	0.0245	0.0557	0.0952
Los Angeles 2**	0.0266	0.0396	0.0612	0.0390	0.0670	0.1044	0.0361	0.0605	0.0954
New York 1***	0.0054	0.0251	0.0598	0.0146	0.0458	0.1078	0.0095	0.0386	0.0991
New York 2***	0.0061	0.0259	0.0593	0.0140	0.0462	0.1057	0.0088	0.0395	0.0985
Philadelphia	0.0052	0.0285	0.0725	0.0155	0.0495	0.1074	0.0085	0.0430	0.0988
Sacramento	0.0217	0.0352	0.0554	0.0343	0.0640	0.1069	0.0319	0.0563	0.0950
St. Louis	0.0050	0.0285	0.0534	0.0117	0.0519	0.1200	0.0093	0.0462	0.1064
Washington, D.C.	0.0053	0.0276	0.0661	0.0110	0.0516	0.1153	0.0078	0.0441	0.1092

*"Boston 1" denotes Suffolk County; "Boston 2" denotes Essex, Middlesex, Norfolk, Suffolk, and Worcester Counties.

**"Los Angeles 1" denotes Los Angeles County; "Los Angeles 2" denotes Los Angeles, Riverside, San Bernardino, and Orange Counties.

***"New York 1" denotes the 5 boroughs of New York City -- Brooklyn, Queens, Manhattan, Bronx, and Staten Island. "New York 2" denotes the 5 boroughs plus Westchester County.

Table 5A-15. Composite Monitor Statistics: 2002

Urban Area	24-Hour Average (ppm)			1-Hour Maximum (ppm)			8-Hour Maximum (ppm)		
	Minimum	Mean	Maximum	Minimum	Mean	Maximum	Minimum	Mean	Maximum
Atlanta	0.0102	0.0308	0.0559	0.0193	0.0623	0.1307	0.0157	0.0540	0.1166
Boston 1*	0.0133	0.0314	0.0783	0.0210	0.0503	0.1185	0.0178	0.0434	0.1128
Boston 2*	0.0132	0.0359	0.0852	0.0213	0.0526	0.1213	0.0169	0.0479	0.1162
Chicago	0.0101	0.0295	0.0545	0.0206	0.0488	0.0986	0.0137	0.0437	0.0899
Cleveland	0.0103	0.0338	0.0685	0.0177	0.0548	0.1070	0.0138	0.0488	0.1044
Detroit	0.0085	0.0277	0.0572	0.0170	0.0516	0.0987	0.0151	0.0450	0.0923
Houston	0.0089	0.0258	0.0568	0.0163	0.0492	0.1167	0.0131	0.0427	0.1017
Los Angeles 1**	0.0158	0.0313	0.0492	0.0283	0.0613	0.1009	0.0252	0.0525	0.0842
Los Angeles 2**	0.0192	0.0385	0.0586	0.0292	0.0652	0.0967	0.0247	0.0587	0.0881
New York 1***	0.0062	0.0280	0.0565	0.0130	0.0529	0.1294	0.0088	0.0448	0.0999
New York 2***	0.0075	0.0286	0.0576	0.0133	0.0537	0.1333	0.0088	0.0458	0.1032
Philadelphia	0.0069	0.0322	0.0619	0.0133	0.0573	0.1235	0.0091	0.0501	0.0999
Sacramento	0.0182	0.0353	0.0604	0.0242	0.0647	0.1090	0.0212	0.0564	0.0954
St. Louis	0.0058	0.0289	0.0585	0.0157	0.0556	0.1127	0.0087	0.0484	0.1000
Washington, D.C.	0.0095	0.0357	0.0708	0.0193	0.0627	0.1430	0.0164	0.0548	0.1210

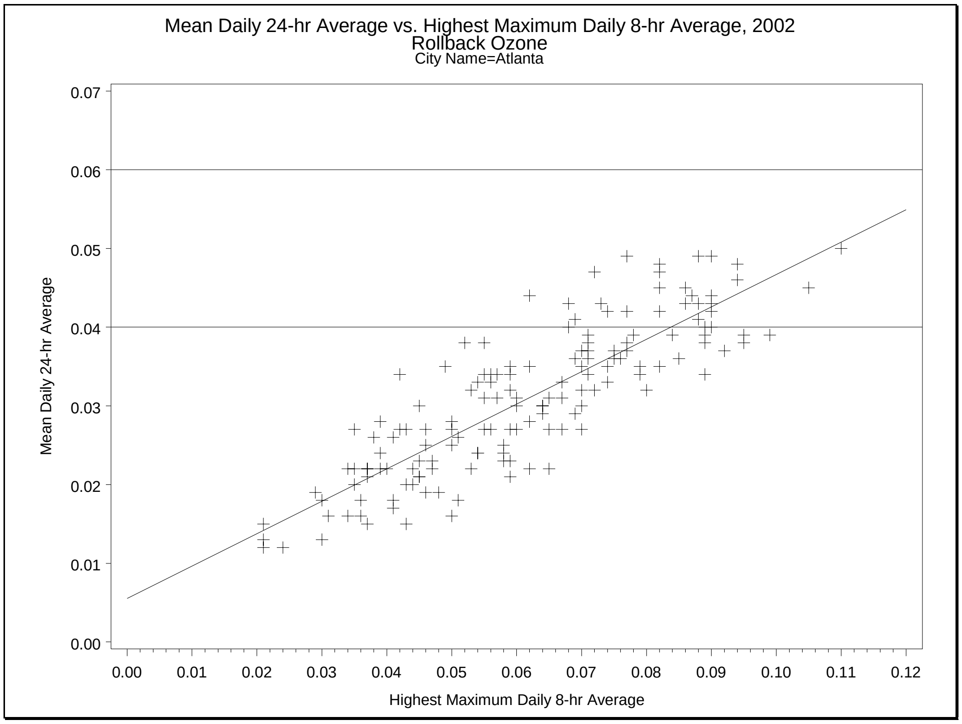
*"Boston 1" denotes Suffolk County; "Boston 2" denotes Essex, Middlesex, Norfolk, Suffolk, and Worcester Counties.

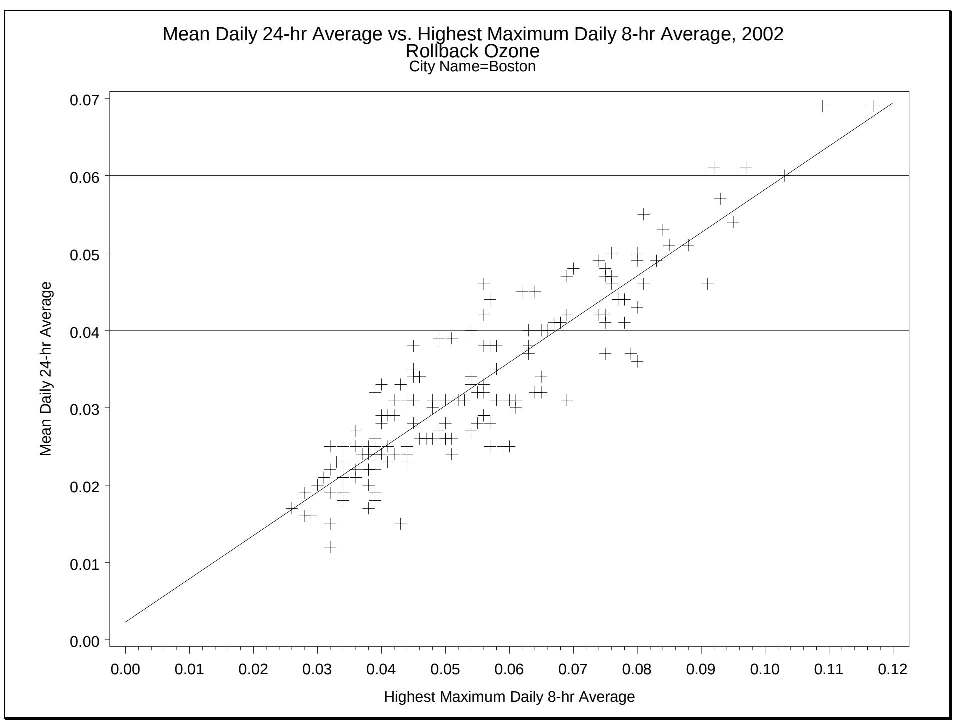
**"Los Angeles 1" denotes Los Angeles County; "Los Angeles 2" denotes Los Angeles, Riverside, San Bernardino, and Orange Counties.

***"New York 1" denotes the 5 boroughs of New York City -- Brooklyn, Queens, Manhattan, Bronx, and Staten Island. "New York 2" denotes the 5 boroughs plus Westchester County.

5A.2 Scatter Plots

This Appendix provides scatter plots comparing 8-hr daily maximum concentrations at the highest monitor with the average of the 24-hr average over all monitors within each of the 12 urban areas included in the risk assessment.


Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2002
Rollback Ozone
City Name=Atlanta
Mean Daily 24-hr Average
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
Highest Maximum Daily 8-hr Average
0.00 0.01 0.02 0.03 0.04 0.05 0.06 0.07 0.08 0.09 0.10 0.11 0.12


Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2002
Rollback Ozone
City Name=Boston
Mean Daily 24-hr Average
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
Highest Maximum Daily 8-hr Average
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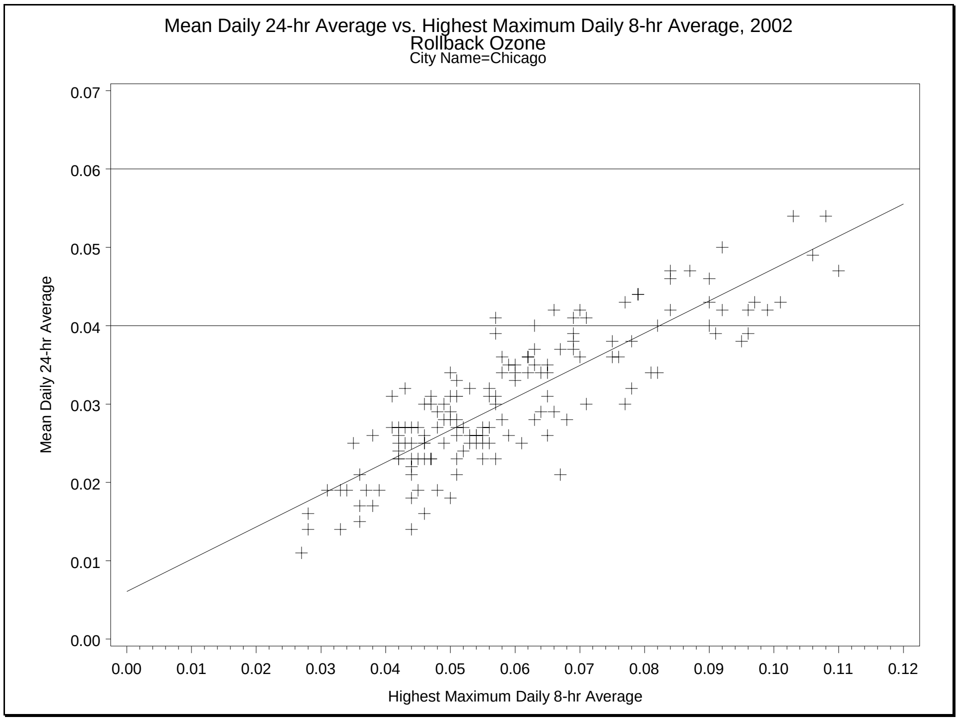
Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2002
Rollback Ozone
City Name=Chicago
Mean Daily 24-hr Average
Highest Maximum Daily 8-hr Average
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0.07
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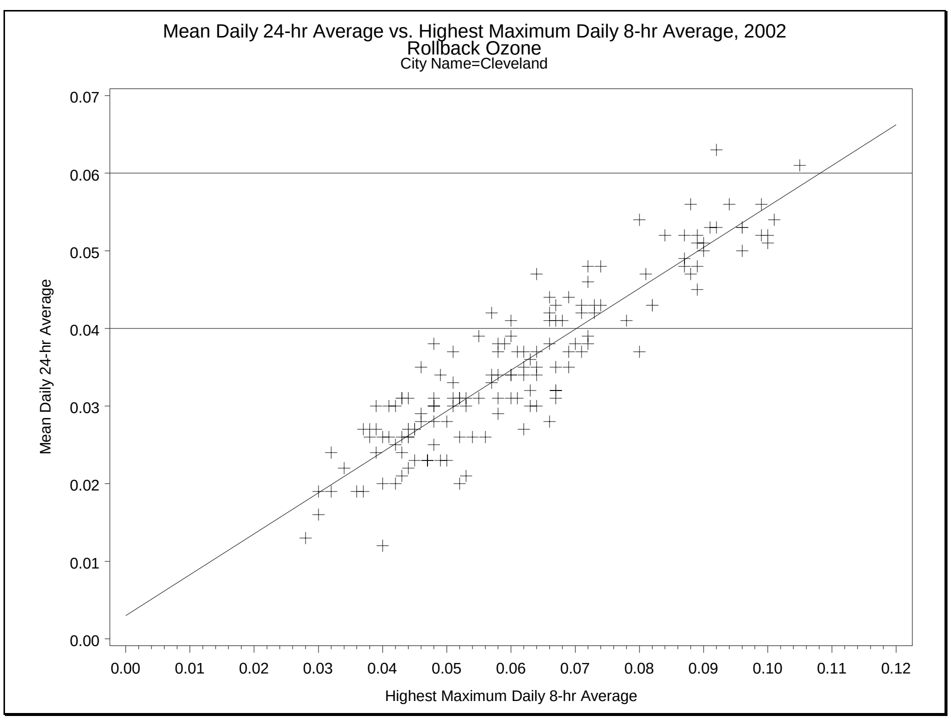
Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2002
Rollback Ozone
City Name=Cleveland
Mean Daily 24-hr Average
Highest Maximum Daily 8-hr Average
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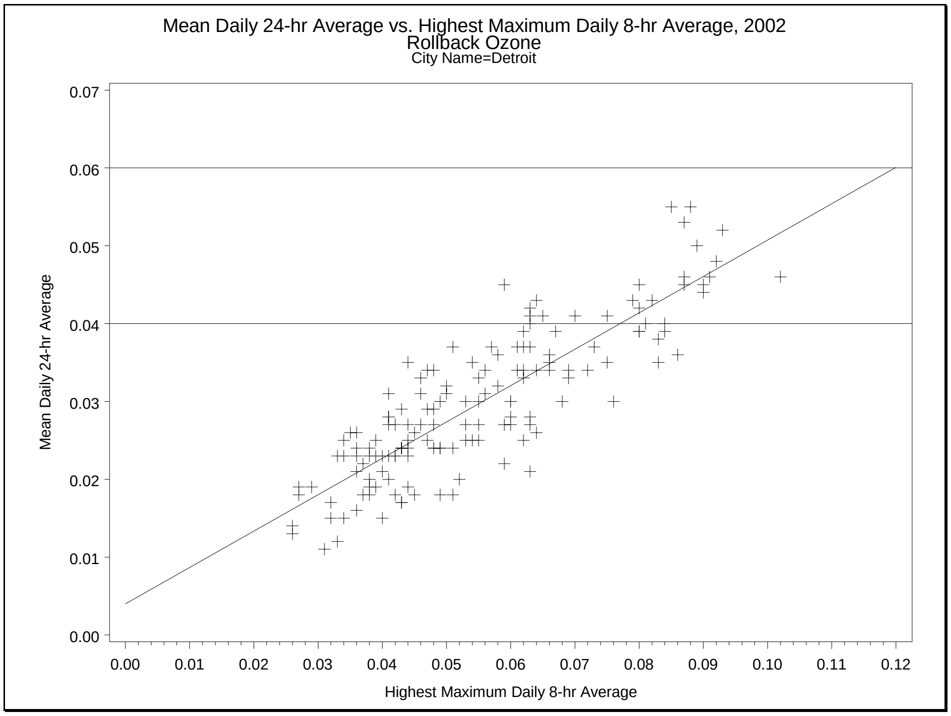
Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2002
Rollback Ozone
City Name=Detroit
Mean Daily 24-hr Average
Highest Maximum Daily 8-hr Average
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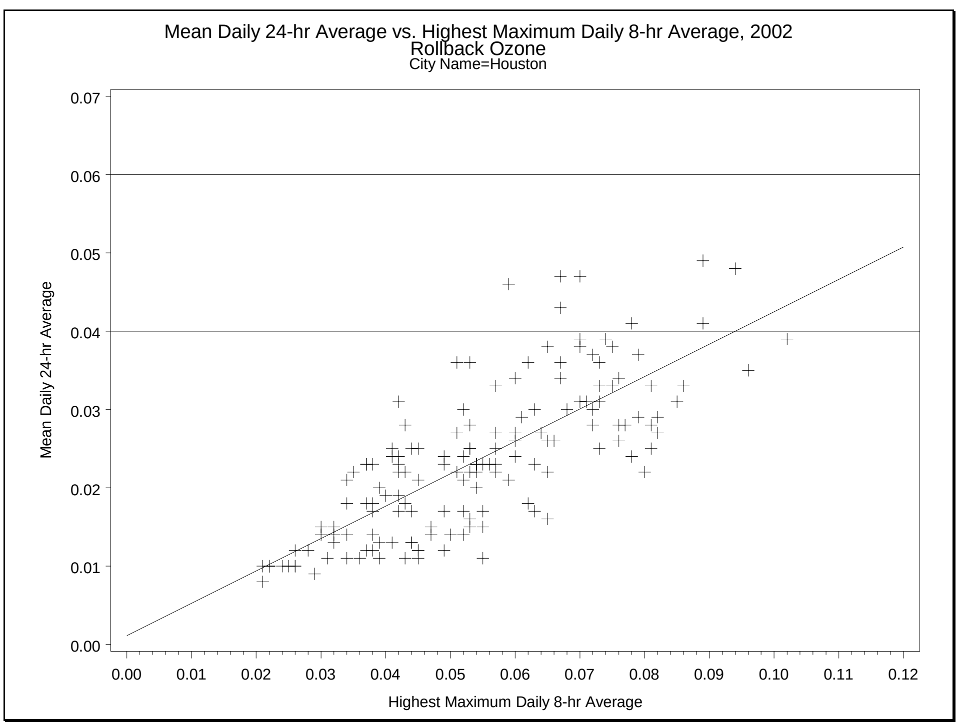
Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2002
Rollback Ozone
City Name=Houston
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Highest Maximum Daily 8-hr Average
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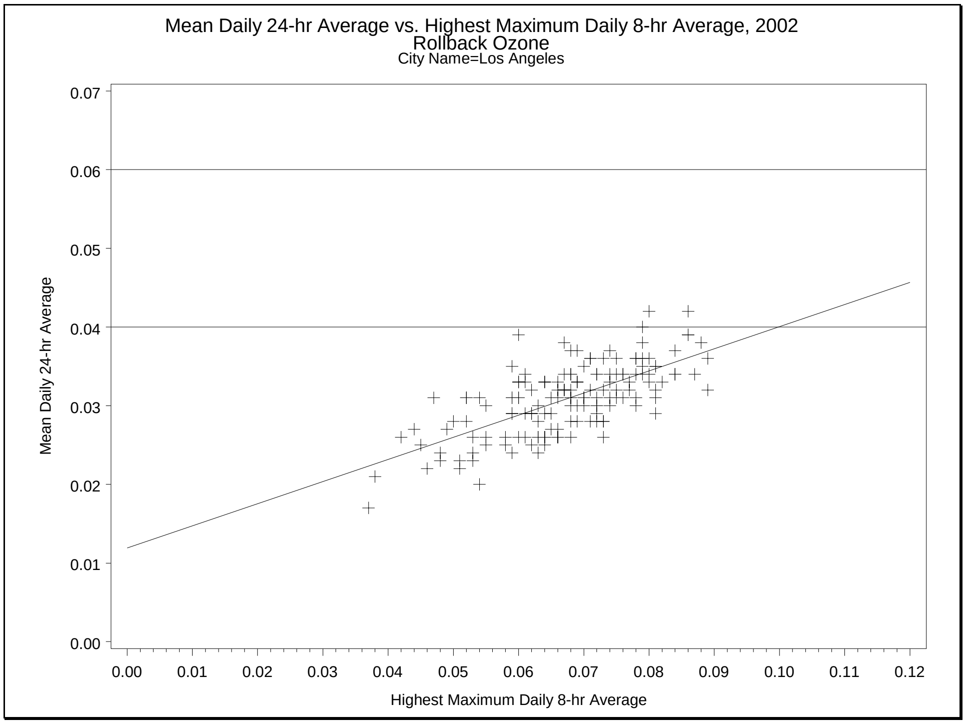
Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2002
Rollback Ozone
City Name=Los Angeles
Mean Daily 24-hr Average
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0.06
0.05
0.04
0.03
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0.01
0.00
0.00
0.01
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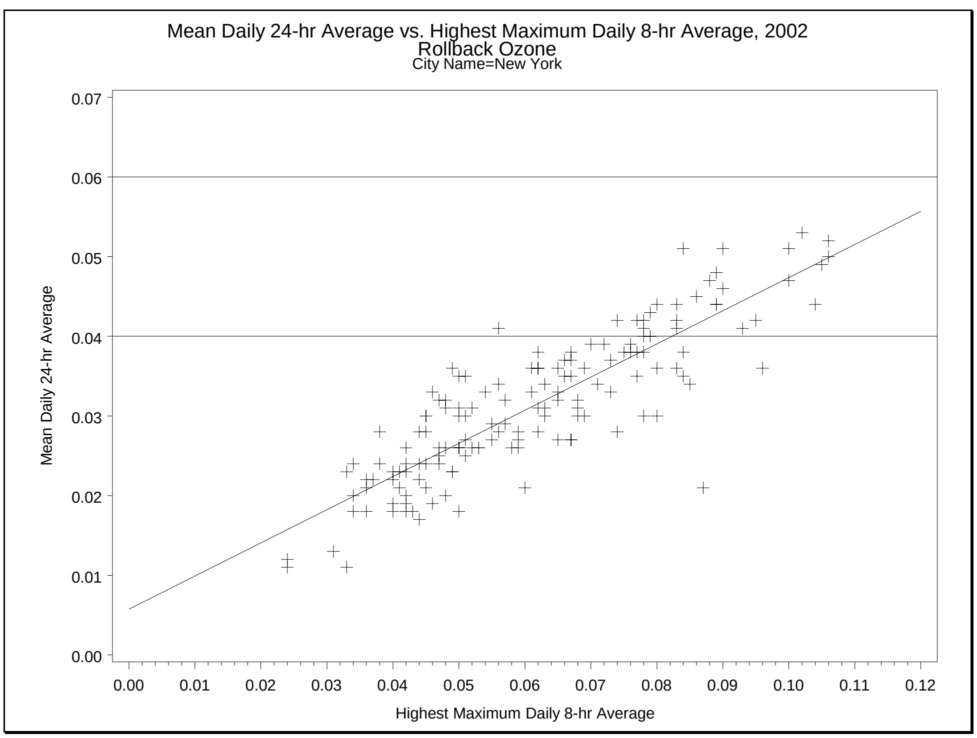
Highest Maximum Daily 8-hr Average


Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2002
Rollback Ozone
City Name=New York
Mean Daily 24-hr Average
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0.06
0.05
0.04
0.03
0.02
0.01
0.00
0.00
0.01
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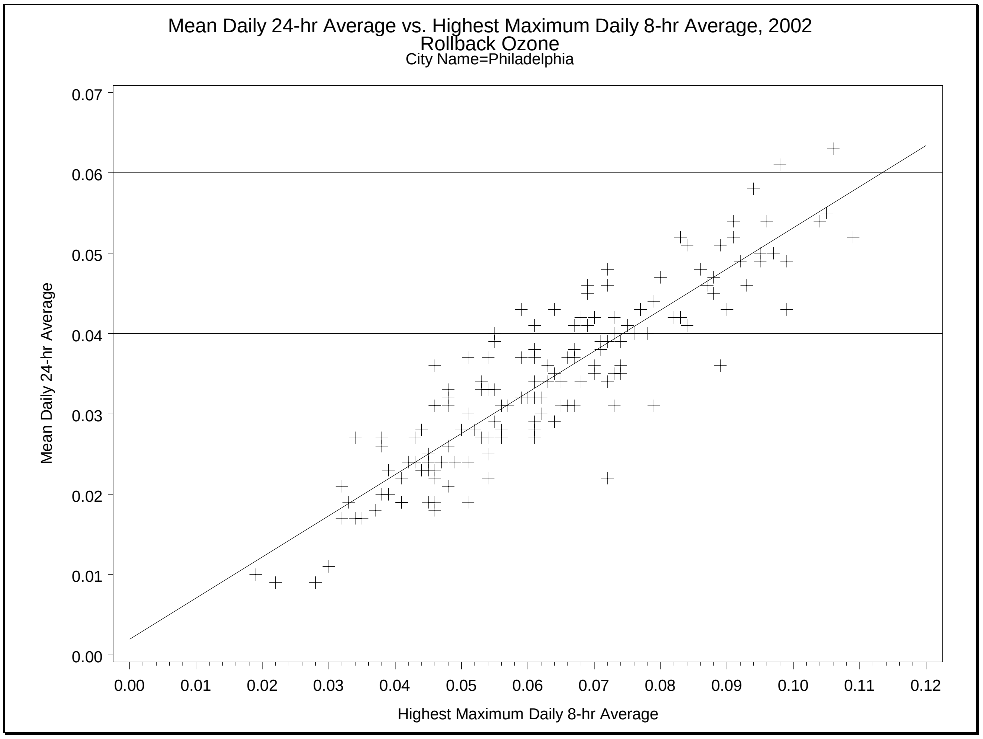
0.11
0.12
Highest Maximum Daily 8-hr Average


Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2002
Rollback Ozone
City Name=Philadelphia
Mean Daily 24-hr Average
Highest Maximum Daily 8-hr Average
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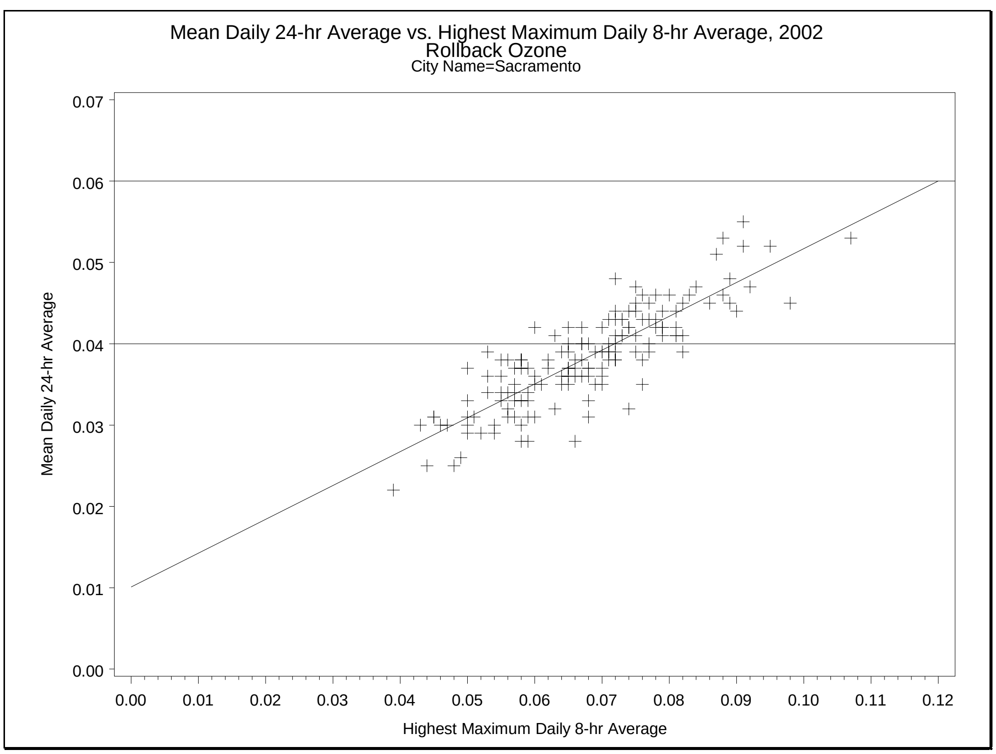
Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2002
Rollback Ozone
City Name=Sacramento
Mean Daily 24-hr Average
Highest Maximum Daily 8-hr Average
0.00
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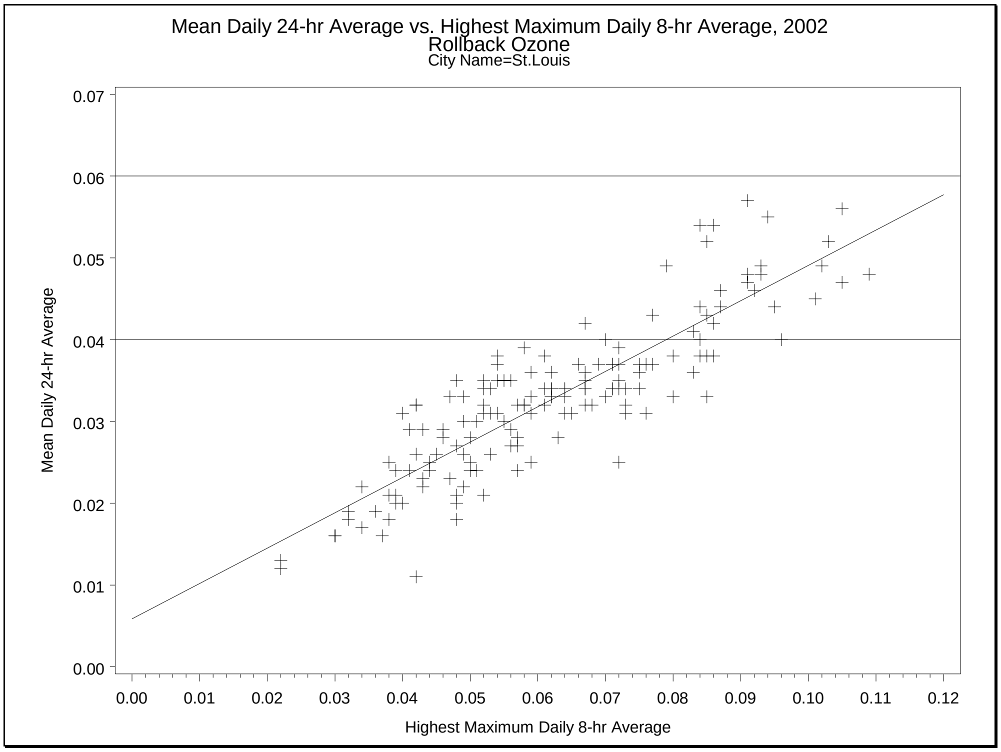

Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2002
Rollback Ozone
City Name=St.Louis
Mean Daily 24-hr Average
Highest Maximum Daily 8-hr Average
0.00
0.01
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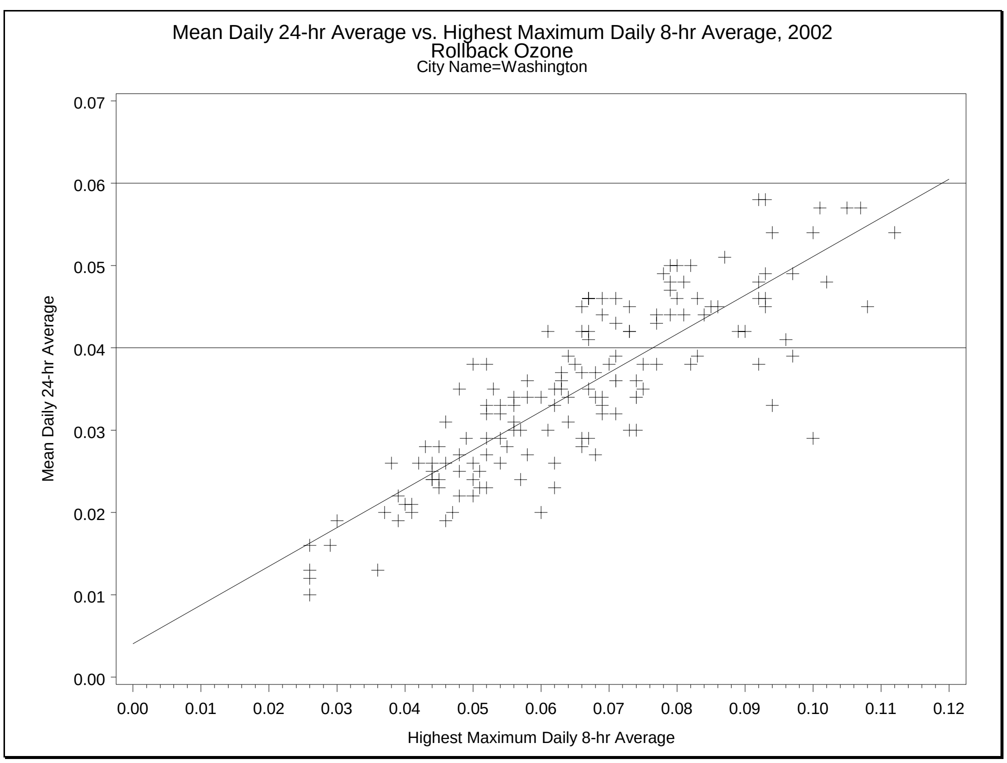

Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2002
Rollback Ozone
City Name=Washington
Mean Daily 24-hr Average
Highest Maximum Daily 8-hr Average
0.00
0.01
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0.03
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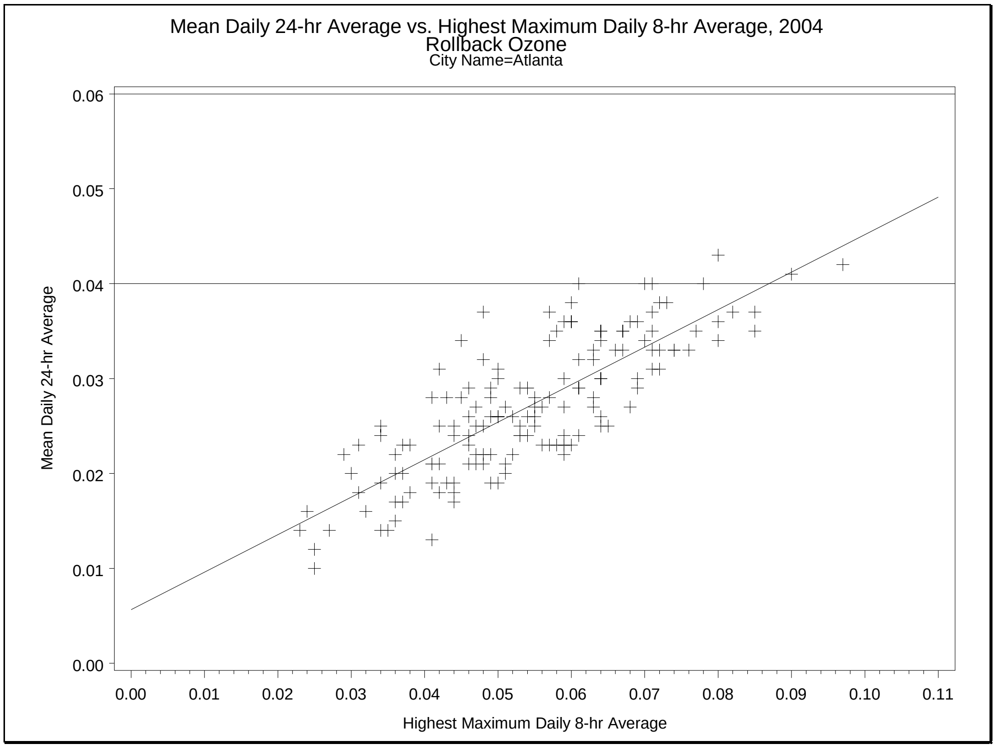
0.05
0.06
0.07
0.08
0.09
0.10
0.11
0.12


Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2004
Rollback Ozone
City Name=Atlanta
Mean Daily 24-hr Average
0.00
0.01
0.02
0.03
0.04
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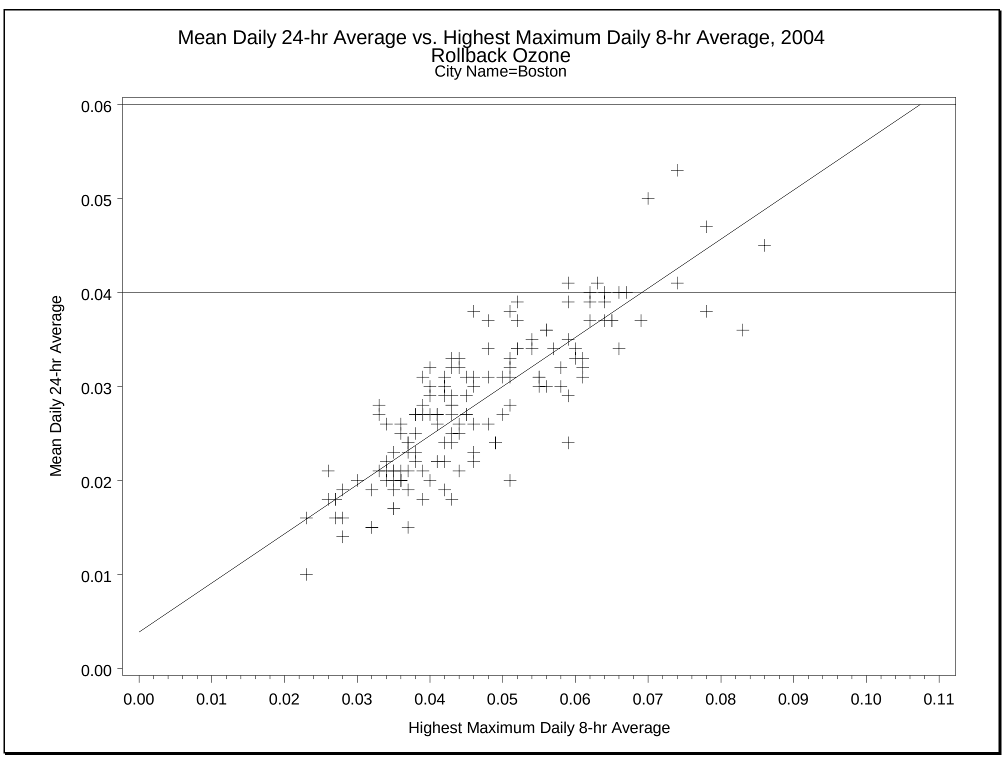
0.00 0.01 0.02 0.03 0.04 0.05 0.06 0.07 0.08 0.09 0.10 0.11
Highest Maximum Daily 8-hr Average


Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2004
Rollback Ozone
City Name=Boston
Mean Daily 24-hr Average
0.00
0.01
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0.04
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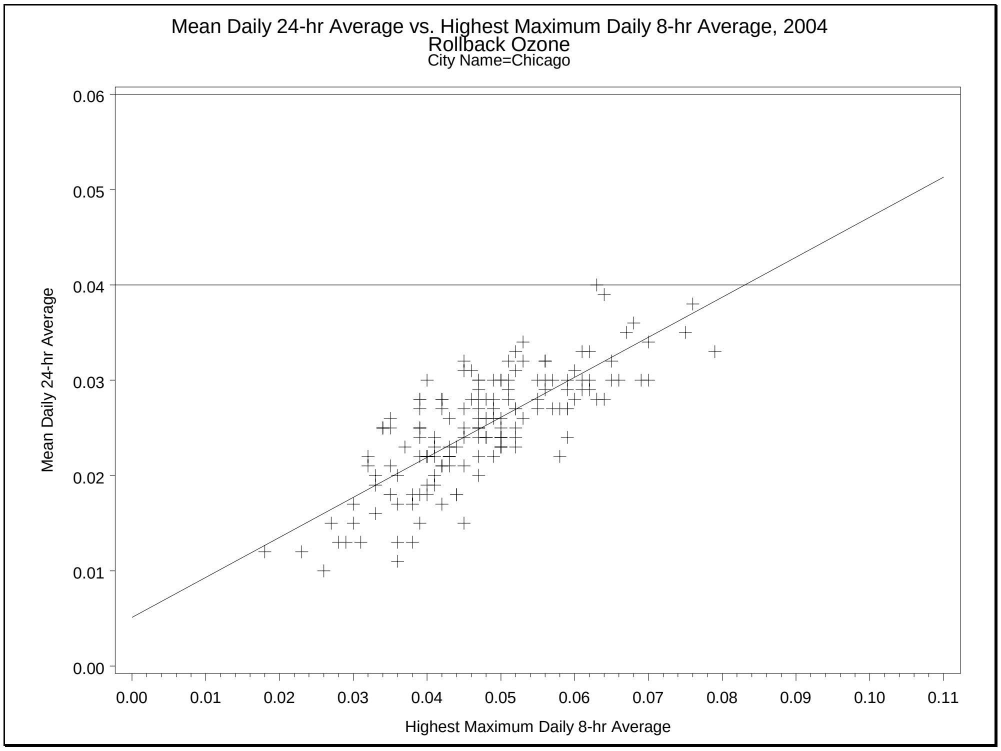
0.00 0.01 0.02 0.03 0.04 0.05 0.06 0.07 0.08 0.09 0.10 0.11
Highest Maximum Daily 8-hr Average


Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2004
Rollback Ozone
City Name=Chicago
Mean Daily 24-hr Average
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0.01
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0.06
0.00
0.01
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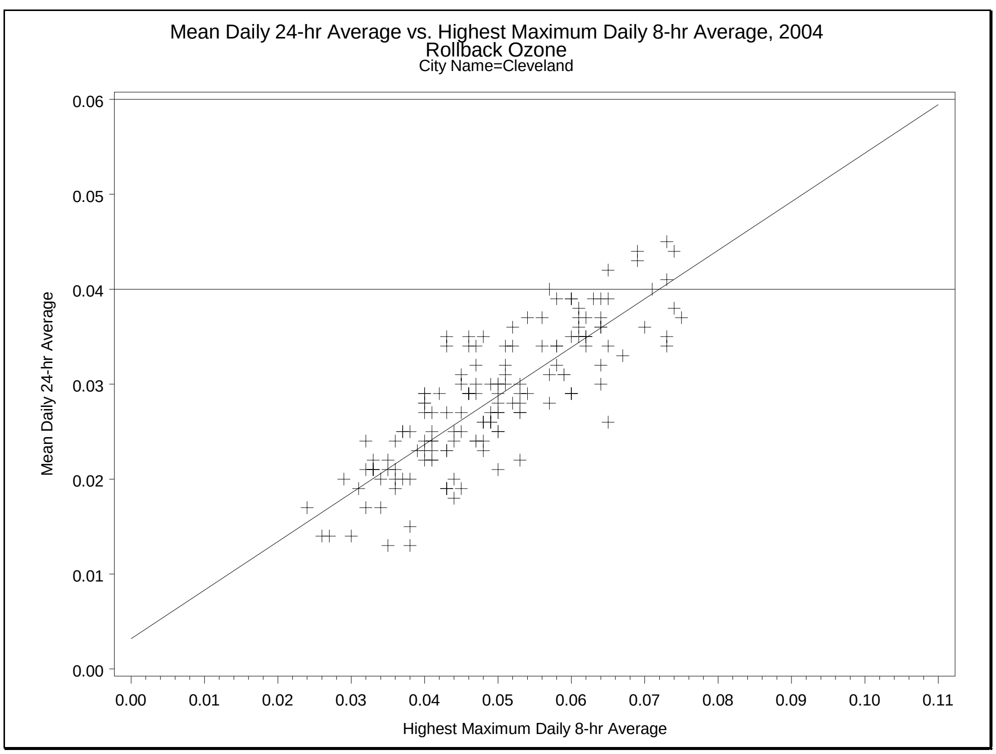
0.11
Highest Maximum Daily 8-hr Average


Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2004
Rollback Ozone
City Name=Cleveland
Mean Daily 24-hr Average
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0.01
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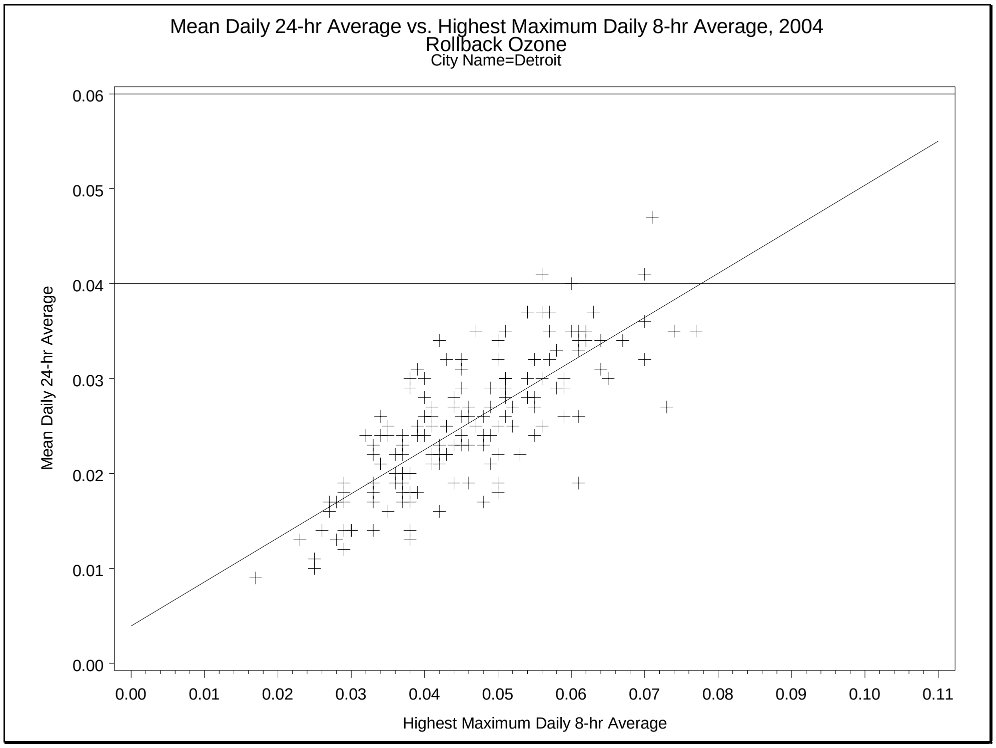
0.11
Highest Maximum Daily 8-hr Average


Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2004
Rollback Ozone
City Name=Detroit
Mean Daily 24-hr Average
0.06
0.05
0.04
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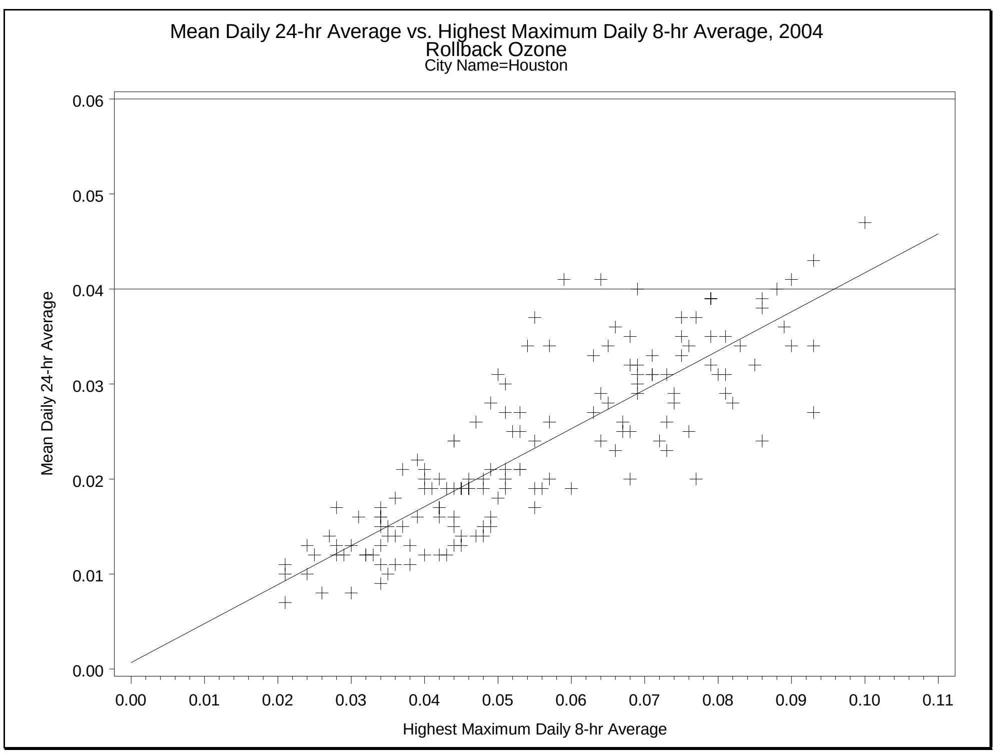
0.11
Highest Maximum Daily 8-hr Average


Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2004
Rollback Ozone
City Name=Houston
Mean Daily 24-hr Average
0.06
0.05
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0.03
0.02
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0.00
0.01
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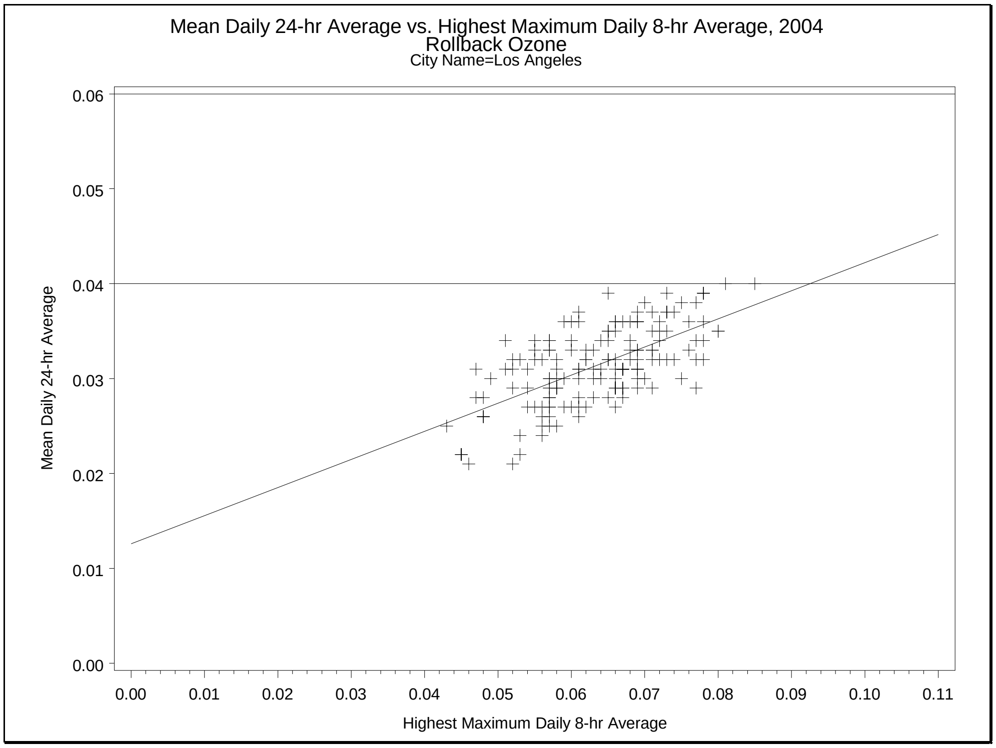
0.11
Highest Maximum Daily 8-hr Average


Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2004
Rollback Ozone
City Name=Los Angeles
Mean Daily 24-hr Average
0.00
0.01
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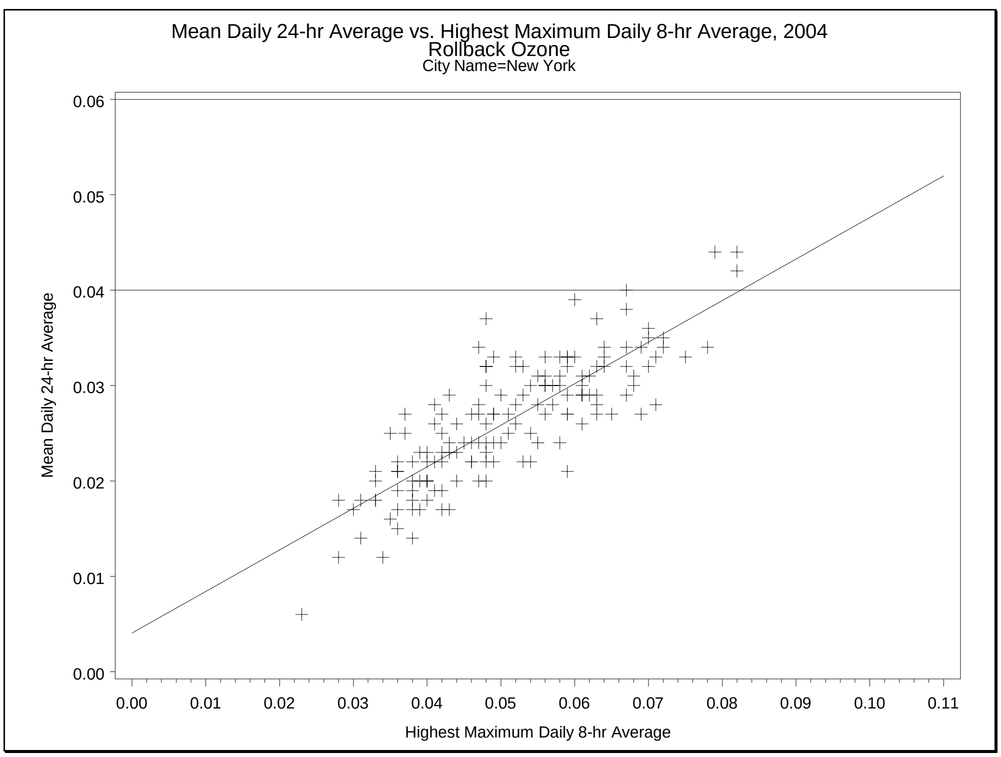
0.00 0.01 0.02 0.03 0.04 0.05 0.06 0.07 0.08 0.09 0.10 0.11
Highest Maximum Daily 8-hr Average


Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2004
Rollback Ozone
City Name=New York
Mean Daily 24-hr Average
0.00
0.01
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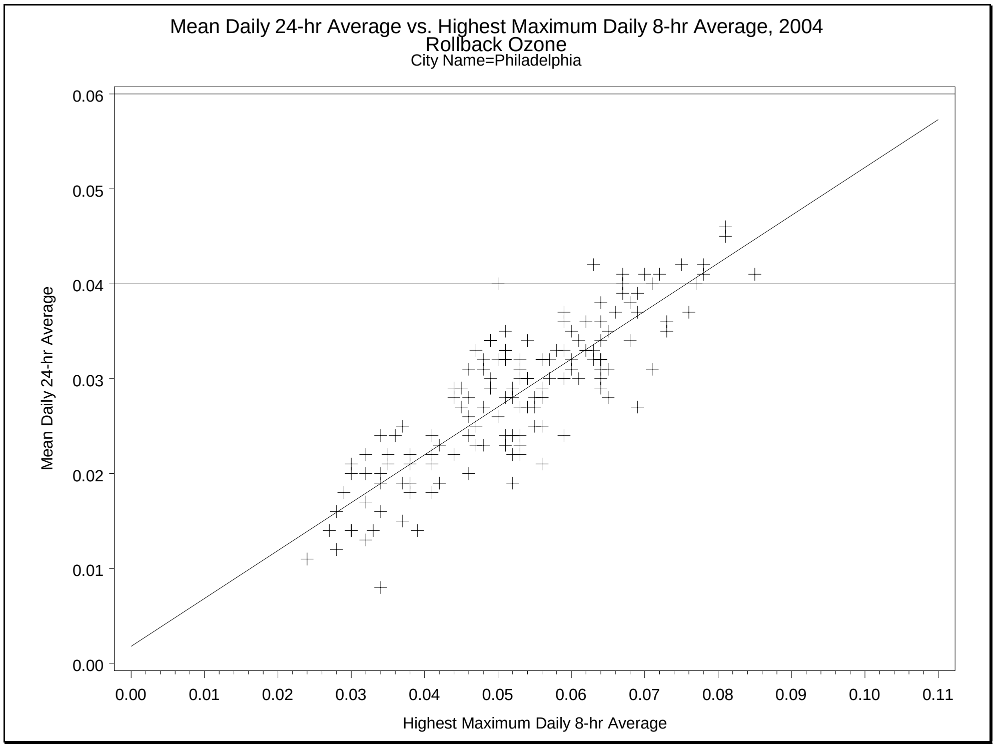
0.00 0.01 0.02 0.03 0.04 0.05 0.06 0.07 0.08 0.09 0.10 0.11
Highest Maximum Daily 8-hr Average


Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2004
Rollback Ozone
City Name=Philadelphia
Mean Daily 24-hr Average
0.00
0.01
0.02
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Highest Maximum Daily 8-hr Average
0.00
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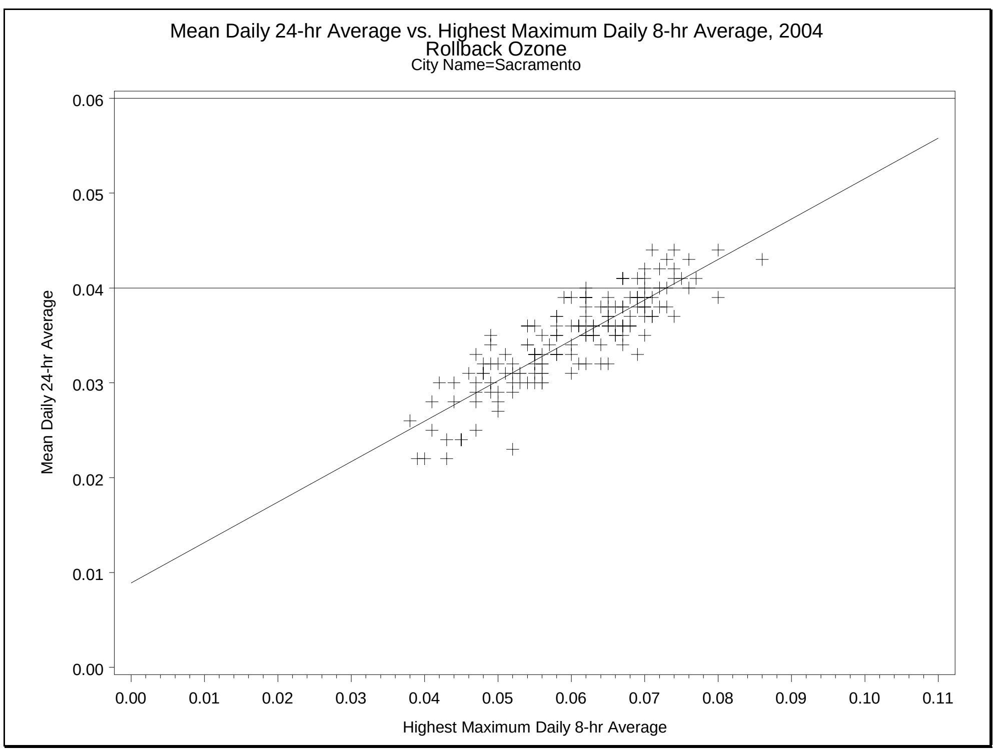
Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2004
Rollback Ozone
City Name=Sacramento
Mean Daily 24-hr Average
0.00
0.01
0.02
0.03
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Highest Maximum Daily 8-hr Average
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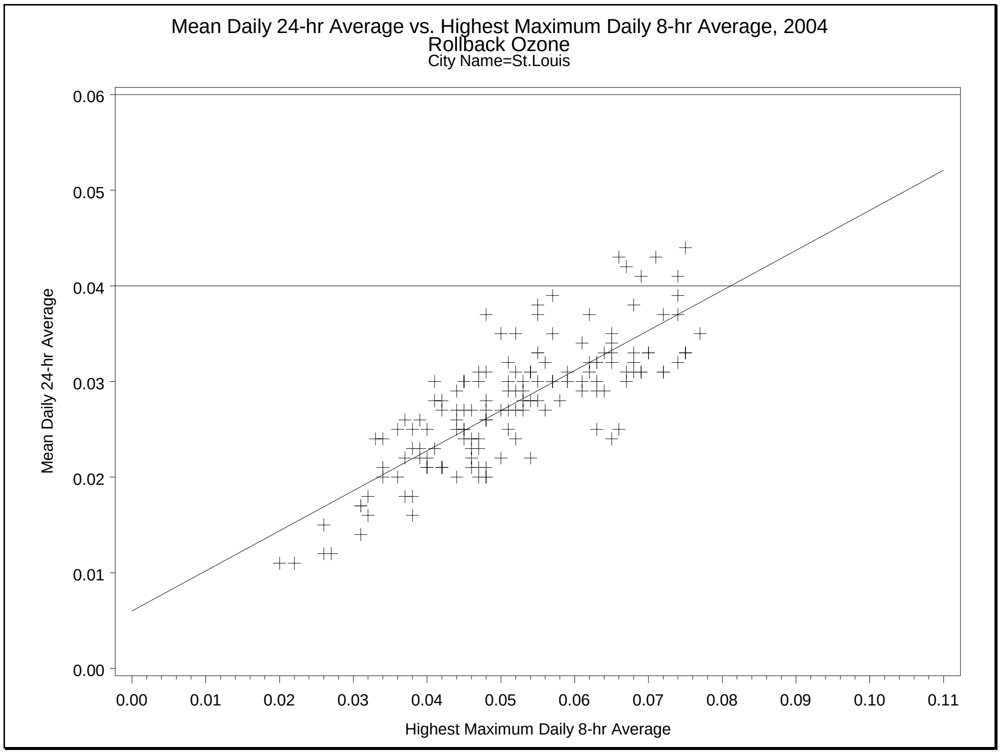
Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2004
Rollback Ozone
City Name=St.Louis
Mean Daily 24-hr Average
Highest Maximum Daily 8-hr Average
0.00
0.01
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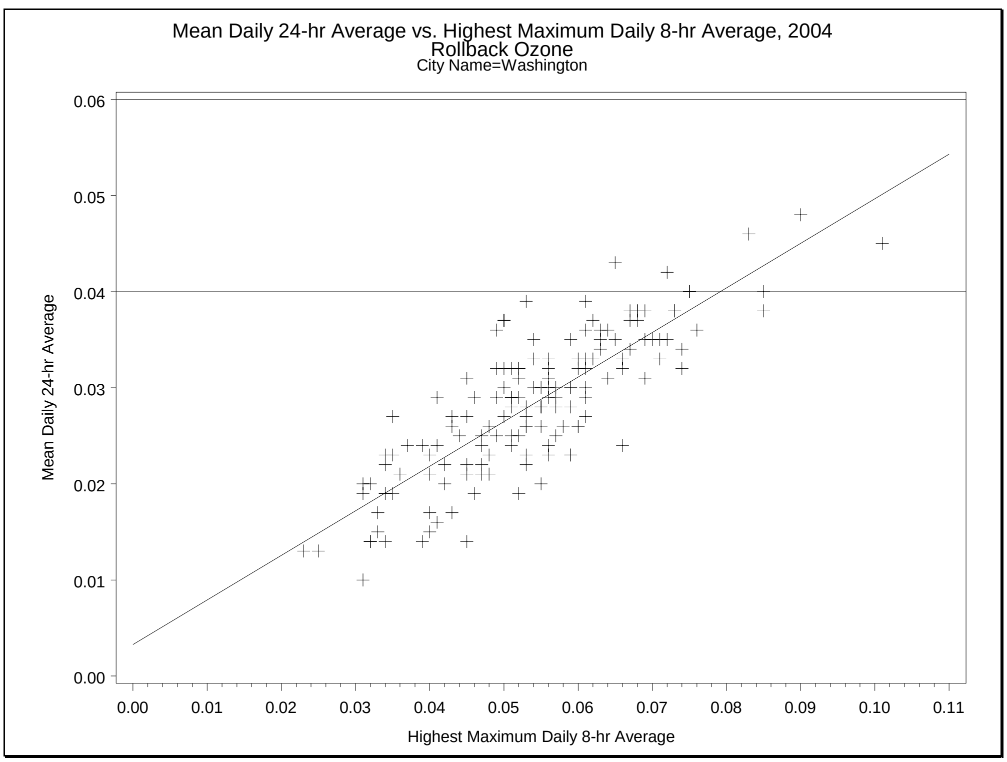
0.00 0.01 0.02 0.03 0.04 0.05 0.06 0.07 0.08 0.09 0.10 0.11


Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2004
Rollback Ozone
City Name=Washington
Mean Daily 24-hr Average
Highest Maximum Daily 8-hr Average
0.00
0.01
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0.00 0.01 0.02 0.03 0.04 0.05 0.06 0.07 0.08 0.09 0.10 0.11

5B.1 Tables of Study-Specific Information

Table 5B-1. Study-Specific Information for O_3 Studies in Atlanta, GA

Study	Health Effects*	ICD-9 Codes	Ages	Lag	Exposure Metric	Model	Other Pollutants in Model	Observed Concentrations** (ppb)		O_3 Coefficient	Lower Bound	Upper Bound
								min.	max.			
Bell et al. (2004)	Mortality, non-accidental	< 800	all	distributed lag	24 hr avg.	log-linear	none	0	71	0.00020	-0.00084	0.00123
Bell et al. -- 95 US Cities (2004)	Mortality, non-accidental	< 800	all	distributed lag	24 hr avg.	log-linear	none	NA	NA	0.00039	0.00013	0.00065
Huang et al. (2004)	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	none	0	71	0.00120	-0.00039	0.00279
Huang et al. -- 19 US Cities (2004)	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	none	NA	NA	0.00124	0.00047	0.00201
Huang et al. -- 19 US Cities (2004)	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	PM10	NA	NA	0.00074	-0.00033	0.00171
Huang et al. -- 19 US Cities (2004)	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	NO2	NA	NA	0.00060	0.00011	0.00109
Huang et al. -- 19 US Cities (2004)	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	SO2	NA	NA	0.00051	0.00001	0.00102
Huang et al. -- 19 US Cities (2004)	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	CO	NA	NA	0.00069	0.00020	0.00117

*Health effects are associated with short-term exposures to O_3.
**Rounded to the nearest ppb.
NA denotes "not available."

Table 5B-2. Study-Specific Information for O_3 Studies in Boston, MA

Study	Health Effects*	ICD-9 Codes	Ages	Lag	Exposure Metric	Model	Other Pollutants in Model	Observed Concentrations** (ppb)		O_3 Coefficient	Lower Bound	Upper Bound
								min.	max.			
Bell et al. -- 95 US Cities (2004)	Mortality, non-accidental	< 800	all	distributed lag	24 hr avg.	log-linear	none	-3	86	0.00028	-0.00079	0.00136
Gent et al. (2003)	Respiratory symptoms -- chest tightness	---	0 - 12	1-day lag	1 hr max.	logistic	none	27	126	0.00462	0.00000	0.00784
Gent et al. (2003)	Respiratory symptoms -- chest tightness	---	0 - 12	0-day lag	1 hr max.	logistic	PM2.5	27	126	0.00771	0.00331	0.01220
Gent et al. (2003)	Respiratory symptoms -- chest tightness	---	0 - 12	1-day lag	1 hr max.	logistic	PM2.5	27	126	0.00701	0.00262	0.01153
Gent et al. (2003)	Respiratory symptoms -- chest tightness	---	0 - 12	1-day lag	8 hr max.	logistic	none	21	100	0.00570	0.00172	0.00965
Gent et al. (2003)	Respiratory symptoms -- shortness of breath	---	0 - 12	1-day lag	1 hr max.	logistic	none	27	126	0.00398	0.00040	0.00743
Gent et al. (2003)	Respiratory symptoms -- shortness of breath	---	0 - 12	1-day lag	8 hr max.	logistic	none	21	100	0.00525	0.00098	0.00952
Gent et al. (2003)	Respiratory symptoms -- wheeze	---	0 - 12	0-day lag	1 hr max.	logistic	PM2.5	21	100	0.00600	0.00209	0.01002

*Health effects are associated with short-term exposures to O_3.
**Rounded to the nearest ppb.

Table 5B-3. Study-Specific Information for O_3 Studies in Chicago, IL

Study	Health Effects*	ICD-9 Codes	Ages	Lag	Exposure Metric	Model	Other Pollutants in Model	Observed Concentrations** (ppb) min.	Observed Concentrations** (ppb) max.	O_3 Coefficient	Lower Bound	Upper Bound
Bell et al. -- 95 US Cities (2004)	Mortality, non-accidental	< 800	all	distributed lag	24 hr avg.	log-linear	none	NA	NA	0.00039	0.00013	0.00065
Schwartz (2004)	Mortality, non-accidental	< 800	all	0-day lag	1 hr max.	logistic	none	NA	NA	0.00099	0.00031	0.00166
Schwartz -- 14 US Cities (2004)	Mortality, non-accidental	< 800	all	0-day lag	1 hr max.	logistic	none	NA	NA	0.00037	0.00012	0.00062
Huang et al. (2004)	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	none	0	65	0.00075	-0.00067	0.00218
Huang et al. -- 19 US Cities (2004)	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	none	NA	NA	0.00124	0.00047	0.00201
Huang et al. -- 19 US Cities (2004)	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	PM10	NA	NA	0.00074	-0.00033	0.00171
Huang et al. -- 19 US Cities (2004)	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	NO2	NA	NA	0.00060	0.00011	0.00109
Huang et al. -- 19 US Cities (2004)	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	SO2	NA	NA	0.00051	0.00001	0.00102
Huang et al. -- 19 US Cities (2004)	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	CO	NA	NA	0.00069	0.00020	0.00117

*Health effects are associated with short-term exposures to O_3.

**Rounded to the nearest ppb.

NA denotes "not available."

Table 5B-4. Study-Specific Information for O_3 Studies in Cleveland, OH

Study	Health Effects*	ICD-9 Codes	Ages	Lag	Exposure Metric	Model	Other Pollutants in Model	Observed Concentrations** (ppb) min.	Observed Concentrations** (ppb) max.	O_3 Coefficient	Lower Bound	Upper Bound
Bell et al. (2004)	Mortality, non-accidental	< 800	all	distributed lag	24 hr avg.	log-linear	none	2	75	0.00061	-0.00038	0.00161
Bell et al. -- 95 US Cities (2004)	Mortality, non-accidental	< 800	all	distributed lag	24 hr avg.	log-linear	none	NA	NA	0.00039	0.00013	0.00065
Huang et al. (2004)	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	none	2	75	0.00148	-0.00004	0.00299
Huang et al. -- 19 US Cities (2004)	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	none	NA	NA	0.00124	0.00047	0.00201
Huang et al. -- 19 US Cities (2004)	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	PM10	NA	NA	0.00074	-0.00033	0.00171
Huang et al. -- 19 US Cities (2004)	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	NO2	NA	NA	0.00060	0.00011	0.00109
Huang et al. -- 19 US Cities (2004)	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	SO2	NA	NA	0.00051	0.00001	0.00102
Huang et al. -- 19 US Cities (2004)	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	CO	NA	NA	0.00069	0.00020	0.00117
Schwartz et al. (1996)	Hospital admissions, respiratory illness	460-519	65+	avg of 1-day and 2-day lags	1 hr max.	log-linear	none	NA	NA	0.00169	0.00039	0.00291

*Health effects are associated with short-term exposures to O_3.

**Rounded to the nearest ppb.

NA denotes "not available."

Table 5B-5. Study-Specific Information for O_3 Studies in Detroit, MI

Study	Health Effects*	ICD-9 Codes	Ages	Lag	Exposure Metric	Model	Other Pollutants in Model	Observed Concentrations** (ppb) min.	Observed Concentrations** (ppb) max.	O_3 Coefficient	Lower Bound	Upper Bound
Bell et al. (2004)	Mortality, non-accidental	< 800	all	distributed lag	24 hr avg.	log-linear	none	2	75	0.00076	-0.00024	0.00177
Bell et al. -- 95 US Cities	Mortality, non-accidental	< 800	all	distributed lag	24 hr avg.	log-linear	none	NA	NA	0.00039	0.00013	0.00065
Schwartz (2004)	Mortality, non-accidental	< 800	all	0-day lag	1 hr max.	logistic	none	NA	NA	0.00068	-0.00011	0.00148
Schwartz -- 14 US Cities (2004)	Mortality, non-accidental	< 800	all	0-day lag	1 hr max.	logistic	none	NA	NA	0.00037	0.00012	0.00062
Ito (2003)	Mortality, non-accidental	< 800	all	0-day lag	24 hr avg.	log-linear (GAM str.	none	NA	55	0.00093	-0.00085	0.00271
Ito (2003)	Mortality, respiratory	460-519	all	0-day lag	24 hr avg.	log-linear	none	NA	55	0.00359	-0.00276	0.00993
Huang et al. (2004)	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	none	2	75	0.00135	-0.00015	0.00286
Huang et al. -- 19 US Cities (2004)	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	none	NA	NA	0.00124	0.00047	0.00201
Huang et al. -- 19 US Cities (2004)	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	PM10	NA	NA	0.00074	-0.00033	0.00171
Huang et al. -- 19 US Cities (2004)	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	NO2	NA	NA	0.00060	0.00011	0.00109
Huang et al. -- 19 US Cities (2004)	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	SO2	NA	NA	0.00051	0.00001	0.00102
Huang et al. -- 19 US Cities (2004)	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	CO	NA	NA	0.00069	0.00020	0.00117
Ito (2003)	Hospital admissions (unscheduled), pneumonia	480-486	65+	0-day lag	24 hr avg.	log-linear (GAM str. estimation)**	none	NA	55	-0.00218	-0.00621	0.00186
Ito (2003)	Hospital admissions (unscheduled), pneumonia	480-486	65+	1-day lag	24 hr avg.	log-linear (GAM str. estimation)	none	NA	55	-0.00054	-0.00459	0.00352
Ito (2003)	Hospital admissions (unscheduled), pneumonia	480-486	65+	2-day lag	24 hr avg.	log-linear (GAM str. estimation)	none	NA	55	0.00066	-0.00342	0.00473
Ito (2003)	Hospital admissions (unscheduled), pneumonia	480-486	65+	3-day lag	24 hr avg.	log-linear (GAM str. estimation)	none	NA	55	0.00190	-0.00216	0.00595
Ito (2003)	Hospital admissions (unscheduled), COPD	490-496	65+	0-day lag	24 hr avg.	log-linear (GAM str. estimation)	none	NA	55	-0.00191	-0.00667	0.00286
Ito (2003)	Hospital admissions (unscheduled), COPD	490-496	65+	1-day lag	24 hr avg.	log-linear (GAM str. estimation)	none	NA	55	0.00187	-0.00293	0.00667
Ito (2003)	Hospital admissions (unscheduled), COPD	490-496	65+	2-day lag	24 hr avg.	log-linear (GAM str. estimation)	none	NA	55	-0.00027	-0.00513	0.00459
Ito (2003)	Hospital admissions (unscheduled), COPD	490-496	65+	3-day lag	24 hr avg.	log-linear (GAM str. estimation)	none	NA	55	0.00011	-0.00475	0.00497

*Health effects are associated with short-term exposures to O_3.

**Rounded to the nearest ppb.

***"GAM str. estimation" denotes that estimation of the log-linear C-R function used a generalized additive model with a stringent convergence criterion. This study also estimated log-linear C-R functions using generalized linear models (GLM).

NA denotes "not available."

Table 5B-6. Study-Specific Information for O_3 Studies in Houston, TX

Study	Health Effects*	ICD-9 Codes	Ages	Lag	Exposure Metric	Model	Other Pollutants in Model	Observed Concentrations** (ppb) min.	Observed Concentrations** (ppb) max.	O_3 Coefficient	Lower Bound	Upper Bound
Bell et al. (2004)	Mortality, non-accidental	< 800	all	distributed lag	24 hr avg.	log-linear	none	1	76	0.00079	0.00005	0.00154
Bell et al. -- 95 US Cities	Mortality, non-accidental	< 800	all	distributed lag	24 hr avg.	log-linear	none	NA	NA	0.00039	0.00013	0.00065
Schwartz (2004)	Mortality, non-accidental	< 800	all	0-day lag	1 hr max.	logistic	none	NA	NA	0.00044	0.00004	0.00084
Schwartz -- 14 US Cities (2004)	Mortality, non-accidental	< 800	all	0-day lag	1 hr max.	logistic	none	NA	NA	0.00037	0.00012	0.00062
Huang et al. (2004)	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	none	1	76	0.00122	-0.00016	0.00261
Huang et al. -- 19 US Cities (2004)	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	none	NA	NA	0.00124	0.00047	0.00201
Huang et al. -- 19 US Cities (2004)	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	PM10	NA	NA	0.00074	-0.00033	0.00171
Huang et al. -- 19 US Cities (2004)	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	NO2	NA	NA	0.00060	0.00011	0.00109
Huang et al. -- 19 US Cities (2004)	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	SO2	NA	NA	0.00051	0.00001	0.00102
Huang et al. -- 19 US Cities (2004)	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	CO	NA	NA	0.00069	0.00020	0.00117

*Health effects are associated with short-term exposures to O_3.
**Rounded to the nearest ppb.
NA denotes "not available."

Table 5B-7. Study-Specific Information for O_3 Studies in Los Angeles, CA

Study	Health Effects*	ICD-9 Codes	Ages	Lag	Exposure Metric	Model	Other Pollutants in Model	Observed Concentrations** (ppb)		O_3 Coefficient	Lower Bound	Upper Bound
								min.	max.			
Bell et al. (2004)***	Mortality, non-accidental	< 800	all	distributed lag	24 hr avg.	log-linear	none	0	68	0.00018	-0.00043	0.00079
Bell et al. -- 95 US Cities (2004)***	Mortality, non-accidental	< 800	all	distributed lag	24 hr avg.	log-linear	none	NA	NA	0.00039	0.00013	0.00065
Huang et al. (2004)***	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	none	0	68	0.00107	0.00001	0.00213
Huang et al. -- 19 US Cities (2004)***	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	none	NA	NA	0.00124	0.00047	0.00201
Huang et al. -- 19 US Cities (2004)***	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	PM10	NA	NA	0.00074	-0.00033	0.00171
Huang et al. -- 19 US Cities (2004)***	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	NO2	NA	NA	0.00060	0.00011	0.00109
Huang et al. -- 19 US Cities (2004)***	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	SO2	NA	NA	0.00051	0.00001	0.00102
Huang et al. -- 19 US Cities (2004)***	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	CO	NA	NA	0.00069	0.00020	0.00117
Linn et al. (2000)****	Hospital admissions (unscheduled), pulmonary illness --	75-101*****	30+	0-day lag	24 hr avg.	log-linear	none	1	70	0.00110	-0.00047	0.00267
Linn et al. (2000)****	Hospital admissions (unscheduled), pulmonary illness --	75-101*****	30+	0-day lag	24 hr avg.	log-linear	none	1	70	0.00060	-0.00077	0.00197

*Health effects are associated with short-term exposures to O_3.
**Rounded to the nearest ppb.
***Los Angeles is defined in this study as Los Angeles County.
****Los Angeles is defined in this study as Los Angeles, Riverside, San Bernardino, and Orange Counties.
*****Linn et al. (2000) used DRG codes instead of ICD codes.

Table 5B-8. Study-Specific Information for O_3 Studies in New York, NY

Study	Health Effects*	ICD-9 Codes	Ages	Lag	Exposure Metric	Model	Other Pollutants in Model	Observed Concentrations** (ppb)		O_3 Coefficient	Lower Bound	Upper Bound
								min.	max.			
Bell et al. -- 95 US Cities (2004)***	Mortality, non-accidental	< 800	all	distributed lag	24 hr avg.	log-linear	none	NA	NA	0.00039	0.00013	0.00065
Huang et al. (2004)***	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	none	-2	81	0.00170	0.00054	0.00286
Huang et al. -- 19 US Cities (2004)***	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	none	NA	NA	0.00124	0.00047	0.00201
Huang et al. -- 19 US Cities (2004)***	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	PM10	NA	NA	0.00074	-0.00033	0.00171
Huang et al. -- 19 US Cities (2004)***	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	NO2	NA	NA	0.00060	0.00011	0.00109
Huang et al. -- 19 US Cities (2004)***	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	SO2	NA	NA	0.00051	0.00001	0.00102
Huang et al. -- 19 US Cities (2004)***	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	CO	NA	NA	0.00069	0.00020	0.00117
Thurston et al. (1992)****	Hospital admissions (unscheduled),	466, 480-486, 490, 491, 492, 493	all	3-day lag	1 hr max.	linear	none	NA	206	1.370E-08	3.312E-09	2.409E-08
Thurston et al. (1992)****	Hospital admissions (unscheduled), asthma	493	all	1-day lag	1 hr max.	linear	none	NA	206	1.170E-08	2.488E-09	2.091E-08

*Health effects are associated with short-term exposures to O_3.

**Rounded to the nearest ppb.

***New York in this study is defined as the five boroughs of New York City plus Westchester County.

****New York in this study is defined as the five boroughs of New York City.

NA denotes "not available."

Table 5B-9. Study-Specific Information for O_3 Studies in Philadelphia, PA

Study	Health Effects*	ICD-9 Codes	Ages	Lag	Exposure Metric	Model	Other Pollutants in Model	Observed Concentrations** (ppb)		O_3 Coefficient	Lower Bound	Upper Bound
								min.	max.			
Bell et al. -- 95 US Cities (2004)	Mortality, non-accidental	< 800	all	distributed lag	24 hr avg.	log-linear	none	NA	NA	0.00039	0.00013	0.00065
Moolgavkar et al. (1995)	Mortality, non-accidental	< 800	all	1-day lag	24 hr avg.	log-linear	none	1	159	0.00140	0.00086	0.00191
Moolgavkar et al. (1995)	Mortality, non-accidental	< 800	all	1-day lag	24 hr avg.	log-linear	TSP, SO2	1	159	0.00139	0.00066	0.00212
Huang et al. (2004)	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	none	-3	84	0.00151	0.00007	0.00296
Huang et al. -- 19 US Cities (2004)	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	none	NA	NA	0.00124	0.00047	0.00201
Huang et al. -- 19 US Cities (2004)	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	PM10	NA	NA	0.00074	-0.00033	0.00171
Huang et al. -- 19 US Cities (2004)	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	NO2	NA	NA	0.00060	0.00011	0.00109
Huang et al. -- 19 US Cities (2004)	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	SO2	NA	NA	0.00051	0.00001	0.00102
Huang et al. -- 19 US Cities (2004)	Mortality, cardiorespiratory	390-448; 490-496; 487; 480-486; 507.	all	distributed lag	24 hr avg.	log-linear	CO	NA	NA	0.00069	0.00020	0.00117

*Health effects are associated with short-term exposures to O_3.

**Rounded to the nearest ppb.

NA denotes "not available."

Table 5B-10. Study-Specific Information for O_3 Studies in Sacramento, CA

Study	Health Effects*	ICD-9 Codes	Ages	Lag	Exposure Metric	Model	Other Pollutants in Model	Observed Concentrations** (ppb)		O_3 Coefficient	Lower Bound	Upper Bound
								min.	max.			
Bell et al. (2004)	Mortality, non-accidental	< 800	all	distributed lag	24 hr avg.	log-linear	none	0	71	0.00026	-0.00079	0.00131
Bell et al. -- 95 US Cities (2004)	Mortality, non-accidental	< 800	all	distributed lag	24 hr avg.	log-linear	none	NA	NA	0.00039	0.00013	0.00065

*Health effects are associated with short-term exposures to O_3.
**Rounded to the nearest ppb.
NA denotes "not available."

Table 5B-11. Study-Specific Information for O_3 Studies in St. Louis, MO

Study	Health Effects*	ICD-9 Codes	Ages	Lag	Exposure Metric	Model	Other Pollutants in Model	Observed Concentrations** (ppb)		O_3 Coefficient	Lower Bound	Upper Bound
								min.	max.			
Bell et al. (2004)	Mortality, non-accidental	< 800	all	distributed lag	24 hr avg.	log-linear	none	0	118	0.00044	-0.00072	0.00159
Bell et al. -- 95 US Cities (2004)	Mortality, non-accidental	< 800	all	distributed lag	24 hr avg.	log-linear	none	NA	NA	0.00039	0.00013	0.00065

*Health effects are associated with short-term exposures to O_3.
**Rounded to the nearest ppb.
NA denotes "not available."

Table 5B-12. Study-Specific Information for O_3 Studies in Washington, D.C.

Study	Health Effects*	ICD-9 Codes	Ages	Lag	Exposure Metric	Model	Other Pollutants in Model	Observed Concentrations** (ppb)		O_3 Coefficient	Lower Bound	Upper Bound
								min.	max.			
Bell et al. -- 95 US Cities (2004)	Mortality, non-accidental	< 800	all	distributed lag	24 hr avg.	log-linear	none	NA	NA	0.00039	0.00013	0.00065

*Health effects are associated with short-term exposures to O_3.
**Rounded to the nearest ppb.
NA denotes "not available."

5B.2 Concentration-Response Functions and Health Impact Functions

Notation:

y_0 = *Incidence under baseline conditions*
y_c = *Incidence under control conditions*
$\Delta y = y_0 - y_c$
$x_0 = O_3$ *levels under baseline conditions*
$x_c = O_3$ *levels under control conditions*
$\Delta x = x_0 - x_c$

5B.2.1 Log-linear

The log-linear concentration-response function is: $y = Be^{\beta x}$

The derivation of the corresponding health impact function is as follows:

$$y = Be^{\beta x}$$

$$y_0 = Be^{\beta x_0}$$

$$y_c = Be^{\beta x_c}$$

$$\Delta y = Be^{\beta x_0} - Be^{\beta x_c}$$

$$\Delta y = Be^{\beta x_0} \cdot \left(1 - \frac{Be^{\beta x_c}}{Be^{\beta x_0}}\right)$$

$$\Delta y = Be^{\beta x_0} \cdot \left(1 - e^{\beta \cdot (x_c - x_0)}\right)$$

$$\Delta y = Be^{\beta x_0} \cdot \left(1 - e^{-\beta \Delta x}\right)$$

$$\Delta y = y_0 \cdot \left(1 - e^{-\beta \Delta x}\right)$$

5B.2.2 Linear

The linear concentration-response function is: $y = \alpha + \beta x$

The derivation of the corresponding health impact function is as follows:

$$y = \alpha + \beta x$$
$$y_0 = \alpha + \beta x_0$$
$$y_c = \alpha + \beta x_c$$
$$\Delta y = y_0 - y_c = \beta x_0 - \beta x_c$$
$$\Delta y = \beta(x_0 - x_c) = \beta \Delta x$$

5B.2.3 Logistic

The logistic concentration-response function is: $y = \left(\frac{e^{\beta x}}{1+e^{\beta x}}\right) = \frac{1}{1+e^{-\beta x}}$

The derivation of the corresponding health impact function is as follows:

$$y = \frac{1}{1+e^{-\beta x}}$$
$$odds = \frac{y}{1-y} = \frac{\left(\frac{1}{1+e^{-\beta x}}\right)}{1-\left(\frac{1}{1+e^{-\beta x}}\right)}$$
$$odds = \frac{\left(\frac{1}{1+e^{-\beta x}}\right)}{\left(\frac{e^{-\beta x}}{1+e^{-\beta x}}\right)} = \frac{1}{e^{-\beta x}} = e^{\beta x}$$
$$odds\ ratio = \frac{e^{\beta x_0}}{e^{\beta x_c}} = e^{\beta \Delta x}$$
$$\frac{\left(\frac{y_c}{1-y_c}\right)}{\left(\frac{y_0}{1-y_0}\right)} = e^{-\beta \Delta x}$$
$$\frac{c}{1-y_c} = \left(\frac{\boldsymbol{y}_0}{1-y_0}\right) \cdot e^{-\beta \Delta x}$$

$$y_c = (1-y_c) \cdot \left(\frac{y_0}{1-y_0}\right) \cdot e^{-\beta \Delta x}$$

$$y_c + y_c \cdot \left(\frac{y_0}{1 - y_0} \right) \cdot e^{-\beta \Delta x} = \left(\frac{y_0}{1 - y_0} \right) \cdot e^{-\beta \Delta x}$$

$$y_c \cdot \left[1 + \left(\frac{y_0}{1 - y_0} \right) \cdot e^{-\beta \Delta x} \right] = \left(\frac{y_0}{1 - y_0} \right) \cdot e^{-\beta \Delta x}$$

$$y_c = \frac{\left(\frac{y_0}{1 - y_0} \right) \cdot e^{-\beta \Delta x}}{1 + \left(\frac{y_0}{1 - y_0} \right) \cdot e^{-\beta \Delta x}}$$

$$y_c = \frac{y_0 \cdot e^{-\beta \Delta x}}{1 - y_0 + y_0 \cdot e^{-\beta \Delta x}}$$

$$y_c = \frac{y_0}{(1 - y_0) \cdot e^{\beta \Delta x} + y_0}$$

$$y_0 - y_c = y_0 - \frac{y_0}{(1 - y_0) \cdot e^{\beta \Delta x} + y_0}$$

$$\Delta y = y_0 \cdot \left(1 - \frac{1}{(1 - y_0) \cdot e^{\beta \Delta x} + y_0} \right)$$

5B.3 The Calculation of "Shrinkage" Estimates from the Location-Specific Estimates Reported in Huang et al. (2004)

"Shrinkage" estimates were calculated from the location-specific estimates reported in Table 1 of Huang et al. (2004), using the method described in DuMouchel (1994). Both Huang et al. (2004) and DuMouchel (1994) consider a Bayesian hierarchical model. Although they use different notation, the models are the same. The notation comparison is given in Table B-13 below.

Given a posterior distribution for τ, π(τ | y), a shrinkage estimate for the ith location is calculated as:

$$\theta_i^* \equiv E[\theta_i \,|\, y] = \int \theta_i^*(\tau)\pi(\tau \,|\, y)d\tau$$

where $\theta_i^*(\tau) \equiv E[\theta_i \,|\, y,\tau] = \mu^*(\tau) + [y_i - \mu^*(\tau)]\tau^2/(\tau^2 + s_i^2)$,

where $\mu^*(\tau) \equiv E[\mu \,|\, y,\tau] = \sum_i w_i(\tau)y_i$,

where $w_i(\tau) = (\tau^2 + s_i^2)^{-1} / \sum_j (\tau^2 + s_j^2)^{-1}$.

A shrinkage estimate for the ith location is thus defined to be the expected value of the ith location-specific parameter, given all the location-specific estimates (see Table 1 for notation explanations). The posterior variance of the true ith location-specific parameter, given all the location-specific estimates, is given by:

$$\theta_i^{**} \equiv V[\theta_i \,|\, y] = \int \{V[\theta_i \,|\, y,\tau] + [\theta_i^*(\tau) - \theta_i^*]^2\}\pi(\tau \,|\, y)\,d\tau \,,$$

where $V[\theta_i \,|\, y,\tau] = [s_i^2/(\tau^2 + s_i^2)]^2 / \sum_j (\tau^2 + s_j^2)^{-1} + \tau^2 s_i^2/(\tau^2 + s_i^2)$.

A 95 percent credible interval around the ith shrinkage estimate was calculated as $\theta_i^* \pm 1.96 * (\sqrt{\theta_i^{**}})$.

Table 5B-13. Notation

	Huang et al. (2004)	DuMouchel (1994)
Location indicator	c	i
parameter being estimated for location c (or i)	θ^c	θ_i
Estimate of parameter for location c (or i)*	$\hat{\theta}^c$	y_i
variance in the overall distribution of true θs.	τ^2	τ^2
variance of the estimate of θ^c or (θ_i)**	v^c	s_i^2
The mean of the overall distribution of true θs	μ	μ
The model:	$\hat{\theta}^c \sim N(\theta^c, v^c)$ (1) $\theta^c \sim N(\mu, \tau^2)$ (2) $(1) \& (2) \Rightarrow \hat{\theta}^c \sim N(\mu, v^c + \tau^2)$	$y_i = \mu + \delta_i + \varepsilon_i$ (1) $\theta_i = \mu + \delta_i$ (2) $\delta_i \sim N(0, \tau^2)$ (3) $\varepsilon_i \sim N(0, s_i^2)$ (4) $(2)\ and\ (3) \Rightarrow \theta_i \sim N(\mu, \tau^2)$ $(1),(2),(3) \& (4) \Rightarrow y_i \sim N(\mu, \tau^2 + s_i^2)$

*Given in Table 1 of Huang et al. (2004)
**Estimated by taking the square of the location-specific standard error, reported in Huang et al. (2004) for each location.

APPENDIX 5C. ADDITIONAL HEALTH RISK ASSESSMENT ESTIMATES

Table 5C-1. Number of All Children (Ages 5-18) Engaged in Moderate Exertion Estimated to Experience At Least One Lung Function Response Associated with Exposure to O3 Concentrations That Just Meet the Current and Alternative Daily Maximum 8-Hour Standards, for Location-Specific O3 Seasons: Based on Adjusting 2002 O3 Concentrations*

Location	Number of All Children (in 1000s) Estimated to Experience at Least One Lung Function Response Associated with O3 Concentrations that Just Meet the Current and Alternative O3 Standards**							
	0.084/4***	0.084/3	0.080/4	0.074/5	0.074/4	0.074/3	0.070/4	0.064/4
	Response = Decrease in FEV1 Greater Than or Equal to 10%							
Atlanta	94 (71 - 133)	92 (69 - 131)	79 (58 - 117)	69 (49 - 105)	63 (44 - 98)	63 (44 - 97)	53 (35 - 84)	40 (25 - 66)
Boston	123 (95 - 167)	106 (80 - 150)	105 (79 - 148)	98 (73 - 141)	81 (58 - 121)	72 (50 - 110)	68 (46 - 104)	50 (31 - 80)
Chicago	186 (140 - 268)	172 (127 - 252)	160 (116 - 238)	141 (99 - 216)	124 (85 - 195)	116 (78 - 183)	104 (68 - 167)	77 (47 - 127)
Cleveland	73 (57 - 99)	64 (49 - 90)	63 (48 - 88)	51 (37 - 77)	49 (35 - 74)	43 (30 - 67)	41 (28 - 64)	31 (20 - 50)
Detroit	121 (92 - 169)	106 (79 - 154)	103 (76 - 151)	99 (73 - 147)	80 (56 - 124)	71 (49 - 113)	67 (45 - 107)	50 (31 - 82)
Houston	70 (50 - 106)	62 (43 - 96)	60 (41 - 92)	48 (31 - 76)	46 (30 - 73)	42 (27 - 67)	38 (24 - 61)	28 (16 - 44)
Los Angeles	120 (87 - 187)	115 (83 - 180)	99 (71 - 155)	70 (49 - 109)	70 (49 - 108)	66 (46 - 102)	52 (36 - 80)	28 (18 - 43)
New York	382 (283 - 555)	355 (259 - 524)	328 (236 - 494)	248 (166 - 392)	258 (175 - 406)	240 (160 - 382)	218 (141 - 350)	165 (99 - 270)
Philadelphia	149 (117 - 201)	134 (103 - 185)	129 (99 - 179)	106 (78 - 156)	101 (74 - 150)	92 (65 - 139)	85 (60 - 131)	65 (42 - 104)
Sacramento	27 (21 - 40)	25 (19 - 37)	23 (18 - 35)	18 (14 - 29)	17 (13 - 27)	16 (12 - 25)	14 (10 - 22)	10 (7 - 16)
St. Louis	72 (56 - 96)	65 (50 - 89)	61 (47 - 86)	52 (38 - 75)	48 (35 - 71)	44 (31 - 66)	40 (28 - 62)	30 (19 - 48)
Washington, DC	168 (129 - 231)	145 (109 - 207)	143 (108 - 205)	122 (89 - 182)	113 (80 - 171)	100 (69 - 155)	96 (65 - 150)	72 (46 - 117)
	Response = Decrease in FEV1 Greater Than or Equal to 15%							
Atlanta	36 (21 - 54)	35 (20 - 52)	29 (15 - 44)	23 (11 - 38)	21 (8 - 34)	20 (8 - 34)	16 (5 - 28)	11 (1 - 21)
Boston	52 (33 - 74)	42 (25 - 62)	42 (24 - 61)	38 (21 - 57)	29 (14 - 45)	24 (11 - 39)	22 (9 - 37)	14 (3 - 26)
Chicago	71 (41 - 106)	63 (35 - 96)	57 (29 - 88)	47 (22 - 76)	40 (15 - 66)	36 (12 - 62)	31 (9 - 55)	20 (2 - 40)
Cleveland	30 (19 - 43)	25 (15 - 37)	24 (15 - 36)	18 (10 - 28)	17 (9 - 27)	14 (6 - 23)	13 (5 - 22)	9 (2 - 16)
Detroit	47 (29 - 69)	40 (23 - 60)	38 (21 - 58)	36 (20 - 55)	27 (12 - 43)	22 (9 - 38)	21 (7 - 35)	14 (1 - 26)
Houston	24 (11 - 38)	20 (8 - 34)	19 (7 - 32)	14 (3 - 25)	13 (3 - 24)	12 (2 - 22)	10 (1 - 20)	7 (0 - 14)
Los Angeles	35 (7 - 62)	33 (6 - 59)	27 (4 - 51)	18 (1 - 35)	18 (1 - 35)	17 (1 - 33)	13 (0 - 26)	7 (0 - 14)

Location	Number of All Children (in 1000s) Estimated to Experience at Least One Lung Function Response Associated with O3 Concentrations that Just Meet the Current and Alternative O3 Standards**							
	0.084/4***	0.084/3	0.080/4	0.074/5	0.074/4	0.074/3	0.070/4	0.064/4
New York	142 (79 - 216)	128 (68 - 197)	114 (57 - 181)	76 (26 - 132)	81 (29 - 138)	73 (23 - 127)	64 (16 - 115)	43 (3 - 86)
Philadelphia	63 (41 - 89)	54 (34 - 78)	51 (31 - 75)	39 (21 - 59)	36 (19 - 56)	31 (15 - 50)	28 (13 - 46)	19 (5 - 34)
Sacramento	10 (5 - 15)	8 (4 - 13)	8 (3 - 12)	6 (2 - 10)	5 (1 - 9)	5 (1 - 8)	4 (1 - 7)	3 (0 - 5)
St. Louis	30 (20 - 43)	26 (16 - 38)	24 (15 - 35)	19 (11 - 29)	17 (9 - 26)	15 (7 - 24)	13 (6 - 22)	9 (2 - 16)
Washington, DC	68 (42 - 98)	55 (32 - 82)	55 (31 - 82)	44 (22 - 68)	39 (18 - 62)	32 (13 - 54)	30 (12 - 51)	20 (4 - 38)
	Response = Decrease in FEV1 Greater Than or Equal to 20%							
Atlanta	10 (3 - 21)	10 (3 - 20)	7 (2 - 16)	5 (1 - 13)	4 (1 - 11)	4 (1 - 11)	3 (0 - 9)	2 (0 - 6)
Boston	18 (8 - 33)	13 (5 - 26)	13 (5 - 25)	11 (4 - 23)	7 (2 - 16)	5 (1 - 14)	5 (1 - 12)	2 (0 - 8)
Chicago	19 (6 - 40)	16 (4 - 35)	13 (3 - 31)	10 (1 - 26)	8 (1 - 22)	7 (0 - 20)	5 (0 - 17)	3 (0 - 12)
Cleveland	9 (4 - 18)	7 (2 - 14)	7 (2 - 14)	4 (1 - 10)	4 (1 - 9)	3 (0 - 8)	3 (0 - 7)	1 (0 - 5)
Detroit	13 (4 - 27)	10 (2 - 22)	9 (2 - 21)	9 (2 - 20)	5 (0 - 14)	4 (0 - 12)	4 (0 - 11)	2 (0 - 8)
Houston	6 (1 - 14)	4 (1 - 11)	4 (1 - 11)	2 (0 - 8)	2 (0 - 7)	2 (0 - 7)	2 (0 - 6)	1 (0 - 4)
Los Angeles	6 (0 - 20)	6 (0 - 19)	4 (0 - 16)	3 (0 - 10)	3 (0 - 10)	2 (0 - 10)	2 (0 - 8)	1 (0 - 4)
New York	37 (11 - 81)	31 (8 - 72)	26 (5 - 64)	14 (1 - 43)	16 (1 - 45)	13 (1 - 41)	11 (0 - 36)	6 (0 - 25)
Philadelphia	21 (9 - 39)	16 (6 - 32)	15 (5 - 30)	10 (2 - 22)	9 (2 - 20)	7 (1 - 17)	6 (1 - 16)	3 (0 - 11)
Sacramento	2 (0 - 5)	2 (0 - 5)	2 (0 - 4)	1 (0 - 3)	1 (0 - 3)	1 (0 - 3)	1 (0 - 2)	0 (0 - 2)
St. Louis	10 (4 - 19)	8 (3 - 15)	7 (2 - 14)	5 (1 - 11)	4 (1 - 9)	3 (0 - 8)	3 (0 - 7)	1 (0 - 5)
Washington, DC	21 (8 - 41)	15 (5 - 32)	15 (5 - 31)	10 (2 - 24)	9 (1 - 21)	7 (1 - 18)	6 (1 - 17)	3 (0 - 12)

*Numbers are median (0.5 fractile) numbers of children. Numbers in parentheses below the median are 95% credible intervals based on statistical uncertainty surrounding the O3 coefficient.

**Incidence was quantified down to estimated policy relevant background levels. Incidences are rounded to the nearest 1000.

***These 8-hr average standards, denoted m/n, are characterized by a concentration of m ppm and an nth daily maximum. So, for example, the current standard is 0.084/4 -- 0.084 ppm, 4th daily maximum 8-hr average. These nth daily maximum standards require that the average of the 3 annual nth daily maxima over a 3-year period be at or below the specified level (e.g., 0.084 ppm).

Table 5C-2. Percent of All Children (Ages 5-18) Engaged in Moderate Exertion Estimated to Experience At Least One Lung Function Response Associated with Exposure to O3 Concentrations That Just Meet the Current and Alternative Daily Maximum 8-Hour Standards, for Location-Specific O3 Seasons: Based on Adjusting 2002 O3 Concentrations*

Location	Percent of All Children Estimated to Experience at Least One Lung Function Response Associated with O3 Concentrations that Just Meet the Current and Alternative O3 Standards**							
	0.084/4***	0.084/3	0.080/4	0.074/5	0.074/4	0.074/3	0.070/4	0.064/4
	Response = Decrease in FEV1 Greater Than or Equal to 10%							
Atlanta	9.9% (7.5% - 14.1%)	9.7% (7.3% - 13.9%)	8.4% (6.2% - 12.5%)	7.3% (5.2% - 11.1%)	6.7% (4.7% - 10.4%)	6.7% (4.6% - 10.3%)	5.6% (3.7% - 8.9%)	4.3% (2.6% - 7%)
Boston	11.2% (8.7% - 15.3%)	9.7% (7.3% - 13.7%)	9.6% (7.2% - 13.5%)	9% (6.7% - 12.8%)	7.4% (5.3% - 11%)	6.6% (4.6% - 10%)	6.2% (4.2% - 9.5%)	4.6% (2.9% - 7.3%)
Chicago	9.6% (7.2% - 13.7%)	8.8% (6.5% - 12.9%)	8.2% (6% - 12.2%)	7.2% (5.1% - 11.1%)	6.4% (4.4% - 10%)	5.9% (4% - 9.4%)	5.3% (3.5% - 8.6%)	4% (2.4% - 6.5%)
Cleveland	12.3% (9.6% - 16.7%)	10.8% (8.3% - 15.2%)	10.5% (8% - 14.9%)	8.7% (6.3% - 12.9%)	8.2% (5.9% - 12.4%)	7.3% (5.1% - 11.3%)	6.9% (4.7% - 10.8%)	5.2% (3.3% - 8.4%)
Detroit	10.9% (8.3% - 15.2%)	9.6% (7.1% - 13.9%)	9.3% (6.9% - 13.6%)	9% (6.6% - 13.2%)	7.2% (5.1% - 11.2%)	6.4% (4.4% - 10.2%)	6% (4% - 9.6%)	4.5% (2.8% - 7.4%)
Houston	6.5% (4.6% - 9.7%)	5.7% (4% - 8.8%)	5.5% (3.8% - 8.5%)	4.4% (2.9% - 7%)	4.2% (2.7% - 6.7%)	3.9% (2.4% - 6.2%)	3.5% (2.2% - 5.6%)	2.6% (1.4% - 4.1%)
Los Angeles	3.3% (2.4% - 5.1%)	3.1% (2.3% - 4.9%)	2.7% (1.9% - 4.2%)	1.9% (1.3% - 3%)	1.9% (1.3% - 2.9%)	1.8% (1.3% - 2.8%)	1.4% (1% - 2.2%)	0.8% (0.5% - 1.2%)
New York	9.2% (6.8% - 13.4%)	8.6% (6.2% - 12.6%)	7.9% (5.7% - 11.9%)	6% (4% - 9.4%)	6.2% (4.2% - 9.8%)	5.8% (3.8% - 9.2%)	5.3% (3.4% - 8.4%)	4% (2.4% - 6.5%)
Philadelphia	12.6% (9.9% - 16.9%)	11.3% (8.7% - 15.6%)	10.9% (8.3% - 15.1%)	9% (6.6% - 13.1%)	8.5% (6.2% - 12.6%)	7.7% (5.5% - 11.7%)	7.2% (5% - 11.1%)	5.5% (3.6% - 8.8%)
Sacramento	6.5% (5.1% - 9.7%)	6% (4.7% - 9.1%)	5.5% (4.3% - 8.4%)	4.5% (3.4% - 7%)	4.2% (3.2% - 6.6%)	3.9% (2.9% - 6.1%)	3.4% (2.5% - 5.4%)	2.5% (1.8% - 3.8%)
St. Louis	12.3% (9.7% - 16.5%)	11.2% (8.6% - 15.4%)	10.5% (8.1% - 14.7%)	8.9% (6.6% - 12.9%)	8.2% (6% - 12.2%)	7.5% (5.4% - 11.4%)	6.9% (4.8% - 10.6%)	5.1% (3.3% - 8.3%)
Washington, DC	11.3% (8.7% - 15.6%)	9.7% (7.3% - 13.9%)	9.7% (7.2% - 13.8%)	8.2% (6% - 12.3%)	7.6% (5.4% - 11.5%)	6.7% (4.6% - 10.4%)	6.4% (4.4% - 10.1%)	4.9% (3.1% - 7.9%)
	Response = Decrease in FEV1 Greater Than or Equal to 15%							
Atlanta	3.8% (2.2% - 5.7%)	3.7% (2.2% - 5.5%)	3% (1.6% - 4.7%)	2.5% (1.1% - 4%)	2.2% (0.9% - 3.6%)	2.2% (0.9% - 3.6%)	1.7% (0.5% - 3%)	1.2% (0.1% - 2.2%)
Boston	4.7% (3% - 6.8%)	3.9% (2.3% - 5.7%)	3.8% (2.2% - 5.6%)	3.5% (2% - 5.2%)	2.6% (1.3% - 4.1%)	2.2% (1% - 3.6%)	2% (0.8% - 3.3%)	1.3% (0.3% - 2.4%)
Chicago	3.6% (2.1% - 5.4%)	3.2% (1.8% - 4.9%)	2.9% (1.5% - 4.5%)	2.4% (1.1% - 3.9%)	2% (0.8% - 3.4%)	1.8% (0.6% - 3.2%)	1.6% (0.4% - 2.8%)	1% (0.1% - 2.1%)
Cleveland	5.1% (3.3% - 7.2%)	4.3% (2.6% - 6.2%)	4.1% (2.5% - 6%)	3.1% (1.7% - 4.8%)	2.9% (1.5% - 4.5%)	2.4% (1.1% - 3.9%)	2.2% (0.9% - 3.7%)	1.5% (0.3% - 2.7%)
Detroit	4.3% (2.6% - 6.3%)	3.6% (2% - 5.4%)	3.4% (1.9% - 5.2%)	3.2% (1.8% - 5%)	2.4% (1.1% - 3.9%)	2% (0.8% - 3.4%)	1.8% (0.6% - 3.2%)	1.2% (0.1% - 2.4%)
Houston	2.2% (1% - 3.5%)	1.9% (0.7% - 3.1%)	1.7% (0.6% - 2.9%)	1.3% (0.3% - 2.3%)	1.2% (0.3% - 2.2%)	1.1% (0.2% - 2%)	0.9% (0.1% - 1.8%)	0.6% (0% - 1.3%)
Los Angeles	0.9% (0.2% - 1.7%)	0.9% (0.2% - 1.6%)	0.7% (0.1% - 1.4%)	0.5% (0% - 1%)	0.5% (0% - 1%)	0.5% (0% - 0.9%)	0.3% (0% - 0.7%)	0.2% (0% - 0.4%)

Location	Percent of All Children Estimated to Experience at Least One Lung Function Response Associated with O3 Concentrations that Just Meet the Current and Alternative O3 Standards**							
	0.084/4***	0.084/3	0.080/4	0.074/5	0.074/4	0.074/3	0.070/4	0.064/4
New York	3.4% (1.9% - 5.2%)	3.1% (1.6% - 4.8%)	2.8% (1.4% - 4.4%)	1.8% (0.6% - 3.2%)	2% (0.7% - 3.3%)	1.8% (0.6% - 3.1%)	1.5% (0.4% - 2.8%)	1% (0.1% - 2.1%)
Philadelphia	5.4% (3.5% - 7.5%)	4.6% (2.8% - 6.6%)	4.3% (2.6% - 6.3%)	3.3% (1.8% - 5%)	3% (1.6% - 4.7%)	2.6% (1.3% - 4.2%)	2.4% (1.1% - 3.9%)	1.6% (0.4% - 2.9%)
Sacramento	2.3% (1.1% - 3.5%)	2% (0.9% - 3.2%)	1.8% (0.7% - 2.9%)	1.4% (0.4% - 2.3%)	1.3% (0.3% - 2.2%)	1.1% (0.3% - 2%)	1% (0.2% - 1.7%)	0.6% (0% - 1.2%)
St. Louis	5.2% (3.4% - 7.4%)	4.5% (2.8% - 6.5%)	4.2% (2.5% - 6.1%)	3.3% (1.8% - 5%)	2.9% (1.5% - 4.5%)	2.6% (1.2% - 4.1%)	2.3% (1% - 3.7%)	1.5% (0.4% - 2.7%)
Washington, DC	4.6% (2.9% - 6.6%)	3.7% (2.1% - 5.6%)	3.7% (2.1% - 5.5%)	2.9% (1.5% - 4.6%)	2.6% (1.2% - 4.2%)	2.2% (0.9% - 3.6%)	2.1% (0.8% - 3.4%)	1.4% (0.3% - 2.5%)
	Response = Decrease in FEV1 Greater Than or Equal to 20%							
Atlanta	1.1% (0.4% - 2.2%)	1% (0.3% - 2.2%)	0.7% (0.2% - 1.7%)	0.6% (0.1% - 1.4%)	0.5% (0.1% - 1.2%)	0.4% (0.1% - 1.2%)	0.3% (0% - 0.9%)	0.2% (0% - 0.7%)
Boston	1.6% (0.7% - 3%)	1.2% (0.5% - 2.3%)	1.1% (0.4% - 2.3%)	1% (0.4% - 2.1%)	0.6% (0.2% - 1.5%)	0.5% (0.1% - 1.2%)	0.4% (0.1% - 1.1%)	0.2% (0% - 0.7%)
Chicago	1% (0.3% - 2.1%)	0.8% (0.2% - 1.8%)	0.7% (0.1% - 1.6%)	0.5% (0.1% - 1.3%)	0.4% (0% - 1.1%)	0.3% (0% - 1%)	0.3% (0% - 0.9%)	0.2% (0% - 0.6%)
Cleveland	1.6% (0.6% - 3%)	1.2% (0.4% - 2.4%)	1.1% (0.3% - 2.3%)	0.7% (0.1% - 1.7%)	0.6% (0.1% - 1.6%)	0.5% (0% - 1.3%)	0.4% (0% - 1.2%)	0.2% (0% - 0.8%)
Detroit	1.2% (0.4% - 2.4%)	0.9% (0.2% - 2%)	0.8% (0.2% - 1.9%)	0.8% (0.2% - 1.8%)	0.5% (0% - 1.3%)	0.4% (0% - 1.1%)	0.3% (0% - 1%)	0.2% (0% - 0.7%)
Houston	0.5% (0.1% - 1.3%)	0.4% (0.1% - 1%)	0.4% (0.1% - 1%)	0.2% (0% - 0.7%)	0.2% (0% - 0.7%)	0.2% (0% - 0.6%)	0.1% (0% - 0.5%)	0.1% (0% - 0.4%)
Los Angeles	0.2% (0% - 0.5%)	0.2% (0% - 0.5%)	0.1% (0% - 0.4%)	0.1% (0% - 0.3%)	0.1% (0% - 0.3%)	0.1% (0% - 0.3%)	0% (0% - 0.2%)	0% (0% - 0.1%)
New York	0.9% (0.3% - 2%)	0.8% (0.2% - 1.7%)	0.6% (0.1% - 1.5%)	0.3% (0% - 1%)	0.4% (0% - 1.1%)	0.3% (0% - 1%)	0.3% (0% - 0.9%)	0.2% (0% - 0.6%)
Philadelphia	1.8% (0.8% - 3.3%)	1.4% (0.5% - 2.7%)	1.3% (0.4% - 2.5%)	0.8% (0.2% - 1.8%)	0.7% (0.2% - 1.7%)	0.6% (0.1% - 1.5%)	0.5% (0.1% - 1.3%)	0.3% (0% - 0.9%)
Sacramento	0.5% (0.1% - 1.3%)	0.4% (0.1% - 1.1%)	0.4% (0% - 1%)	0.3% (0% - 0.8%)	0.2% (0% - 0.7%)	0.2% (0% - 0.6%)	0.2% (0% - 0.5%)	0.1% (0% - 0.4%)
St. Louis	1.7% (0.7% - 3.2%)	1.4% (0.5% - 2.7%)	1.2% (0.4% - 2.4%)	0.8% (0.2% - 1.8%)	0.7% (0.1% - 1.6%)	0.6% (0.1% - 1.4%)	0.5% (0% - 1.2%)	0.3% (0% - 0.8%)
Washington, DC	1.4% (0.6% - 2.8%)	1% (0.3% - 2.1%)	1% (0.3% - 2.1%)	0.7% (0.2% - 1.6%)	0.6% (0.1% - 1.4%)	0.4% (0% - 1.2%)	0.4% (0% - 1.1%)	0.2% (0% - 0.8%)

*Percents are median (0.5 fractile) percents of children. Percents in parentheses below the median are 95% credible intervals based on statistical uncertainty surrounding the O3 coefficient.

**Incidence was quantified down to estimated policy relevant background levels. Percents are rounded to the nearest tenth.

***These 8-hr average standards, denoted m/n, are characterized by a concentration of m ppm and an nth daily maximum. So, for example, the current standard is 0.084/4 -- 0.084 ppm, 4th daily maximum 8-hr average. These nth daily maximum standards require that the average of the 3 annual nth daily maxima over a 3-year period be at or below the specified level (e.g., 0.084 ppm).

Table 5C-3. Estimated Number of Occurrences of Lung Function Response Associated with Exposure to O3 Concentrations That Just Meet the Current and Alternative Daily Maximum 8-Hour Standards Among All Children (Ages 5-18) Engaged in Moderate Exertion, for Location-Specific O3 Seasons: Based on Adjusting 2002 O3 Concentrations*

Location	Number of Occurrences (in 1000s) of Lung Function Response Associated with O3 Concentrations that Just Meet the Current and Alternative O3 Standards**							
	0.084/4*	**0.084/3**	**0.080/4**	**0.074/5**	**0.074/4**	**0.074/3**	**0.070/4**	**0.064/4**
	Response = Decrease in FEV1 Greater Than or Equal to 10%							
Atlanta	782 (312 - 1365)	770 (304 - 1348)	693 (254 - 1230)	621 (210 - 1115)	580 (185 - 1050)	577 (184 - 1045)	510 (145 - 935)	415 (95 - 777)
Boston	795 (326 - 1379)	718 (273 - 1267)	711 (268 - 1256)	679 (247 - 1208)	594 (193 - 1079)	550 (166 - 1008)	527 (152 - 972)	433 (99 - 820)
Chicago	1286 (521 - 2239)	1202 (465 - 2111)	1140 (424 - 2018)	1038 (360 - 1858)	946 (303 - 1711)	895 (273 - 1629)	827 (233 - 1517)	670 (149 - 1255)
Cleveland	564 (254 - 962)	513 (217 - 889)	502 (209 - 872)	433 (162 - 770)	417 (151 - 744)	383 (129 - 692)	367 (119 - 666)	300 (79 - 557)
Detroit	864 (374 - 1490)	782 (317 - 1369)	764 (304 - 1342)	743 (291 - 1311)	633 (218 - 1140)	578 (184 - 1052)	553 (169 - 1012)	450 (110 - 841)
Houston	404 (153 - 679)	362 (131 - 610)	346 (124 - 583)	278 (91 - 467)	264 (85 - 443)	239 (74 - 398)	209 (64 - 343)	106 (35 - 150)
Los Angeles	1504 (336 - 2792)	1447 (314 - 2692)	1266 (255 - 2364)	863 (149 - 1613)	851 (146 - 1590)	796 (134 - 1486)	575 (90 - 1058)	206 (35 - 323)
New York	3053 (1184 - 5374)	2879 (1070 - 5107)	2730 (971 - 4878)	2237 (663 - 4097)	2304 (700 - 4205)	2189 (633 - 4019)	2044 (548 - 3783)	1654 (350 - 3125)
Philadelphia	1232 (565 - 2082)	1132 (493 - 1939)	1100 (470 - 1891)	958 (371 - 1680)	925 (349 - 1631)	860 (306 - 1529)	818 (279 - 1464)	677 (192 - 1237)
Sacramento	315 (106 - 566)	296 (95 - 534)	279 (86 - 506)	238 (65 - 439)	229 (60 - 423)	216 (54 - 402)	199 (46 - 371)	156 (29 - 296)
St. Louis	515 (235 - 869)	476 (208 - 814)	455 (193 - 782)	396 (154 - 695)	374 (139 - 661)	350 (124 - 623)	326 (109 - 586)	264 (73 - 484)
Washington, DC	1327 (560 - 2293)	1190 (465 - 2090)	1183 (460 - 2078)	1055 (377 - 1884)	994 (338 - 1788)	908 (285 - 1651)	882 (269 - 1610)	728 (182 - 1358)
	Response = Decrease in FEV1 Greater Than or Equal to 15%							
Atlanta	196 (39 - 442)	192 (37 - 435)	166 (25 - 392)	143 (16 - 352)	131 (12 - 330)	130 (12 - 328)	111 (6 - 291)	86 (1 - 240)
Boston	210 (56 - 458)	181 (40 - 412)	179 (39 - 408)	167 (34 - 389)	139 (20 - 341)	124 (14 - 316)	117 (12 - 304)	91 (4 - 252)
Chicago	325 (68 - 727)	297 (54 - 679)	276 (45 - 644)	243 (31 - 588)	215 (21 - 537)	200 (16 - 510)	180 (11 - 472)	139 (2 - 388)
Cleveland	153 (43 - 320)	133 (32 - 290)	129 (30 - 284)	105 (18 - 245)	99 (15 - 236)	88 (11 - 217)	83 (9 - 208)	64 (2 - 172)
Detroit	226 (56 - 488)	197 (41 - 441)	190 (38 - 431)	183 (34 - 420)	147 (18 - 359)	130 (12 - 328)	123 (9 - 315)	94 (2 - 259)
Houston	99 (13 - 223)	87 (9 - 199)	82 (8 - 191)	64 (4 - 153)	61 (3 - 145)	55 (2 - 131)	48 (1 - 114)	26 (0 - 54)
Los Angeles	315 (9 - 869)	302 (8 - 837)	261 (5 - 735)	175 (1 - 502)	173 (1 - 496)	161 (1 - 463)	117 (0 - 333)	46 (0 - 112)

Location	Number of Occurrences (in 1000s) of Lung Function Response Associated with O3 Concentrations that Just Meet the Current and Alternative O3 Standards**							
	0.084/4* **	**0.084/3**	**0.080/4**	**0.074/5**	**0.074/4**	**0.074/3**	**0.070/4**	**0.064/4**
New York	753 (140 - 1727)	695 (113 - 1630)	646 (91 - 1547)	494 (35 - 1277)	513 (40 - 1314)	480 (31 - 1252)	439 (20 - 1174)	339 (4 - 962)
Philadelphia	335 (92 - 696)	297 (71 - 638)	284 (64 - 619)	234 (39 - 539)	223 (34 - 521)	202 (25 - 485)	189 (20 - 462)	147 (7 - 386)
Sacramento	72 (8 - 179)	67 (6 - 168)	62 (5 - 159)	51 (2 - 137)	49 (2 - 132)	46 (1 - 125)	41 (1 - 115)	31 (0 - 91)
St. Louis	141 (40 - 292)	126 (32 - 269)	118 (28 - 257)	98 (18 - 224)	91 (15 - 211)	83 (11 - 198)	75 (9 - 185)	57 (2 - 150)
Washington, DC	345 (82 - 752)	296 (57 - 674)	293 (55 - 670)	250 (36 - 599)	231 (28 - 564)	205 (19 - 517)	197 (16 - 503)	154 (4 - 420)
	Response = Decrease in FEV1 Greater Than or Equal to 20%							
Atlanta	30 (4 - 118)	29 (4 - 116)	23 (2 - 101)	18 (1 - 88)	16 (1 - 81)	16 (1 - 80)	12 (0 - 69)	8 (0 - 55)
Boston	39 (10 - 130)	30 (6 - 111)	29 (6 - 110)	26 (4 - 103)	19 (2 - 85)	15 (1 - 77)	14 (1 - 73)	9 (0 - 57)
Chicago	51 (7 - 195)	44 (5 - 179)	38 (3 - 166)	31 (1 - 148)	26 (1 - 132)	23 (0 - 123)	20 (0 - 112)	13 (0 - 88)
Cleveland	27 (5 - 91)	22 (3 - 79)	20 (3 - 77)	15 (1 - 63)	13 (1 - 60)	11 (0 - 54)	10 (0 - 51)	7 (0 - 40)
Detroit	37 (5 - 134)	30 (3 - 117)	28 (2 - 114)	26 (2 - 110)	18 (0 - 89)	15 (0 - 80)	14 (0 - 76)	9 (0 - 59)
Houston	14 (1 - 60)	11 (1 - 52)	10 (1 - 50)	7 (0 - 39)	7 (0 - 37)	6 (0 - 33)	5 (0 - 29)	3 (0 - 15)
Los Angeles	31 (0 - 199)	29 (0 - 191)	24 (0 - 166)	15 (0 - 112)	15 (0 - 110)	14 (0 - 103)	10 (0 - 75)	4 (0 - 28)
New York	112 (13 - 455)	98 (9 - 421)	86 (6 - 392)	56 (1 - 306)	59 (1 - 317)	53 (1 - 298)	46 (0 - 275)	32 (0 - 216)
Philadelphia	61 (13 - 201)	50 (8 - 177)	46 (7 - 170)	33 (3 - 141)	31 (2 - 134)	26 (1 - 123)	23 (1 - 115)	16 (0 - 92)
Sacramento	9 (1 - 44)	8 (0 - 41)	7 (0 - 38)	5 (0 - 32)	5 (0 - 31)	5 (0 - 29)	4 (0 - 26)	3 (0 - 20)
St. Louis	26 (6 - 84)	22 (4 - 75)	19 (3 - 71)	14 (1 - 59)	13 (1 - 55)	11 (1 - 50)	9 (0 - 46)	6 (0 - 36)
Washington, DC	58 (11 - 208)	45 (6 - 179)	44 (6 - 177)	34 (3 - 152)	30 (2 - 141)	24 (1 - 126)	23 (1 - 122)	15 (0 - 97)

*Numbers are median (0.5 fractile) numbers of occurrences. Numbers in parentheses below the median are 95% credible intervals based on statistical uncertainty surrounding the O3 coefficient.

**Incidence was quantified down to estimated policy relevant background levels. Incidences are rounded to the nearest 1000.

***These 8-hr average standards, denoted m/n, are characterized by a concentration of m ppm and an nth daily maximum. So, for example, the current standard is 0.084/4 -- 0.084 ppm, 4th daily maximum 8-hr average. These nth daily maximum standards require that the average of the 3 annual nth daily maxima over a 3-year period be at or below the specified level (e.g., 0.084 ppm).

Table 5C-4. Number of Asthmatic Children (Ages 5-18) Engaged in Moderate Exertion Estimated to Experience At Least One Lung Function Response (Change in FEV1>=10%) Associated with Exposure to O_3 Concentrations That Just Meet the Current and Two Alternative Daily Maximum 8-Hour Standards, for Five Location-Specific O_3 Seasons, Based on 2002, 2003, and 2004 O3 Concentrations*

Location	Number of Asthmatic Children (in 1000s) Estimated to Experience at Least One Lung Function Response Associated with O3 Concentrations that Just Meet the Current and Alternative O3 Standards**			
	A Recent Year of Air Quality	0.084/4***	0.074/4	0.064/4
	Based on 2002 Air Quality Data			
Atlanta	18 (14 - 23)	13 (10 - 18)	9 (6 - 13)	5 (3 - 9)
Chicago	40 (32 - 53)	27 (20 - 39)	18 (12 - 29)	11 (7 - 19)
Houston	17 (13 - 23)	9 (6 - 14)	6 (4 - 9)	4 (2 - 6)
Los Angeles	61 (51 - 79)	16 (11 - 24)	9 (6 - 14)	4 (2 - 6)
New York	118 (97 - 147)	63 (47 - 91)	43 (29 - 67)	27 (16 - 44)
	Based on 2003 Air Quality Data			
Atlanta	12 (9 - 17)	9 (6 - 13)	6 (4 - 10)	4 (2 - 6)
Chicago	21 (15 - 32)	18 (12 - 28)	12 (7 - 19)	7 (4 - 12)
Houston	20 (17 - 26)	8 (5 - 12)	5 (3 - 8)	3 (2 - 5)
Los Angeles	77 (65 - 95)	16 (12 - 25)	9 (6 - 14)	3 (2 - 5)
New York	81 (64 - 109)	42 (29 - 64)	27 (17 - 44)	17 (9 - 27)
	Based on 2004 Air Quality Data			
Atlanta	12 (9 - 17)	8 (6 - 12)	5 (3 - 9)	3 (2 - 5)
Chicago	14 (9 - 22)	9 (5 - 14)	6 (3 - 9)	3 (1 - 6)
Houston	17 (14 - 23)	9 (6 - 14)	6 (4 - 10)	4 (2 - 6)
Los Angeles	62 (52 - 81)	16 (11 - 25)	9 (6 - 14)	4 (2 - 6)
New York	51 (37 - 76)	26 (16 - 42)	17 (9 - 28)	11 (4 - 17)

*Numbers are median (0.5 fractile) numbers of children. Numbers in parentheses below the median are 95% credible intervals based on statistical uncertainty surrounding the O3 coefficient.

**Incidence was quantified down to estimated policy relevant background levels. Incidences are rounded to the nearest 1000.

***These 8-hr average standards, denoted m/n, are characterized by a concentration of m ppm and an nth daily maximum. So, for example, the current standard is 0.084/4 -- 0.084 ppm, 4th daily maximum 8-hr average. These nth daily maximum standards require that the average of the 3 annual nth daily maxima over a 3-year period be at or below the specified level (e.g., 0.084 ppm).

Table 5C-5. Percent of Asthmatic Children (Ages 5-18) Engaged in Moderate Exertion Estimated to Experience At Least One Lung Function Response (Change in FEV1>=10%) Associated with Exposure to O_3 Concentrations That Just Meet the Current and Two Alternative Daily Maximum 8-Hour Standards, for Five Location-Specific O_3 Seasons, Based on 2002, 2003, and 2004 O3 Concentrations*

Location	Percent of Asthmatic Children Estimated to Experience at Least One Lung Function Response Associated with O3 Concentrations that Just Meet the Current and Alternative O3 Standards**			
	A Recent Year of Air Quality	0.084/4***	0.074/4	0.064/4
	Based on 2002 Air Quality Data			
Atlanta	15.2% (12.2% - 19.8%)	10.9% (8.3% - 15.3%)	7.3% (5.1% - 11.2%)	4.6% (2.9% - 7.4%)
Chicago	14.5% (11.6% - 18.9%)	9.8% (7.3% - 14%)	6.5% (4.5% - 10.2%)	4.1% (2.5% - 6.7%)
Houston	12.5% (9.9% - 16.7%)	6.7% (4.8% - 10.1%)	4.4% (2.8% - 7%)	2.7% (1.5% - 4.2%)
Los Angeles	13.3% (11.1% - 17.2%)	3.4% (2.5% - 5.3%)	2% (1.4% - 3%)	0.8% (0.5% - 1.2%)
New York	18.3% (15.1% - 22.9%)	9.8% (7.3% - 14.1%)	6.6% (4.5% - 10.3%)	4.2% (2.6% - 6.8%)
	Based on 2003 Air Quality Data			
Atlanta	10.1% (7.6% - 14.5%)	7.5% (5.4% - 11.5%)	5.1% (3.3% - 8.2%)	3.2% (1.8% - 5.2%)
Chicago	7.6% (5.5% - 11.5%)	6.3% (4.3% - 9.8%)	4.2% (2.6% - 6.8%)	2.6% (1.4% - 4.2%)
Houston	15.1% (12.3% - 19.5%)	5.9% (4% - 9.2%)	3.9% (2.4% - 6.2%)	2.2% (1.1% - 3.4%)
Los Angeles	16.8% (14.3% - 20.9%)	3.5% (2.6% - 5.4%)	1.9% (1.4% - 3%)	0.7% (0.5% - 1.2%)
New York	12.7% (10% - 17%)	6.5% (4.5% - 10%)	4.2% (2.6% - 6.9%)	2.6% (1.3% - 4.2%)
	Based on 2004 Air Quality Data			
Atlanta	9.9% (7.4% - 14.2%)	6.9% (4.8% - 10.6%)	4.6% (2.9% - 7.4%)	2.9% (1.6% - 4.7%)
Chicago	4.9% (3.1% - 7.8%)	3.2% (1.8% - 5.1%)	2.1% (1% - 3.4%)	1.2% (0.3% - 2%)
Houston	12.6% (10% - 16.8%)	6.7% (4.7% - 10.1%)	4.4% (2.9% - 7%)	2.6% (1.5% - 4.2%)
Los Angeles	13.6% (11.4% - 17.7%)	3.5% (2.5% - 5.5%)	2% (1.4% - 3.1%)	0.8% (0.5% - 1.2%)
New York	8% (5.8% - 11.8%)	4.1% (2.5% - 6.6%)	2.7% (1.4% - 4.3%)	1.6% (0.6% - 2.7%)

*Percents are median (0.5 fractile) percents of children. Percents in parentheses below the median are 95% credible intervals based on statistical uncertainty surrounding the O3 coefficient.

**Incidence was quantified down to estimated policy relevant background levels. Percents are rounded to the nearest tenth.

***These 8-hr average standards, denoted m/n, are characterized by a concentration of m ppm and an nth daily maximum. So, for example, the current standard is 0.084/4 -- 0.084 ppm, 4th daily maximum 8-hr average. These nth daily maximum standards require that the average of the 3 annual nth daily maxima over a 3-year period be at or below the specified level (e.g., 0.084 ppm).

Table 5C-6. Estimated Number of Occurrences of Lung Function Response (Change in FEV1>=10%) Associated with Exposure to O_3 Concentrations That Just Meet the Current and Two Alternative Daily Maximum 8-Hour Standards Among Asthmatic Children (Ages 5-18) Engaged in Moderate Exertion, for Five Location-Specific O_3 Seasons, Based on 2002, 2003, and 2004 O3 Concentrations*

Location	Number of Occurrences (in 1000s) of Lung Function Response Associated with O3 Concentrations that Just Mee the Current and Alternative O3 Standards**			
	A Recent Year of Air Quality	0.084/4***	0.074/4	0.064/4
	Based on 2002 Air Quality Data			
Atlanta	145 (68 - 244)	109 (44 - 190)	81 (26 - 146)	58 (13 - 108)
Chicago	257 (125 - 427)	186 (75 - 324)	137 (44 - 247)	97 (22 - 182)
Houston	96 (45 - 158)	52 (20 - 88)	34 (11 - 57)	14 (5 - 19)
Los Angeles	561 (255 - 942)	182 (42 - 335)	102 (18 - 189)	25 (4 - 39)
New York	834 (435 - 1356)	509 (200 - 894)	385 (119 - 700)	275 (59 - 519)
	Based on 2003 Air Quality Data			
Atlanta	106 (40 - 187)	83 (26 - 150)	61 (14 - 114)	43 (7 - 82)
Chicago	163 (56 - 291)	137 (42 - 250)	100 (22 - 187)	69 (9 - 134)
Houston	131 (64 - 213)	55 (19 - 95)	32 (9 - 55)	7 (3 - 6)
Los Angeles	690 (352 - 1119)	177 (45 - 320)	86 (18 - 153)	11 (4 - 8)
New York	506 (215 - 868)	304 (88 - 557)	227 (47 - 431)	158 (19 - 310)
	Based on 2004 Air Quality Data			
Atlanta	109 (38 - 196)	82 (22 - 151)	61 (12 - 116)	44 (5 - 86)
Chicago	114 (27 - 214)	80 (12 - 154)	57 (5 - 113)	38 (1 - 78)
Houston	110 (51 - 181)	61 (22 - 103)	40 (12 - 68)	18 (5 - 27)
Los Angeles	660 (308 - 1108)	219 (49 - 405)	134 (21 - 253)	46 (4 - 84)
New York	399 (131 - 720)	240 (46 - 458)	179 (21 - 353)	124 (6 - 252)

*Numbers are median (0.5 fractile) numbers of occurrences. Numbers in parentheses below the median are 95% credible intervals based on statistical uncertainty surrounding the O3 coefficient.

**Incidence was quantified down to estimated policy relevant background levels. Incidences are rounded to the nearest 1000.

***These 8-hr average standards, denoted m/n, are characterized by a concentration of m ppm and an nth daily maximum. So, for example, the current standard is 0.084/4 -- 0.084 ppm, 4th daily maximum 8-hr average. These nth daily maximum standards require that the average of the 3 annual nth daily maxima over a 3-year period be at or below the specified level (e.g., 0.084 ppm).

Table 5C-7. Estimated Incidence of Health Risks Associated with O_3 Concentrations that Just Meet the Current and Alternative 8-Hour Daily Maximum Standards: Boston, MA, April - September, Based on 2004 O_3 Concentrations

Respiratory Symptoms*	Study	Ages	Lag	Exposure Metric	Other Pollutants in Model	Incidence of Respiratory Symptom-Days (in 100s) Associated with O_3 Concentrations that Just Meet the Current and Alternative O_3 Standards**							
						0.084/4***	0.084/3	0.080/4****	0.074/5	0.074/4	0.074/3	0.070/4****	0.064/4
Chest tightness	Gent et al. (2003)	0 - 12	1-day lag	1 hr max.	none	45 (7 - 79)	42 (7 - 75)	42 (7 - 74)	41 (7 - 73)	38 (6 - 67)	36 (6 - 64)	35 (6 - 62)	31 (5 - 55)
Chest tightness	Gent et al. (2003)	0 - 12	0-day lag	1 hr max.	PM2.5	72 (32 - 107)	68 (30 - 102)	67 (30 - 101)	66 (29 - 99)	61 (27 - 92)	58 (26 - 88)	56 (25 - 85)	50 (22 - 75)
Chest tightness	Gent et al. (2003)	0 - 12	1-day lag	1 hr max.	PM2.5	66 (25 - 102)	62 (24 - 97)	62 (24 - 96)	61 (23 - 94)	56 (21 - 87)	53 (20 - 83)	52 (20 - 81)	45 (17 - 71)
Chest tightness	Gent et al. (2003)	0 - 12	1-day lag	8 hr max.	none	46 (15 - 75)	44 (14 - 71)	43 (14 - 70)	42 (13 - 69)	39 (12 - 63)	37 (12 - 61)	36 (11 - 59)	31 (10 - 52)
Shortness of breath	Gent et al. (2003)	0 - 12	1-day lag	1 hr max.	none	48 (6 - 87)	46 (6 - 83)	45 (5 - 82)	44 (5 - 80)	41 (5 - 74)	39 (5 - 71)	38 (5 - 69)	33 (4 - 60)
Shortness of breath	Gent et al. (2003)	0 - 12	1-day lag	8 hr max.	none	53 (10 - 92)	50 (10 - 87)	50 (10 - 87)	49 (9 - 85)	45 (9 - 78)	43 (8 - 75)	41 (8 - 72)	36 (7 - 64)
Wheeze	Gent et al. (2003)	0 - 12	0-day lag	1 hr max.	PM2.5	132 (47 - 208)	124 (44 - 197)	123 (44 - 196)	121 (43 - 192)	111 (39 - 177)	106 (37 - 169)	103 (36 - 164)	90 (32 - 145)

*Respiratory symptoms among asthmatic medication-users associated with short-term exposures to O_3.

**Incidence was quantified down to estimated policy relevant background levels. Incidences of respiratory symptom-days are rounded to the nearest 100.

***An 8-hr average standard, denoted m/n is characterized by a concentration of m ppm and an nth daily maximum. So, for example, the current standard is 0.084/4 -- 0.084 ppm, 4th daily maximum 8-hr average using the current rounding convention.

****This alternative 8-hr standard assumes an alternative rounding convention where the standard is specified to the third decimal place.

Note: Numbers in parentheses are 95% confidence or credible intervals based on statistical uncertainty surrounding the O_3 coefficient.

Table 5C-8. Estimated Percent of Total Incidence of Health Risks Associated with O_3 Concentrations that Just Meet the Current and Alternative 8-Hour Daily Maximum Standards: Boston, MA, April - September, Based on 2004 O_3 Concentrations

Respiratory Symptoms*	Study	Ages	Lag	Exposure Metric	Other Pollutants in Model	Percent of Total Incidence of Respiratory Symptom-Days Associated with O_3 Concentrations that Just Meet the Current and Alternative O_3 Standards**							
						0.084/4***	0.084/3	0.080/4****	0.074/5	0.074/4	0.074/3	0.070/4****	0.064/4
Chest tightness	Gent et al. (2003)	0 - 12	1-day lag	1 hr max.	none	8% (1.3% - 14.2%)	7.6% (1.2% - 13.4%)	7.5% (1.2% - 13.3%)	7.4% (1.2% - 13.1%)	6.8% (1.1% - 12%)	6.5% (1% - 11.5%)	6.3% (1% - 11.2%)	5.5% (0.9% - 9.8%)
Chest tightness	Gent et al. (2003)	0 - 12	0-day lag	1 hr max.	PM2.5	12.9% (5.8% - 19.3%)	12.2% (5.5% - 18.3%)	12.1% (5.4% - 18.2%)	11.9% (5.3% - 17.8%)	11% (4.9% - 16.5%)	10.5% (4.6% - 15.8%)	10.1% (4.5% - 15.3%)	8.9% (3.9% - 13.5%)
Chest tightness	Gent et al. (2003)	0 - 12	1-day lag	1 hr max.	PM2.5	11.9% (4.6% - 18.4%)	11.2% (4.3% - 17.4%)	11.1% (4.3% - 17.3%)	10.9% (4.2% - 17%)	10% (3.8% - 15.7%)	9.6% (3.7% - 15%)	9.3% (3.5% - 14.6%)	8.2% (3.1% - 12.8%)
Chest tightness	Gent et al. (2003)	0 - 12	1-day lag	8 hr max.	none	8.3% (2.6% - 13.4%)	7.8% (2.5% - 12.7%)	7.8% (2.5% - 12.6%)	7.6% (2.4% - 12.4%)	7% (2.2% - 11.4%)	6.7% (2.1% - 10.9%)	6.5% (2% - 10.6%)	5.7% (1.8% - 9.3%)
Shortness of breath	Gent et al. (2003)	0 - 12	1-day lag	1 hr max.	none	7% (0.8% - 12.6%)	6.6% (0.8% - 11.9%)	6.5% (0.8% - 11.8%)	6.4% (0.8% - 11.6%)	5.9% (0.7% - 10.6%)	5.6% (0.7% - 10.2%)	5.4% (0.6% - 9.9%)	4.7% (0.6% - 8.7%)
Shortness of breath	Gent et al. (2003)	0 - 12	1-day lag	8 hr max.	none	7.6% (1.5% - 13.2%)	7.2% (1.4% - 12.5%)	7.2% (1.4% - 12.4%)	7% (1.4% - 12.2%)	6.4% (1.2% - 11.2%)	6.1% (1.2% - 10.7%)	5.9% (1.1% - 10.4%)	5.2% (1% - 9.1%)
Wheeze	Gent et al. (2003)	0 - 12	0-day lag	1 hr max.	PM2.5	10.1% (3.6% - 16%)	9.6% (3.4% - 15.2%)	9.5% (3.4% - 15.1%)	9.3% (3.3% - 14.8%)	8.6% (3% - 13.7%)	8.2% (2.9% - 13%)	7.9% (2.8% - 12.7%)	6.9% (2.4% - 11.2%)

*Respiratory symptoms among asthmatic medication-users associated with short-term exposures to O_3.

**Incidence was quantified down to estimated policy relevant background levels. Percents are rounded to the nearest tenth.

***An 8-hr average standard, denoted m/n is characterized by a concentration of m ppm and an nth daily maximum. So, for example, the current standard is 0.084/4 -- 0.084 ppm, 4th daily maximum 8-hr average using the current rounding convention.

****This alternative 8-hr standard assumes an alternative rounding convention where the standard is specified to the third decimal place.

Note: Numbers in parentheses are 95% confidence or credible intervals based on statistical uncertainty surrounding the O_3 coefficient.

Table 5C-9. Estimated Incidence of Health Risks Associated with O_3 Concentrations that Just Meet the Current and Alternative 8-Hour Daily Maximum Standards: Boston, MA, April - September, Based on 2002 O_3 Concentrations

Respiratory Symptoms*	Study	Ages	Lag	Exposure Metric	Other Pollutants in Model	Incidence of Respiratory Symptom-Days (in 100s) Associated with O_3 Concentrations that Just Meet the Current and Alternative O_3 Standards**							
						0.084/4***	0.084/3	0.080/4****	0.074/5	0.074/4	0.074/3	0.070/4****	0.064/4
Chest tightness	Gent et al. (2003)	0 - 12	1-day lag	1 hr max.	none	61 (10 - 105)	58 (9 - 101)	58 (9 - 1)	57 (9 - 99)	53 (9 - 93)	52 (8 - 90)	50 (8 - 88)	46 (7 - 80)
Chest tightness	Gent et al. (2003)	0 - 12	0-day lag	1 hr max.	PM2.5	96 (44 - 141)	93 (42 - 136)	92 (42 - 135)	90 (41 - 133)	85 (38 - 126)	82 (37 - 122)	80 (36 - 119)	73 (33 - 109)
Chest tightness	Gent et al. (2003)	0 - 12	1-day lag	1 hr max.	PM2.5	89 (35 - 135)	85 (33 - 130)	85 (33 - 129)	83 (32 - 127)	78 (30 - 120)	76 (29 - 116)	74 (29 - 114)	67 (26 - 104)
Chest tightness	Gent et al. (2003)	0 - 12	1-day lag	8 hr max.	none	64 (21 - 101)	61 (20 - 97)	60 (20 - 97)	59 (19 - 95)	56 (18 - 90)	54 (17 - 87)	53 (17 - 85)	48 (15 - 77)
Shortness of breath	Gent et al. (2003)	0 - 12	1-day lag	1 hr max.	none	66 (8 - 117)	63 (8 - 113)	63 (8 - 112)	61 (8 - 110)	58 (7 - 103)	56 (7 - 1)	54 (7 - 98)	49 (6 - 89)
Shortness of breath	Gent et al. (2003)	0 - 12	1-day lag	8 hr max.	none	73 (15 - 125)	70 (14 - 120)	70 (14 - 119)	68 (13 - 117)	64 (13 - 110)	62 (12 - 107)	61 (12 - 104)	55 (11 - 95)
Wheeze	Gent et al. (2003)	0 - 12	0-day lag	1 hr max.	PM2.5	178 (65 - 277)	171 (62 - 266)	169 (61 - 264)	166 (60 - 259)	156 (56 - 245)	151 (54 - 238)	147 (53 - 232)	134 (48 - 212)

*Respiratory symptoms among asthmatic medication-users associated with short-term exposures to O_3.

**Incidence was quantified down to estimated policy relevant background levels. Incidences of respiratory symptom-days are rounded to the nearest 100.

***An 8-hr average standard, denoted m/n is characterized by a concentration of m ppm and an nth daily maximum. So, for example, the current standard is 0.084/4 -- 0.084 ppm, 4th daily maximum 8-hr average using the current rounding convention.

****This alternative 8-hr standard assumes an alternative rounding convention where the standard is specified to the third decimal place.

Note: Numbers in parentheses are 95% confidence or credible intervals based on statistical uncertainty surrounding the O_3 coefficient.

Table 5C-10. Estimated Percent of Total Incidence of Health Risks Associated with O_3 Concentrations that Just Meet the Current and Alternative 8-Hour Daily Maximum Standards: Boston, MA, April - September, Based on 2002 O_3 Concentrations

Respiratory Symptoms*	Study	Ages	Lag	Exposure Metric	Other Pollutants in Model	Percent of Total Incidence of Respiratory Symptom-Days Associated with O_3 Concentrations that Just Meet the Current and Alternative O_3 Standards**							
						0.084/4***	0.084/3	0.080/4****	0.074/5	0.074/4	0.074/3	0.070/4****	0.064/4
Chest tightness	Gent et al. (2003)	0 - 12	1-day lag	1 hr max.	none	11% (1.8% - 18.9%)	10.5% (1.7% - 18.2%)	10.4% (1.7% - 18.1%)	10.2% (1.6% - 17.7%)	9.6% (1.5% - 16.7%)	9.3% (1.5% - 16.2%)	9% (1.4% - 15.8%)	8.2% (1.3% - 14.4%)
Chest tightness	Gent et al. (2003)	0 - 12	0-day lag	1 hr max.	PM2.5	17.3% (7.9% - 25.4%)	16.6% (7.6% - 24.5%)	16.5% (7.5% - 24.3%)	16.2% (7.3% - 23.9%)	15.3% (6.9% - 22.6%)	14.8% (6.7% - 21.9%)	14.4% (6.5% - 21.4%)	13.1% (5.9% - 19.6%)
Chest tightness	Gent et al. (2003)	0 - 12	1-day lag	1 hr max.	PM2.5	16% (6.3% - 24.3%)	15.3% (6% - 23.3%)	15.2% (6% - 23.2%)	14.9% (5.8% - 22.7%)	14% (5.5% - 21.5%)	13.6% (5.3% - 20.9%)	13.3% (5.1% - 20.4%)	12% (4.6% - 18.7%)
Chest tightness	Gent et al. (2003)	0 - 12	1-day lag	8 hr max.	none	11.4% (3.7% - 18.2%)	10.9% (3.5% - 17.5%)	10.9% (3.5% - 17.4%)	10.6% (3.4% - 17%)	10% (3.2% - 16.1%)	9.7% (3.1% - 15.6%)	9.5% (3% - 15.2%)	8.6% (2.7% - 13.9%)
Shortness of breath	Gent et al. (2003)	0 - 12	1-day lag	1 hr max.	none	9.5% (1.2% - 16.9%)	9.1% (1.1% - 16.2%)	9% (1.1% - 16.1%)	8.8% (1.1% - 15.8%)	8.3% (1% - 14.9%)	8% (1% - 14.4%)	7.8% (0.9% - 14%)	7.1% (0.9% - 12.8%)
Shortness of breath	Gent et al. (2003)	0 - 12	1-day lag	8 hr max.	none	10.6% (2.1% - 17.9%)	10.1% (2% - 17.2%)	10% (2% - 17.1%)	9.8% (1.9% - 16.8%)	9.2% (1.8% - 15.8%)	8.9% (1.8% - 15.4%)	8.7% (1.7% - 15%)	7.9% (1.5% - 13.7%)
Wheeze	Gent et al. (2003)	0 - 12	0-day lag	1 hr max.	PM2.5	13.7% (5% - 21.3%)	13.1% (4.8% - 20.5%)	13% (4.7% - 20.4%)	12.8% (4.6% - 20%)	12% (4.3% - 18.9%)	11.6% (4.2% - 18.3%)	11.3% (4.1% - 17.9%)	10.3% (3.7% - 16.3%)

*Respiratory symptoms among asthmatic medication-users associated with short-term exposures to O_3.

**Incidence was quantified down to estimated policy relevant background levels. Percents are rounded to the nearest tenth.

***An 8-hr average standard, denoted m/n is characterized by a concentration of m ppm and an nth daily maximum. So, for example, the current standard is 0.084/4 -- 0.084 ppm, 4th daily maximum 8-hr average using the current rounding convention.

****This alternative 8-hr standard assumes an alternative rounding convention where the standard is specified to the third decimal place.

Note: Numbers in parentheses are 95% confidence or credible intervals based on statistical uncertainty surrounding the O_3 coefficient.

Table 5C-11. Estimated Incidence, Incidence per 100,000 Relevant Population, and Percent of Total Incidence of Hospital Admissions Associated with O_3 Concentrations that Just Meet the Current and Alternative 8-Hour Daily Maximum Standards: New York, NY, April - September, Based on 2004 O_3 Concentrations*

Hospital Admissions	Lag	Incidence of Health Effects Associated with O_3 Concentrations that Just Meet the Current and Alternative O_3 Standards**							
		0.084/4***	0.084/3	0.080/4****	0.074/5	0.074/4	0.074/3	0.070/4****	0.064/4
Respiratory illness (unscheduled)	3-day lag	366 (89 - 644)	334 (81 - 588)	341 (82 - 599)	314 (76 - 551)	304 (73 - 534)	279 (67 - 490)	278 (67 - 489)	241 (58 - 424)
Asthma (unscheduled)	1-day lag	313 (66 - 559)	286 (61 - 510)	291 (62 - 520)	268 (57 - 479)	259 (55 - 464)	238 (51 - 425)	238 (51 - 425)	206 (44 - 368)
Hospital Admissions	**Lag**	**Incidence of Health Effects per 100,000 Relevant Population Associated with O_3 Concentrations that Just Meet the Current and Alternative O_3 Standards**							
		0.084/4***	0.084/3	0.080/4****	0.074/5	0.074/4	0.074/3	0.070/4****	0.064/4
Respiratory illness (unscheduled)	3-day lag	4.6 (1.1 - 8)	4.2 (1 - 7.3)	4.3 (1 - 7.5)	3.9 (0.9 - 6.9)	3.8 (0.9 - 6.7)	3.5 (0.8 - 6.1)	3.5 (0.8 - 6.1)	3 (0.7 - 5.3)
Asthma (unscheduled)	1-day lag	3.9 (0.8 - 7)	3.6 (0.8 - 6.4)	3.6 (0.8 - 6.5)	3.3 (0.7 - 6)	3.2 (0.7 - 5.8)	3 (0.6 - 5.3)	3 (0.6 - 5.3)	2.6 (0.5 - 4.6)
Hospital Admissions	**Lag**	**Percent of Total Incidence of Health Effects Associated with O_3 Concentrations that Just Meet the Current and Alternative O_3 Standards**							
		0.084/4***	0.084/3	0.080/4****	0.074/5	0.074/4	0.074/3	0.070/4****	0.064/4
Respiratory illness (unscheduled)	3-day lag	1% (0.3% - 1.8%)	0.9% (0.2% - 1.7%)	1% (0.2% - 1.7%)	0.9% (0.2% - 1.6%)	0.9% (0.2% - 1.5%)	0.8% (0.2% - 1.4%)	0.8% (0.2% - 1.4%)	0.7% (0.2% - 1.2%)
Asthma (unscheduled)	1-day lag	2.4% (0.5% - 4.3%)	2.2% (0.5% - 3.9%)	2.2% (0.5% - 4%)	2% (0.4% - 3.6%)	2% (0.4% - 3.5%)	1.8% (0.4% - 3.2%)	1.8% (0.4% - 3.2%)	1.6% (0.3% - 2.8%)

*Based on single-pollutant models from Thurston et al. (1992) relating daily hospital admissions among all ages to daily 1-hr maximum O_3 exposures. New York in this study is defined as the five boroughs of New York City.

**Incidence was quantified down to estimated policy relevant background levels. Incidences are rounded to the nearest whole number; incidences per 100,000 relevant population and percent of total incidence are rounded to the nearest tenth.

***An 8-hr average standard, denoted m/n is characterized by a concentration of m ppm and an nth daily maximum. So, for example, the current standard is 0.084/4 -- 0.084 ppm, 4th daily maximum 8-hr average using the current rounding convention.

****This alternative 8-hr standard assumes an alternative rounding convention where the standard is specified to the third decimal place.

Note: Numbers in parentheses are 95% confidence or credible intervals based on statistical uncertainty surrounding the O_3 coefficient.

Table 5C-12. Estimated Incidence, Incidence per 100,000 Relevant Population, and Percent of Total Incidence of Hospital Admissions Associated with O_3 Concentrations that Just Meet the Current and Alternative 8-Hour Daily Maximum Standards: New York, NY, April - September, Based on 2002 O_3 Concentrations*

Hospital Admissions	Lag	Incidence of Health Effects Associated with O_3 Concentrations that Just Meet the Current and Alternative O_3 Standards**							
		0.084/4***	0.084/3	0.080/4****	0.074/5	0.074/4	0.074/3	0.070/4****	0.064/4
Respiratory illness (unscheduled)	3-day lag	513 (124 - 902)	472 (114 - 830)	483 (117 - 850)	452 (109 - 795)	439 (106 - 772)	404 (98 - 710)	410 (99 - 721)	365 (88 - 642)
Asthma (unscheduled)	1-day lag	438 (93 - 783)	403 (86 - 720)	413 (88 - 738)	386 (82 - 690)	375 (80 - 670)	345 (73 - 617)	350 (75 - 626)	312 (66 - 558)
Hospital Admissions	**Lag**	**Incidence of Health Effects per 100,000 Relevant Population Associated with O_3 Concentrations that Just Meet the Current and Alternative O_3 Standards**							
		0.084/4***	0.084/3	0.080/4****	0.074/5	0.074/4	0.074/3	0.070/4****	0.064/4
Respiratory illness (unscheduled)	3-day lag	6.4 (1.5 - 11.3)	5.9 (1.4 - 10.4)	6 (1.5 - 10.6)	5.6 (1.4 - 9.9)	5.5 (1.3 - 9.6)	5 (1.2 - 8.9)	5.1 (1.2 - 9)	4.6 (1.1 - 8)
Asthma (unscheduled)	1-day lag	5.5 (1.2 - 9.8)	5 (1.1 - 9)	5.2 (1.1 - 9.2)	4.8 (1 - 8.6)	4.7 (1 - 8.4)	4.3 (0.9 - 7.7)	4.4 (0.9 - 7.8)	3.9 (0.8 - 7)
Hospital Admissions	**Lag**	**Percent of Total Incidence of Health Effects Associated with O_3 Concentrations that Just Meet the Current and Alternative O_3 Standards**							
		0.084/4***	0.084/3	0.080/4****	0.074/5	0.074/4	0.074/3	0.070/4****	0.064/4
Respiratory illness (unscheduled)	3-day lag	1.5% (0.4% - 2.6%)	1.3% (0.3% - 2.3%)	1.4% (0.3% - 2.4%)	1.3% (0.3% - 2.2%)	1.2% (0.3% - 2.2%)	1.1% (0.3% - 2%)	1.2% (0.3% - 2%)	1% (0.2% - 1.8%)
Asthma (unscheduled)	1-day lag	3.3% (0.7% - 6%)	3.1% (0.7% - 5.5%)	3.1% (0.7% - 5.6%)	2.9% (0.6% - 5.3%)	2.9% (0.6% - 5.1%)	2.6% (0.6% - 4.7%)	2.7% (0.6% - 4.8%)	2.4% (0.5% - 4.2%)

*Based on single-pollutant models from Thurston et al. (1992) relating daily hospital admissions among all ages to daily 1-hr maximum O_3 exposures. New York in this study is defined as the five boroughs of New York City.

**Incidence was quantified down to estimated policy relevant background levels. Incidences are rounded to the nearest whole number; incidences per 100,000 relevant population and percent of total incidence are rounded to the nearest tenth.

***An 8-hr average standard, denoted m/n is characterized by a concentration of m ppm and an nth daily maximum. So, for example, the current standard is 0.084/4 -- 0.084 ppm, 4th daily maximum 8-hr average using the current rounding convention.

****This alternative 8-hr standard assumes an alternative rounding convention where the standard is specified to the third decimal place.

Note: Numbers in parentheses are 95% confidence or credible intervals based on statistical uncertainty surrounding the O_3 coefficient.

Table 5C-13. Estimated Incidence of Non-Accidental Mortality Associated with O_3 Concentrations that Just Meet the Current and Alternative 8-Hour Daily Maximum Standards: April - September, Based on 2004 O_3 Concentrations*

Location	Study	Lag	Exposure Metric	Incidence of Non-Accidental Mortality Associated with O_3 Concentrations that Just Meet the Current and Alternative O_3 Standards**							
				0.084/4***	0.084/3	0.080/4****	0.074/5	0.074/4	0.074/3	0.070/4****	0.064/4
Atlanta	Bell et al. (2004)	distributed lag	24 hr avg.	5 (-20 - 29)	5 (-20 - 29)	4 (-18 - 26)	4 (-16 - 23)	4 (-15 - 22)	4 (-15 - 22)	3 (-13 - 19)	3 (-11 - 16)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	9 (3 - 15)	9 (3 - 15)	8 (3 - 14)	7 (2 - 12)	7 (2 - 12)	7 (2 - 12)	6 (2 - 10)	5 (2 - 8)
Boston	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	6 (2 - 9)	5 (2 - 9)	5 (2 - 9)	5 (2 - 8)	4 (1 - 7)	4 (1 - 7)	4 (1 - 7)	3 (1 - 6)
Chicago	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	33 (11 - 55)	31 (10 - 52)	29 (10 - 48)	26 (9 - 43)	23 (8 - 39)	22 (7 - 36)	19 (6 - 32)	14 (5 - 24)
	Schwartz (2004)	0-day lag	1 hr max.	314 (99 - 525)	300 (95 - 501)	288 (91 - 482)	268 (85 - 448)	249 (79 - 417)	238 (75 - 399)	222 (70 - 372)	183 (58 - 307)
	Schwartz -- 14 US Cities (2004)	0-day lag	1 hr max.	118 (37 - 199)	113 (35 - 190)	108 (34 - 182)	101 (31 - 170)	93 (29 - 157)	89 (28 - 151)	83 (26 - 140)	69 (21 - 116)
Cleveland	Bell et al. (2004)	distributed lag	24 hr avg.	19 (-12 - 49)	18 (-11 - 46)	17 (-11 - 44)	15 (-9 - 39)	14 (-9 - 37)	14 (-9 - 36)	13 (-8 - 33)	10 (-6 - 26)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	12 (4 - 20)	11 (4 - 19)	11 (4 - 18)	9 (3 - 16)	9 (3 - 15)	9 (3 - 14)	8 (3 - 13)	6 (2 - 11)
Detroit	Bell et al. (2004)	distributed lag	24 hr avg.	24 (-8 - 56)	22 (-7 - 51)	21 (-7 - 49)	21 (-7 - 48)	17 (-6 - 40)	16 (-5 - 38)	15 (-5 - 35)	11 (-4 - 27)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	12 (4 - 20)	11 (4 - 19)	11 (4 - 18)	11 (4 - 18)	9 (3 - 15)	8 (3 - 14)	8 (3 - 13)	6 (2 - 10)
	Schwartz (2004)	0-day lag	1 hr max.	107 (-17 - 229)	102 (-17 - 218)	99 (-16 - 212)	97 (-16 - 209)	87 (-14 - 186)	83 (-13 - 178)	78 (-13 - 168)	66 (-11 - 142)
	Schwartz -- 14 US Cities (2004)	0-day lag	1 hr max.	58 (18 - 98)	55 (17 - 93)	54 (17 - 91)	53 (17 - 89)	47 (15 - 79)	45 (14 - 76)	42 (13 - 72)	36 (11 - 61)
	Ito (2003)	0-day lag	24 hr avg.	29 (-27 - 85)	27 (-25 - 78)	26 (-24 - 75)	25 (-23 - 73)	21 (-20 - 62)	20 (-18 - 57)	18 (-17 - 53)	14 (-13 - 41)
Houston	Bell et al. (2004)	distributed lag	24 hr avg.	22 (1 - 42)	20 (1 - 39)	19 (1 - 37)	17 (1 - 32)	16 (1 - 30)	15 (1 - 28)	13 (1 - 25)	8 (0 - 15)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	11 (4 - 18)	10 (3 - 16)	10 (3 - 16)	8 (3 - 13)	8 (3 - 13)	7 (2 - 12)	6 (2 - 11)	4 (1 - 6)
	Schwartz (2004)	0-day lag	1 hr max.	70 (6 - 132)	66 (6 - 126)	65 (6 - 123)	59 (5 - 112)	57 (5 - 109)	55 (5 - 104)	52 (5 - 99)	42 (4 - 80)
	Schwartz -- 14 US Cities (2004)	0-day lag	1 hr max.	58 (18 - 98)	55 (17 - 93)	54 (17 - 91)	49 (15 - 83)	48 (15 - 81)	46 (14 - 77)	43 (14 - 73)	35 (11 - 59)

Location	Study	Lag	Exposure Metric	Incidence of Non-Accidental Mortality Associated with O_3 Concentrations that Just Meet the Current and Alternative O_3 Standards**							
				0.084/4***	0.084/3	0.080/4****	0.074/5	0.074/4	0.074/3	0.070/4****	0.064/4
Los Angeles	Bell et al. (2004)	distributed lag	24 hr avg.	31 (-74 - 135)	30 (-72 - 131)	27 (-66 - 120)	22 (-52 - 95)	20 (-49 - 90)	19 (-46 - 83)	16 (-38 - 69)	9 (-22 - 41)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	67 (22 - 111)	64 (22 - 107)	59 (20 - 98)	47 (16 - 78)	44 (15 - 74)	41 (14 - 68)	34 (11 - 56)	20 (7 - 33)
New York	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	43 (15 - 72)	38 (13 - 63)	39 (13 - 65)	35 (12 - 58)	33 (11 - 55)	29 (10 - 48)	29 (10 - 49)	24 (8 - 39)
Philadelphia	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	17 (6 - 28)	15 (5 - 25)	15 (5 - 25)	13 (4 - 22)	13 (4 - 21)	12 (4 - 20)	11 (4 - 19)	9 (3 - 15)
	Moolgavkar et al. (1995)	1-day lag	24 hr avg.	59 (37 - 81)	54 (34 - 75)	54 (34 - 74)	47 (30 - 65)	46 (29 - 63)	42 (27 - 58)	41 (26 - 56)	33 (21 - 46)
Sacramento	Bell et al. (2004)	distributed lag	24 hr avg.	8 (-25 - 42)	8 (-25 - 41)	8 (-23 - 39)	7 (-21 - 35)	7 (-21 - 34)	7 (-20 - 34)	6 (-19 - 31)	5 (-16 - 26)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	12 (4 - 21)	12 (4 - 20)	11 (4 - 19)	10 (4 - 17)	10 (3 - 17)	10 (3 - 17)	9 (3 - 15)	8 (3 - 13)
St Louis	Bell et al. (2004)	distributed lag	24 hr avg.	3 (-4 - 9)	2 (-4 - 8)	2 (-4 - 8)	2 (-3 - 6)	2 (-3 - 6)	1 (-2 - 5)	1 (-2 - 5)	1 (-1 - 3)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	2 (1 - 4)	2 (1 - 3)	2 (1 - 3)	2 (1 - 3)	1 (0 - 2)	1 (0 - 2)	1 (0 - 2)	1 (0 - 1)
Washington	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	7 (2 - 12)	6 (2 - 10)	6 (2 - 11)	6 (2 - 9)	6 (2 - 9)	5 (2 - 8)	5 (2 - 8)	4 (1 - 7)

*All results are for mortality (among all ages) associated with short-term exposures to O_3. All results are based on single-pollutant models.

**Incidence was quantified down to estimated policy relevant background levels. Incidences are rounded to the nearest whole number.

8-hr average.

Note: Numbers in parentheses are 95% confidence or credible intervals based on statistical uncertainty surrounding the O_3 coefficient.

Table 5C-14. Estimated Percent of Total Incidence of Non-Accidental Mortality Associated with O_3 Concentrations that Just Meet the Current and Alternative 8-Hour Daily Maximum Standards: April - September, Based on 2004 O_3 Concentrations*

Location	Study	Lag	Exposure Metric	Percent of Total Incidence of Non-Accidental Mortality Associated with O_3 Concentrations that Just Meet the Current and Alternative O_3 Standards**							
				0.084/4*	**0.084/3**	**0.080/4****	**0.074/5**	**0.074/4**	**0.074/3**	**0.070/4****	**0.064/4**
Atlanta	Bell et al. (2004)	distributed lag	24 hr avg.	0.1% (-0.4% -0.6%)	0.1% (-0.4% -0.6%)	0.1% (-0.4% -0.6%)	0.1% (-0.3% -0.5%)	0.1% (-0.3% -0.5%)	0.1% (-0.3% -0.5%)	0.1% (-0.3% -0.4%)	0.1% (-0.2% -0.3%)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	0.2% (0.1% -0.3%)	0.2% (0.1% -0.3%)	0.2% (0.1% -0.3%)	0.2% (0.1% -0.3%)	0.2% (0.1% -0.3%)	0.2% (0.1% -0.3%)	0.1% (0% -0.2%)	0.1% (0% -0.2%)
Boston	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	0.2% (0.1% -0.4%)	0.2% (0.1% -0.3%)	0.2% (0.1% -0.3%)	0.2% (0.1% -0.3%)	0.2% (0.1% -0.3%)	0.2% (0.1% -0.3%)	0.2% (0.1% -0.3%)	0.1% (0% -0.2%)
Chicago	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	0.2% (0.1% -0.3%)	0.1% (0% -0.2%)	0.1% (0% -0.2%)	0.1% (0% -0.2%)	0.1% (0% -0.2%)	0.1% (0% -0.2%)	0.1% (0% -0.2%)	0.1% (0% -0.1%)
	Schwartz (2004)	0-day lag	1 hr max.	1.5% (0.5% -2.5%)	1.4% (0.5% -2.4%)	1.4% (0.4% -2.3%)	1.3% (0.4% -2.1%)	1.2% (0.4% -2%)	1.1% (0.4% -1.9%)	1.1% (0.3% -1.8%)	0.9% (0.3% -1.5%)
	Schwartz -- 14 US Cities (2004)	0-day lag	1 hr max.	0.6% (0.2% -0.9%)	0.5% (0.2% -0.9%)	0.5% (0.2% -0.9%)	0.5% (0.1% -0.8%)	0.4% (0.1% -0.7%)	0.4% (0.1% -0.7%)	0.4% (0.1% -0.7%)	0.3% (0.1% -0.6%)
Cleveland	Bell et al. (2004)	distributed lag	24 hr avg.	0.3% (-0.2% -0.7%)	0.2% (-0.1% -0.6%)	0.2% (-0.1% -0.6%)	0.2% (-0.1% -0.5%)	0.2% (-0.1% -0.5%)	0.2% (-0.1% -0.5%)	0.2% (-0.1% -0.4%)	0.1% (-0.1% -0.4%)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	0.2% (0.1% -0.3%)	0.2% (0.1% -0.3%)	0.1% (0% -0.2%)	0.1% (0% -0.2%)	0.1% (0% -0.2%)	0.1% (0% -0.2%)	0.1% (0% -0.2%)	0.1% (0% -0.1%)
Detroit	Bell et al. (2004)	distributed lag	24 hr avg.	0.3% (-0.1% -0.6%)	0.2% (-0.1% -0.5%)	0.2% (-0.1% -0.5%)	0.2% (-0.1% -0.5%)	0.2% (-0.1% -0.4%)	0.2% (-0.1% -0.4%)	0.2% (-0.1% -0.4%)	0.1% (0% -0.3%)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	0.1% (0% -0.2%)	0.1% (0% -0.2%)	0.1% (0% -0.2%)	0.1% (0% -0.2%)	0.1% (0% -0.2%)	0.1% (0% -0.1%)	0.1% (0% -0.1%)	0.1% (0% -0.1%)
	Schwartz (2004)	0-day lag	1 hr max.	1.1% (-0.2% -2.4%)	1.1% (-0.2% -2.3%)	1.1% (-0.2% -2.3%)	1% (-0.2% -2.2%)	0.9% (-0.1% -2%)	0.9% (-0.1% -1.9%)	0.8% (-0.1% -1.8%)	0.7% (-0.1% -1.5%)
	Schwartz -- 14 US Cities (2004)	0-day lag	1 hr max.	0.6% (0.2% -1%)	0.6% (0.2% -1%)	0.6% (0.2% -1%)	0.6% (0.2% -0.9%)	0.5% (0.2% -0.8%)	0.5% (0.1% -0.8%)	0.5% (0.1% -0.8%)	0.4% (0.1% -0.6%)
	Ito (2003)	0-day lag	24 hr avg.	0.3% (-0.3% -0.9%)	0.3% (-0.3% -0.8%)	0.3% (-0.3% -0.8%)	0.3% (-0.2% -0.8%)	0.2% (-0.2% -0.7%)	0.2% (-0.2% -0.6%)	0.2% (-0.2% -0.6%)	0.1% (-0.1% -0.4%)
Houston	Bell et al. (2004)	distributed lag	24 hr avg.	0.2% (0% -0.5%)	0.2% (0% -0.4%)	0.2% (0% -0.4%)	0.2% (0% -0.4%)	0.2% (0% -0.3%)	0.2% (0% -0.3%)	0.1% (0% -0.3%)	0.1% (0% -0.2%)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	0.1% (0% -0.2%)	0.1% (0% -0.2%)	0.1% (0% -0.2%)	0.1% (0% -0.1%)	0.1% (0% -0.1%)	0.1% (0% -0.1%)	0.1% (0% -0.1%)	0% (0% -0.1%)
	Schwartz (2004)	0-day lag	1 hr max.	0.8% (0.1% -1.5%)	0.7% (0.1% -1.4%)	0.7% (0.1% -1.4%)	0.6% (0.1% -1.2%)	0.6% (0.1% -1.2%)	0.6% (0.1% -1.1%)	0.6% (0.1% -1.1%)	0.5% (0% -0.9%)
	Schwartz -- 14 US Cities (2004)	0-day lag	1 hr max.	0.6% (0.2% -1.1%)	0.6% (0.2% -1%)	0.6% (0.2% -1%)	0.5% (0.2% -0.9%)	0.5% (0.2% -0.9%)	0.5% (0.2% -0.8%)	0.5% (0.1% -0.8%)	0.4% (0.1% -0.7%)

Location	Study	Lag	Exposure Metric	Percent of Total Incidence of Non-Accidental Mortality Associated with O_3 Concentrations that Just Meet the Current and Alternative O_3 Standards**							
				0.084/4***	0.084/3	0.080/4****	0.074/5	0.074/4	0.074/3	0.070/4****	0.064/4
Los Angeles	Bell et al. (2004)	distributed lag	24 hr avg.	0.1% (-0.3% -0.5%)	0.1% (-0.3% -0.5%)	0.1% (-0.2% -0.4%)	0.1% (-0.2% -0.3%)	0.1% (-0.2% -0.3%)	0.1% (-0.2% -0.3%)	0.1% (-0.1% -0.3%)	0% (-0.1% -0.2%)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	0.2% (0.1% -0.4%)	0.2% (0.1% -0.4%)	0.2% (0.1% -0.4%)	0.2% (0.1% -0.3%)	0.2% (0.1% -0.3%)	0.2% (0.1% -0.3%)	0.1% (0% -0.2%)	0.1% (0% -0.1%)
New York	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	0.1% (0% -0.2%)	0.1% (0% -0.2%)	0.1% (0% -0.2%)	0.1% (0% -0.2%)	0.1% (0% -0.2%)	0.1% (0% -0.2%)	0.1% (0% -0.2%)	0.1% (0% -0.1%)
Philadelphia	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	0.2% (0.1% -0.3%)	0.2% (0.1% -0.3%)	0.2% (0.1% -0.3%)	0.2% (0.1% -0.3%)	0.2% (0.1% -0.3%)	0.1% (0% -0.2%)	0.1% (0% -0.2%)	0.1% (0% -0.2%)
	Moolgavkar et al. (1995)	1-day lag	24 hr avg.	0.7% (0.5% -1%)	0.7% (0.4% -0.9%)	0.7% (0.4% -0.9%)	0.6% (0.4% -0.8%)	0.6% (0.4% -0.8%)	0.5% (0.3% -0.7%)	0.5% (0.3% -0.7%)	0.4% (0.3% -0.6%)
Sacramento	Bell et al. (2004)	distributed lag	24 hr avg.	0.2% (-0.6% -1%)	0.2% (-0.6% -1%)	0.2% (-0.6% -0.9%)	0.2% (-0.5% -0.8%)	0.2% (-0.5% -0.8%)	0.2% (-0.5% -0.8%)	0.1% (-0.5% -0.7%)	0.1% (-0.4% -0.6%)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	0.3% (0.1% -0.5%)	0.3% (0.1% -0.5%)	0.3% (0.1% -0.5%)	0.2% (0.1% -0.4%)	0.2% (0.1% -0.4%)	0.2% (0.1% -0.4%)	0.2% (0.1% -0.4%)	0.2% (0.1% -0.3%)
St Louis	Bell et al. (2004)	distributed lag	24 hr avg.	0.1% (-0.2% -0.5%)	0.1% (-0.2% -0.4%)	0.1% (-0.2% -0.4%)	0.1% (-0.1% -0.3%)	0.1% (-0.1% -0.3%)	0.1% (-0.1% -0.3%)	0.1% (-0.1% -0.2%)	0% (-0.1% -0.1%)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	0.1% (0% -0.2%)	0.1% (0% -0.2%)	0.1% (0% -0.2%)	0.1% (0% -0.1%)	0.1% (0% -0.1%)	0.1% (0% -0.1%)	0.1% (0% -0.1%)	0% (0% -0.1%)
Washington	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	0.3% (0.1% -0.4%)	0.2% (0.1% -0.4%)	0.2% (0.1% -0.4%)	0.2% (0.1% -0.3%)	0.2% (0.1% -0.3%)	0.2% (0.1% -0.3%)	0.2% (0.1% -0.3%)	0.2% (0.1% -0.3%)

*All results are for mortality (among all ages) associated with short-term exposures to O_3. All results are based on single-pollutant models.

**Incidence was quantified down to estimated policy relevant background levels. Percents are rounded to the nearest tenth.

***An 8-hr average standard, denoted m/n is characterized by a concentration of m ppb and an nth daily maximum. So, for example, the current standard is 84/4 -- 84 ppb, 4th daily maximum 8-hr average.

Note: Numbers in parentheses are 95% confidence or credible intervals based on statistical uncertainty surrounding the O_3 coefficient.

Table 5C-15. Estimated Incidence of Non-Accidental Mortality Associated with O_3 Concentrations that Just Meet the Current and Alternative 8-Hour Daily Maximum Standards: April - September, Based on 2002 O_3 Concentrations*

Location	Study	Lag	Exposure Metric	Incidence of Non-Accidental Mortality Associated with O_3 Concentrations that Just Meet the Current and Alternative O_3 Standards**							
				0.084/4***	**0.084/3**	**0.080/4******	**0.074/5**	**0.074/4**	**0.074/3**	**0.070/4******	**0.064/4**
Atlanta	Bell et al. (2004)	distributed lag	24 hr avg.	7 (-30 - 43)	7 (-30 - 43)	6 (-28 - 40)	6 (-26 - 38)	6 (-24 - 35)	6 (-24 - 35)	5 (-22 - 32)	4 (-19 - 27)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	14 (5 - 23)	14 (5 - 23)	13 (4 - 21)	12 (4 - 20)	11 (4 - 19)	11 (4 - 19)	10 (3 - 17)	9 (3 - 14)
Boston	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	9 (3 - 15)	8 (3 - 14)	8 (3 - 14)	8 (3 - 13)	7 (3 - 12)	7 (2 - 12)	7 (2 - 12)	6 (2 - 10)
Chicago	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	55 (18 - 91)	52 (18 - 87)	50 (17 - 84)	47 (16 - 79)	44 (15 - 74)	43 (14 - 71)	40 (13 - 67)	34 (11 - 57)
	Schwartz (2004)	0-day lag	1 hr max.	427 (136 - 712)	412 (131 - 687)	401 (127 - 669)	381 (121 - 636)	361 (115 - 603)	350 (111 - 585)	335 (106 - 559)	294 (93 - 493)
	Schwartz -- 14 US Cities (2004)	0-day lag	1 hr max.	161 (51 - 271)	156 (49 - 261)	151 (47 - 254)	144 (45 - 242)	136 (43 - 229)	132 (41 - 222)	126 (39 - 212)	111 (35 - 187)
Cleveland	Bell et al. (2004)	distributed lag	24 hr avg.	49 (-31 - 128)	47 (-30 - 123)	46 (-29 - 120)	43 (-27 - 112)	42 (-26 - 109)	40 (-25 - 105)	39 (-25 - 102)	35 (-22 - 91)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	31 (10 - 52)	30 (10 - 50)	29 (10 - 49)	27 (9 - 45)	27 (9 - 44)	26 (9 - 43)	25 (8 - 41)	22 (7 - 37)
Detroit	Bell et al. (2004)	distributed lag	24 hr avg.	46 (-15 - 106)	43 (-14 - 100)	43 (-14 - 98)	42 (-14 - 97)	38 (-12 - 87)	35 (-11 - 81)	34 (-11 - 79)	29 (-9 - 67)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	24 (8 - 39)	22 (7 - 37)	22 (7 - 36)	22 (7 - 36)	19 (6 - 32)	18 (6 - 30)	18 (6 - 29)	15 (5 - 25)
	Schwartz (2004)	0-day lag	1 hr max.	158 (-26 - 336)	150 (-24 - 320)	148 (-24 - 316)	147 (-24 - 313)	134 (-22 - 287)	128 (-21 - 274)	125 (-20 - 268)	111 (-18 - 239)
	Schwartz -- 14 US Cities (2004)	0-day lag	1 hr max.	86 (27 - 144)	82 (26 - 137)	81 (25 - 136)	80 (25 - 134)	73 (23 - 123)	70 (22 - 117)	68 (21 - 115)	61 (19 - 102)
	Ito (2003)	0-day lag	24 hr avg.	56 (-52 - 162)	53 (-49 - 151)	52 (-48 - 150)	51 (-48 - 147)	46 (-42 - 132)	43 (-40 - 124)	42 (-39 - 120)	36 (-33 - 103)
Houston	Bell et al. (2004)	distributed lag	24 hr avg.	18 (1 - 34)	16 (1 - 32)	16 (1 - 31)	13 (1 - 26)	13 (1 - 25)	12 (1 - 23)	11 (1 - 21)	7 (0 - 13)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	9 (3 - 15)	8 (3 - 13)	8 (3 - 13)	7 (2 - 11)	6 (2 - 10)	6 (2 - 10)	5 (2 - 9)	3 (1 - 5)
	Schwartz (2004)	0-day lag	1 hr max.	63 (6 - 119)	59 (5 - 113)	58 (5 - 110)	53 (5 - 100)	51 (5 - 97)	48 (4 - 92)	46 (4 - 87)	36 (3 - 69)
	Schwartz -- 14 US Cities (2004)	0-day lag	1 hr max.	53 (16 - 88)	50 (16 - 84)	49 (15 - 82)	44 (14 - 74)	43 (13 - 72)	40 (13 - 68)	38 (12 - 64)	30 (9 - 51)

Location	Study	Lag	Exposure Metric	Incidence of Non-Accidental Mortality Associated with O_3 Concentrations that Just Meet the Current and Alternative O_3 Standards**							
				0.084/4***	0.084/3	0.080/4****	0.074/5	0.074/4	0.074/3	0.070/4****	0.064/4
Los Angeles	Bell et al. (2004)	distributed lag	24 hr avg.	24 (-58 - 105)	23 (-55 - 100)	21 (-50 - 91)	15 (-36 - 66)	15 (-35 - 64)	13 (-32 - 59)	11 (-26 - 48)	7 (-16 - 29)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	52 (17 - 86)	49 (17 - 82)	45 (15 - 74)	33 (11 - 54)	32 (11 - 53)	29 (10 - 48)	24 (8 - 39)	14 (5 - 23)
New York	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	84 (28 - 139)	76 (25 - 126)	78 (26 - 130)	73 (24 - 121)	70 (23 - 116)	64 (21 - 106)	65 (22 - 108)	57 (19 - 95)
Philadelphia	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	30 (10 - 50)	28 (10 - 47)	28 (9 - 47)	26 (9 - 43)	26 (9 - 42)	24 (8 - 40)	24 (8 - 40)	21 (7 - 35)
	Moolgavkar et al. (1995)	1-day lag	24 hr avg.	107 (67 - 146)	101 (63 - 138)	101 (63 - 137)	93 (58 - 127)	91 (57 - 124)	86 (54 - 117)	85 (53 - 116)	75 (47 - 103)
Sacramento	Bell et al. (2004)	distributed lag	24 hr avg.	12 (-37 - 60)	12 (-36 - 58)	11 (-35 - 57)	11 (-32 - 53)	10 (-32 - 52)	10 (-31 - 50)	10 (-30 - 49)	9 (-27 - 44)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	18 (6 - 30)	17 (6 - 29)	17 (6 - 28)	16 (5 - 26)	15 (5 - 26)	15 (5 - 25)	14 (5 - 24)	13 (4 - 22)
St Louis	Bell et al. (2004)	distributed lag	24 hr avg.	5 (-9 - 20)	5 (-9 - 19)	5 (-8 - 18)	4 (-8 - 16)	4 (-7 - 15)	4 (-7 - 15)	4 (-6 - 14)	3 (-5 - 12)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	5 (2 - 8)	5 (2 - 8)	4 (1 - 7)	4 (1 - 7)	4 (1 - 6)	4 (1 - 6)	3 (1 - 6)	3 (1 - 5)
Washington	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	14 (5 - 23)	12 (4 - 20)	13 (4 - 21)	12 (4 - 19)	12 (4 - 19)	10 (3 - 17)	11 (4 - 18)	10 (3 - 16)

*All results are for mortality (among all ages) associated with short-term exposures to O_3. All results are based on single-pollutant models.

**Incidence was quantified down to estimated policy relevant background levels. Incidences are rounded to the nearest whole number.

***An 8-hr average standard, denoted m/n is characterized by a concentration of m ppb and an nth daily maximum. So, for example, the current standard is 84/4 -- 84 ppb, 4th daily maximum 8-hr average.

Note: Numbers in parentheses are 95% confidence or credible intervals based on statistical uncertainty surrounding the O_3 coefficient.

Table 5C-16. Estimated Percent of Total Incidence of Non-Accidental Mortality Associated with O_3 Concentrations that Just Meet the Current and Alternative 8-Hour Daily Maximum Standards: April - September, Based on 2002 O_3 Concentrations*

Location	Study	Lag	Exposure Metric	Percent of Total Incidence of Non-Accidental Mortality Associated with O_3 Concentrations that Just Meet the Current and Alternative O_3 Standards**							
				0.084/4***	0.084/3	0.080/4****	0.074/5	0.074/4	0.074/3	0.070/4****	0.064/4
Atlanta	Bell et al. (2004)	distributed lag	24 hr avg.	0.2% (-0.7% -0.9%)	0.1% (-0.6% -0.9%)	0.1% (-0.6% -0.9%)	0.1% (-0.6% -0.8%)	0.1% (-0.5% -0.8%)	0.1% (-0.5% -0.8%)	0.1% (-0.5% -0.7%)	0.1% (-0.4% -0.6%)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	0.3% (0.1% -0.5%)	0.3% (0.1% -0.5%)	0.3% (0.1% -0.5%)	0.3% (0.1% -0.4%)	0.2% (0.1% -0.4%)	0.2% (0.1% -0.4%)	0.2% (0.1% -0.4%)	0.2% (0.1% -0.3%)
Boston	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	0.3% (0.1% -0.6%)	0.3% (0.1% -0.5%)	0.3% (0.1% -0.5%)	0.3% (0.1% -0.5%)	0.3% (0.1% -0.5%)	0.3% (0.1% -0.5%)	0.3% (0.1% -0.5%)	0.2% (0.1% -0.4%)
Chicago	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	0.3% (0.1% -0.4%)	0.2% (0.1% -0.4%)	0.2% (0.1% -0.4%)	0.2% (0.1% -0.4%)	0.2% (0.1% -0.3%)	0.2% (0.1% -0.3%)	0.2% (0.1% -0.3%)	0.2% (0.1% -0.3%)
	Schwartz (2004)	0-day lag	1 hr max.	2% (0.6% -3.4%)	2% (0.6% -3.3%)	1.9% (0.6% -3.2%)	1.8% (0.6% -3%)	1.7% (0.5% -2.9%)	1.7% (0.5% -2.8%)	1.6% (0.5% -2.7%)	1.4% (0.4% -2.3%)
	Schwartz -- 14 US Cities (2004)	0-day lag	1 hr max.	0.8% (0.2% -1.3%)	0.7% (0.2% -1.2%)	0.7% (0.2% -1.2%)	0.7% (0.2% -1.1%)	0.6% (0.2% -1.1%)	0.6% (0.2% -1.1%)	0.6% (0.2% -1%)	0.5% (0.2% -0.9%)
Cleveland	Bell et al. (2004)	distributed lag	24 hr avg.	0.7% (-0.4% -1.7%)	0.6% (-0.4% -1.7%)	0.6% (-0.4% -1.6%)	0.6% (-0.4% -1.5%)	0.6% (-0.4% -1.5%)	0.5% (-0.3% -1.4%)	0.5% (-0.3% -1.4%)	0.5% (-0.3% -1.2%)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	0.4% (0.1% -0.7%)	0.4% (0.1% -0.7%)	0.4% (0.1% -0.7%)	0.4% (0.1% -0.6%)	0.4% (0.1% -0.6%)	0.3% (0.1% -0.6%)	0.3% (0.1% -0.6%)	0.3% (0.1% -0.5%)
Detroit	Bell et al. (2004)	distributed lag	24 hr avg.	0.5% (-0.2% -1.1%)	0.5% (-0.1% -1.1%)	0.5% (-0.1% -1%)	0.4% (-0.1% -1%)	0.4% (-0.1% -0.9%)	0.4% (-0.1% -0.9%)	0.4% (-0.1% -0.8%)	0.3% (-0.1% -0.7%)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	0.3% (0.1% -0.4%)	0.2% (0.1% -0.4%)	0.2% (0.1% -0.4%)	0.2% (0.1% -0.4%)	0.2% (0.1% -0.3%)	0.2% (0.1% -0.3%)	0.2% (0.1% -0.3%)	0.2% (0.1% -0.3%)
	Schwartz (2004)	0-day lag	1 hr max.	1.7% (-0.3% -3.6%)	1.6% (-0.3% -3.4%)	1.6% (-0.3% -3.4%)	1.6% (-0.3% -3.3%)	1.4% (-0.2% -3%)	1.4% (-0.2% -2.9%)	1.3% (-0.2% -2.8%)	1.2% (-0.2% -2.5%)
	Schwartz -- 14 US Cities (2004)	0-day lag	1 hr max.	0.9% (0.3% -1.5%)	0.9% (0.3% -1.5%)	0.9% (0.3% -1.4%)	0.8% (0.3% -1.4%)	0.8% (0.2% -1.3%)	0.7% (0.2% -1.2%)	0.7% (0.2% -1.2%)	0.6% (0.2% -1.1%)
	Ito (2003)	0-day lag	24 hr avg.	0.6% (-0.6% -1.7%)	0.6% (-0.5% -1.6%)	0.6% (-0.5% -1.6%)	0.5% (-0.5% -1.6%)	0.5% (-0.5% -1.4%)	0.5% (-0.4% -1.3%)	0.4% (-0.4% -1.3%)	0.4% (-0.3% -1.1%)
Houston	Bell et al. (2004)	distributed lag	24 hr avg.	0.2% (0% -0.4%)	0.2% (0% -0.3%)	0.2% (0% -0.3%)	0.1% (0% -0.3%)	0.1% (0% -0.3%)	0.1% (0% -0.2%)	0.1% (0% -0.2%)	0.1% (0% -0.1%)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	0.1% (0% -0.2%)	0.1% (0% -0.1%)	0.1% (0% -0.1%)	0.1% (0% -0.1%)	0.1% (0% -0.1%)	0.1% (0% -0.1%)	0.1% (0% -0.1%)	0% (0% -0.1%)
	Schwartz (2004)	0-day lag	1 hr max.	0.7% (0.1% -1.3%)	0.7% (0.1% -1.2%)	0.6% (0.1% -1.2%)	0.6% (0.1% -1.1%)	0.6% (0.1% -1.1%)	0.5% (0% -1%)	0.5% (0% -1%)	0.4% (0% -0.8%)
	Schwartz -- 14 US Cities (2004)	0-day lag	1 hr max.	0.6% (0.2% -1%)	0.5% (0.2% -0.9%)	0.5% (0.2% -0.9%)	0.5% (0.2% -0.8%)	0.5% (0.1% -0.8%)	0.4% (0.1% -0.7%)	0.4% (0.1% -0.7%)	0.3% (0.1% -0.6%)

Location	Study	Lag	Exposure Metric	Percent of Total Incidence of Non-Accidental Mortality Associated with O_3 Concentrations that Just Meet the Current and Alternative O_3 Standards**							
				0.084/4***	0.084/3	0.080/4****	0.074/5	0.074/4	0.074/3	0.070/4****	0.064/4
Los Angeles	Bell et al. (2004)	distributed lag	24 hr avg.	0.1% (-0.2% -0.4%)	0.1% (-0.2% -0.4%)	0.1% (-0.2% -0.3%)	0.1% (-0.1% -0.2%)	0.1% (-0.1% -0.2%)	0% (-0.1% -0.2%)	0% (-0.1% -0.2%)	0% (-0.1% -0.1%)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	0.2% (0.1% -0.3%)	0.2% (0.1% -0.3%)	0.2% (0.1% -0.3%)	0.1% (0% -0.2%)	0.1% (0% -0.2%)	0.1% (0% -0.2%)	0.1% (0% -0.1%)	0.1% (0% -0.1%)
New York	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	0.3% (0.1% -0.4%)	0.2% (0.1% -0.4%)	0.2% (0.1% -0.4%)	0.2% (0.1% -0.4%)	0.2% (0.1% -0.4%)	0.2% (0.1% -0.3%)	0.2% (0.1% -0.3%)	0.2% (0.1% -0.3%)
Philadelphia	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	0.4% (0.1% -0.6%)	0.4% (0.1% -0.6%)	0.4% (0.1% -0.6%)	0.3% (0.1% -0.5%)	0.3% (0.1% -0.5%)	0.3% (0.1% -0.5%)	0.3% (0.1% -0.5%)	0.3% (0.1% -0.4%)
	Moolgavkar et al. (1995)	1-day lag	24 hr avg.	1.3% (0.8% -1.8%)	1.3% (0.8% -1.7%)	1.3% (0.8% -1.7%)	1.2% (0.7% -1.6%)	1.1% (0.7% -1.5%)	1.1% (0.7% -1.5%)	1.1% (0.7% -1.4%)	0.9% (0.6% -1.3%)
Sacramento	Bell et al. (2004)	distributed lag	24 hr avg.	0.3% (-0.9% -1.4%)	0.3% (-0.8% -1.4%)	0.3% (-0.8% -1.3%)	0.3% (-0.8% -1.3%)	0.2% (-0.8% -1.2%)	0.2% (-0.7% -1.2%)	0.2% (-0.7% -1.2%)	0.2% (-0.6% -1%)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	0.4% (0.1% -0.7%)	0.4% (0.1% -0.7%)	0.4% (0.1% -0.7%)	0.4% (0.1% -0.6%)	0.4% (0.1% -0.6%)	0.4% (0.1% -0.6%)	0.3% (0.1% -0.6%)	0.3% (0.1% -0.5%)
St Louis	Bell et al. (2004)	distributed lag	24 hr avg.	0.3% (-0.5% -1%)	0.3% (-0.4% -0.9%)	0.2% (-0.4% -0.9%)	0.2% (-0.4% -0.8%)	0.2% (-0.4% -0.8%)	0.2% (-0.3% -0.7%)	0.2% (-0.3% -0.7%)	0.2% (-0.3% -0.6%)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	0.2% (0.1% -0.4%)	0.2% (0.1% -0.4%)	0.2% (0.1% -0.4%)	0.2% (0.1% -0.3%)	0.2% (0.1% -0.3%)	0.2% (0.1% -0.3%)	0.2% (0.1% -0.3%)	0.1% (0% -0.2%)
Washington	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	0.5% (0.2% -0.8%)	0.4% (0.1% -0.7%)	0.5% (0.2% -0.8%)	0.4% (0.1% -0.7%)	0.4% (0.1% -0.7%)	0.4% (0.1% -0.6%)	0.4% (0.1% -0.7%)	0.4% (0.1% -0.6%)

*All results are for mortality (among all ages) associated with short-term exposures to O_3. All results are based on single-pollutant models.

**Incidence was quantified down to estimated policy relevant background levels. Percents are rounded to the nearest tenth.

***An 8-hr average standard, denoted m/n is characterized by a concentration of m ppb and an nth daily maximum. So, for example, the current standard is 84/4 -- 84 ppb, 4th daily maximum 8-hr average.

Note: Numbers in parentheses are 95% confidence or credible intervals based on statistical uncertainty surrounding the O_3 coefficient.

Table 5C-17. Sensitivity Analysis: Impact of Alternative Estimates of Policy Relevant Background (PRB) on Estimated Number of All Children (Ages 5-1 Engaged in Moderate Exertion Estimated to Experience At Least One Lung Function Response (Change in FEV_1>=15%) Associated with Exposure to O_3 Concentrations That Just Meet the Current and Alternative Daily Maximum 8-Hour Standards, for Location-Specific O_3 Seasons*

Location	Number of All Children (in 1000s) with at Least One Response, Based on Adjusting 2004 O_3 Concentrations**				Number of All Children (in 1000s) with at Least One Response, Based on Adjusting 2002 O_3 Concentrations**			
	2004 Air Quality	0.084/4***	0.074/4	0.064/4	2002 Air Quality	0.084/4***	0.074/4	0.064/4
Atlanta	34 (19 - 51)	20 (8 - 34)	12 (2 - 22)	6 (0 - 14)	59 (40 - 81)	36 (21 - 54)	21 (8 - 34)	11 (1 - 21)
Atlanta - with lower PRB	35 (19 - 54)	21 (8 - 36)	12 (2 - 25)	7 (0 - 16)	60 (40 - 84)	37 (21 - 56)	21 (8 - 37)	12 (1 - 24)
Atlanta - with higher PRB	33 (19 - 48)	19 (8 - 31)	11 (2 - 19)	5 (0 - 11)	58 (40 - 79)	35 (21 - 51)	20 (8 - 31)	10 (1 - 18)
Los Angeles	220 (149 - 298)	34 (5 - 62)	17 (1 - 36)	6 (0 - 14)	220 (150 - 297)	35 (7 - 62)	18 (1 - 35)	7 (0 - 14)
Los Angeles - with lower PRB	225 (149 - 312)	38 (5 - 75)	22 (1 - 49)	11 (0 - 27)	225 (150 - 311)	39 (7 - 75)	23 (1 - 48)	11 (0 - 27)
Los Angeles - with higher PRB	218 (149 - 293)	32 (5 - 57)	16 (1 - 31)	4 (0 - 9)	218 (150 - 292)	33 (7 - 57)	16 (1 - 30)	5 (0 - 9)
New York	112 (55 - 176)	43 (6 - 84)	25 (0 - 56)	14 (0 - 35)	346 (244 - 462)	142 (79 - 216)	81 (29 - 138)	43 (3 - 86)
New York - with lower PRB	114 (55 - 183)	45 (6 - 92)	27 (0 - 63)	16 (0 - 43)	348 (244 - 469)	144 (79 - 222)	83 (29 - 145)	45 (3 - 93)
New York - with higher PRB	110 (55 - 169)	41 (6 - 78)	23 (0 - 49)	12 (0 - 29)	343 (244 - 455)	140 (79 - 208)	79 (29 - 131)	41 (3 - 79)

*Numbers are median (0.5 fractile) numbers of children. Numbers in parentheses below the median are 95% credible intervals based on statistical uncertainty surrounding the O_3 coefficient.

**Incidence was quantified down to estimated policy relevant background levels. Incidences are rounded to the nearest 1000.

***These 8-hr average standards, denoted m/n, are characterized by a concentration of m ppm and an nth daily maximum. So, for example, the current standard is 0.084/4 -- 0.084 ppm, 4th daily maximum 8-hr average. These nth daily maximum standards require that the average of the 3 annual nth daily maxima over a 3-year period be at or below the specified level (e.g., 0.084 ppm).

Table 5C-18. Sensitivity Analysis: Impact of Alternative Estimates of Policy Relevant Background (PRB) on Estimated Incidence of Non-Accidental Mortality Associated with O_3 Concentrations that Just Meet the Current Standard (0.084 ppm, 4th Daily Maximum): April - September, 2002*

Location	Study	Lag	Exposure Metric	Incidence of Non-Accidental Mortality Associated with O_3 Above:**		
				Estimates of PRB Concentrations	Estimates of PRB Concentrations Minus 5 ppb***	Estimates of PRB Concentrations Plus 5 ppb
Atlanta	Bell et al. (2004)	distributed lag	24 hr avg.	7 (-30 - 43)	15 (-63 - 90)	4 (-18 - 26)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	14 (5 - 23)	29 (10 - 48)	8 (3 - 14)
Boston	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	9 (3 - 15)	13 (4 - 21)	6 (2 - 9)
Chicago	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	55 (18 - 91)	88 (29 - 146)	31 (10 - 51)
	Schwartz (2004)	0-day lag	1 hr max.	427 (136 - 712)	526 (167 - 876)	333 (106 - 556)
	Schwartz -- 14 US Cities (2004)	0-day lag	1 hr max.	161 (51 - 271)	199 (62 - 334)	126 (39 - 212)
Cleveland	Bell et al. (2004)	distributed lag	24 hr avg.	49 (-31 - 128)	69 (-44 - 180)	33 (-21 - 87)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	31 (10 - 52)	44 (15 - 73)	21 (7 - 35)
Detroit	Bell et al. (2004)	distributed lag	24 hr avg.	46 (-15 - 106)	73 (-24 - 169)	27 (-9 - 63)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	24 (8 - 39)	38 (13 - 62)	14 (5 - 23)
	Schwartz (2004)	0-day lag	1 hr max.	158 (-26 - 336)	189 (-31 - 403)	128 (-21 - 273)
	Schwartz -- 14 US Cities (2004)	0-day lag	1 hr max.	86 (27 - 144)	103 (32 - 173)	70 (22 - 117)
	Ito (2003)	0-day lag	24 hr avg.	56 (-52 - 162)	89 (-83 - 256)	33 (-31 - 95)
Houston	Bell et al. (2004)	distributed lag	24 hr avg.	18 (1 - 34)	34 (2 - 65)	8 (1 - 16)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	9 (3 - 15)	17 (6 - 28)	4 (1 - 7)
	Schwartz (2004)	0-day lag	1 hr max.	63 (6 - 119)	80 (7 - 151)	48 (4 - 92)
	Schwartz -- 14 US Cities (2004)	0-day lag	1 hr max.	53 (16 - 88)	66 (21 - 112)	40 (13 - 68)
Los Angeles	Bell et al. (2004)	distributed lag	24 hr avg.	24 (-58 - 105)	44 (-106 - 192)	9 (-22 - 41)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	52 (17 - 86)	95 (32 - 157)	20 (7 - 33)
New York	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	84 (28 - 139)	121 (41 - 202)	45 (15 - 74)
Philadelphia	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	30 (10 - 50)	43 (14 - 71)	19 (6 - 32)
	Moolgavkar et al. (1995)	1-day lag	24 hr avg.	107 (67 - 146)	152 (96 - 208)	68 (43 - 94)
Sacramento	Bell et al. (2004)	distributed lag	24 hr avg.	12 (-37 - 60)	17 (-51 - 83)	8 (-24 - 40)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	18 (6 - 30)	25 (8 - 41)	12 (4 - 20)
St Louis	Bell et al. (2004)	distributed lag	24 hr avg.	5 (-9 - 20)	9 (-15 - 31)	3 (-5 - 11)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	5 (2 - 8)	8 (3 - 13)	3 (1 - 4)
Washington	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	14 (5 - 23)	17 (6 - 28)	9 (3 - 14)

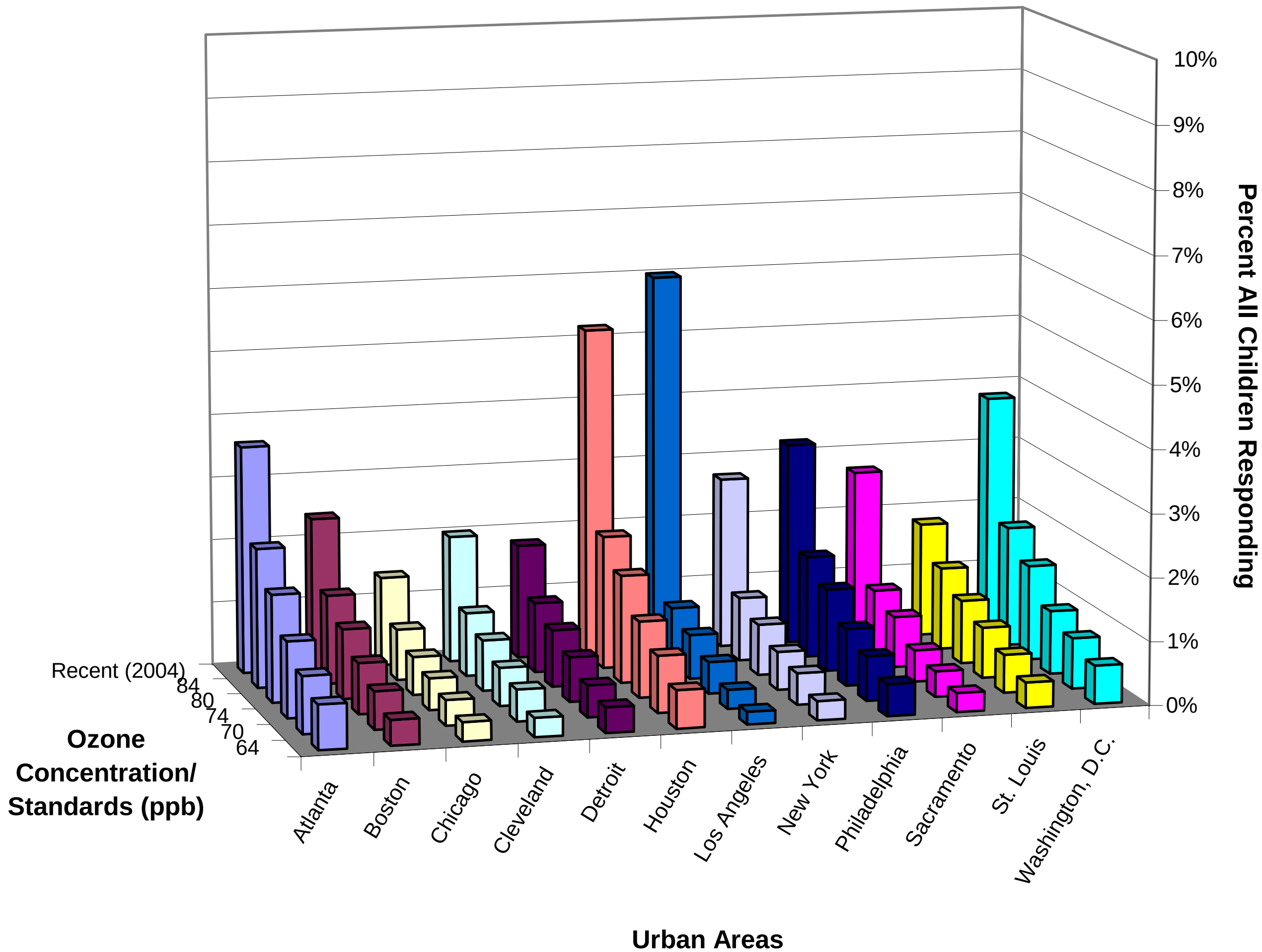
*All results are for mortality (among all ages) associated with short-term exposures to O_3. All results are based on single-pollutant models.

**Incidences are rounded to the nearest whole number; incidences per 100,000 relevant population and percents are rounded to the nearest tenth.

***In Atlanta, 10 ppb were subtracted from estimated PRB concentrations; in all other locations, 5 ppb were subtracted.

Note: Numbers in parentheses are 95% confidence or credible intervals based on statistical uncertainty surrounding the O_3 coefficient.

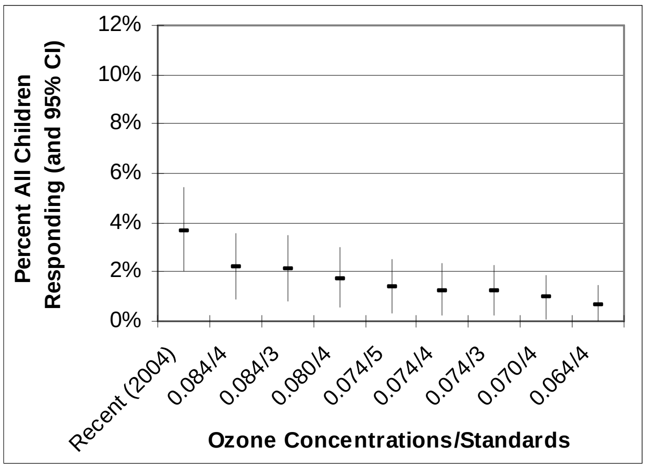
Figure 5C-1. Percent of All Children (Ages 5-18) Engaged in Moderate Exertion Estimated to Experience At Least One Lung Function Response (Decrement in $FEV_1 \geq 15\%$) Associated with Exposure to O_3 Concentrations That Just Meet the Current and Alternative Average 4th Daily Maximum 8-Hour Standards, for Location-Specific O_3 Seasons (Based on Adjusting 2004 Air Quality)



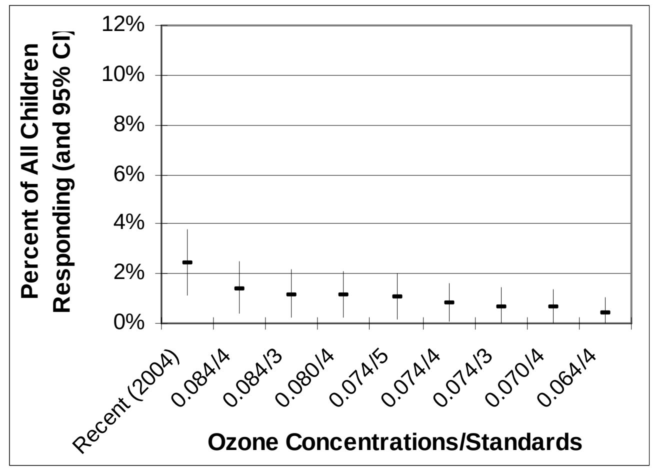
*95% confidence intervals associated with these risk estimates are provided in Table 5C-2 of this Appendix. An 8-hr average standard, denoted m/n is characterized by a concentration of m ppm and an nth daily maximum. So, for example, the current standard is 0.084/4 – 0.084 ppm, 4th daily maximum 8-hr average. The 4th daily maximum standards, denoted m/4, require that the average of the 3 annual nth daily maxima over a 3-year period be at or below the specified level

Figure 5C-2.Percent of All Children (Ages 5-18) Engaged in Moderate Exertion Estimated to Experience At Least One Lung Function Response (Decrement in $FEV_1 \geq 15$ %) Associated with Recent Air Quality (2004) and Exposure to O_3 Concentrations That Just Meet the Current and Alternative Average 4th Daily Maximum 8-Hour Standards, for Location-Specific O_3 Seasons (Based on Adjusting 2004 Air Quality)*

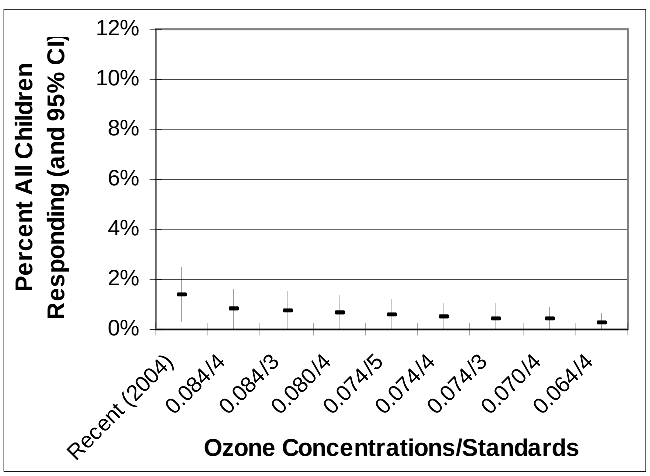
Atlanta



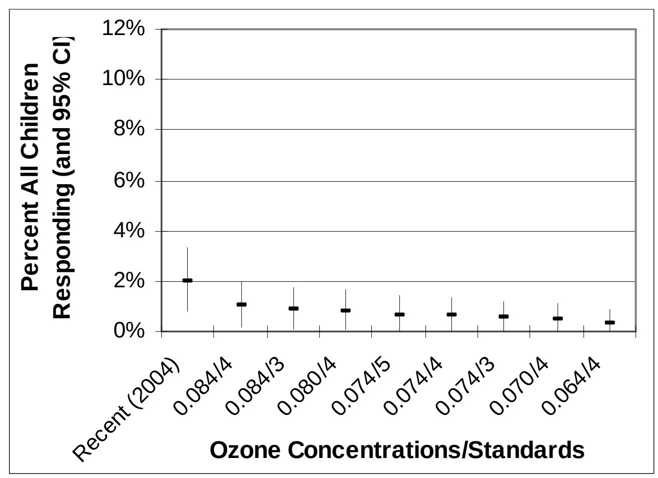
Boston



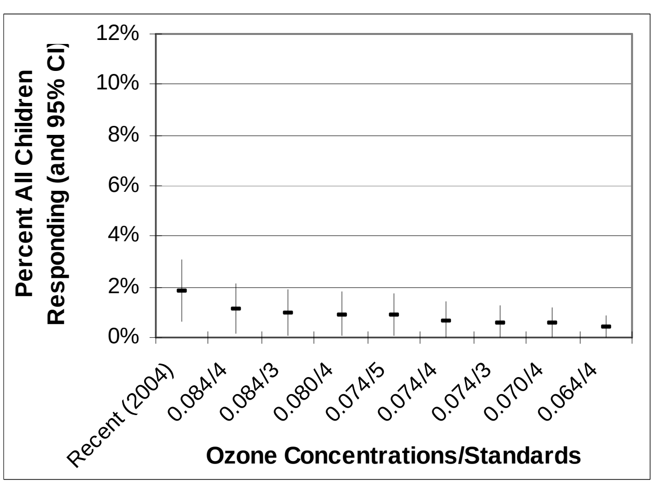
Chicago



Cleveland



Detroit



Houston

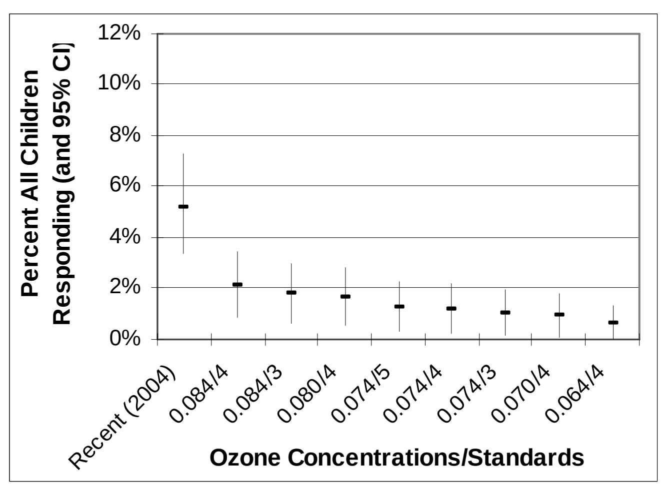
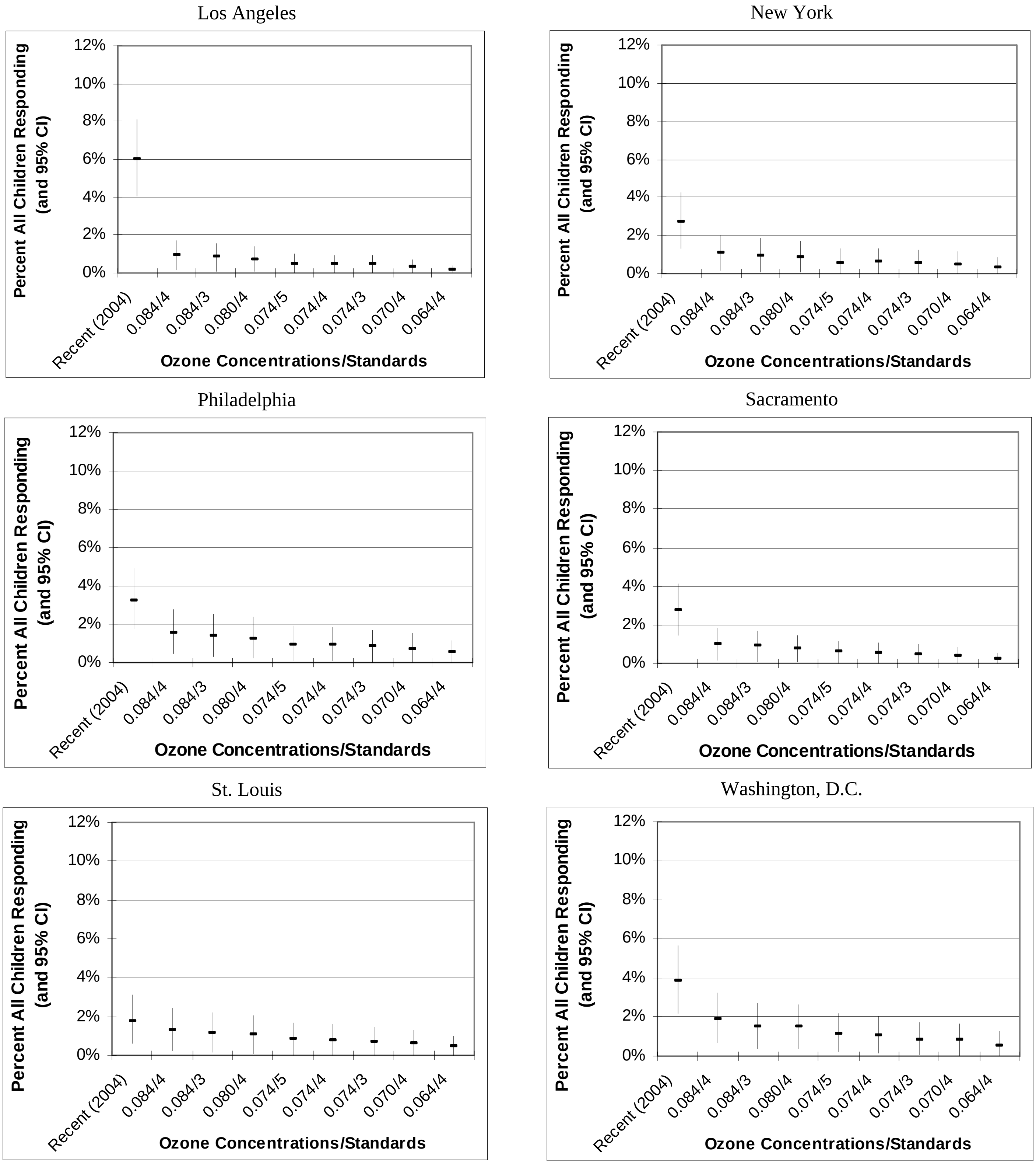
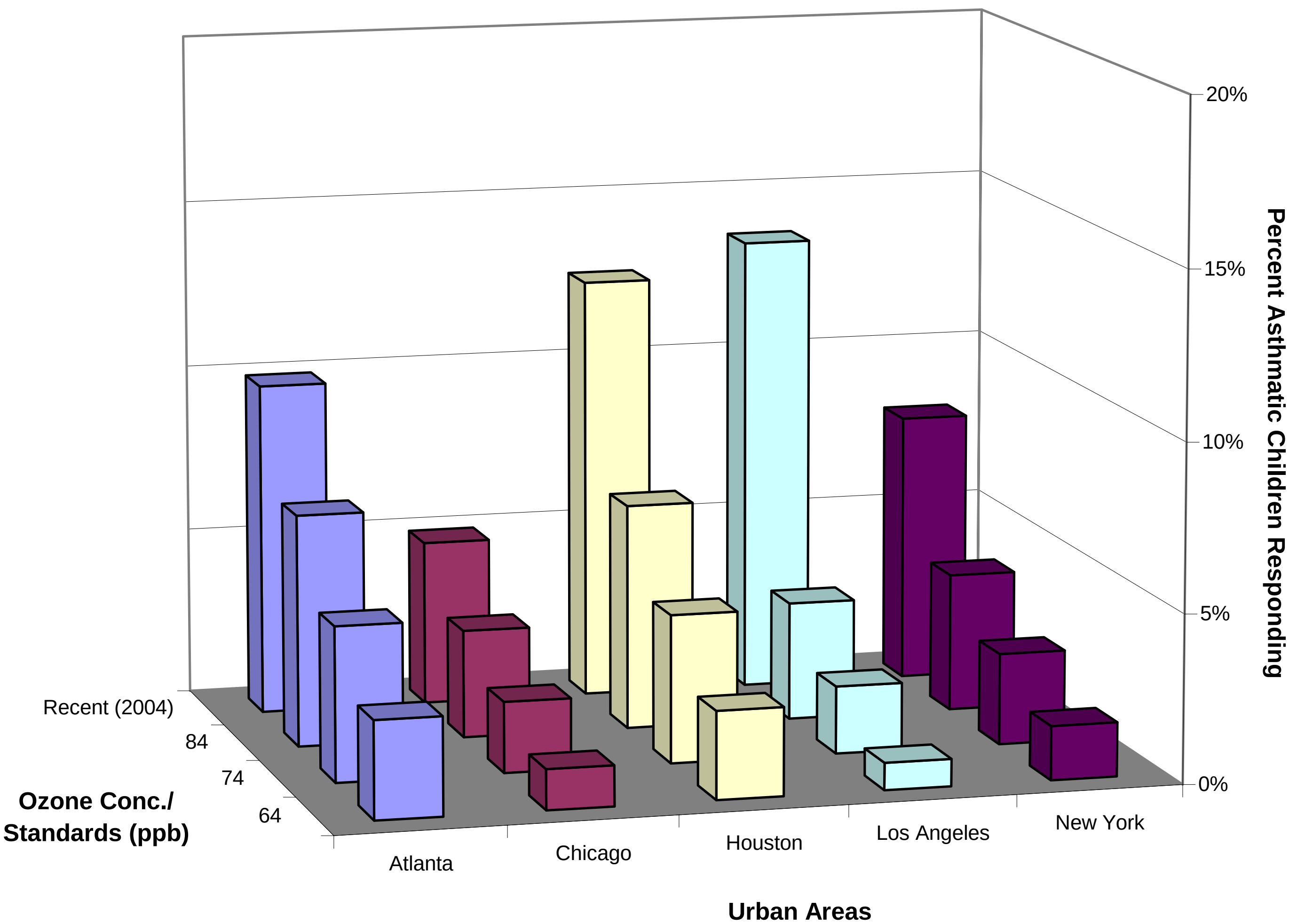


Figure 5C-2. (Continued)



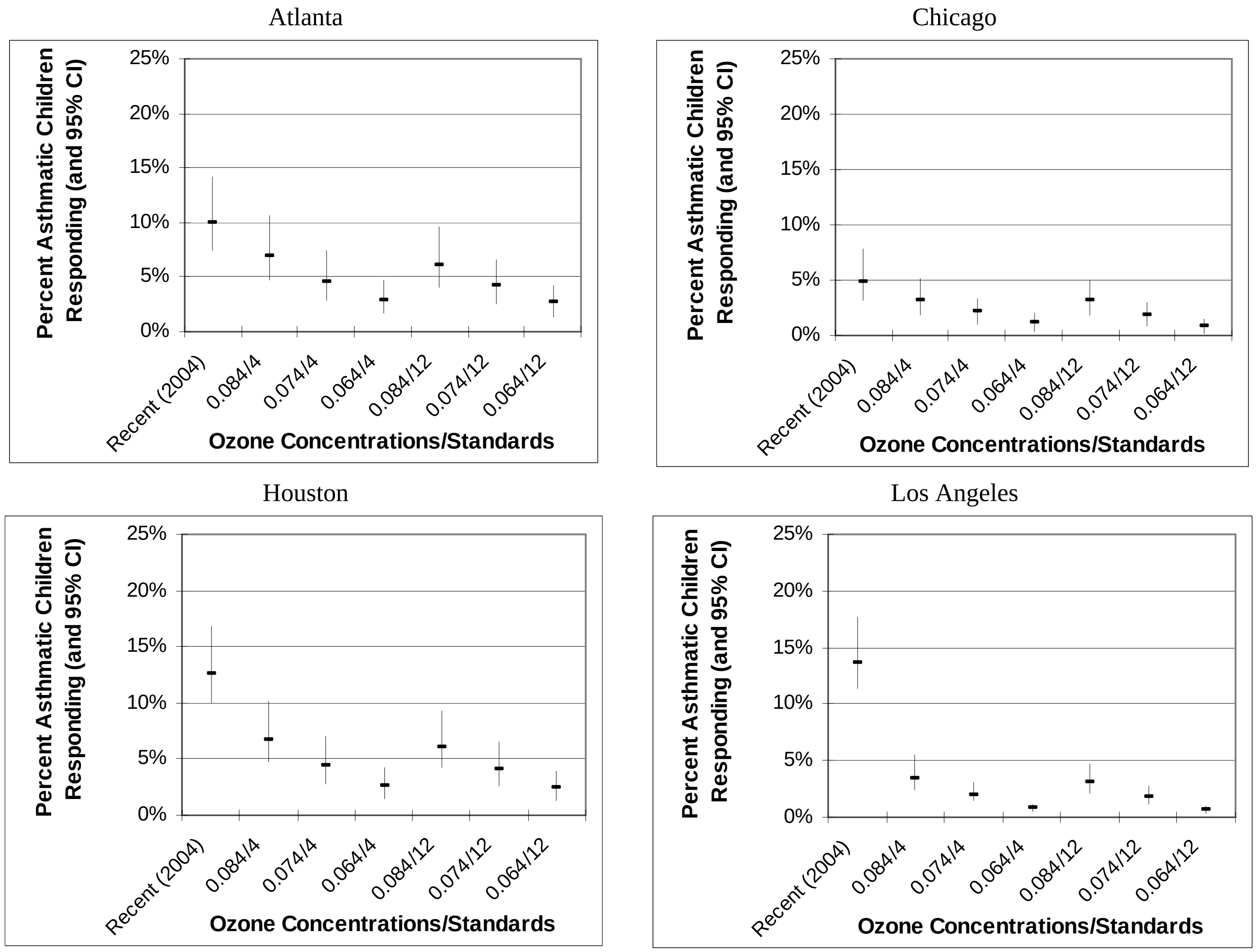
* An 8-hr average standard, denoted m/n is characterized by a concentration of m ppm and an nth daily maximum. So, for example, the current standard is 0.084/4 – 0.084 ppm, 4th daily maximum 8-hr average. The 4th daily maximum standards, denoted m/4, require that the average of the 3 annual nth daily maxima over a 3-year period be at or below the specified level..

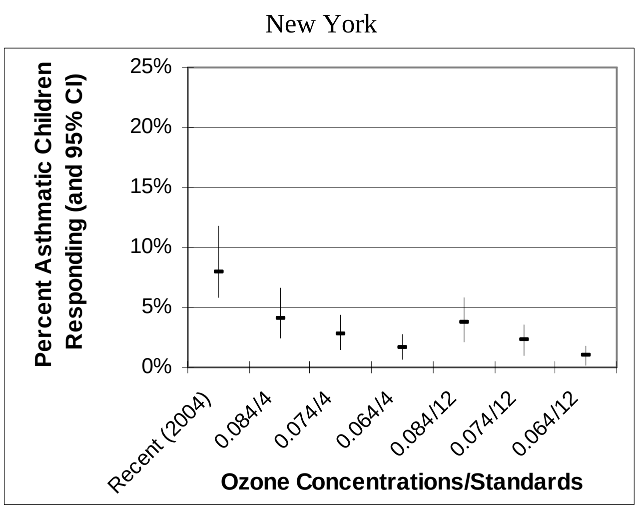
Figure 5C-3. Percent of Asthmatic Children (Ages 5-18) Engaged in Moderate Exertion Estimated to Experience At Least One Lung Function Response (Decrement in $FEV_1 \geq 10\%$) Associated with Exposure to O_3 Concentrations That Just Meet the Current and Alternative Average 4th Daily Maximum 8-Hour Standards, for Location-Specific O_3 Seasons (Based on Adjusting 2004 Air Quality)



*95% confidence intervals associated with these risk estimates are provided in Table 5C-5 of this Appendix. An 8-hr average standard, denoted m/n is characterized by a concentration of m ppm and an nth daily maximum. So, for example, the current standard is 0.084/4 – 0.084 ppm, 4th daily maximum 8-hr average. The 4th daily maximum standards, denoted m/4, require that the average of the 3 annual nth daily maxima over a 3-year period be at or below the specified level

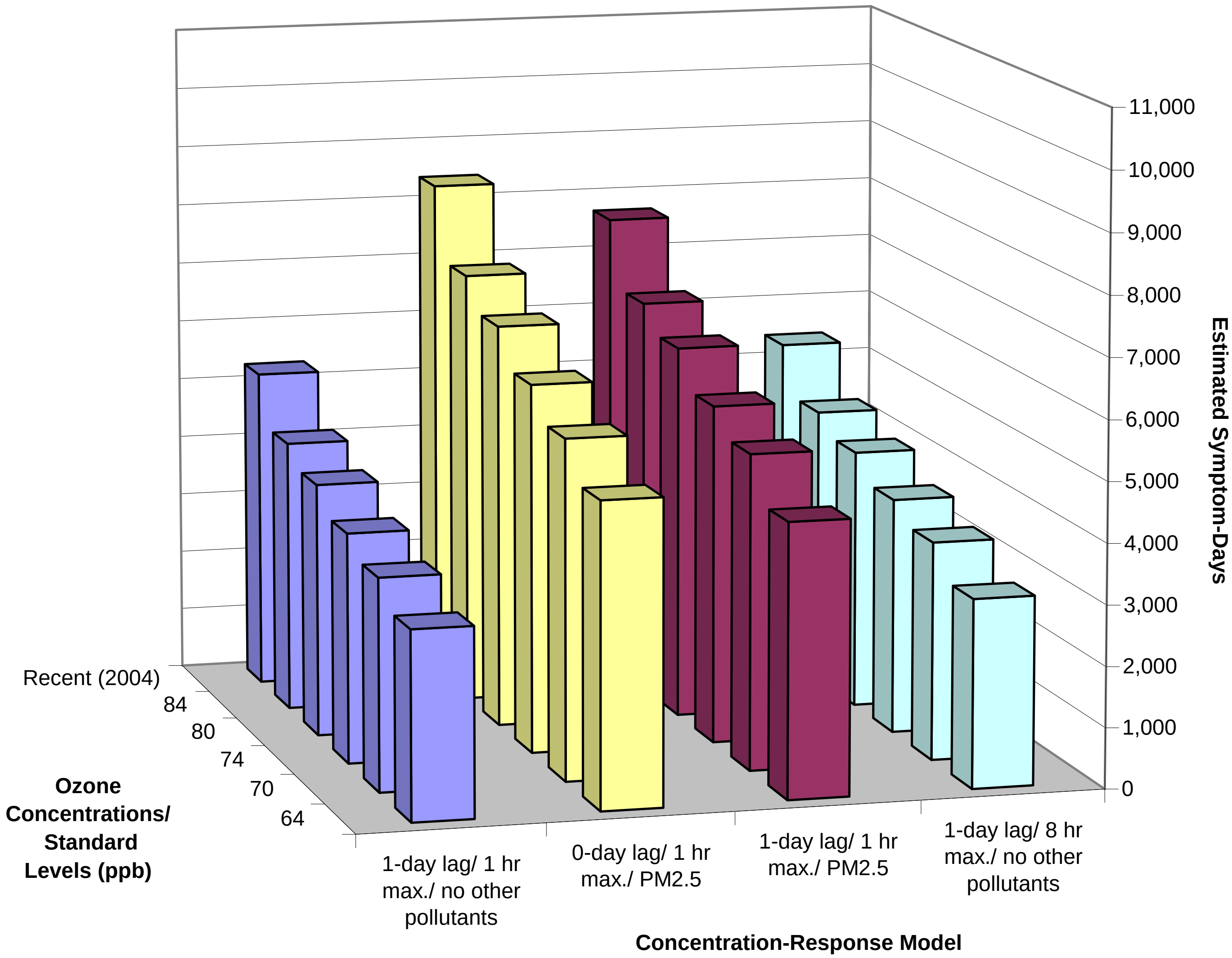
Figure 5C-4. Percent of Asthmatic Children (Ages 5-18) Engaged in Moderate Exertion Estimated to Experience At Least One Lung Function Response (Decrement in $FEV_1 \geq 10$ %) Associated with Recent Air Quality (2004) and Exposure to O_3 Concentrations That Just Meet the Current and Alternative 8-Hour Standards, for Location-Specific O_3 Seasons: Based on Adjusting 2004 O_3 Concentrations*





* An 8-hr average standard, denoted m/n is characterized by a concentration of m ppm and an nth daily maximum. So, for example, the current standard is 0.084/4 – 0.084 ppm, 4th daily maximum 8-hr average. The 4th daily maximum standards, denoted m/4, require that the average of the 3 annual nth daily maxima over a 3-year period be at or below the specified level (e.g., 0.084 ppm).

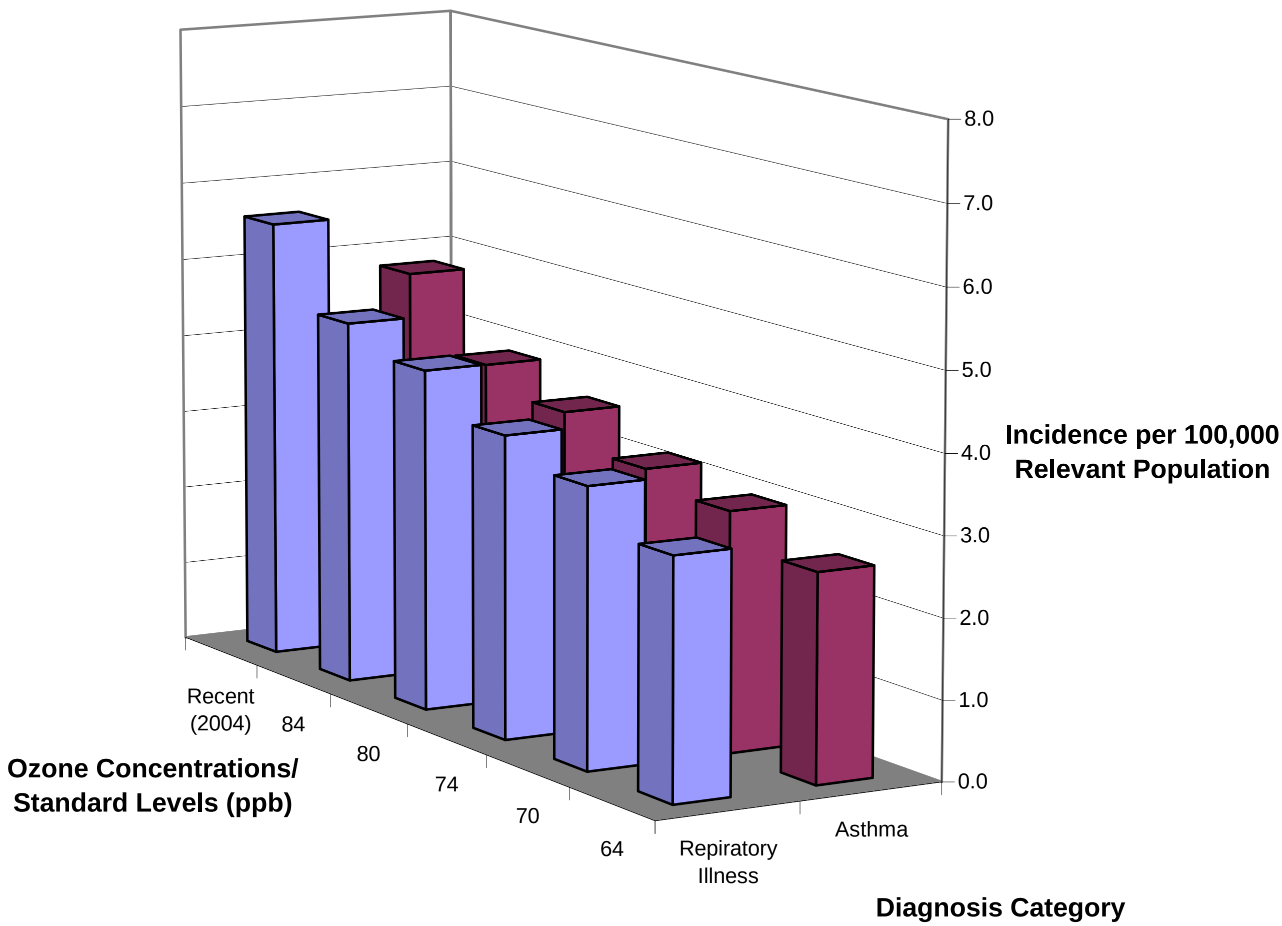
Figure 5C-5. Estimated Symptom-Days for Chest Tightness Among Moderate/Severe Asthmatic Children (Ages 0 – 12) in Boston Associated with Recent (April-September 2004) O_3 Levels and with Levels Just Meeting Alternative Average 4th-HighestDaily Maximum 8-Hour Ozone Standards* Based on Gent et al., 2003)



*95% confidence intervals associated with these risk estimates are provided in Table 5C-5 of this Appendix. An 8-hr average standard, denoted m/n is characterized by a concentration of m ppm and an nth-highest daily maximum. So, for example, the current standard is 0.084/4 – 0.084 ppm, 4th-highest daily maximum 8-hr average. The 4th–highest daily maximum standards, denoted m/4, require that the average of the 3 annual nth-highest daily maxima over a 3-year period be at or below the specified level

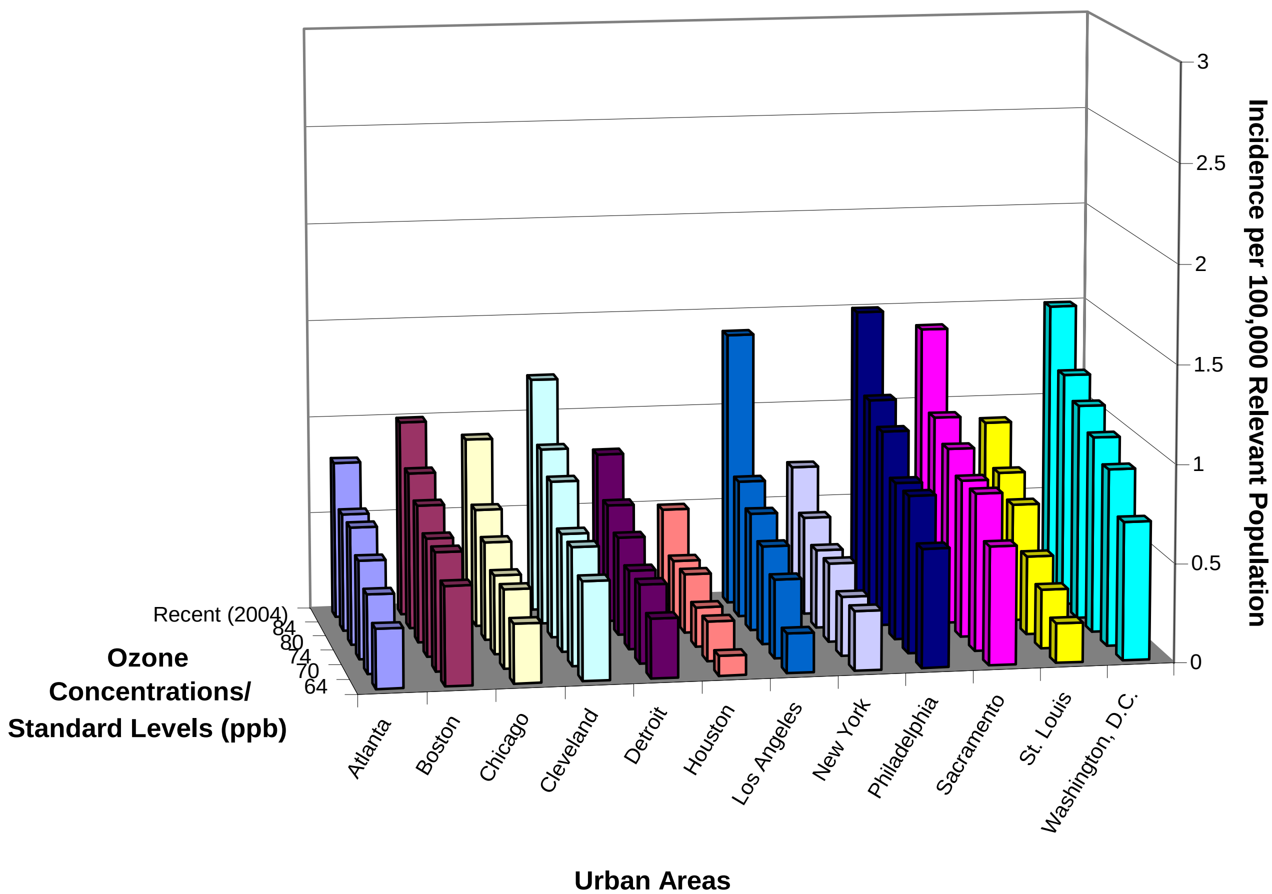
Figure 5C-6. Estimated Incidence of (Unscheduled) Respiratory Hospital Admissions per 100,000 Relevant Population in New York Associated with Recent (April – September, 2004) O_3 Levels and with O_3 Levels Just Meeting Alternative Average 4th-Highest Daily Maximum 8-Hour Standards

(based on Thurston et al., 1992)



*95% confidence intervals associated with these risk estimates are provided in Table 5C-7 of this Appendix. An 8-hr average standard, denoted m/n is characterized by a concentration of m ppm and an nth-highest daily maximum. So, for example, the current standard is 0.084/4 – 0.084 ppm, 4th-highest daily maximum 8-hr average. The 4th-highest daily maximum standards, denoted m/4, require that the average of the 3 annual nth-highest daily maxima over a 3-year period be at or below the specified level

Figure 5C-7. Estimated Incidence of Non-Accidental Mortality per 100,000 Relevant Population Associated with Recent Air Quality (2004) and with Just Meeting Alternative Average 4th-Highest Daily Maximum 8-Hour O_3 Standards (Using Bell et al., 2004 – 95 U.S. Cities Function), Based on 2004 Ozone Concentrations



*95% confidence intervals associated with these risk estimates are provided in Table 5C-13 of this Appendix. An 8-hr average standard, denoted m/n is characterized by a concentration of m ppm and an nth daily maximum. So, for example, the current standard is 0.084/4 – 0.084 ppm, 4th-highest daily maximum 8-hr average. The 4th-highest daily maximum standards, denoted m/4, require that the average of the 3 annual nth-highest daily maxima over a 3-year period be at or below the specified level

Figure 5C-8. Annual Warm Season (April to September) Estimated O_3-Related Non-Accidental Mortality Associated with Recent (2004) O_3 Levels and Levels Just Meeting Alternative 8-hr O_3 Standards (Using Bell et al., 2004 – 95 U.S. Cities Function)

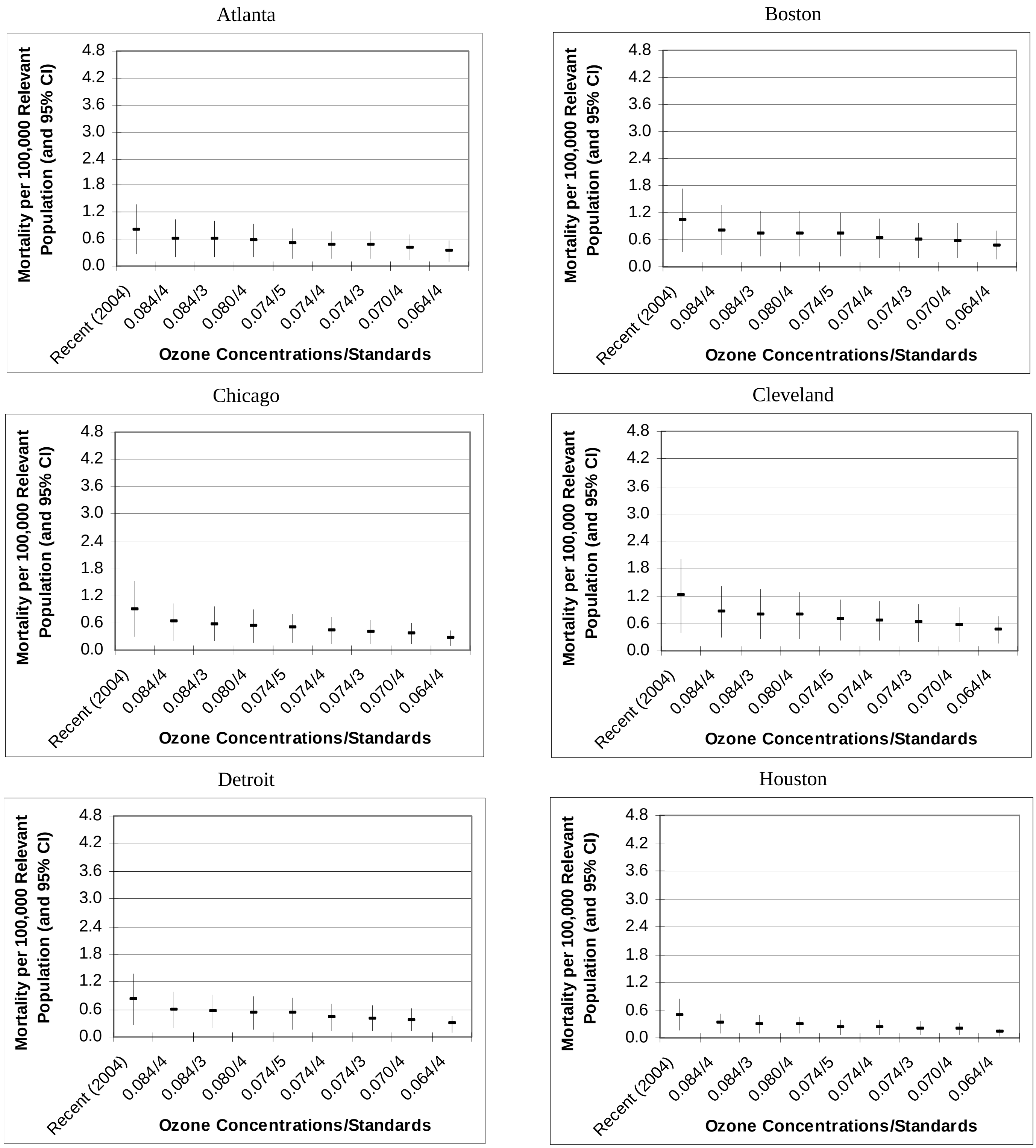
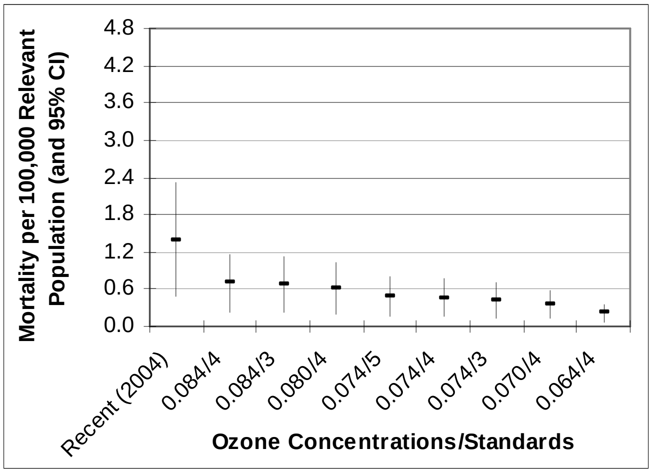
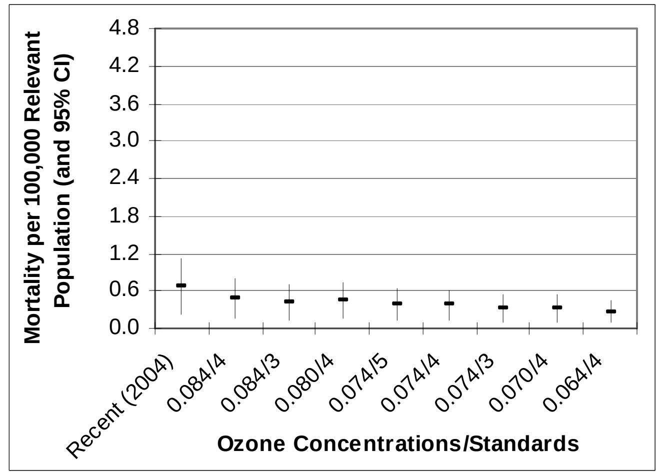


Figure 5C-8 (continued)

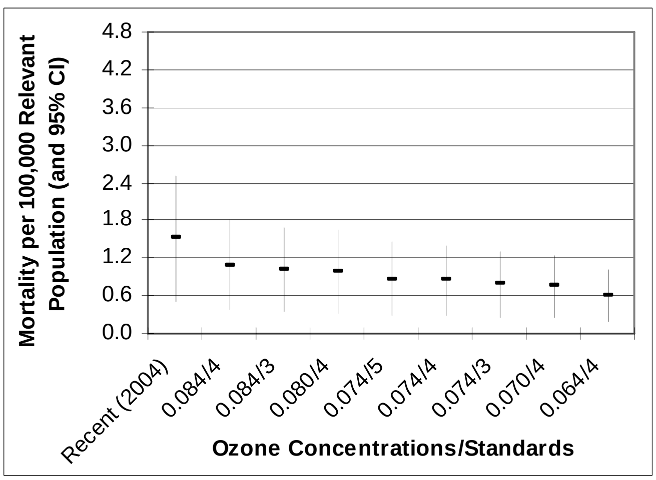
Los Angeles



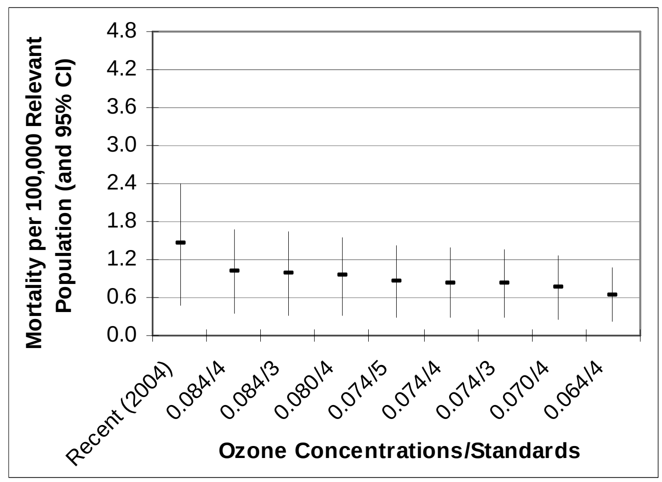
New York



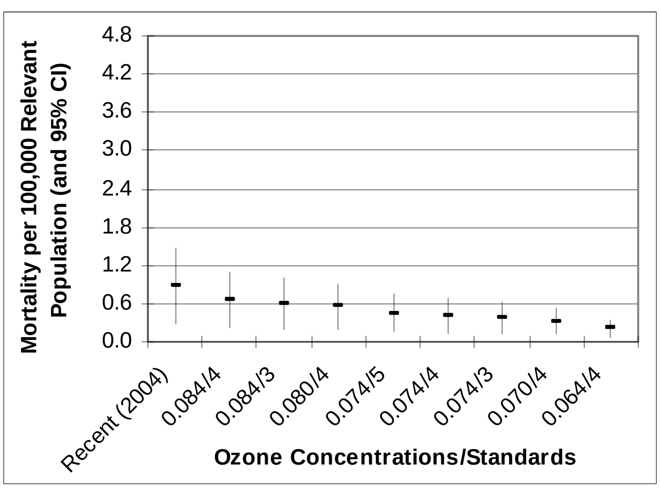
Philadelphia



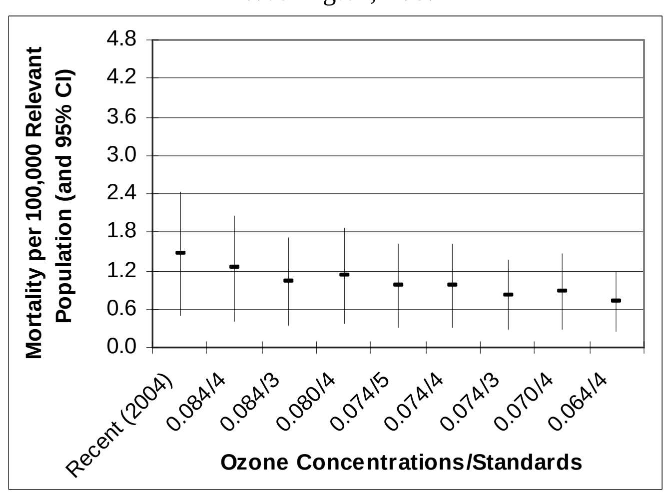
Sacramento



St. Louis



Washington, D.C.



*An 8-hr average standard, denoted m/n is characterized by a concentration of m ppm and an nth-highest daily maximum. So, for example, the current standard is 0.084/4 – 0.084 ppm, 4^{th}-highest daily maximum 8-hr average. The 4^{th}-highest daily maximum standards, denoted m/4, require that the average of the 3 annual nth-highest daily maxima over a 3-year period be at or below the specified level

Predicted percent of counties with monitors (and percent of population in counties with monitors) not likely to meet alternative ozone standards.

Alternative Standards and Levels (ppm)	Percent of counties, total and by region, (and total percent population) not likely to meet stated standard and level*								
	Total counties (population)	Northeast	Southeast	Industrial Midwest	Upper Midwest	Southwest	Northwest	Southern CA	Outside Regions**
No. of counties with monitors (Population)	641 (189,802,858)	122	187	187	29	23	74	17	2
3 year daily 8-hr max:									
0.085 4th max	31 (49)	52	22	35	0	22	15	71	0
0.085 3rd max	40 (58)	66	30	48	0	22	22	71	0
0.080 4th max	48 (66)	74	39	57	3	30	26	82	0
0.074 5th max	69 (78)	89	67	78	14	52	41	88	0
0.074 4th max	74 (81)	95	74	84	21	61	41	88	0
0.074 3rd max	79 (86)	97	81	88	28	65	46	88	0
0.070 4th max	86 (90)	98	88	95	34	87	55	94	0
0.064 4th max	95 (96)	99	99	100	62	91	80	100	0

***Based on 2002-2004 data for sites that are at least 75% complete for the ozone season. As such, these estimates are not based on the same air quality data that would be used to determine whether an area would attain a given standard or set of standards. These are estimates can only approximate the number of counties that are likely not to attain the given standards and should be interpreted with caution.**

****"Outside Regions" include Alaska and Hawaii.**

APPENDICES FOR CHAPTER 7

APPENDIX 7A: BIOLOGICALLY RELEVANT FORMS OF AIR QUALITY INDICES APPROPRIATE FOR CHARACTERIZING VEGETATION EXPOSURES AND ASSOCIATED LEVELS

APPENDIX 7A.

This appendix provides a general overview of several biologically relevant forms considered appropriate for characterizing exposures relevant to vegetation and currently in use or considered for use in a management context.

CUMULATIVE, CONCENTRATION WEIGHTED FORMS: SUM06, W126, AOT40

In an analysis done by Lee, et al., 1989, a group of cumulative, concentration-weighted forms performed equally well in predicting crop yield loss using data from the NCLAN studies. All three indices were evaluated in the 1996 Staff Paper. In some cases such O_3 exposure indices have been shown to explain O_3 effects as well or better than calculated internal O_3 dose (Grulke, et al. 2002; Hanson et al., 1994). Additional research needs to be done to better evaluate the performance of these indices under a wide range of exposure scenarios.

In the interim between the 1996 proposal notice and the 1997 final rule, the results of a consensus-building workshop on the need for a long-term cumulative secondary O_3 standard were published. At this workshop, expert scientists expressed their judgments on what standard form(s) and level(s) would provide vegetation with adequate protection from O_3-related adverse effects. After agreeing that some form of a cumulative standard would be most appropriate for a secondary standard, consensus was achieved that the SUM06 and W126 forms would give very similar protection against O_3 effects on vegetation. It was agreed that SUM06 was an acceptable form of a secondary standard with the caveat that the acceptance of the SUM06 should not be interpreted as an acceptance of a threshold (Heck and Cowling, 1997).

Consensus was also reached with respect to selecting appropriate levels in terms of a 3-month, 12-hr SUM06 standard. Below are the 3-month, 12-hr SUM06 ranges participants agreed should be considered for a number of endpoints. For foliar injury to natural ecosystems – a SUM06 range of 8 to 12 ppm-hr; for growth effects to tree seedlings in natural forest stands – a range of 10 to 15 ppm-hr; for growth effects to tree seedlings and saplings in plantations – a range of 12 to 16 ppm-hr; and for yield reductions in agricultural crops – a range of 15 to 20 ppm-hr (Heck and Cowling, 1997). Staff note that the AOT40 is another cumulative, concentration weighted form that is currently in use in Europe. This form cumulates the area over the 40 ppb threshold by subtracting 40 ppb from the value of the measured O_3 level. See the Critical Level discussion below for levels of the AOT40 identified with protection for various vegetation effects endpoints.

FLUX-BASED INDICES

As discussed in Chapter 7 above, a measure or prediction of plant O_3 uptake is intuitively a better predictor of plant response to O_3 exposure in the field than a measure of ambient exposure because it accounts for the plant's integration of environmental factors that influence stomatal conductance. In practice, however, there are a number of complicating factors that are not easily accounted for in predictive uptake models. These include:

(1) The potential disconnect between the timing of two diunal patterns: 1) of maximum stomatal conductance and 2) the timing of peak exposure events. In the absence of synchronicity between these patterns, maximal stomatal conductance of O_3 will not occur and the predicted O_3 effect for that species/individual on the basis of flux will be an overestimation. This concern is especially apparent when assessing the impact of O_3 across all the varied climatic regions and species occurring within the United States.

(2) Not all O_3 stomatal uptake results in a reduction in yield. This nonlinear relationship between O_3 uptake and plant injury (not growth alteration) response depends to some degree on the amount of internal detoxification occurring with each particular species; species having high amounts of detoxification potential may show less of a relationship between O_3 stomatal uptake and plant response. Because detoxification potential is genetically determined, it cannot be generalized across species. Scientific understanding of the detoxification mechanisms is not yet complete, so that much more needs to be learned about the detoxification processes available to plants and to what extent they modify the potentially phytotoxic dose in the leaf interior before this factor can be meaningfully considered in a biologically-relevant index.

(3) The varying significance of nocturnal stomatal conductance. Musselman and Minnick (2000) performed an extensive review of the literature and reported that a large number of species had varying degrees of nocturnal stomatal conductance (Musselman and Minnick, 2000). Although stomatal conductance was lower at night than during the day for most plants, nocturnal conductance could result in some measurable O_3 flux into the plants. In addition, it was suggested that plants might be more susceptible to O_3 exposure at night than during the daytime, because of possibly lower plant defenses at night (Musselman and Minnick, 2000). Nocturnal O_3 flux also depends on the level of

turbulence that intermittently occurs at night. Thus, it would appear that the importance of nocturnal conductance and its contribution to total diurnal flux is species and site specific. For additional information on nocturnal conductance see Chapter 9 and AX9 of CD (EPA, 2006).

As is evident from the above discussion, multiple meteorological, species- and site-specific factors influence O_3 uptake. In order to integrate those factors that drive the patterns of stomatal conductance and exposure, the use of O_3 flux models is required. Though significant new research into flux model development has occurred since the last review, at this point in time these models remain species and site specific which limits their usefulness in national or regional scale risk assessments. However, in some countries, efforts are under way to incorporate flux into the policy context (see Critical Level discussion below).

The Critical Level Approach

Both the concentration-based and flux-based exposure index forms can be used to establish a “critical level” for plant exposure to O_3. One definition of a critical level is “the concentration of pollutant in the atmosphere above which direct adverse effects on receptors, such as plants, ecosystems, or materials may occur according to present knowledge” (UNECE, 1988). As used by the United Nations Economic Commission for Europe International Cooperative Programme (UNECE ICP), the critical levels are not air quality regulatory standards in the U.S. sense, but rather planning targets for reductions in pollutant emissions to protect ecological resources. Critical levels for O_3 are intended to prevent long-term deleterious effects on the most sensitive plant species under the most sensitive environmental conditions, but not to quantify O_3 effects. The nature of the “adverse effects” was not specified in the original definition, which provided for different levels for different types of harmful effect (e.g., visible injury or loss of crop yield). There are also different levels for crops, forests, and seminatural vegetation. The caveat, “according to present knowledge,” is important because critical levels are not rigid; they are revised periodically as new scientific information becomes available. To date, critical levels (Level I) have been set for agricultural crops, for foliar injury symptoms in the field and for forest trees in terms of the AOT40 index (see section 7.2.5 and U.S. EPA, 2006). Specifically, critical levels of a 3 month, 3 ppm-hr and a 6 month, 10 ppm-hr AOT40 have been established for crops and tree seedlings, respectively. An additional provisional level of 7 ppm-hr over 6 months for herbaceous perennials has been recommended. Level I critical levels are currently used to map and identify areas in

Europe in which the levels are exceeded, and that information is then used to plan optimized and effects-based abatement strategies.

In the 1990s, however, many exposure studies demonstrated that the simple, exposure-based approach led to the overestimation of effects in some regions and underestimation in others (Fuhrer et al., 1997; Kärenlampi and Skärby, 1996) because it did not differentiate between plant species, and it did not include modifying site and micrometeorological factors of O_3 uptake such vapor pressure deficit (VPD), water stress, temperature, and light and variation in canopy height. At that time, a decision was made by the UNECE ICP to work towards a flux-based approach for the critical levels ("Level II"), with the goal of modeling O_3 flux-effect relationships for three vegetation types: crops, forests, and seminatural vegetation (Grünhage and Jäger, 2003). Progress has been made in modeling flux (Ashmore et al., 2004a,b) and the Mapping Manual is being revised (Ashmore et al., 2004a,b; Grennfelt, 2004; Karlsson et al., 2003). The revisions may include a flux-based approach for three crops: wheat, potatoes, and cotton. However, because of a lack of flux-response data, a cumulative, cutoff concentration-based (e.g., AOT40) exposure index will remain in use for the near future for most crops and for forests and seminatural herbaceous vegetation (Ashmore et al., 2004a).

Summary

Flux-based models are currently limited by the species-specific information required and by the observed nonlinearity between total flux and plant response. Better understanding of the detoxification and compensation processes would be required to account for this nonlinearity in future models. Other relevant information that should be evaluated include the extent to which: (1) nighttime exposures represent a significant percentage of total diurnal exposures, and whether their impact on growth or foliar injury effects are proportional; (2) the degree to which elevation and nocturnal turbulence alter actual nocturnal uptake; and (3) differences in plant defense mechanisms and other processes at night.

Until such research can be done, the current CD (U.S. EPA, 2006) concludes that, at this time, based on the current state of knowledge, exposure indices that differentially weight the higher hourly average O_3 concentrations but include the mid-level values still represent the best approach for relating vegetation effects to O_3 exposure in the U.S.. This is due in part to the existence of a large database that has been used for establishing exposure-response relationships. Such a database does not yet exist for relating O_3 flux to growth response.

Staff anticipate that, as the overlapping mathematical relationships of conductance, concentration, and defense mechanisms are better defined, O_3-flux-based models may be able to predict vegetation injury and/or damage at least for some categories of canopy-types with more accuracy than the currently available exposure-response models. The results of these studies and reviews indicate the need to continue to develop indices that are more physiologically and meteorologically connected to the actual dose of O_3 the plant receives. The flux approach should provide an opportunity to improve upon the concentration-based exposure index in the future, recognizing that a concerted research effort is needed to develop the necessary experimental data and modeling tools that will provide the scientific basis for such critical levels for O_3 (Dämmgen et al., 1994; Fuhrer et al., 1997; Grünhage et al., 2004).

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APPENDIX 7B: Comparisons between Ozone Metrics

Calculation of Approximate Equivalent 12-hr SUM06 and 12-hr W126

Despite various metrics reported in the vegetation effects literature, there is no standard method for calculating equivalent levels between metrics. The maximum 3-month 12-hr SUM06 of 25 ppm-hr secondary standard that was proposed in the last review (62 FR 38877) was based on a yield loss prevention of approximately 10% in 50% of crop cases studied in the National Crop Loss Analysis Network (NCLAN) experiments. For consistency, staff judged it appropriate to use the NCLAN experiments to derive equivalents between the 12-hr SUM06 and W126. For example, below are the 12-hr SUM06 and W126 NCLAN equations to protect 50% of crop cases from a specified percent yield loss (Lee and Hogsett 1996):

Metric	**Weibull Equation**
12-hr SUM06	Predicted Relative Yield Loss = 1- exp(-[SUM06/87.42]^1.82)
12-hr W126	Predicted Relative Yield Loss = 1- exp(-[W126/96.05]^1.48)

In the first equation, solving for a SUM06 of 25 ppm-hr equals a predicted relative yield loss of 10%. Solving the second equation for a 10% yield loss equals a W126 of 21 ppm-hr. Thus, staff considers a 12-hr SUM06 of 25 ppm-hr and a 12-hr W126 of 21 ppm-hr approximately equivalent.

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Yearly plots of 8-hr versus 12-hr W126 metrics

Figure 7B-1. The 2001 4th highest maximum 8-hr average versus the highest 3-month 12-hr W126, by county

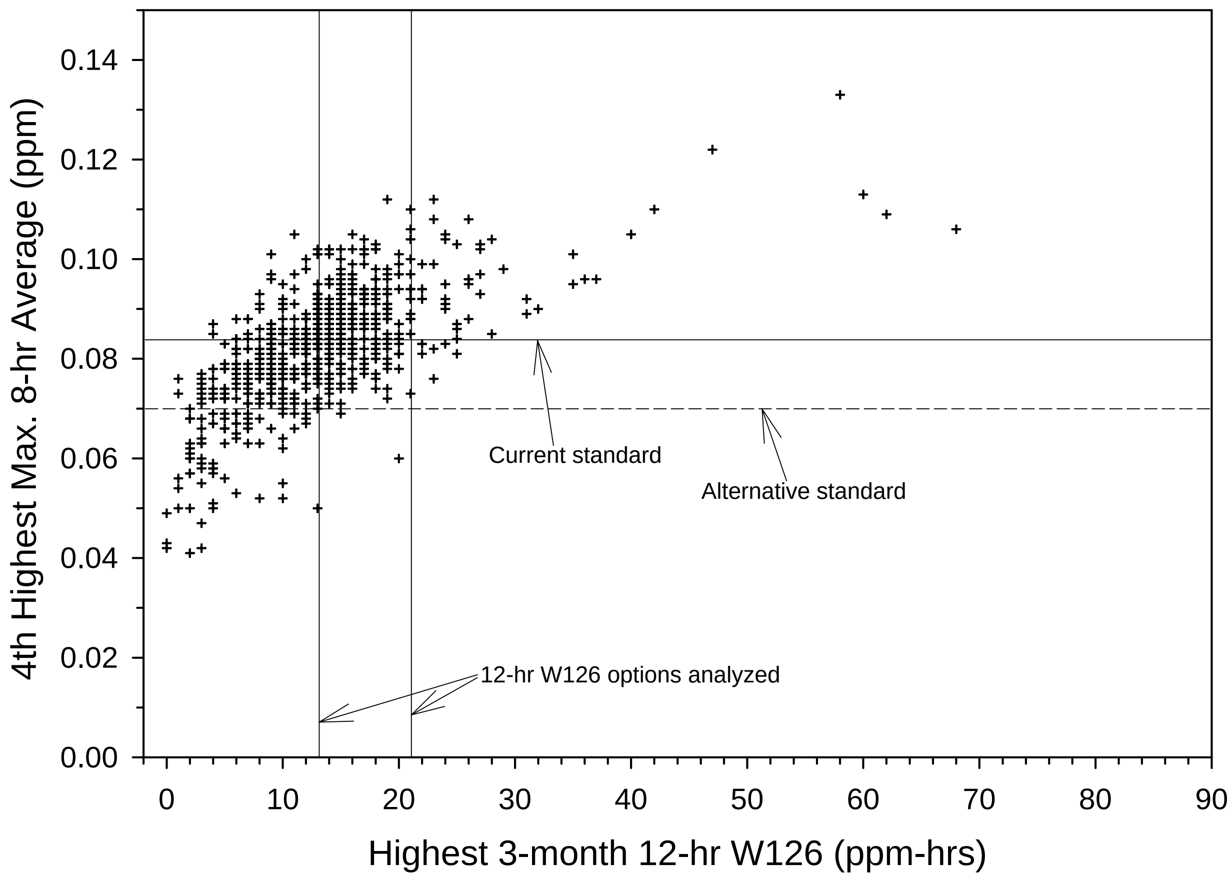
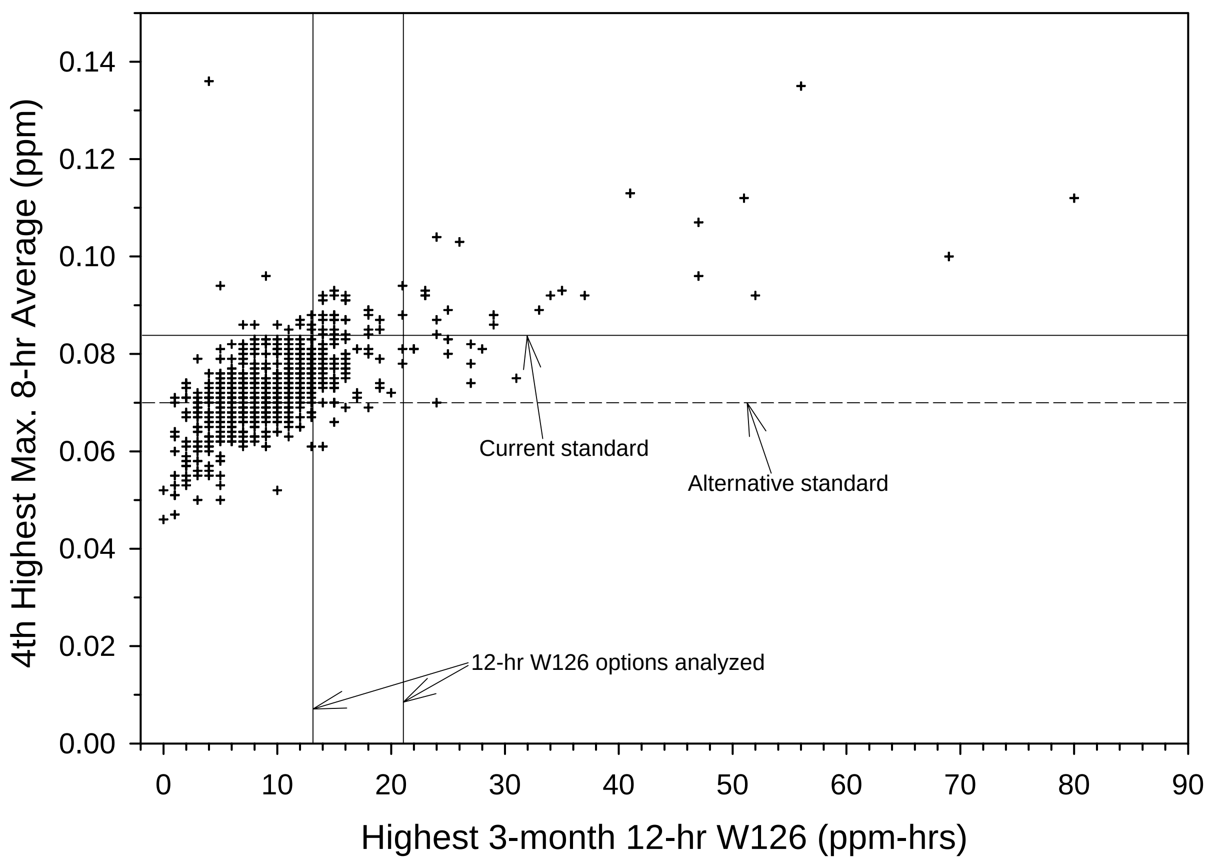


Figure 7B-2. The 2004 4th highest maximum 8-hr average versus the highest 3-month 12-hr W126, by county



APPENDIX 7C: CMAQ EXPOSURE MODEL

APPENDIX 7C.

Staff investigated the appropriateness of using the spatial scaling from the EPA/NOAA Community Multi-scale Air Quality (CMAQ) model system (http://www.epa.gov/asmdnerl/CMAQ, Byun and Ching, 1999; Arnold et al. 2003, Eder and Yu, 2005) O_3 outputs to improve spatial interpolations based on a regionally limited and unevenly distributed O_3 monitoring network in the western U.S. (see section 7.5.3). The CMAQ model is a multi-pollutant, multiscale air quality model that contains state-of-science techniques for simulating all atmospheric and land processes that affect the transport, transformation, and deposition of atmospheric pollutants and/or their precursors on both regional and urban scales. It is designed as a science-based modeling tool for handling many major pollutants (including photochemical oxidants/O_3, particulate matter, and nutrient deposition) holistically. The CMAQ model can generate estimates of hourly O_3 concentrations for the contiguous U.S., making it possible to express model outputs in terms of a variety of exposure indices (e.g., SUM06, 8-hr average). Due to the significant resources required to run CMAQ, however, model outputs are only available for a limited number of years. For this review, 2001 outputs from CMAQ version 4.5 were the most recent data available. This version of CMAQ utilizes the more refined 12 km x 12 km grid for the eastern U.S., while using the 36 km x 36 km grid for the western U.S. The 12 km x 12 km domain covers an area from roughly central Texas, north to North Dakota, east to Maine, and south to central Florida.

The CMAQ modeling system has undergone two external peer reviews through the Community Modeling and Analysis System (CMAS) based at the University of North Carolina at Chapel Hill (UNC) Carolina Environmental Program (Amar et al. 2005, 2004). In addition, EPA/NOAA recently conducted an initial evaluation of the eastern U.S. domain of CMAQ version 4.5 (Appel et al., 2005; http://www.cmascenter.org/docs/CMAQ/v4.5/CMAQv4.5_EvaluationDocument-Final2005.pdf). Based on this evaluation, hourly O_3 patterns are predicted well during the daytime. The prediction of daily maximum 8-hr average O_3 was relatively good, showing a slight positive normalized mean bias of 1.62% and a normalized mean error of 17.4%. Overall, CMAQ predictions of daily maximum 8-hr O_3 averages were improved in the 12 km x 12 km grid size when compared to the 36 km x 36 km grid size. However, the CMAQ consistently over-predicted hourly O_3 at night. Since many of the assessments outlined below rely daytime O_3 accumulated in the 12-hr SUM06 (8 am-8 pm), the night-time over-prediction is less of an issue.

The results of the CMAQ version 4.5 evaluation should be used with caution for several reasons. First, this evaluation ignores the mismatch of spatial resolution and treats CMAQ output as a point-value, a concern raised by Fuentes and Rafterty 2005. The problem is well known, but is often ignored since there are not standard operational methods that can be applied to the CMAQ model output to deal with this problem. Secondly, the size of the grid being used is unable to capture the rapidly changing O_3 gradients that often occur in complex terrain, across urban/rural gradients and along coastal areas. In these cases significant differences in O_3 concentration could occur with a 12x12km cell and the uncertainties associated with these areas are unknown. Many such features occur in rural areas of importance in this assessment and it is recognized that any estimates of O_3 exposure in complex terrain are very uncertain. Unfortunately, complex terrain is of greater significance in the west, where the CMAQ grid is even larger and the monitoring network is for the most part, sparse. These limitations proved to be determinant in selecting an interpolation technique for the west.

The CMAQ model incorporates output fields from emissions and meteorological modeling systems and several other data sources through special interface processors into the CMAQ Chemical Transport Model (CCTM). Currently, the Sparse Matrix Operator Kernel Emissions (SMOKE) System produces the emissions factors and the Fifth Generation Penn State University/ National Center for Atmospheric Research Mesoscale Model (MM5) provides the meteorological fields. CCTM then performs chemical transport modeling for multiple pollutants on multiple scales. Emission inventories of SO_2, CO, NOx, and VOCs are based on EPA's 2001 National Emission Inventory (NEI) and are consistent with inventories used for the analysis of the Clean Air Interstate Rule (CAIR) rule (EPA, 2005b). Biogenic emissions, from natural sources, were processed using the Biogenic Emissions Inventory System (BEIS) version 3.13. The staff recognizes that O_3 exposures vary between years depending on meteorology and other factors.

Recently EPA/NOAA conducted an initial evaluation of the eastern U.S. domain of CMAQ version 4.5 (Appel et al., 2005; http://www.cmascenter.org/docs/CMAQ/v4.5/CMAQv4.5_EvaluationDocument-Final2005.pdf). This evaluation used the same metrics published by Eder and Yu (2005) for the CMAQ version 4.4 model release. For the modeled summer months of June, July and August of 2001, CMAQ version 4.5 predictions were compared to AQS monitor sites. The prediction of daily maximum 8-hr average O_3 was relatively good, showing a slight positive normalized mean bias of 1.62% and a normalized mean error of 17.4%. Hourly ozone patterns are predicted well during the daytime. However, the CMAQ consistently over-predicted hourly O_3 at night. Nighttime over-predictions in O_3 have been improved over CMAQ version 4.4 by modifications to the minimum K_z approximation in CMAQ version 4.5, but additional investigations are needed. Again, since many of the assessments outlined below rely daytime O_3 accumulated in the 12-hr SUM06 (8 am to 8 pm), the night-time over-prediction is less of an issue. Overall, CMAQ predictions of daily 8hr O_3 averages were improved in the 12km x 12km grid size when compared to the 36km x 36km grid size. Since CMAQ output is averaged over large square blocks and monitor observations are effectively averages over much smaller regions, CMAQ output and monitor observations have a mismatch in spatial resolution. (Fuentes and Rafterty 2005). The problem is well known, but is often ignored since there are not standard operational methods that can be applied to the CMAQ model output to deal with this problem. The CMAQ version 4.5 evaluation described above ignores the mismatch of spatial resolution and treats CMAQ output as a point-value. The staff believes this simplification is reasonable in flat rural areas where many important crops and vegetation grow, because O_3 is a secondary pollutant and its concentration generally varies fairly smoothly across those areas. However, O_3 is notably more variable in complex terrain, across urban/rural gradients and along coastal areas. In these cases significant differences in O_3 concentration could occur with a 12x12km cell and the uncertainties associated with these areas are unknown. The current assessment is most concerned with rural areas and it is recognized that any estimates of O_3 exposure in complex terrain are very uncertain. Unfortunately, complex terrain is of greater significance in the west, where the CMAQ grid is larger and the monitoring network is for the most part, sparse. These limitations proved to be determinant in selecting an interpolation technique for the west.

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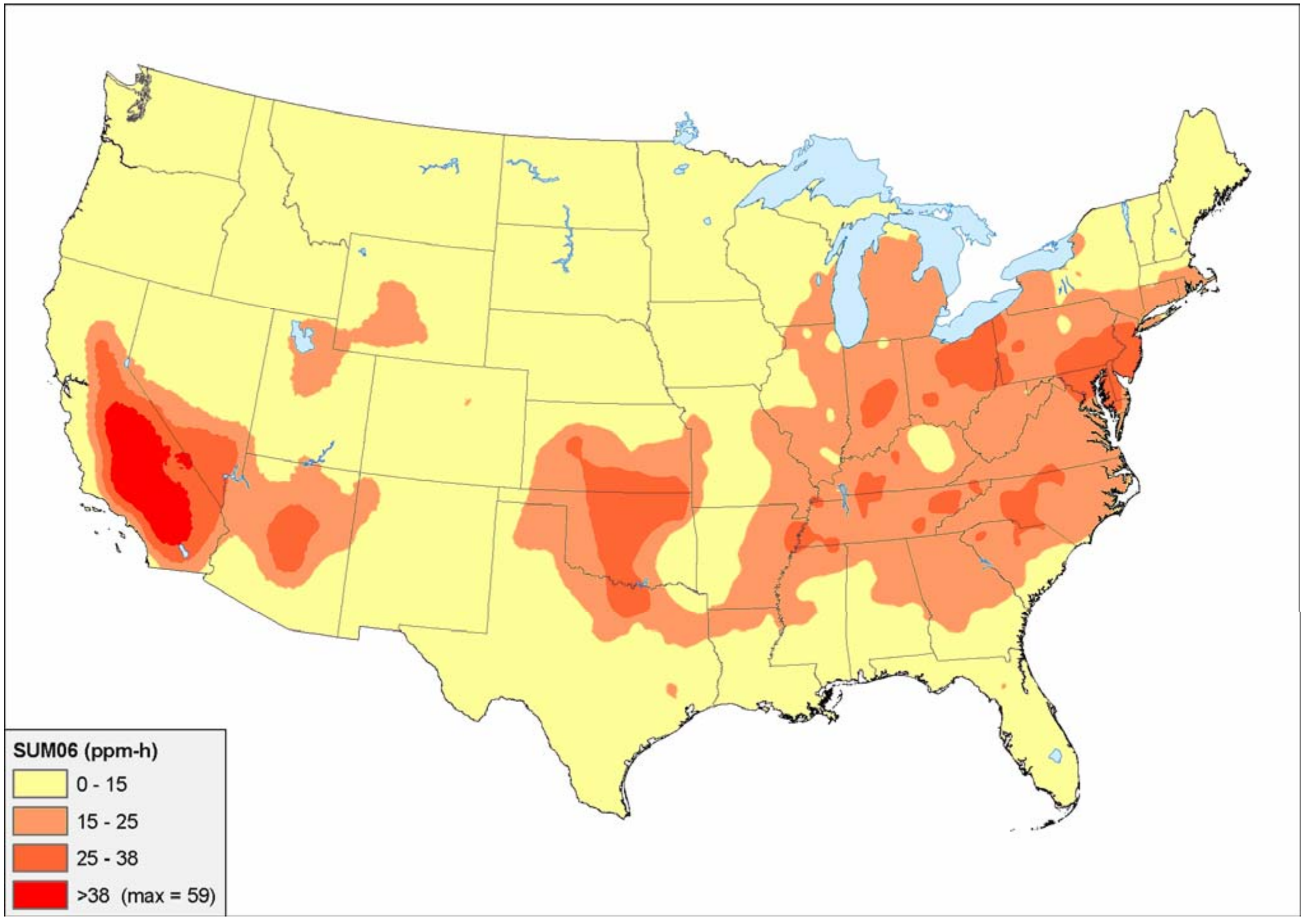
APPENDIX 7D. INTERPOLATED 3-MONTH, 12-HR SUM06 EXPOSURES

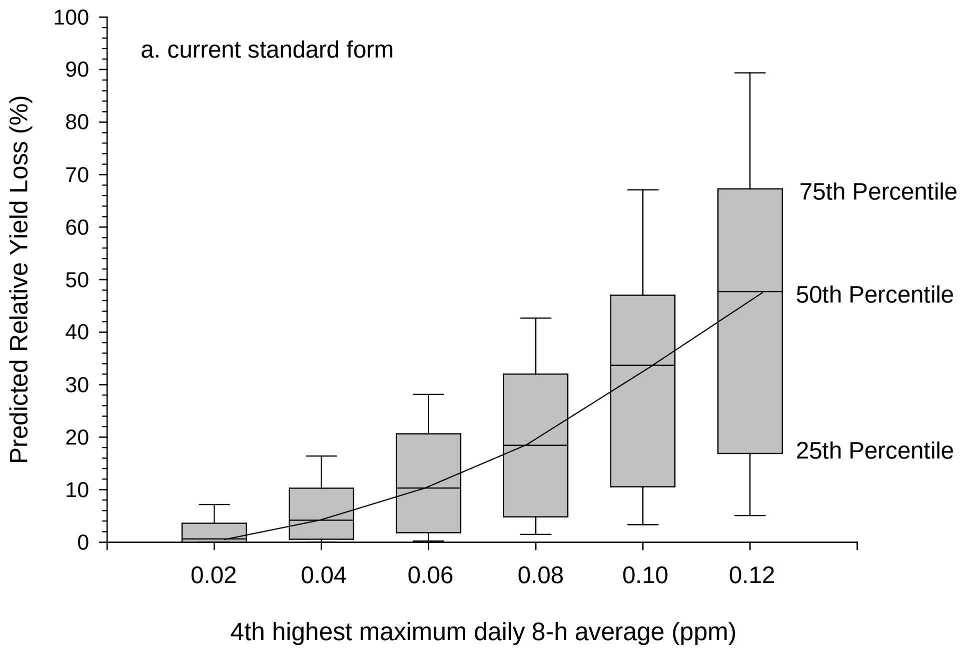
Figure 7D-1. Estimated 12-Hr SUM06 Ozone Exposure – Max 3-months for 2001

"As Is" scenario



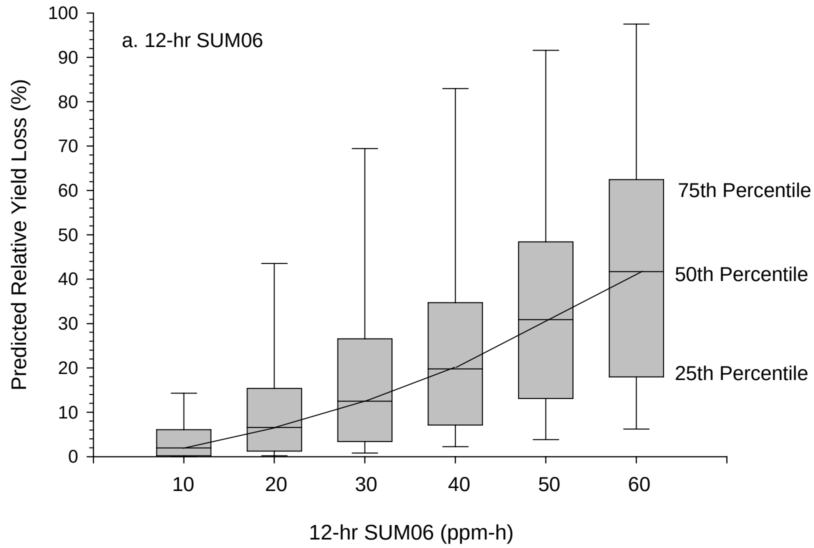
APPENDIX 7E. NCLAN C-R ANALYSIS USING THE 8-HR AVERAGE AND SUM06 METRIC

Figure 7E-1. Median crop yield loss from NCLAN crops characterized the annual 4th highest maximum 8-hr average (the current standard form).



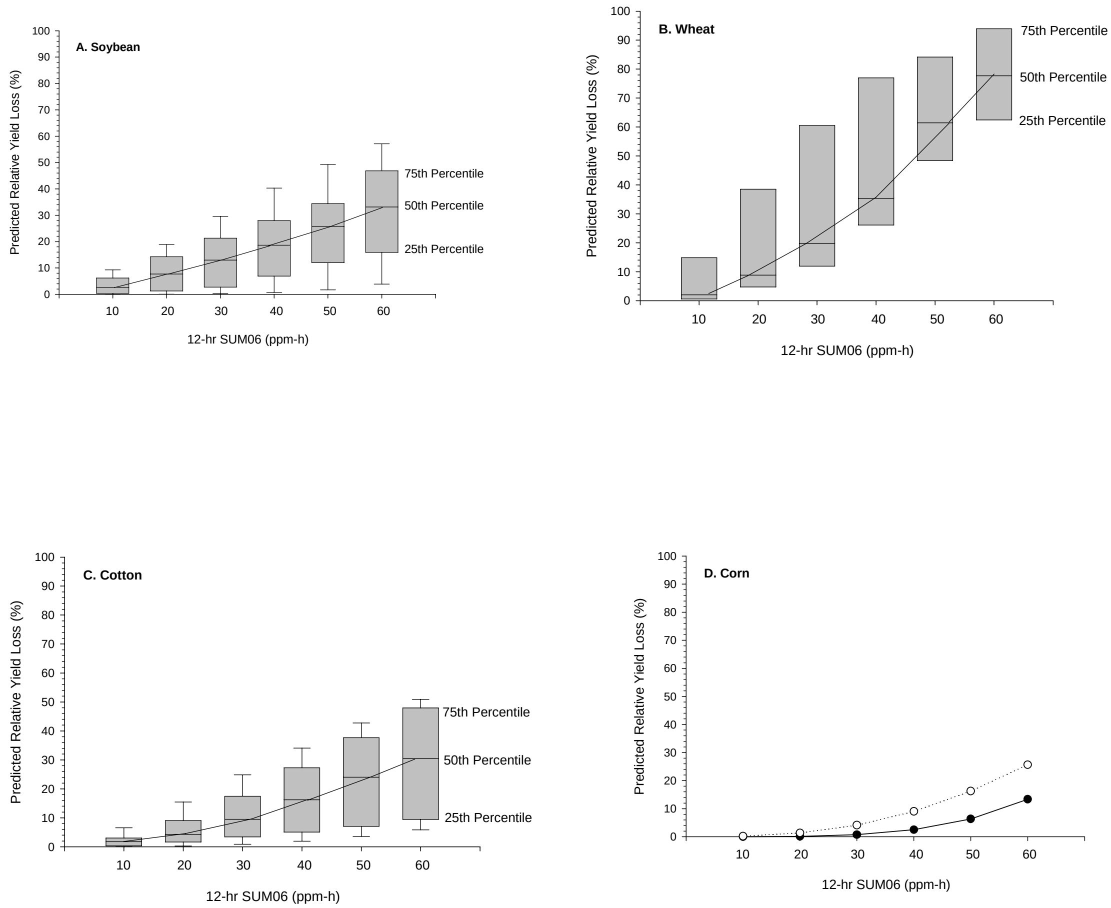
Distribution of biomass loss predictions from Weibull exposure-response models that relate yield to O_3 exposure characterized with the 4th highest max. 8-hr average statistic using data from 31 crop studies from National Crop Loss Assessment Network (NCLAN). Separate regressions were calculated for studies with multiple harvests or cultivars, resulting in a total of 54 individual equations from the 31 NCLAN studies. Each equation was used to calculate the predicted relative yield or biomass loss at 0.02, 0.04, 0.06, 0.10 and 0.12 ppm, and the distributions of the resulting loss were plotted.

Figure E-2. Median crop yield loss from NCLAN crops characterized with the 12-hr SUM06



Distribution of yield loss predictions from Weibull exposure-response models that relate yield to O_3 exposure characterized with the 12-hr SUM06 statistic using data from 31 crop studies from National Crop Loss Assessment Network (NCLAN). Separate regressions were calculated for studies with multiple harvests or cultivars, resulting in a total of 54 individual equations from the 31 NCLAN studies. Each equation was used to calculate the predicted relative yield or biomass loss at 10, 20, 30, 40, 50, and 60 ppm-h, and the distributions of the resulting loss were plotted. Source: EPA, 1996a; Lee and Hogsett 1995.

Figure 7E-2 (A-D). Median soybean (A), wheat (B), cotton (C) and corn (D) yield loss from NCLAN crops characterized with the 12hr SUM06



Distribution of yield loss predictions from Weibull exposure-response models that relate yield to O_3 exposure characterized with the 12-hr SUM06 statistic using data from 22 soybean, 7 wheat, 9 cotton and 2 corn studies from National Crop Loss Assessment Network (NCLAN). Separate regressions were calculated for studies with multiple harvests or cultivars. Each equation was used to calculate the predicted relative yield loss at a 12-h SUM06 of 10, 20, 30, 40, 50, and 60 ppm-h, and the distributions of the resulting loss were plotted. Source: EPA, 1996a; Lee and Hogsett 1995.

APPENDIX 7F. C-R FUNCTIONS USED IN CROP AND TREE SEEDLING ANALYSES

Table 7F-1. Ozone Exposure-Response Functions for Selected NCLAN Crops

Ozone Index	Quantity	Crop	Function
W126	Max	Cotton	1-exp(-(index/74.6)^1.068)
W126	Min	Cotton	1-exp(-(index/113.3)^1.397)
W126	Median	Cotton	1-exp(-(index/96.1)^1.482)
W126	Max	Field Corn	1-exp(-(index/92.7)^2.585)
W126	Min	Field Corn	1-exp(-(index/94.2)^4.167)
W126	Median	Field Corn	1-exp(-(index/97.9)^2.966)
W126	Median	Grain Sorghum*	1-exp(-(index/205.9)^1.963)
W126	Median	Peanut*	1-exp(-(index/96.8)^1.890)
W126	Max	Soybean	1-exp(-(index/130.1)^1)
W126	Min	Soybean	1-exp(-(index/476.7)^1.113)
W126	Median	Soybean	1-exp(-(index/110.2)^1.359)
W126	Max	Winter Wheat	1-exp(-(index/24.7)^1.0)
W126	Min	Winter Wheat	1-exp(-(index/76.8)^2.031)
W126	Median	Winter Wheat	1-exp(-(index/53.4)^2.367)
W126	Median	Lettuce*	1-exp(-(index/54.6)^4.917)
W126	Median	Kidney Bean*	1-exp(-(index/43.1)^2.219)
W126	Min	Potato	1-exp(-(index/113.8)^1.299)
W126	Max	Potato	1-exp(-(index/96.3)^1)
W126	Median	Potato	1-exp(-(index/99.5)^1.242)

Source: Lee and Hogsett (1996) table 10. *Peanuts, Grain Soghum, Lettuce and Kidney Bean only have one C-R function and therefore do not have a max and min.

Table 7F-2. Ozone Exposure-Response Functions for Selected Fruits and Vegetable Crops

Ozone Index	Quantity	Fruit/Vegetable	Function
12-hr	Median	Onion*	1-(5034-(10941*12hr))/(5034-(10941*base12))
7-hr	Median	Rice*	1-(exp(-((7hr/0.2016)^2.474)))/(exp(-((base7/0.2016)^2.474)))
12-hr	Median	Valencia Oranges*	1-(53.7-(261.1*12hr))/(53.7-(261.1*base12))
7-hr	Median	Cantaloupes*	1-(35.8-(280.8*7hr))/(35.8-(280.8*base7))
12-hr	Min	Grapes	1-(1.121-(6.63*12hr))/(1.121-(6.63*base12))
12-hr	Max	Grapes	1-(9315-(64700*12hr))/(9315-(64700*base12))
12-hr	Median	Grapes	1-(357.254-(2300*12hr))/(357.254-(2300*base12))
12-hr	Max	Tomatoes-Processing	1-(8590-(41277*12hr))/(8590-(41277*base12))
12-hr	Min	Tomatoes-Processing	1-(6315-(21070*12hr))/(6315-(21070*base12))
12-hr	Median	Tomatoes-Processing	1-(9055-(32367*12hr))/(9055-(32367*base12))

Source: Abt (1995) Exhibit 11. *Onions, Rice, Oranges, and Cantaloupes only have one C-R function and therefore do not have a max and min. base7 = 0.027 and base12 = 0.025 which are equal to the concentrations in the charcoal-filtered treatments.

Table 7F-3. Median Composite Ozone Exposure-Response Functions* for Tree Seedlings

Ozone Index	Quantity	Crop	Function
W126	Median	Ponderosa Pine	1-exp(-(index/159.63)^1.190)
W126	Median	Red Alder	1-exp(-(index/179.06)^1.2377)
W126	Median	Black Cherry	1-exp(-(index/38.92)^0.9921)
W126	Median	Tulip Poplar	1-exp(-(index/51.38)^2..0889)
W126	Median	Sugar Maple	1-exp(-(index/36.35)^5.7785)
W126	Median	E. White Pine	1-exp(-(index/63.23)^1.6582)
W126	Median	Red Maple	1-exp(-(index/318.12)^1.3756)
W126	Median	Douglas Fir	1-exp(-(index/106.83)^5.9631)
W126	Median	Aspen	1-exp(-(index/109.81)^1.2198)
W126	Median	Virginia Pine	1-exp(-(index/1714.64)^1)

Source: Lee and Hogsett (1996) table 14. *Individual exposure-response curves are reported using the 12-hr-SUM06 index adjusted to a 92-day exposure duration.

Table 7F-4. Maximum county-level percent relative yield loss* for crops using median C-R functions and 2001 exposures. The range of yield loss represents calculations from exposures with hourly O_3 concentrations reduced by 10% and without an adjustment.

	Air Quality Scenarios				
Crops	**As Is (2001)**	**8-hr, 84 ppb**	**SUM06 25**	**8-hr, 70 ppb**	**SUM06 15**
Kidney Bean	4-9%	2-5%	0-1%	0-1%	0-0.5%
Grapes	23-28%	21-25%	17-21%	17-21%	15-19%
Lettuce	0-0%	0-0%	0-0%	0-0%	0-0%
Potato	13-20%	9-15%	3-7%	3-7%	2-5%
Grain Sorghum	1-2%	0.5-1%	0-0.5%	0-0.5%	0-0%
Cantaloupe	24-29%	19-24%	15-20%	15-20%	13-17%
Corn	0-0.5%	0-0%	0-0%	0-0%	0-0%
Cotton	8-14%	5-10%	1-3%	1-4%	1-2%
Onion	8-10%	7-8%	6-7%	6-7%	5-6%
Peanut	5-11%	3-8%	1-3%	1-2%	0-1%
Soybean	3-6%	2-4%	2-4%	1-2%	1-2%
Valencia Orange	17-20%	15-18%	12-15%	12-15%	11-14%
Tomato Processing	14-16%	12-14%	10-12%	10-12%	9-11%
Winter Wheat	1-4%	0.5-2%	0-0.5%	0-0.5%	0-0%

* Modified from Figures for Yield Loss (G-1) and Yield Gain (G-2 to G-6) in the Environmental Assessment TSD (Abt, 2007)

Table 7F-5. Maximum percent relative biomass loss* for tree seedlings using median C-R functions and 2001 12-hr W126 exposures. The range of biomass loss represents calculations from exposures with hourly O_3 concentrations reduced by 10% and without an adjustment.

	Air Quality Scenarios				
Tree Species	**As Is (2001)**	**8-hr, 84 ppb**	**SUM06 25**	**8-hr, 70 ppb**	**SUM06 15**
Aspen	12-18%	6-12%	6-12%	2-8%	3-9%
Black Cherry	41-53%	24-36%	26-37%	12-24%	16-28%
Douglas Fir	0-0%	0-0%	0-0%	0-0%	0-0%
Ponderosa Pine	20-28%	11-18%	3-11%	4-12%	2-10%
Red Alder	0.5-1%	0.5-1%	0.5-1%	0.5-1%	0.5-1%
Red Maple	2-4%	1-2%	1-3%	0-2%	0.5-2%
Sugar Maple	3-25%	0-22%	0-22%	0-22%	0-22%
Tulip Poplar	14-26%	4-17%	5-18%	1-14%	1-14%
Virginia Pine	1-2%	1-1%	1-1%	0-1%	0-1%
Eastern White Pine	14-24%	6-16%	6-16%	2-13%	2-13%

* Modified from Figures for Tree Seedling Biomass Loss (H-1) and Biomass Gain (H-2 to H-6) in the Environmental Assessment TSD (Abt, 2007)

APPENDIX 7G. PREDICTED YIELD LOSS FOR SELECTED MAJOR COMMODITY CROPS BASED ON PLANTING AREAS AND PREDICTIONS OF 2001 O_3 EXPOSURE USING THE 12-HR W126 INDEX.

Figure 7G-1. Estimated soybean yield loss based on interpolated 2001 3-month 12-hr W126. (Without a 10% reduction in exposure.)

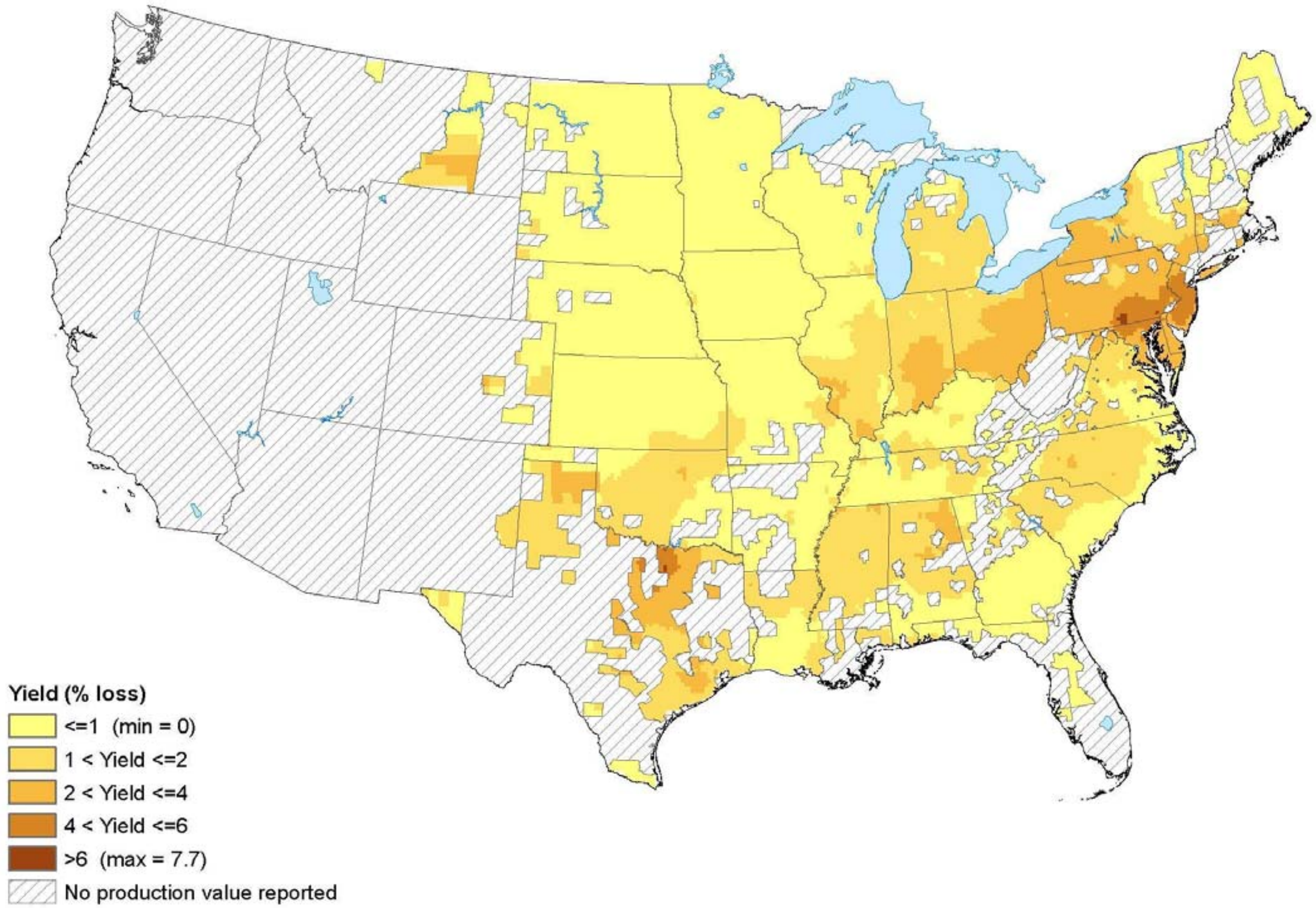


Figure 7G-2. Estimated corn yield loss based on interpolated 2001 3-month 12-hr W126. (With and without a 10% reduction in exposure.)

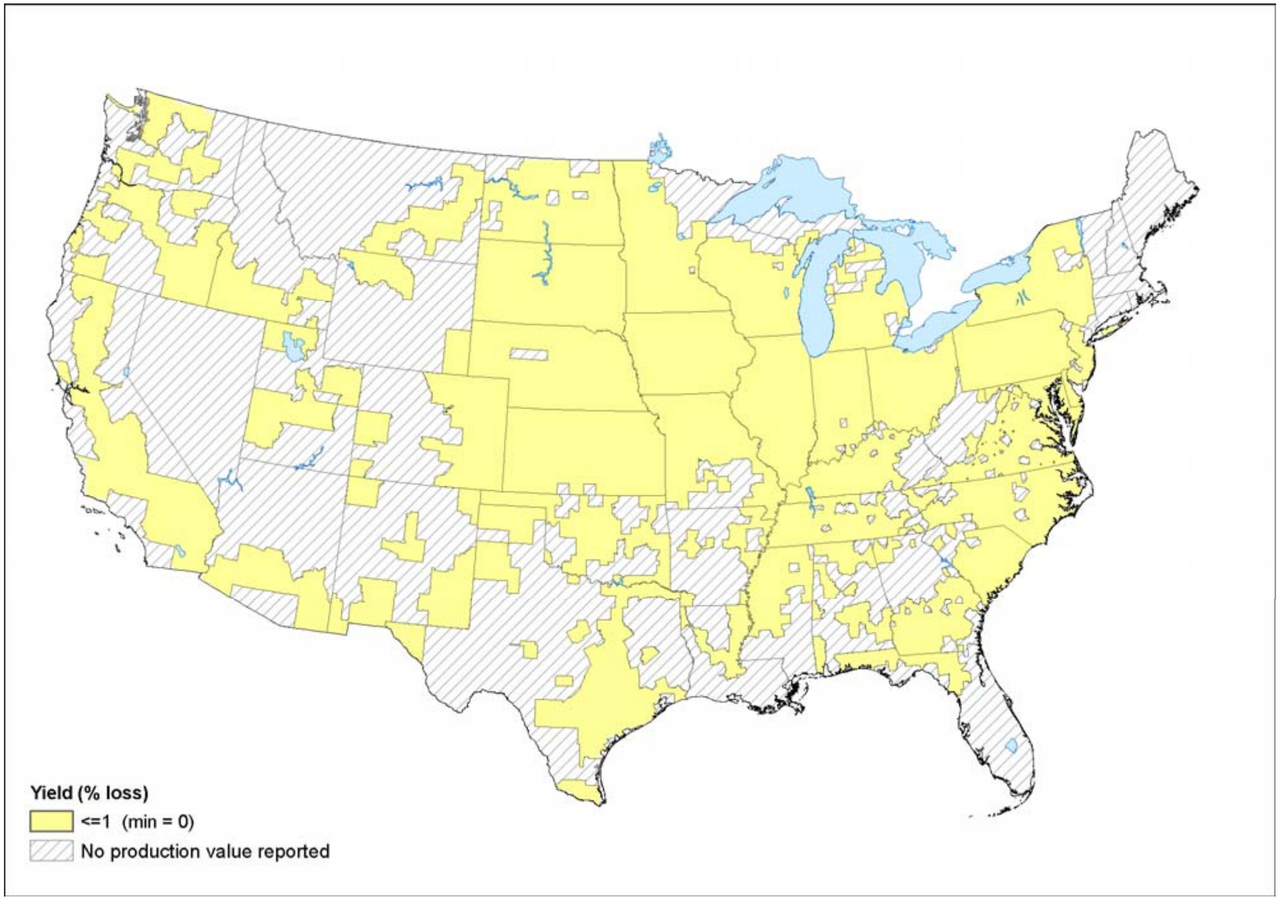


Figure 7G-3. Estimated cotton yield loss based on interpolated 2001 3-month 12-hr W126. (With a 10% reduction in exposure.)

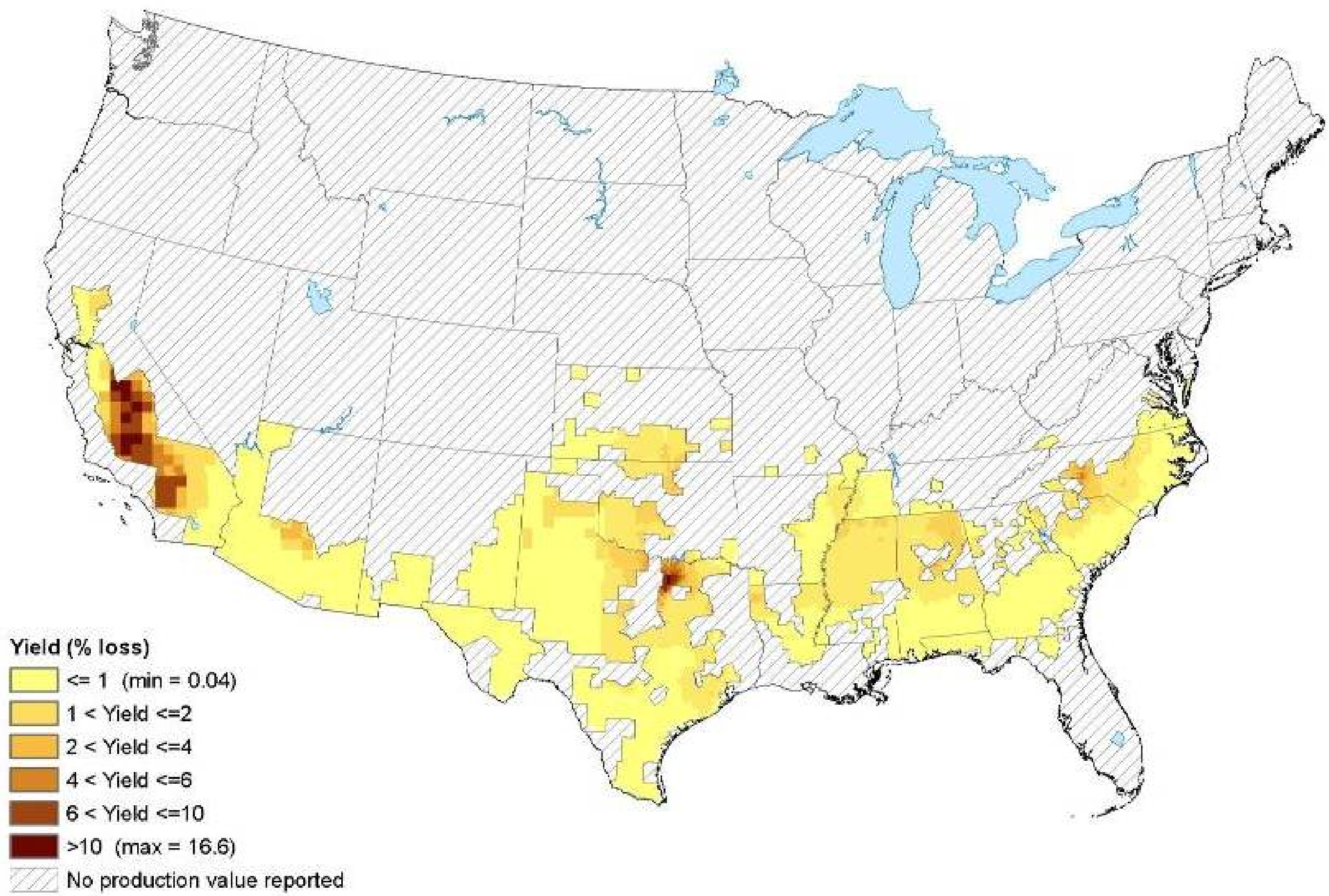


Figure 7G-4. Estimated cotton yield loss based on interpolated 2001 3-month 12-hr W126. (Without a 10% reduction in exposure.)

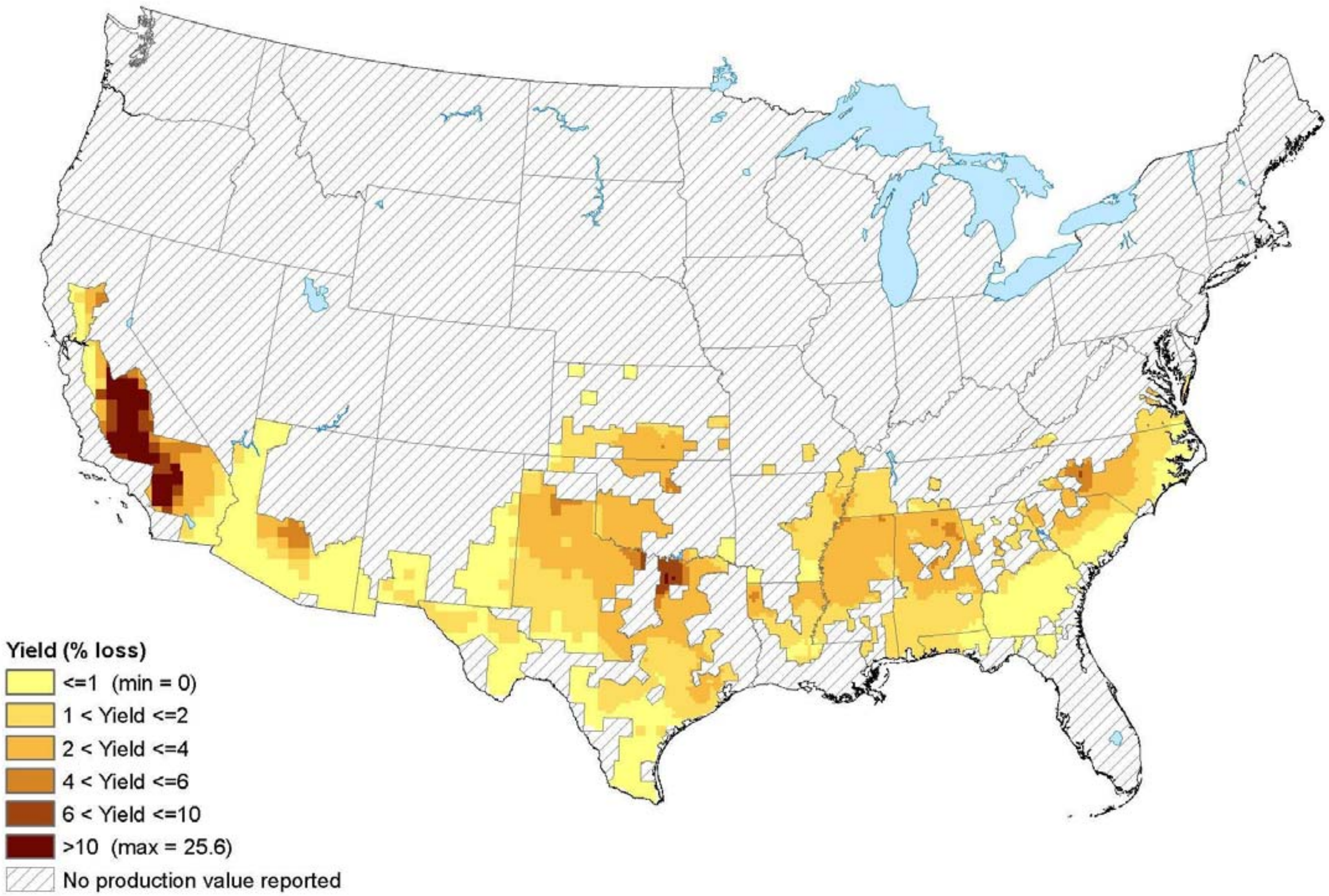


Figure 7G-5. Estimated winter wheat yield loss based on interpolated 2001 3-month 12-hr W126. (With a 10% reduction in exposure.)

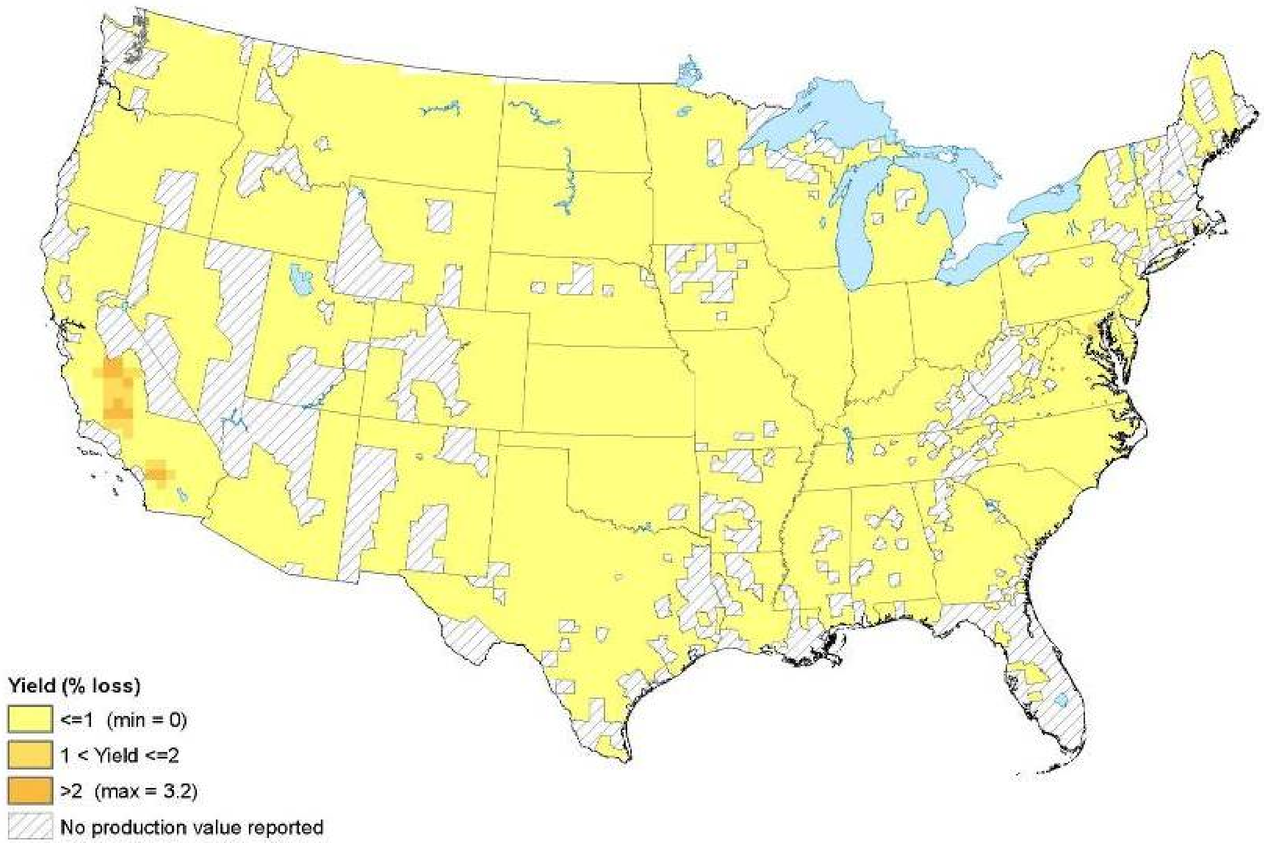
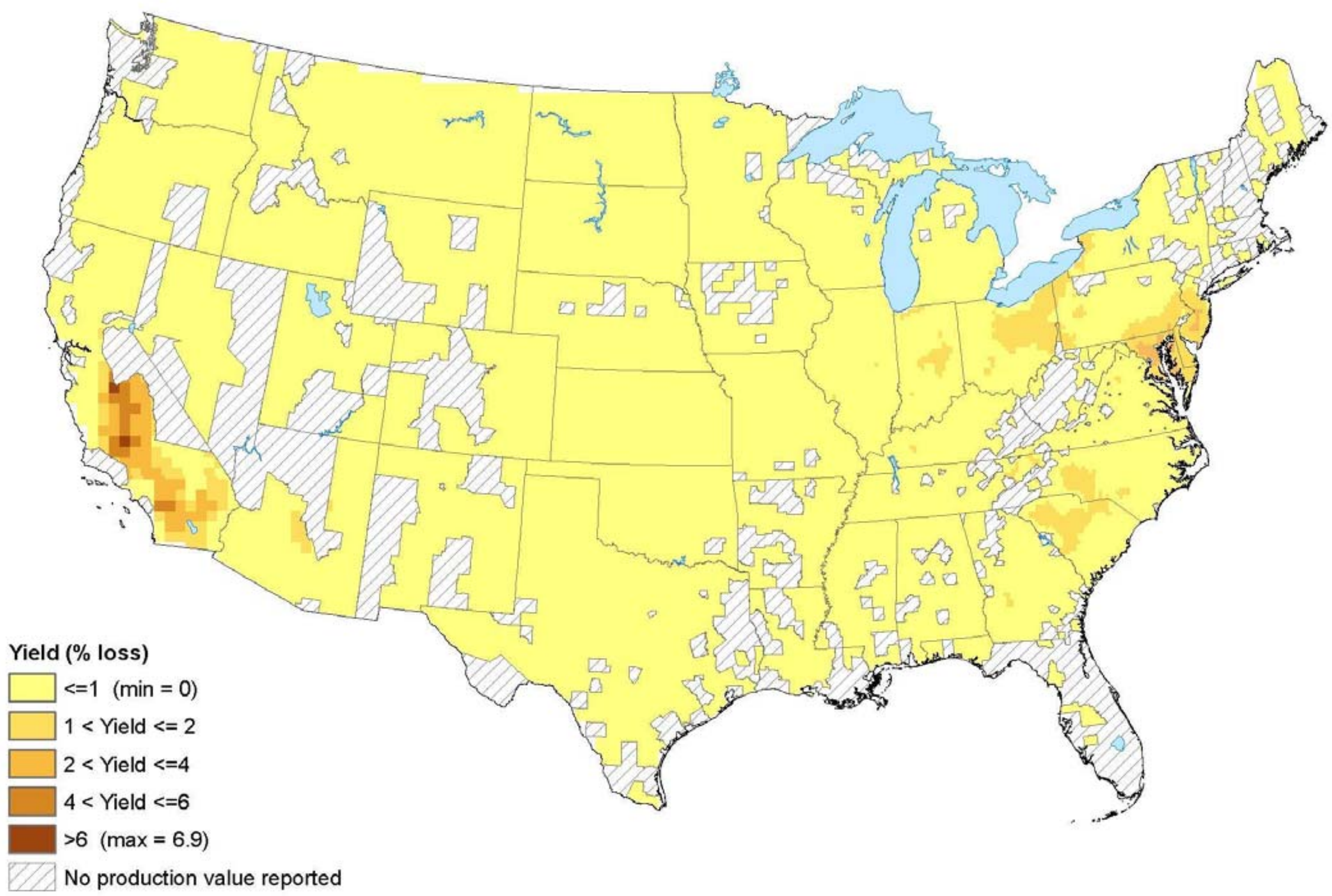


Figure 7G-6. Estimated winter wheat yield loss based on interpolated 2001 3-month 12-hr W126. (Without a 10% reduction in exposure.)



APPENDIX 7H. TREE SEEDLING BIOMASS LOSS MAPS UNDER VARYING AIR QUALITY SCENARIOS

Figure 7H-1. Estimated quaking aspen seedling annual biomass loss based on interpolated 2001 maximum 3-month 12-hr W126 **without** a 10% downward adjustment of hourly O_3 concentrations. This map indicates the geographic range for quaking aspen (*Populus tremoloides)*, but it does not necessarily indicate that quaking aspen will be found at every point within its range.

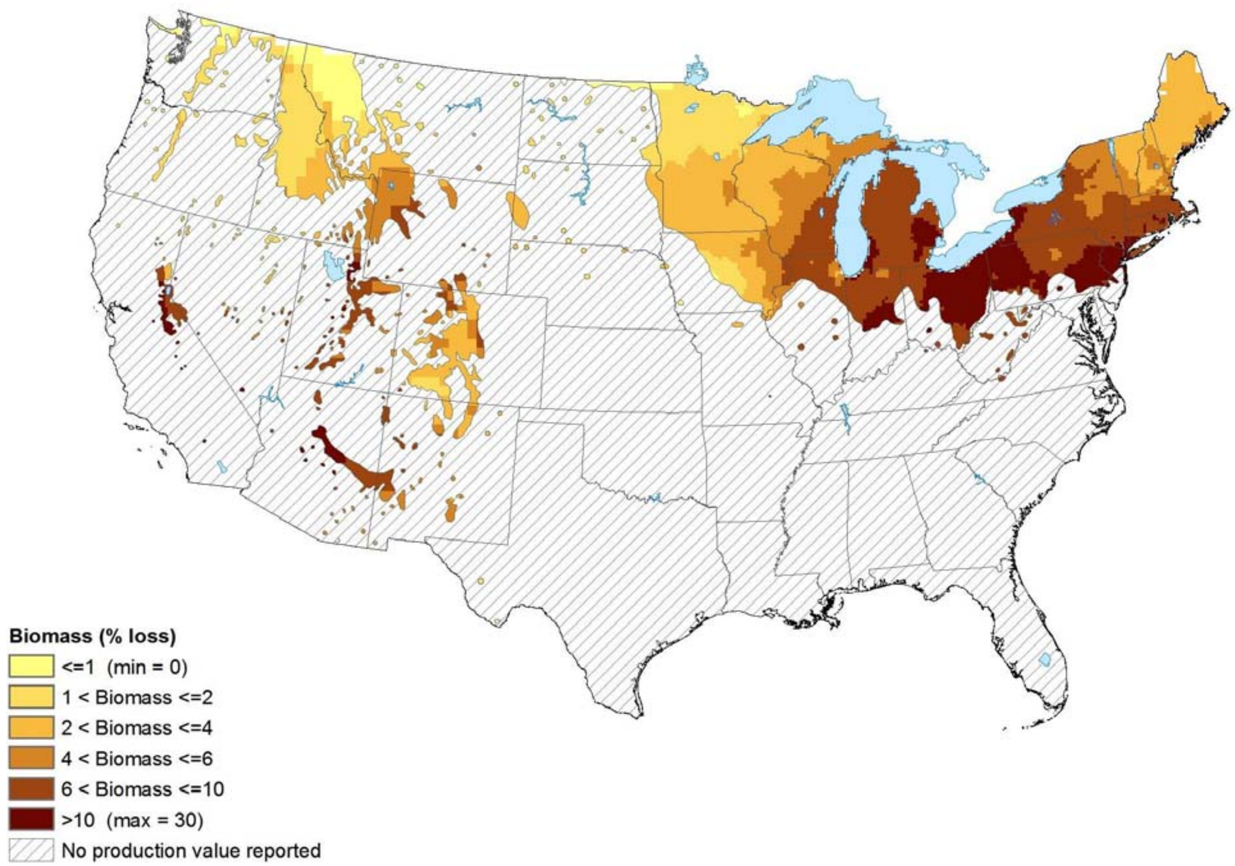


Figure 7H-2. . Estimated black cherry annual biomass loss based on interpolated 2001 maximum 3-month 12-hr W126 **with** a 10% downward adjustment of hourly O_3 concentrations. This map indicates the geographic range for black cherry (*Prunus serotina)*, but it does not necessarily indicate that black cherry will be found at every point within its range.

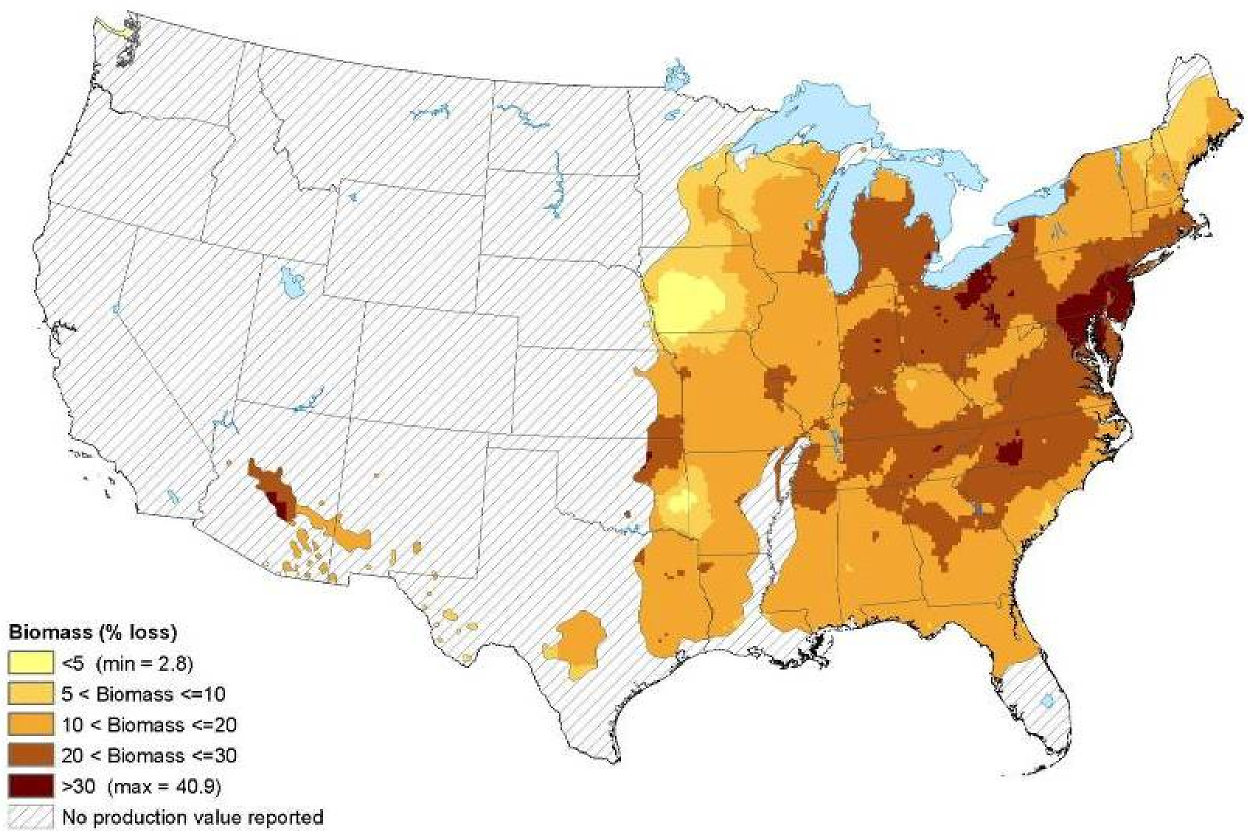


Figure 7H-3. Estimated black cherry annual biomass loss based on interpolated 2001 maximum 3-month 12-hr W126 **without** a 10% downward adjustment of hourly O_3 concentrations. This map indicates the geographic range for black cherry (*Prunus serotina)*, but it does not necessarily indicate that black cherry will be found at every point within its range.

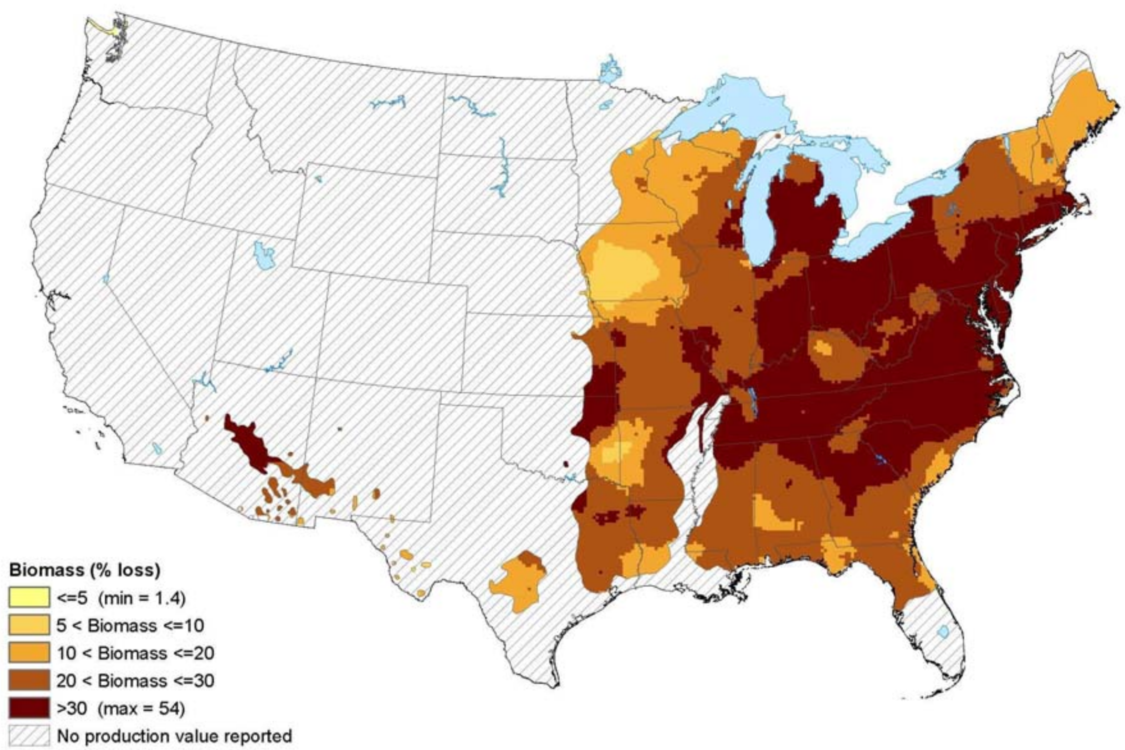


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Figure 7H-4. Estimated ponderosa pine annual biomass loss based on interpolated 2001 maximum 3-month 12-hr W126 **with** a 10% downward adjustment of hourly O_3 concentrations. This map indicates the geographic range for ponderosa pine (*Pinus ponderosa)*, but it does not necessarily indicate that ponderosa pine will be found at every point within its range.

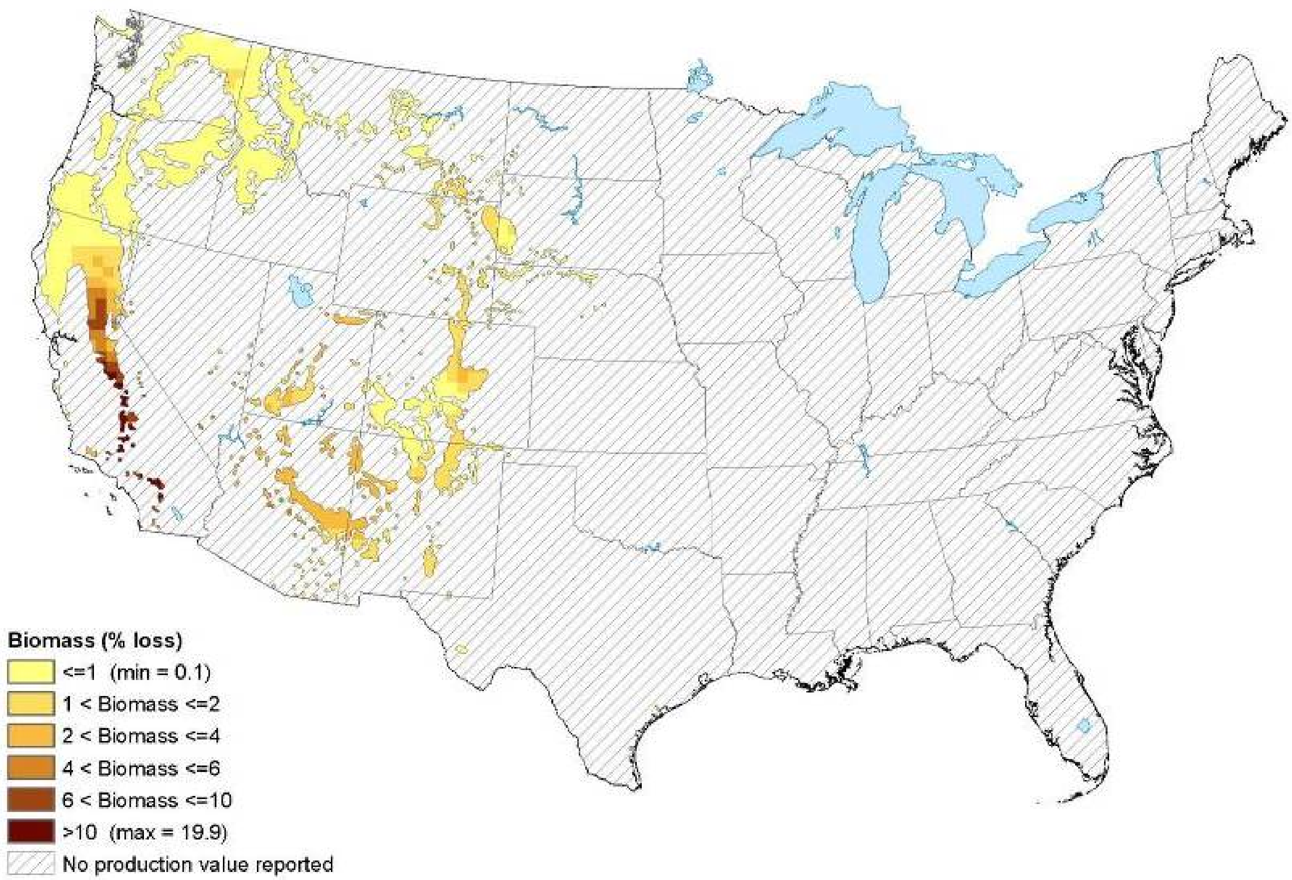
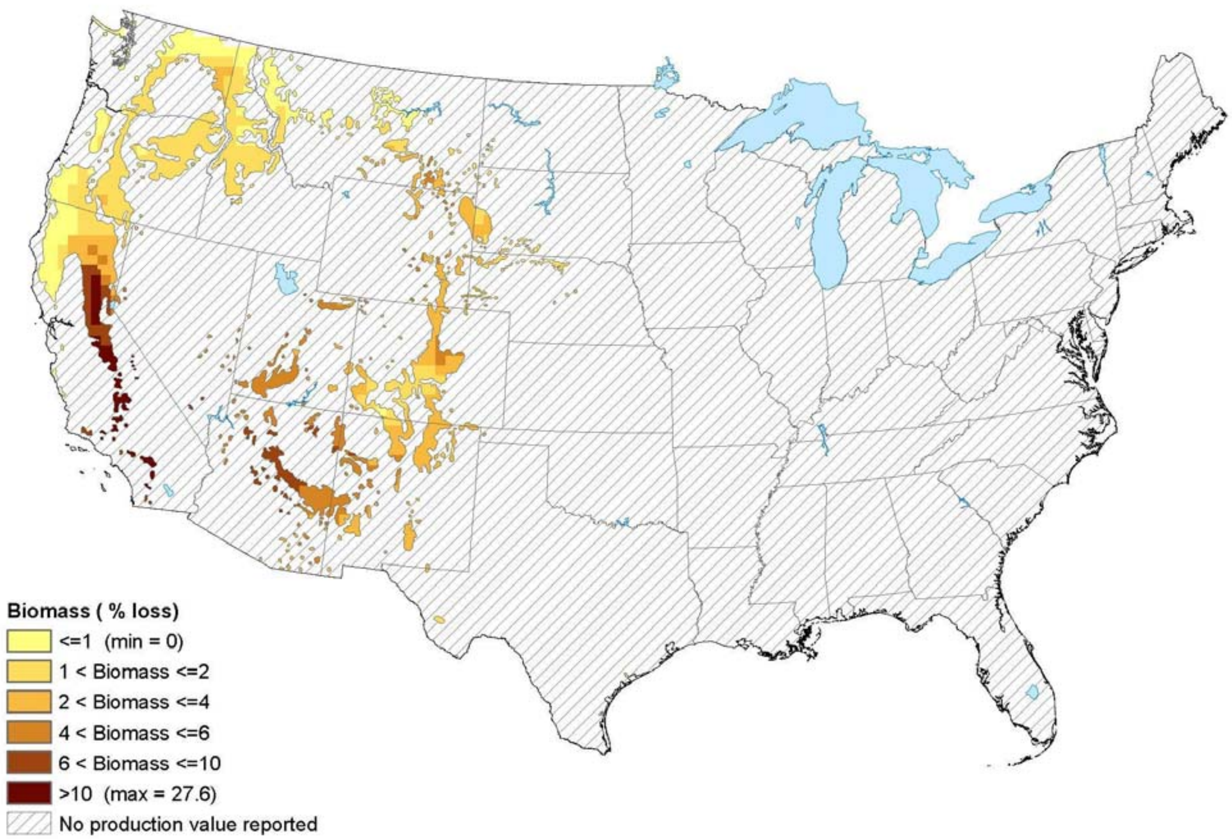
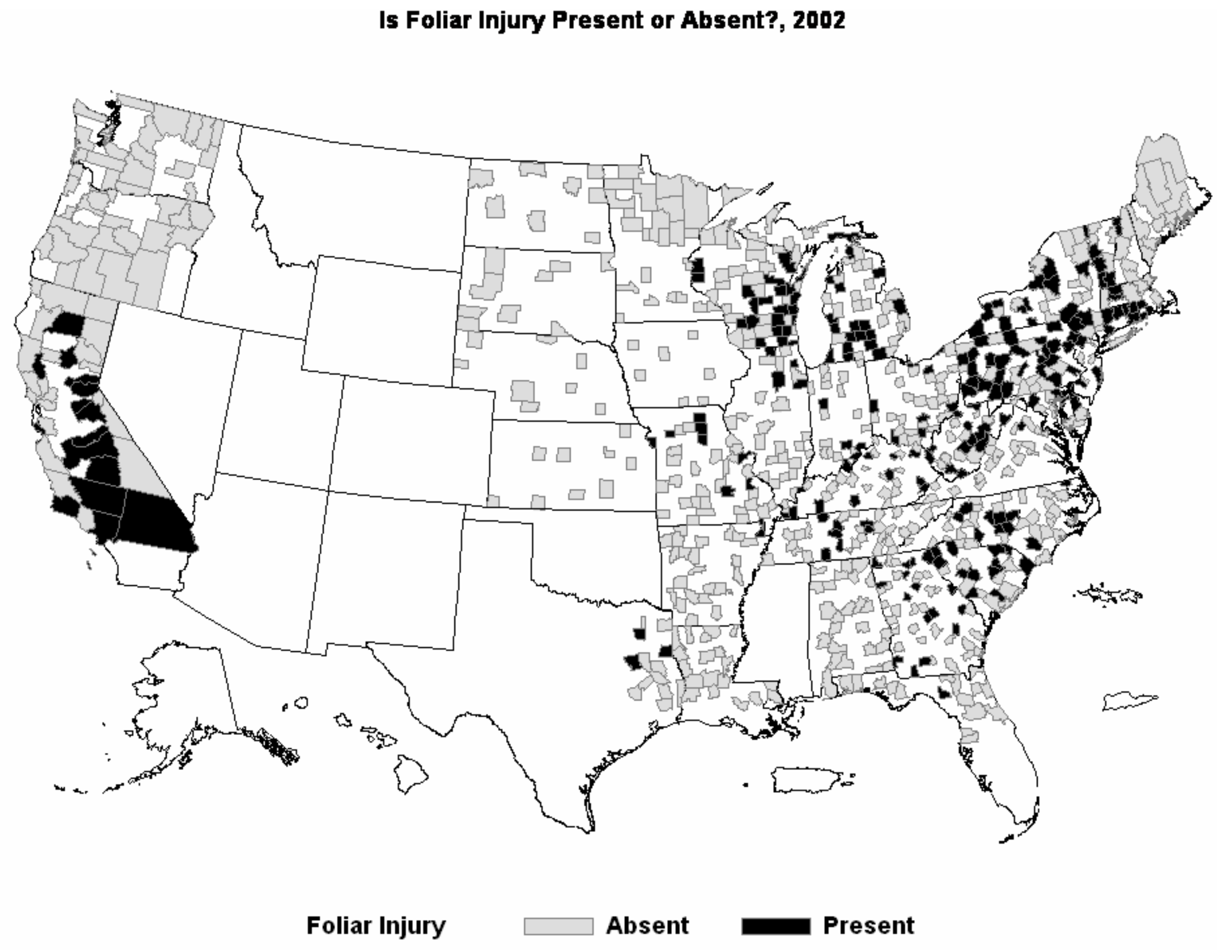


Figure 7H-5 Estimated ponderosa pine annual biomass loss based on interpolated 2001 maximum 3-month 12-hr W126 **without** a 10% downward adjustment of hourly O_3 concentrations. This map indicates the geographic range for ponderosa pine (*Pinus ponderosa)*, but it does not necessarily indicate that ponderosa pine will be found at every point within its range.



APPENDIX 7I. COUNTY-LEVEL INCIDENCE OF FOLIAR INJURY

Figure 7I-1. 2002 County-level incidence of visible foliar injury in the eastern and western U.S. as measured by the US Forest Service FIA program



APPENDIX 7J. OZONE SENSITIVE PLANTS IN CLASS I AREAS AND BY STATE

Table 7J-1

Ozone Sensitive Plant Species in National Parks and Class I Areas

Modified from:

http://www2.nature.nps.gov/air/Pubs/pdf/flag/NPSozonesensppFLAG06.pdf

Alaska

Denali NP

Saskatoon serviceberry *Amelanchier alnifolia*
Quaking aspen *Populus tremuloides*
Thimbleberry *Rubus parviflorus*
Scouler's willow *Salix scouleriana*
Red elderberry *Sambucus racemosa*

Arizona

Chiricahua NM

Dogbane, Indian hemp *Apocynum cannibinum*
Silver wormwood *Artemisia ludoviciana*
Virginia creeper *Parthenocissus quinquefolia*
Arizona pine *Pinus ponderosa*
Black cherry *Prunus serotina*
Choke cherry *Prunus virginiana*
Skunkbush *Rhus trilobata*
Cutleaf coneflower *Rudbeckia laciniata*
Gooding's willow *Salix goodingii*
Scouler's willow *Salix scouleriana*
Goldenrod *Solidago altissima*

Grand Canyon NP

Tree-of-heaven *Ailanthus altissima*
Spreading dogbane *Apocynum androsaemifolium*
Dogbane, Indian hemp *Apocynum cannibinum*
Silver wormwood *Artemisia ludoviciana*
Ponderosa pine *Pinus ponderosa*
Quaking aspen *Populus tremuloides*
Skunkbush *Rhus trilobata*
Gooding's willow *Salix goodingii*
Scouler's willow *Salix scouleriana*
Goldenrod *Solidago altissima*

Petrified Forest NP
Tree-of-heaven *Ailanthus altissima*
Silver wormwood *Artemisia ludoviciana*
Skunkbush *Rhus trilobata*
Gooding's willow *Salix goodingii*

Saguaro NP
Spreading dogbane *Apocynum androsaemifolium*
Dogbane, Indian hemp *Apocynum cannibinum*
Silver wormwood *Artemisia ludoviciana*
Evening primrose *Oenothera elata*
Ponderosa pine *Pinus ponderosa*
Quaking aspen *Populus tremuloides*
Skunkbush *Rhus trilobata*
Cutleaf coneflower *Rudbeckia laciniata*
Gooding's willow *Salix goodingii*
Scouler's willow *Salix scouleriana*
Blue elderberry *Sambucus mexicana*
Goldenrod *Solidago altissima*

California

Joshua Tree NP
Dogbane, Indian hemp *Apocynum cannibinum*
Silver wormwood *Artemisia ludoviciana*
Skunkbush *Rhus trilobata*
Black locust *Robinia pseudoacacia*
Gooding's willow *Salix goodingii*
Blue elderberry *Sambucus mexicana*

Kings Canyon NP
Spreading dogbane *Apocynum androsaemifolium*
Dogbane, Indian hemp *Apocynum cannibinum*
Mugwort *Artemisia douglasiana*
Ninebark *Physocarpus capitatus*
Jeffrey pine *Pinus jeffreyi*
Ponderosa pine *Pinus ponderosa*
Quaking aspen *Populus tremuloides*
California black oak *Quercus kelloggii*
Skunkbush *Rhus trilobata*
Thimbleberry *Rubus parviflorus*
Scouler's willow *Salix scouleriana*
Blue elderberry *Sambucus mexicana*

Lassen Volcanic NP

Spreading dogbane *Apocynum androsaemifolium*
Mugwort *Artemisia douglasiana*
Jeffrey pine *Pinus jeffreyi*
Ponderosa pine *Pinus ponderosa*
Quaking aspen *Populus tremuloides*
California black oak *Quercus kelloggii*
Skunkbush *Rhus trilobata*
Thimbleberry *Rubus parviflorus*
Scouler's willow *Salix scouleriana*
Blue elderberry *Sambucus mexicana*

Lava Beds NM

Jeffrey pine *Pinus jeffreyi*
Ponderosa pine *Pinus ponderosa*
Quaking aspen *Populus tremuloides*
Choke cherry *Prunus virginiana*
Scouler's willow *Salix scouleriana*

Pinnacles NM

Tree-of-heaven *Ailanthus altissima*
Dogbane, Indian hemp *Apocynum cannibinum*
Mugwort *Artemisia douglasiana*
Blue elderberry *Sambucus mexicana*

Point Reyes National Seashore

Red alder *Alnus rubra*
Mugwort *Artemisia douglasiana*
Ninebark *Physocarpus capitatus*
Monterey pine *Pinus radiata*
Virginia pine *Pinus virginiana*
Thimbleberry *Rubus parviflorus*
Blue elderberry *Sambucus mexicana*

Redwood NP

Red alder *Alnus rubra*
Saskatoon serviceberry *Amelanchier alnifolia*
Spreading dogbane *Apocynum androsaemifolium*
Dogbane, Indian hemp *Apocynum cannibinum*
Mugwort *Artemisia douglasiana*
Yellow-poplar *Liriodendron tulipifera*
Evening primrose *Oenothera elata*

Ninebark *Physocarpus capitatus*
Jeffrey pine *Pinus jeffreyi*
Monterey pine *Pinus radiata*
Chokecherry *Prunus virginiana*
California black oak *Quercus kelloggii*
Black locust *Robinia pseudoacacia*
Thimbleberry *Rubus parviflorus*
Scouler's willow *Salix scouleriana*
Blue elderberry *Sambucus mexicana*
Red elderberry *Sambucus racemosa*

<u>Sequoia NP</u>
Spreading dogbane *Apocynum androsaemifoli*um
Dogbane, Indian hemp *Apocynum cannibinum*
Mugwort *Artemisia douglasiana*
Ninebark *Physocarpus capitatus*
Jeffrey pine *Pinus jeffreyi*
Ponderosa pine *Pinus ponderosa*
Quaking aspen *Populus tremuloides*
California black oak *Quercus kelloggii*
Skunkbush *Rhus trilobata*
Thimbleberry *Rubus parviflorus*
Scouler's willow *Salix scouleriana*
Blue elderberry *Sambucus mexicana*

<u>Yosemite NP</u>
Spreading dogbane *Apocynum androsaemifolium*
Dogbane, Indian hemp *Apocynum cannibinum*
Mugwort *Artemisia douglasiana*
Ninebark *Physocarpus capitatus*
Jeffrey pine *Pinus jeffreyi*
Ponderosa pine *Pinus ponderosa*
Quaking aspen *Populus tremuloides*
California black oak *Quercus kelloggii*
Skunkbush *Rhus trilobata*
Thimbleberry *Rubus parviflorus*
Scouler's willow *Salix scouleriana*
Blue elderberry *Sambucus mexicana*

Colorado
<u>Arches NP</u>
Dogbane, Indian hemp *Apocynum cannibinum*

Silver wormwood *Artemisia ludoviciana*
Black locust *Robinia pseudoacacia*

Black Canyon of the Gunnison NP
Serviceberry *Amelanchier alnifolia*
Pinus ponderosa *Pinus ponderosa*
Quaking aspen *Populus tremuloides*

Great Sand Dunes NM
Serviceberry *Amelanchier alnifolia*
Spreading dogbane *Apocynum androsaemifolium*
Dogbane, Indian hemp *Apocynum cannibinum*
Silver wormwood *Artemisia ludoviciana*
Evening primrose *Oenothera elata*
Ponderosa pine *Pinus ponderosa*
Quaking aspen *Populus tremuloides*
Virginia pine *Prunus virginiana*
Skunkbush *Rhus trilobata*
Cutleaf coneflower *Rudbeckia laciniata*
Scouler's willow *Salix scouleriana*
Red elderberry *Sambucus racemosa*

Mesa Verde NP
Spreading dogbane *Apocynum androsaemifolium*
Dogbane, Indian hemp *Apocynum cannibinum*
Silver wormwood *Artemisia ludoviciana*
Ponderosa pine *Pinus ponderosa*
Quaking aspen *Populus tremuloides*
Choke cherry *Prunus virginiana*
Skunkbush *Rhus trilobata*

Rocky Mountain NP
Saskatoon serviceberry *Amelanchier alnifolia*
Spreading dogbane *Apocynum androsaemifolium*
Dogbane, Indian hemp *Apocynum cannibinum*
Silver wormwood *Artemisia ludoviciana*
Quaking aspen *Populus tremuloides*
Cutleaf coneflower *Rudbeckia laciniata*
Scouler's willow *Salix scouleriana*

Florida
Everglades NP

Groundnut *Apios americana*
Swamp milkweed *Asclepias incarnata*
Virginia creeper *Parthenocissus quinquefolia*
American elder *Sambucus canadensis*
Smooth cordgrass *Spartina alterniflora*

Hawaii

Haleakala NP
Jack pine *Pinus banksiana*
Jeffrey pine *Pinus jeffreyi*
Ponderosa pine *Pinus ponderosa*
Monterey pine *Pinus radiata*

Hawaii Volcanoes NP
White ash *Fraxinus americana*
Sweetgum *Liquidambar styraciflua*
Monterey pine *Pinus radiata*
Loblolly pine *Pinus taeda*
Blue elderberry *Sambucus mexicana*

Idaho

Craters of the Moon NM
Saskatoon serviceberry *Amelanchier alnifolia*
Spreading dogbane *Apocynum androsaemifolium*
Silver wormwood *Artemisia ludoviciana*
Quaking aspen *Populus tremuloides*
Choke cherry *Prunus virginiana*
Thimbleberry *Rubus parviflorus*
Scouler's willow *Salix scouleriana*

Kentucky

Mammoth Cave NP
Tree-of-heaven *Ailanthus altissima*
Groundnut *Apios americana*
Dogbane, Indian hemp *Apocynum cannibinum*
Silver wormwood *Artemisia ludoviciana*
Poke milkweed *Asclepias exaltata*
Swamp milkweed *Asclepias incarnata*
Common milkweed *Asclepias syriaca*
Big-leaf aster *Aster macrophyllus*

Redbud *Cercis canadensis*
Virgin's bower *Clematis virginiana*
American hazelnut *Corylus americana*
White snakeroot *Eupatorium rugosum*
White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*
Black huckleberry *Gaylussacia baccata*
Sweetgum *Liquidambar styraciflua*
Yellow-poplar *Liriodendron tulipifera*
Virginia creeper *Parthenocissus quinquefolia*
Loblolly pine *Pinus taeda*
Virginia pine *Pinus virginiana*
American sycamore *Platanus occidentalis*
Black cherry *Prunus serotina*
Winged sumac *Rhus copallina*
Black locust *Robinia pseudoacacia*
Cutleaf coneflower *Rudbeckia laciniata*
American elder *Sambucus canadensis*
Sassafras Sassafras *Sassafras albidum*
Goldenrod *Solidago altissima*
Crownbeard *Verbesina occidentalis*

Maine

<u>Acadia NP</u>
Groundnut *Apios americana*
Spreading dogbane *Apocynum androsaemifolium*
Dogbane, Indian hemp *Apocynum cannibinum*
Common milkweed *Asclepias syriaca*
Big-leaf aster *Aster macrophyllus*
Virgin's bower *Clematis virginiana*
White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*
Black huckleberry *Gaylussacia baccata*
Virginia creeper *Parthenocissus quinquefolia*
Jack pine *Pinus banksiana*
Pitch pine *Pinus rigida*
Quaking aspen *Populus tremuloides*
Black cherry *Prunus serotina*
Choke cherry *Prunus virginiana*
Allegheny blackberry *Rubus allegheniensis*
Thornless blackberry *Rubus canadensis*
American elder *Sambucus canadensis*

Smooth cordgrass *Spartina alterniflora*
Common snowberry *Symphoricarpos albus*

Michigan

Isle Royale NP
Speckled alder *Alnus rugosa*
Spreading dogbane *Apocynum androsaemifolium*
Common milkweed *Asclepias syriaca*
Big-leaf aster *Aster macrophyllus*
Virgin's bower *Clematis virginiana*
White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*
Black huckleberry *Gaylussacia baccata*
Virginia creeper *Parthenocissus quinquefolia*
Jack pine *Pinus banksiana*
Quaking aspen *Populus tremuloides*
Black cherry *Prunus serotina*
Chokecherry *Prunus virginiana*
Black locust *Robinia pseudoacacia*
Thornless blackberry *Rubus canadensis*
Thimbleberry *Rubus parviflorus*
Red elderberry *Sambucus racemosa*
Goldenrod *Solidago altissima*
Common snowberry *Symphoricarpos albus*
Huckleberry *Vaccinium membranaceum*

Minnesota

Voyageurs NP
Saskatoon serviceberry *Amelanchier alnifolia*
Groundnut *Apios americana*
Spreading dogbane *Apocynum androsaemifolium*
Dogbane, Indian hemp *Apocynum cannibinum*
Silver wormwood *Artemisia ludoviciana*
Swamp milkweed *Asclepias incarnata*
Common milkweed *Asclepias syriaca*
Virgin's bower *Clematis virginiana*
American hazelnut *Corylus americana*
Green ash *Fraxinus pennsylvanica*
Black huckleberry *Gaylussacia baccata*
Virginia creeper *Parthenocissus quinquefolia*
Jack pine *Pinus banksiana*

Quaking aspen *Populus tremuloides*
Black cherry *Prunus serotina*
Chokecherry *Prunus virginiana*
Black locust *Robinia pseudoacacia*
Allegheny blackberry *Rubus allegheniensis*
Thornless blackberry *Rubus canadensis*
Thimbleberry *Rubus parviflorus*
Cutleaf coneflower *Rudbeckia laciniata*
American elder *Sambucus canadensis*
Snowberry *Symphoricarpos albus*

Montana
<u>Glacier NP</u>
Saskatoon serviceberry *Amelanchier alnifolia*
Spreading dogbane *Apocynum androsaemifolium*
Dogbane, Indian hemp *Apocynum cannibinum*
Pacific ninebark *Physocarpus malvaceum*
Ponderosa pine *Pinus ponderosa*
Quaking aspen *Populus tremuloides*
Thimbleberry *Rubus parviflorus*
Scouler's willow *Salix scouleriana*
Red elderberry *Sambucus racemosa*
Snowberry *Symphoricarpos albus*
Huckleberry *Vaccinium membranaceum*

New Mexico
<u>Bandelier NM</u>
Tree-of-heaven *Ailanthus altissima*
Spreading dogbane *Apocynum androsaemifolium*
Dogbane, Indian hemp *Apocynum cannibinum*
Virginia creeper *Parthenocissus quinquefolia*
Quaking aspen *Populus tremuloides*
Skunkbush *Rhus trilobata*
Thimbleberry *Rubus parviflorus*
Cutleaf coneflower *Rudbeckia laciniata*
Goldenrod *Solidago altissima*

<u>Carlsbad Caverns NP</u>
Silver wormwood *Artemisia ludoviciana*
Ponderosa pine *Pinus ponderosa*
Skunkbush *Rhus trilobata*

North Carolina/Tennessee

Great Smoky Mountains NP

Tree-of-heaven *Ailanthus altissima*

Groundnut *Apios americana*

Spreading dogbane *Apocynum androsaemifolium*

Dogbane, Indian hemp *Apocynum cannibinum*

Silver wormwood *Artemisia ludoviciana*

Tall milkweed *Asclepias exaltata*

Swamp milkweed *Asclepias incarnata*

Common milkweed *Asclepias syriaca*

Whorled aster *Aster acuminatus*

Big-leaf aster *Aster macrophyllus*

Redbud *Cercis canadensis*

Virgin's bower *Clematis virginiana*

American hazelnut *Corylus americana*

White ash *Fraxinus americana*

Green ash *Fraxinus pennsylvanica*

Black huckleberry *Gaylussacia baccata*

Mountain dandelion *Krigia montana*

Sweetgum *Liquidambar styraciflua*

Yellow-poplar *Liriodendron tulipifera*

Maleberry *Lyonia ligustrina*

Virginia creeper *Parthenocissus quinquefolia*

Table-mountain pine *Pinus pungens*

Pitch pine *Pinus rigida*

Loblolly pine *Pinus taeda*

Virginia pine *Pinus virginiana*

American sycamore *Platanus occidentalis*

Black cherry *Prunus serotina*

Choke cherry *Prunus virginiana*

Black locust *Robinia pseudoacacia*

Allegheny blackberry *Rubus allegheniensis*

Thornless blackberry *Rubus canadensis*

Cutleaf coneflower *Rudbeckia laciniata*

American elder *Sambucus canadensis*

Sassafras *Sassafras albidum*

Goldenrod *Solidago altissima*

Crown-beard *Verbesina occidentalis*

Northern fox grape *Vitis labrusca*

North Dakota

Theodore Roosevelt NP

Saskatoon serviceberry *Amelanchier alnifolia*

Spreading dogbane *Apocynum androsaemifolium*

Dogbane, Indian hemp *Apocynum cannibinum*

Silver wormwood *Artemisia ludoviciana*

Green ash *Fraxinus pennsylvanica*

Ponderosa pine *Pinus ponderosa*

Quaking aspen *Populus tremuloides*

Chokecherry *Prunus virginiana*

Skunkbush *Rhus trilobata*

Common snowberry *Symphoricarpos albus*

Oregon

Crater Lake NP

Saskatoon serviceberry *Amelanchier alnifolia*

Spreading dogbane *Apocynum androsaemifolium*

Ponderosa pine *Pinus ponderosa*

Quaking aspen *Populus tremuloides*

Thimbleberry *Rubus parviflorus*

Scouler's willow *Salix scouleriana*

Red elderberry *Sambucus racemosa*

Common snowberry *Symphoricarpos albus*

Huckleberry *Vaccinium membranaceum*

South Dakota

Badlands NP

Dogbane, Indian hemp *Apocynum cannibinum*

Silver wormwood *Artemisia ludoviciana*

Green ash *Fraxinus pennsylvanica*

Ponderosa pine *Pinus ponderosa*

Chokecherry *Prunus virginiana*

Skunkbush *Rhus trilobata*

Snowberry *Symphoricarpos albus*

Wind Cave NP

Saskatoon serviceberry *Amelanchier alnifolia*

Spreading dogbane *Apocynum androsaemifolium*

Dogbane, Indian hemp *Apocynum cannibinum*

Silver wormwood *Artemisia ludoviciana*

Swamp milkweed *Asclepias incarnata*

Common milkweed *Asclepias syriaca*
Green ash *Fraxinus pennsylvanica*
Virginia creeper *Parthenocissus quinquefolia*
Ponderosa pine *Pinus ponderosa*
Quaking aspen *Populus tremuloides*
Chokecherry *Prunus virginiana*
Skunkbush *Rhus trilobata*
Red elderberry *Sambucus racemosa*
Common snowberry *Symphoricarpos albus*

Texas

Big Bend NP

Silver wormwood *Artemisia ludoviciana*
Swamp milkweed *Asclepias incarnata*
Ponderosa pine *Pinus ponderosa*
Skunkbush *Rhus trilobata*

Guadalupe Mountains NP

Silver wormwood *Artemisia ludoviciana*
Ponderosa pine *Pinus ponderosa*
Quaking aspen *Populus tremuloides*
Chokecherry *Prunus virginiana*

Utah

Arches NP

Cottonwood *Populus fremontii*
Single-leaf ash *Fraxinus anomala*
Skunkbush *Rhus trilobata*
White stem blazingstar *Mentzelia albicaulis*

Bryce Canyon NP

Spreading dogbane *Apocynum androsaemifolium*
Silver wormwood *Artemisia ludoviciana*
Ponderosa pine *Pinus ponderosa*
Quaking aspen *Populus tremuloides*
Choke cherry *Prunus virginiana*
Skunkbush *Rhus trilobata*

Canyonlands NP

Serviceberry *Amelanchier alnifolia*
Dogbane, Indian hemp *Apocynum cannibinum*

Silver wormwood *Artemisia ludoviciana*
Ponderosa pine *Pinus ponderosa*
Quaking aspen *Populus tremuloides*
Choke cherry *Prunus virginiana*
Gooding's willow *Salix goodingii*

<u>Capitol Reef NP</u>
Tree-of-heaven *Ailanthus altissima*
Saskatoon serviceberry *Amelanchier alnifolia*
Dogbane, Indian hemp *Apocynum cannibinum*
Silver wormwood *Artemisia ludoviciana*
White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*
Ponderosa pine *Pinus ponderosa*
Quaking aspen *Populus tremuloides*
Black locust *Robinia pseudoacacia*
Gooding's willow *Salix goodingii*
Northern fox grape *Vitis labrusca*

<u>Zion NP</u>
Tree-of-heaven *Ailanthus altissima*
Saskatoon serviceberry *Amelanchier alnifolia*
Dogbane, Indian hemp *Apocynum cannibinum*
Ponderosa pine *Pinus ponderosa*
American sycamore *Platanus occidentalis*
Quaking aspen *Populus tremuloides*
Black locust *Robinia pseudoacacia*
Gooding's willow *Salix goodingii*
Scouler's willow *Salix scouleriana*
Red elderberry *Sambucus racemosa*

Virginia
<u>Shenandoah NP</u>
Tree-of-heaven *Ailanthus altissima*
Speckled alder *Alnus rugosa*
Groundnut *Apios americana*
Spreading dogbane *Apocynum androsaemifolium*
Dogbane, Indian hemp *Apocynum cannibinum*
Tall milkweed *Asclepias exaltata*
Swamp milkweed *Asclepias incarnata*
Common milkweed *Asclepias syriaca*
Whorled aster *Aster acuminatus*

Big-leaf aster *Aster macrophyllus*
Redbud *Cercis canadensis*
Virgin's bower *Clematis virginiana*
American hazelnut *Corylus americana*
White snakeroot *Eupatorium rugosum*
White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*
Black huckleberry *Gaylussacia baccata*
Sweetgum *Liquidambar styraciflua*
Yellow-poplar *Liriodendron tulipifera*
Maleberry *Lyonia ligustrina*
Virginia creeper *Parthenocissus quinquefolia*
Sweet mock orange *Philadelphus coronarius*
Table-mountain pine *Pinus pungens*
Pitch pine *Pinus rigida*
Loblolly pine *Pinus taeda*
Virginia pine *Pinus virginiana*
American sycamore *Platanus occidentalis*
Quaking aspen *Populus tremuloides*
Black cherry *Prunus serotina*
Choke cherry *Prunus virginiana*
Winged sumac *Rhus copallina*
Black locust *Robinia pseudoacacia*
Allegheny blackberry *Rubus allegheniensis*
Sand blackberry *Rubus cuneifolius*
Cutleaf coneflower *Rudbeckia laciniata*
American elder *Sambucus canadensis*
Red elderberry *Sambucus racemosa*
Sassafras *Sassafras albidum*
Goldenrod *Solidago altissima*
Common snowberry *Symphoricarpos albus*
Crownbeard *Verbesina occidentalis*
Northern fox grape *Vitis labrusca*

Washington

<u>Mount Rainier NP</u>
Red alder *Alnus rubra*
Serviceberry *Amelanchier alnifolia*
Spreading dogbane *Apocynum androsaemifolium*
Dogbane, Indian hemp *Apocynum cannibinum*
Mugwort *Artemisia douglasiana*
Silver wormwood *Artemisia ludoviciana*

Virginia creeper *Parthenocissus quinquefolia*
Ninebark *Physocarpus capitatus*
Ponderosa pine *Pinus ponderosa*
Quaking aspen *Populus tremuloides*
Thimbleberry *Rubus parviflorus*
Cutleaf coneflower *Rudbeckia laciniata*
Scouler's willow *Salix scouleriana*
Snowberry *Symphoricarpos albus*
Huckleberry *Vaccinium membranaceum*

<u>North Cascades NP</u>
Ponderosa pine *Pinus ponderosa*
Black poplar *Populus balsamifera trichocarpa*
Paper birch *Betula papyrifera*
Box elder *Acer negundo*
Twinberry *Lonicera involucrata*
Serviceberry *Amelanchier alnifolia*
Snowberry *Symphoricarpos albus*

<u>Olympic NP</u>
Red alder *Alnus rubra*
Ninebark *Physocarpus capitatus*
Quaking aspen *Populus tremuloides*
Black locust *Robinia pseudoacacia*
Scouler's willow *Salix scouleriana*
Huckleberry *Vaccinium membranaceum*

Wyoming
<u>Grand Teton NP</u>
Spreading dogbane *Apocynum androsaemifolium*
Pacific ninebark *Physocarpus malvaceum*
Quaking aspen *Populus tremuloides*
Scouler's willow *Salix scouleriana*

<u>Yellowstone NP</u>
Spreading dogbane *Apocynum androsaemifolium*
Dogbane, Indian hemp *Apocynum cannibinum*
Green ash *Fraxinus pennsylvanica*
Pacific ninebark *Physocarpus malvaceum*
Quaking aspen *Populus tremuloides*
Skunkbush *Rhus trilobata*
Thimbleberry *Rubus parviflorus*

Scouler’s willow *Salix scouleriana*
Huckleberry *Vaccinium membranaceum*

Table 7J-2. Ozone sensitive plants by state

This table lists the O_3 sensitive plant species and important crops that occur in each of the 50 states. Ozone sensitive plant species were identified by the National Park Service in the 2003 report entitled "Ozone Sensitive Plant Species on National Park Service and U.S. Fish and Wildlife Service Lands"[1]. Important sensitive crops were identified in the National Crop Loss Assessment[2]. Current distrubution information of the O_3 sensitive plant species is from the USDA PLANTS database[3].

[1]National Park Service Ozone Sensitive (2003) Ozone Sensitive Plant Species on National Park Service and U.S. Fish and Wildlife Service Lands: Results of a June 24-25, 2003 Workshop Baltimore, Maryland. Natural Resource Report NPS/NRARD/NRR-2003/01. http://www2.nature.nps.gov/air/Pubs/pdf/BaltFinalReport1.pdf

[2] Heck, W. W.; Taylor, O. C.; Tingey, D. T., eds. (1988) Assessment of crop loss from air pollutants: proceedings of an international conference; October 1987; Raleigh, NC. New York, NY: Elsevier Applied Science.

[3]USDA, NRCS (2006) The PLANTS Database (http://plants.usda.gov, December 2006). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

Alaska

Saskatoon serviceberry *Amelanchier alnifolia*
Quaking aspen *Populus tremuloides*
Thimbleberry *Rubus parviflorus*
Scouler's willow *Salix scouleriana*
Red elderberry *Sambucus racemosa*
Choke cherry *Prunus virginiana*
Spreading dogbane *Apocynum androsaemifolium*

Alabama

Virginia creeper *Parthenocissus quinquefolia*
Black cherry *Prunus serotina*
Cutleaf coneflower *Rudbeckia laciniata*
Spreading dogbane *Apocynum androsaemifolium*
Sweetgum *Liquidambar styraciflua*

Yellow-poplar *Liriodendron tulipifera*
Loblolly pine *Pinus taeda*
Tall milkweed *Asclepias exaltata*
Goldenrod *Solidago altissima*
Black locust *Robinia pseudoacacia*
Allegheny blackberry *Rubus allegheniensis*
Redbud *Cercis Canadensis*
White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*
American elder *Sambucus canadensis*
Virginia pine *Pinus virginiana*

Sensitive Crops
Winter Wheat
Peanuts
Soybeans
Cotton
Potatoes

Arkansas
Virginia creeper *Parthenocissus quinquefolia*
Black cherry *Prunus serotina*
Cutleaf coneflower *Rudbeckia laciniata*
Spreading dogbane *Apocynum androsaemifolium*
Sweetgum *Liquidambar styraciflua*
Yellow-poplar *Liriodendron tulipifera*
Loblolly pine *Pinus taeda*
Goldenrod *Solidago altissima*
Common milkweed *Asclepias syriaca*
Black locust *Robinia pseudoacacia*
Choke cherry *Prunus virginiana*
Allegheny blackberry *Rubus allegheniensis*
Redbud *Cercis Canadensis*
White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*
American elder *Sambucus canadensis*

Sensitive Crops
Winter Wheat
Soybeans
Cotton

Arizona

Dogbane, Indian hemp *Apocynum cannibinum*
Silver wormwood *Artemisia ludoviciana*
Virginia creeper *Parthenocissus quinquefolia*
Black cherry *Prunus serotina*
Choke cherry *Prunus virginiana*
Cutleaf coneflower *Rudbeckia laciniata*
Gooding's willow *Salix goodingii*
Tree-of-heaven *Ailanthus altissima*
Spreading dogbane *Apocynum androsaemifolium*
Ponderosa pine *Pinus ponderosa*
Quaking aspen *Populus tremuloides*
Skunkbush *Rhus trilobata*
Scouler's willow *Salix scouleriana*
Goldenrod *Solidago altissima*
Evening primrose *Oenothera elata*
Blue elderberry *Sambucus mexicana*
Thimbleberry *Rubus parviflorus*
Red elderberry *Sambucus racemosa*
Black locust *Robinia pseudoacacia*
American elder *Sambucus canadensis*

<u>Sensitive Crops</u>
Winter Wheat
Cotton
Potatoes

California

Dogbane, Indian hemp *Apocynum cannibinum*
Silver wormwood *Artemisia ludoviciana*
Skunkbush *Rhus trilobata*
Black locust *Robinia pseudoacacia*
Gooding's willow *Salix goodingii*
Blue elderberry *Sambucus mexicana*
Spreading dogbane *Apocynum androsaemifolium*
Mugwort *Artemisia douglasiana*
Ninebark *Physocarpus capitatus*
Jeffrey pine *Pinus jeffreyi*
Ponderosa pine *Pinus ponderosa*
Quaking aspen *Populus tremuloides*
California black oak *Quercus kelloggii*
Thimbleberry *Rubus parviflorus*

Scouler's willow *Salix scouleriana*
Choke cherry *Prunus virginiana*
Tree-of-heaven *Ailanthus altissima*
Red alder *Alnus rubra*
Monterey pine *Pinus radiata*
Virginia pine *Pinus virginiana*
Saskatoon serviceberry *Amelanchier alnifolia*
Yellow-poplar *Liriodendron tulipifera*
Evening primrose *Oenothera elata*
Ninebark *Physocarpus capitatus*
Red elderberry *Sambucus racemosa*
Skunkbush *Rhus trilobata*
Sweetgum *Liquidambar styraciflua*
Goldenrod *Solidago altissima*
Allegheny blackberry *Rubus allegheniensis*

<u>Sensitive Crops</u>
Winter Wheat
Cotton
Potatoes

Colorado
Dogbane, Indian hemp *Apocynum cannibinum*
Silver wormwood *Artemisia ludoviciana*
Black locust *Robinia pseudoacacia*
Serviceberry *Amelanchier alnifolia*
Pinus ponderosa *Pinus ponderosa*
Quaking aspen *Populus tremuloides*
Spreading dogbane *Apocynum androsaemifolium*
Evening primrose *Oenothera elata*
Virginia pine *Prunus virginiana*
Skunkbush *Rhus trilobata*
Cutleaf coneflower *Rudbeckia laciniata*
Scouler's willow *Salix scouleriana*
Red elderberry *Sambucus racemosa*
Choke cherry *Prunus virginiana*
Saskatoon serviceberry *Amelanchier alnifolia*
Thimbleberry *Rubus parviflorus*
Virginia creeper Parthenocissus quinquefolia
Goldenrod *Solidago altissima*
White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*

American elder *Sambucus canadensis*

Sensitive Crops
Winter Wheat
Potatoes

Connecticut
Virginia creeper *Parthenocissus quinquefolia*
Quaking aspen *Populus tremuloides*
Red elderberry *Sambucus racemosa*
Black cherry *Prunus serotina*
Cutleaf coneflower *Rudbeckia laciniata*
Spreading dogbane *Apocynum androsaemifolium*
Sweetgum *Liquidambar styraciflua*
Yellow-poplar *Liriodendron tulipifera*
Tall milkweed *Asclepias exaltata*
Goldenrod *Solidago altissima*
Common milkweed *Asclepias syriaca*
Thornless blackberry *Rubus canadensis*
Black locust *Robinia pseudoacacia*
Choke cherry *Prunus virginiana*
Allegheny blackberry *Rubus allegheniensis*
Speckled alder *Alnus rugosa*
Whorled aster *Aster acuminatus*
Big-leaf aster *Aster macrophyllus*
Redbud *Cercis Canadensis*
White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*
American elder *Sambucus canadensis*

Sensitive Crops
Tobacco

Delaware
Virginia creeper *Parthenocissus quinquefolia*
Black cherry *Prunus serotina*
Cutleaf coneflower *Rudbeckia laciniata*
Spreading dogbane *Apocynum androsaemifolium*
Sweetgum *Liquidambar styraciflua*
Yellow-poplar *Liriodendron tulipifera*
Loblolly pine *Pinus taeda*

Tall milkweed *Asclepias exaltata*
Goldenrod *Solidago altissima*
Common milkweed *Asclepias syriaca*
Black locust *Robinia pseudoacacia*
Choke cherry *Prunus virginiana*
Allegheny blackberry *Rubus allegheniensis*
Redbud *Cercis Canadensis*
White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*
American elder *Sambucus canadensis*
Virginia pine *Pinus virginiana*

<u>Sensitive Crops</u>
Winter Wheat
Soybeans
Potatoes

Florida
Groundnut *Apios americana*
Swamp milkweed *Asclepias incarnata*
Virginia creeper *Parthenocissus quinquefolia*
American elder *Sambucus canadensis*
Smooth cordgrass *Spartina alterniflora*
Black cherry *Prunus serotina*
Cutleaf coneflower *Rudbeckia laciniata*
Sweetgum *Liquidambar styraciflua*
Yellow-poplar *Liriodendron tulipifera*
Loblolly pine *Pinus taeda*
Goldenrod *Solidago altissima*
Black locust *Robinia pseudoacacia*
Redbud *Cercis Canadensis*
White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*

<u>Sensitive Crops</u>
Winter Wheat
Peanuts
Soybeans
Cotton
Tobacco
Potatoes

Georigia

Virginia creeper *Parthenocissus quinquefolia*
Red elderberry *Sambucus racemosa*
Black cherry *Prunus serotina*
Cutleaf coneflower *Rudbeckia laciniata*
Spreading dogbane *Apocynum androsaemifolium*
Sweetgum *Liquidambar styraciflua*
Yellow-poplar *Liriodendron tulipifera*
Loblolly pine *Pinus taeda*
Tall milkweed *Asclepias exaltata*
Goldenrod *Solidago altissima*
Thornless blackberry *Rubus canadensis*
Black locust *Robinia pseudoacacia*
Choke cherry *Prunus virginiana*
Allegheny blackberry *Rubus allegheniensis*
Whorled aster *Aster acuminatus*
Big-leaf aster *Aster macrophyllus*
Redbud *Cercis Canadensis*
White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*
American elder *Sambucus canadensis*
Virginia pine *Pinus virginiana*

<u>Sensitive Crops</u>
Winter Wheat
Peanuts
Soybeans
Cotton
Tobacco

Hawaii

Jack pine *Pinus banksiana*
Jeffrey pine *Pinus jeffreyi*
Ponderosa pine *Pinus ponderosa*
Monterey pine *Pinus radiata*
White ash *Fraxinus americana*
Sweetgum *Liquidambar styraciflua*
Loblolly pine *Pinus taeda*
Blue elderberry *Sambucus mexicana*
White ash *Fraxinus americana*

Iowa

Virginia creeper *Parthenocissus quinquefolia*
Quaking aspen *Populus tremuloides*
Red elderberry *Sambucus racemosa*
Black cherry *Prunus serotina*
Cutleaf coneflower *Rudbeckia laciniata*
Spreading dogbane *Apocynum androsaemifolium*
Goldenrod *Solidago altissima*
Common milkweed *Asclepias syriaca*
Black locust *Robinia pseudoacacia*
Choke cherry *Prunus virginiana*
Allegheny blackberry *Rubus allegheniensis*
Speckled alder *Alnus rugosa*
Big-leaf aster *Aster macrophyllus*
Redbud *Cercis Canadensis*
White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*
American elder *Sambucus canadensis*

Sensitive Crops
Winter Wheat
Soybeans

Idaho

Saskatoon serviceberry *Amelanchier alnifolia*
Spreading dogbane *Apocynum androsaemifolium*
Silver wormwood *Artemisia ludoviciana*
Choke cherry *Prunus virginiana*
Thimbleberry *Rubus parviflorus*
Scouler's willow *Salix scouleriana*
Quaking aspen *Populus tremuloides*
Red elderberry *Sambucus racemosa*
Ponderosa pine *Pinus ponderosa*
Cutleaf coneflower *Rudbeckia laciniata*
Black locust *Robinia pseudoacacia*
Evening primrose *Oenothera elata*

Sensitive Crops
Winter Wheat
Potatoes

Illinois

Virginia creeper *Parthenocissus quinquefolia*
Quaking aspen *Populus tremuloides*
Red elderberry *Sambucus racemosa*
Black cherry *Prunus serotina*
Cutleaf coneflower *Rudbeckia laciniata*
Spreading dogbane *Apocynum androsaemifolium*
Sweetgum *Liquidambar styraciflua*
Yellow-poplar *Liriodendron tulipifera*
Loblolly pine *Pinus taeda*
Tall milkweed *Asclepias exaltata*
Goldenrod *Solidago altissima*
Common milkweed *Asclepias syriaca*
Black locust *Robinia pseudoacacia*
Choke cherry *Prunus virginiana*
Allegheny blackberry *Rubus allegheniensis*
Speckled alder *Alnus rugosa*
Big-leaf aster *Aster macrophyllus*
Redbud *Cercis Canadensis*
White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*
American elder *Sambucus canadensis*
Virginia pine *Pinus virginiana*

<u>Sensitive Crops</u>
Winter Wheat
Soybeans
Potatoes

Indiana

Virginia creeper *Parthenocissus quinquefolia*
Quaking aspen *Populus tremuloides*
Red elderberry *Sambucus racemosa*
Black cherry *Prunus serotina*
Cutleaf coneflower *Rudbeckia laciniata*
Spreading dogbane *Apocynum androsaemifolium*
Sweetgum *Liquidambar styraciflua*
Yellow-poplar *Liriodendron tulipifera*
Tall milkweed *Asclepias exaltata*
Goldenrod *Solidago altissima*
Common milkweed *Asclepias syriaca*

Black locust *Robinia pseudoacacia*
Choke cherry *Prunus virginiana*
Allegheny blackberry *Rubus allegheniensis*
Speckled alder *Alnus rugosa*
Big-leaf aster *Aster macrophyllus*
Redbud *Cercis Canadensis*
White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*
American elder *Sambucus canadensis*
Virginia pine *Pinus virginiana*

<u>Sensitive Crops</u>
Winter Wheat
Soybeans

Kansas
Virginia creeper *Parthenocissus quinquefolia*
Black cherry *Prunus serotina*
Cutleaf coneflower *Rudbeckia laciniata*
Spreading dogbane *Apocynum androsaemifolium*
Goldenrod *Solidago altissima*
Common milkweed *Asclepias syriaca*
Black locust *Robinia pseudoacacia*
Choke cherry *Prunus virginiana*
Allegheny blackberry *Rubus allegheniensis*
Redbud *Cercis Canadensis*
White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*
American elder *Sambucus canadensis*

<u>Sensitive Crops</u>
Winter Wheat
Soybeans
Cotton
Potatoes

Kentucky
Tree-of-heaven *Ailanthus altissima*
Groundnut *Apios americana*
Dogbane, Indian hemp *Apocynum cannibinum*
Silver wormwood *Artemisia ludoviciana*

Poke milkweed *Asclepias exaltata*
Swamp milkweed *Asclepias incarnata*
Common milkweed *Asclepias syriaca*
Big-leaf aster *Aster macrophyllus*
Redbud *Cercis canadensis*
Virgin's bower *Clematis virginiana*
American hazelnut *Corylus americana*
White snakeroot *Eupatorium rug*osum
White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*
Black huckleberry *Gaylussacia baccata*
Sweetgum *Liquidambar styraciflua*
Yellow-poplar *Liriodendron tulipifera*
Virginia creeper *Parthenocissus quinquefolia*
Loblolly pine *Pinus taeda*
Virginia pine *Pinus virginiana*
American sycamore *Platanus occidentalis*
Black cherry *Prunus serotina*
Winged sumac *Rhus copallina*
Black locust *Robinia pseudoacacia*
Cutleaf coneflower *Rudbeckia laciniata*
American elder *Sambucus canadensis*
Sassafras Sassafras Sassafras albidum
Goldenrod *Solidago altissima*
Crownbeard *Verbesina occidentalis*
Allegheny blackberry *Rubus allegheniensis*
Red elderberry *Sambucus racemosa*
Spreading dogbane *Apocynum androsaemifolium*
Tall milkweed *Asclepias exaltata*
Thornless blackberry *Rubus canadensis*
Choke cherry *Prunus virginiana*
Whorled aster *Aster acuminatus*

Sensitive Crops
Winter Wheat
Soybeans
Tobacco

Louisiana
Virginia creeper *Parthenocissus quinquefolia*
Black cherry *Prunus serotina*
Cutleaf coneflower *Rudbeckia laciniata*

Sweetgum *Liquidambar styraciflua*
Yellow-poplar *Liriodendron tulipifera*
Loblolly pine *Pinus taeda*
Goldenrod *Solidago altissima*
Common milkweed *Asclepias syriaca*
Black locust *Robinia pseudoacacia*
Redbud *Cercis Canadensis*
White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*
American elder *Sambucus canadensis*

<u>Sensitive Crops</u>
Winter Wheat
Soybeans
Cotton

Maryland
Virginia creeper *Parthenocissus quinquefolia*
Quaking aspen *Populus tremuloides*
Red elderberry *Sambucus racemosa*
Black cherry *Prunus serotina*
Cutleaf coneflower *Rudbeckia laciniata*
Spreading dogbane *Apocynum androsaemifolium*
Sweetgum *Liquidambar styraciflua*
Yellow-poplar *Liriodendron tulipifera*
Tall milkweed *Asclepias exaltata*
Goldenrod *Solidago altissima*
Common milkweed *Asclepias syriaca*
Thornless blackberry *Rubus canadensis*
Black locust *Robinia pseudoacacia*
Choke cherry *Prunus virginiana*
Allegheny blackberry *Rubus allegheniensis*
Loblolly pine *Pinus taeda*
Speckled alder *Alnus rugosa*
Whorled aster *Aster acuminatus*
Big-leaf aster *Aster macrophyllus*
Redbud *Cercis Canadensis*
White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*
American elder *Sambucus canadensis*
Virginia pine *Pinus virginiana*

Sensitive Crops

Winter Wheat

Soybeans

Potatoes

Massachussets

Virginia creeper *Parthenocissus quinquefolia*

Quaking aspen *Populus tremuloides*

Red elderberry *Sambucus racemosa*

Black cherry *Prunus serotina*

Cutleaf coneflower *Rudbeckia laciniata*

Spreading dogbane *Apocynum androsaemifolium*

Yellow-poplar *Liriodendron tulipifera*

Tall milkweed *Asclepias exaltata*

Goldenrod *Solidago altissima*

Common milkweed *Asclepias syriaca*

Thornless blackberry *Rubus canadensis*

Black locust *Robinia pseudoacacia*

Choke cherry *Prunus virginiana*

Allegheny blackberry *Rubus allegheniensis*

Speckled alder *Alnus rugosa*

Whorled aster *Aster acuminatus*

Big-leaf aster *Aster macrophyllus*

Redbud *Cercis Canadensis*

White ash *Fraxinus americana*

Green ash *Fraxinus pennsylvanica*

American elder *Sambucus canadensis*

Sensitive Crops

Tobacco

Potatoes

Maine

Groundnut *Apios americana*

Spreading dogbane *Apocynum androsaemifolium*

Dogbane, Indian hemp *Apocynum cannibinum*

Common milkweed *Asclepias syriaca*

Big-leaf aster *Aster macrophyllus*

Virgin's bower Clematis virginiana

White ash *Fraxinus americana*

Green ash *Fraxinus pennsylvanica*

Black huckleberry *Gaylussacia baccata*
Virginia creeper *Parthenocissus quinquefolia*
Jack pine *Pinus banksiana*
Pitch pine *Pinus rigida*
Quaking aspen *Populus tremuloides*
Black cherry *Prunus serotina*
Allegheny blackberry *Rubus allegheniensis*
Thornless blackberry *Rubus canadensis*
American elder *Sambucus canadensis*
Smooth cordgrass *Spartina alterniflora*
Common snowberry Symphoricarpos albus
Choke cherry *Prunus virginiana*
Speckled alder *Alnus rugosa*
Whorled aster *Aster acuminatus*
Red elderberry *Sambucus racemosa*
Cutleaf coneflower *Rudbeckia laciniata*
Tall milkweed *Asclepias exaltata*
Goldenrod *Solidago altissima*
Black locust *Robinia pseudoacacia*

<u>Sensitive Crops</u>
Potatoes

Michigan
Spreading dogbane *Apocynum androsaemifolium*
Common milkweed *Asclepias syriaca*
Big-leaf aster *Aster macrophyllus*
Virgin's bower *Clematis virginiana*
White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*
Black huckleberry *Gaylussacia baccata*
Virginia creeper *Parthenocissus quinquefolia*
Jack pine *Pinus banksiana*
Quaking aspen *Populus tremuloides*
Black cherry *Prunus serotina*
Chokecherry *Prunus virginiana*
Black locust *Robinia pseudoacacia*
Thornless blackberry *Rubus canadensis*
Thimbleberry *Rubus parviflorus*
Red elderberry *Sambucus racemosa*
Goldenrod *Solidago altissima*
Common snowberry *Symphoricarpos albus*
Huckleberry *Vaccinium membranaceum*

Speckled alder *Alnus rugosa*
Cutleaf coneflower *Rudbeckia laciniata*
Yellow-poplar *Liriodendron tulipifera*
Tall milkweed *Asclepias exaltata*
Allegheny blackberry *Rubus allegheniensis*
Redbud *Cercis Canadensis*
American elder *Sambucus canadensis*

Sensitive Crops
Winter Wheat
Soybeans
Potatoes

Minnesota
Saskatoon serviceberry *Amelanchier alnifolia*
Groundnut *Apios americana*
Spreading dogbane *Apocynum androsaemifolium*
Dogbane, Indian hemp *Apocynum cannibinum*
Silver wormwood *Artemisia ludoviciana*
Swamp milkweed *Asclepias incarnata*
Common milkweed *Asclepias syriaca*
Virgin's bower *Clematis virginiana*
American hazelnut *Corylus americana*
Green ash *Fraxinus pennsylvanica*
Black huckleberry *Gaylussacia baccata*
Virginia creeper *Parthenocissus quinquefolia*
Jack pine *Pinus banksiana*
Quaking aspen *Populus tremuloides*
Black cherry *Prunus serotina*
Chokecherry *Prunus virginiana*
Black locust *Robinia pseudoacacia*
Allegheny blackberry *Rubus allegheniensis*
Thornless blackberry *Rubus canadensis*
Thimbleberry *Rubus parviflorus*
Cutleaf coneflower *Rudbeckia laciniata*
American elder *Sambucus canadensis*
Snowberry *Symphoricarpos albus*
Red elderberry *Sambucus racemosa*
Tall milkweed *Asclepias exaltata*
Goldenrod *Solidago altissima*
Speckled alder *Alnus rugosa*
Big-leaf aster *Aster macrophyllus*

White ash *Fraxinus americana*

Sensitive Crops
Winter Wheat
Soybeans
Potatoes

Missouri
Virginia creeper *Parthenocissus quinquefolia*
Quaking aspen *Populus tremuloides*
Red elderberry *Sambucus racemosa*
Black cherry *Prunus serotina*
Cutleaf coneflower *Rudbeckia laciniata*
Spreading dogbane *Apocynum androsaemifolium*
Sweetgum *Liquidambar styraciflua*
Yellow-poplar *Liriodendron tulipifera*
Loblolly pine *Pinus taeda*
Goldenrod *Solidago altissima*
Common milkweed *Asclepias syriaca*
Black locust *Robinia pseudoacacia*
Choke cherry *Prunus virginiana*
Allegheny blackberry *Rubus allegheniensis*
Big-leaf aster *Aster macrophyllus*
Redbud *Cercis Canadensis*
White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*
American elder *Sambucus canadensis*
Virginia pine *Pinus virginiana*

Sensitive Crops
Winter Wheat
Soybeans
Cotton
Tobacco
Potatoes

Mississippi
Virginia creeper *Parthenocissus quinquefolia*
Black cherry *Prunus serotina*
Cutleaf coneflower *Rudbeckia laciniata*
Sweetgum *Liquidambar styraciflua*

Yellow-poplar *Liriodendron tulipifera*
Loblolly pine *Pinus taeda*
Goldenrod *Solidago altissima*
Black locust *Robinia pseudoacacia*
Redbud *Cercis Canadensis*
White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*
American elder *Sambucus canadensis*
Virginia pine *Pinus virginiana*

<u>Sensitive Crops</u>
Winter Wheat
Peanuts
Soybeans
Cotton

Montana
Saskatoon serviceberry *Amelanchier alnifolia*
Spreading dogbane *Apocynum androsaemifolium*
Dogbane, Indian hemp *Apocynum cannibinum*
Pacific ninebark *Physocarpus malvaceum*
Ponderosa pine *Pinus ponderosa*
Quaking aspen *Populus tremuloides*
Thimbleberry *Rubus parviflorus*
Scouler's willow *Salix scouleriana*
Red elderberry *Sambucus racemosa*
Snowberry *Symphoricarpos albus*
Huckleberry *Vaccinium membranaceum*
Choke cherry *Prunus virginiana*
Cutleaf coneflower *Rudbeckia laciniata*
Goldenrod *Solidago altissima*
Common milkweed *Asclepias syriaca*
Green ash *Fraxinus pennsylvanica*
Evening primrose *Oenothera elata*
American elder *Sambucus canadensis*

<u>Sensitive Crops</u>
Winter Wheat
Potatoes

Nebraska

Virginia creeper *Parthenocissus quinquefolia*
Quaking aspen *Populus tremuloides*
Saskatoon serviceberry *Amelanchier alnifolia*
Ponderosa pine *Pinus ponderosa*
Black cherry *Prunus serotina*
Cutleaf coneflower *Rudbeckia laciniata*
Spreading dogbane *Apocynum androsaemifolium*
Goldenrod *Solidago altissima*
Common milkweed *Asclepias syriaca*
Black locust *Robinia pseudoacacia*
Choke cherry *Prunus virginiana*
Allegheny blackberry *Rubus allegheniensis*
Redbud *Cercis Canadensis*
White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*
American elder *Sambucus canadensis*

<u>Sensitive Crops</u>
Winter Wheat
Soybeans
Potatoes

Nevada
Quaking aspen *Populus tremuloides*
Saskatoon serviceberry *Amelanchier alnifolia*
Thimbleberry *Rubus parviflorus*
Scouler's willow *Salix scouleriana*
Red elderberry *Sambucus racemosa*
Ponderosa pine *Pinus ponderosa*
Spreading dogbane *Apocynum androsaemifolium*
Jeffrey pine *Pinus jeffreyi*
Black locust *Robinia pseudoacacia*
Choke cherry *Prunus virginiana*
Evening primrose *Oenothera elata*

<u>Sensitive Crops</u>
Winter Wheat
Potatoes

New Mexico
Tree-of-heaven *Ailanthus altissima*

Spreading dogbane *Apocynum androsaemifolium*
Dogbane, Indian hemp *Apocynum cannibinum*
Virginia creeper *Parthenocissus quinquefolia*
Quaking aspen *Populus tremuloides*
Skunkbush *Rhus trilobata*
Thimbleberry *Rubus parviflorus*
Cutleaf coneflower *Rudbeckia laciniata*
Goldenrod *Solidago altissima*
Silver wormwood *Artemisia ludoviciana*
Ponderosa pine *Pinus ponderosa*
Scouler's willow *Salix scouleriana*
Red elderberry *Sambucus racemosa*
Black cherry *Prunus serotina*
Spreading dogbane *Apocynum androsaemifolium*
Black locust *Robinia pseudoacacia*
Choke cherry *Prunus virginiana*
Redbud *Cercis Canadensis*
Green ash *Fraxinus pennsylvanica*
Evening primrose *Oenothera elata*
American elder *Sambucus canadensis*

<u>Sensitive Crops</u>
Winter Wheat
Peanuts
Cotton
Potatoes

New Hampshire
Virginia creeper *Parthenocissus quinquefolia*
Quaking aspen *Populus tremuloides*
Red elderberry *Sambucus racemosa*
Black cherry *Prunus serotina*
Cutleaf coneflower *Rudbeckia laciniata*
Spreading dogbane *Apocynum androsaemifolium*
Tall milkweed *Asclepias exaltata*
Goldenrod *Solidago altissima*
Common milkweed *Asclepias syriaca*
Thornless blackberry *Rubus canadensis*
Black locust *Robinia pseudoacacia*
Choke cherry *Prunus virginiana*
Allegheny blackberry *Rubus allegheniensis*
Speckled alder *Alnus rugosa*

Whorled aster *Aster acuminatus*
Big-leaf aster *Aster macrophyllus*
White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*
American elder *Sambucus canadensis*

New Jersey
Virginia creeper *Parthenocissus quinquefolia*
Quaking aspen *Populus tremuloides*
Red elderberry *Sambucus racemosa*
Black cherry *Prunus serotina*
Cutleaf coneflower *Rudbeckia laciniata*
Spreading dogbane *Apocynum androsaemifolium*
Sweetgum *Liquidambar styraciflua*
Yellow-poplar *Liriodendron tulipifera*
Loblolly pine *Pinus taeda*
Tall milkweed *Asclepias exaltata*
Goldenrod *Solidago altissima*
Common milkweed *Asclepias syriaca*
Thornless blackberry *Rubus canadensis*
Black locust *Robinia pseudoacacia*
Choke cherry *Prunus virginiana*
Allegheny blackberry *Rubus allegheniensis*
Speckled alder *Alnus rugosa*
Whorled aster *Aster acuminatus*
Big-leaf aster *Aster macrophyllus*
Redbud *Cercis Canadensis*
White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*
American elder *Sambucus canadensis*
Virginia pine *Pinus virginiana*

<u>Sensitive Crops</u>
Winter Wheat
Soybeans
Potatoes

New York
Virginia creeper *Parthenocissus quinquefolia*
Quaking aspen *Populus tremuloides*
Red elderberry *Sambucus racemosa*

Black cherry *Prunus serotina*
Cutleaf coneflower *Rudbeckia laciniata*
Spreading dogbane *Apocynum androsaemifolium*
Sweetgum *Liquidambar styraciflua*
Yellow-poplar *Liriodendron tulipifera*
Tall milkweed *Asclepias exaltata*
Goldenrod *Solidago altissima*
Common milkweed *Asclepias syriaca*
Thornless blackberry *Rubus canadensis*
Black locust *Robinia pseudoacacia*
Choke cherry *Prunus virginiana*
Allegheny blackberry *Rubus allegheniensis*
Speckled alder *Alnus rugosa*
Whorled aster *Aster acuminatus*
Big-leaf aster *Aster macrophyllus*
Redbud *Cercis Canadensis*
White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*
American elder *Sambucus canadensis*
Virginia pine *Pinus virginiana*

<u>Sensitive Crops</u>
Winter Wheat
Soybeans
Potatoes

North Carolina
Tree-of-heaven *Ailanthus altissima*
Groundnut *Apios americana*
Spreading dogbane *Apocynum androsaemifolium*
Dogbane, Indian hemp *Apocynum cannibinum*
Silver wormwood *Artemisia ludoviciana*
Tall milkweed *Asclepias exaltata*
Swamp milkweed *Asclepias incarnata*
Common milkweed *Asclepias syriaca*
Whorled aster *Aster acuminatus*
Big-leaf aster *Aster macrophyllus*
Redbud *Cercis canadensis*
Virgin's bower *Clematis virginiana*
American hazelnut *Corylus americana*
White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*

Black huckleberry *Gaylussacia baccata*
Mountain dandelion *Krigia montana*
Sweetgum *Liquidambar styraciflua*
Yellow-poplar *Liriodendron tulipifera*
Maleberry *Lyonia ligustrina*
Virginia creeper *Parthenocissus quinquefolia*
Table-mountain pine *Pinus pungens*
Pitch pine *Pinus rigida*
Loblolly pine *Pinus taeda*
Virginia pine *Pinus virginiana*
American sycamore *Platanus occidentalis*
Black cherry *Prunus serotina*
Choke cherry *Prunus virginiana*
Black locust *Robinia pseudoacacia*
Allegheny blackberry *Rubus allegheniensis*
Thornless blackberry *Rubus canadensis*
Cutleaf coneflower *Rudbeckia laciniata*
American elder *Sambucus canadensis*
Sassafras *Sassafras albidum*
Goldenrod *Solidago altissima*
Crown-beard *Verbesina occidentalis*
Northern fox grape *Vitis labrusca*
Red elderberry *Sambucus racemosa*

<u>Sensitive Crops</u>
Winter Wheat
Peanuts
Soybeans
Cotton
Tobacco
Potatoes

North Dakota
Saskatoon serviceberry *Amelanchier alnifolia*
Spreading dogbane *Apocynum androsaemifolium*
Dogbane, Indian hemp *Apocynum cannibinum*
Silver wormwood *Artemisia ludoviciana*
Green ash *Fraxinus pennsylvanica*
Ponderosa pine *Pinus ponderosa*
Quaking aspen *Populus tremuloides*
Chokecherry *Prunus virginiana*
Skunkbush *Rhus trilobata*

Common snowberry *Symphoricarpos albus*
Red elderberry *Sambucus racemosa*
Black cherry *Prunus serotina*
Cutleaf coneflower *Rudbeckia laciniata*
Goldenrod *Solidago altissima*
Common milkweed *Asclepias syriaca*
Speckled alder *Alnus rugosa*
American elder *Sambucus canadensis*

<u>Sensitive Crops</u>
Soybeans
Potatoes

Ohio
Virginia creeper *Parthenocissus quinquefolia*
Quaking aspen *Populus tremuloides*
Red elderberry *Sambucus racemosa*
Black cherry *Prunus serotina*
Cutleaf coneflower *Rudbeckia laciniata*
Spreading dogbane *Apocynum androsaemifolium*
Sweetgum *Liquidambar styraciflua*
Yellow-poplar *Liriodendron tulipifera*
Tall milkweed *Asclepias exaltata*
Goldenrod *Solidago altissima*
Common milkweed *Asclepias syriaca*
Black locust *Robinia pseudoacacia*
Choke cherry *Prunus virginiana*
Allegheny blackberry *Rubus allegheniensis*
Speckled alder *Alnus rugosa*
Whorled aster *Aster acuminatus*
Big-leaf aster *Aster macrophyllus*
Redbud *Cercis Canadensis*
White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*
American elder *Sambucus canadensis*
Virginia pine *Pinus virginiana*

<u>Sensitive Crops</u>
Winter Wheat
Soybeans
Tobacco
Potatoes

Oklahoma

Black Cherry *Prunus serotina*
Cottonwood *Populus deltoids*
Sweetgum *Liquadambar styraciflua*
Loblolly Pine *Pinus taeda*
Ohio Buckeye, Horse chestnut *Aesculus glabra*
Basswood *Tilia Americana*
Virginia creeper *Parthenocissus quinquefolia*
Ponderosa pine *Pinus ponderosa*
Cutleaf coneflower *Rudbeckia laciniata*
Spreading dogbane *Apocynum androsaemifolium*
Goldenrod *Solidago altissima*
Common milkweed *Asclepias syriaca*
Black locust *Robinia pseudoacacia*
Choke cherry *Prunus virginiana*
Allegheny blackberry *Rubus allegheniensis*
Redbud *Cercis Canadensis*
White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*
Evening primrose *Oenothera elata*
American elder *Sambucus canadensis*

<u>Sensitive Crops</u>
Winter Wheat
Peanuts
Soybeans
Cotton

Oregon

Saskatoon serviceberry *Amelanchier alnifolia*
Spreading dogbane *Apocynum androsaemifolium*
Ponderosa pine *Pinus ponderosa*
Quaking aspen *Populus tremuloides*
Thimbleberry *Rubus parviflorus*
Scouler’s willow *Salix scouleriana*
Red elderberry *Sambucus racemosa*
Common snowberry *Symphoricarpos albus*
Huckleberry *Vaccinium membranaceum*
Common milkweed *Asclepias syriaca*

Jeffrey pine *Pinus jeffreyi*
Black locust *Robinia pseudoacacia*
Choke cherry *Prunus virginiana*
Evening primrose *Oenothera elata*

Sensitive Crops
Winter Wheat
Potatoes

Pennsylvania
Virginia creeper *Parthenocissus quinquefolia*
Quaking aspen *Populus tremuloides*
Red elderberry *Sambucus racemosa*
Black cherry *Prunus serotina*
Cutleaf coneflower *Rudbeckia laciniata*
Spreading dogbane *Apocynum androsaemifolium*
Sweetgum *Liquidambar styraciflua*
Yellow-poplar *Liriodendron tulipifera*
Tall milkweed *Asclepias exaltata*
Goldenrod *Solidago altissima*
Common milkweed *Asclepias syriaca*
Thornless blackberry *Rubus canadensis*
Black locust *Robinia pseudoacacia*
Choke cherry *Prunus virginiana*
Allegheny blackberry *Rubus allegheniensis*
Speckled alder *Alnus rugosa*
Whorled aster *Aster acuminatus*
Big-leaf aster *Aster macrophyllus*
Redbud *Cercis Canadensis*
White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*
American elder *Sambucus canadensis*
Virginia pine *Pinus virginiana*

Sensitive Crops
Winter Wheat
Soybeans
Tobacco
Potatoes

Rhode Island

Virginia creeper *Parthenocissus quinquefolia*
Quaking aspen *Populus tremuloides*
Red elderberry *Sambucus racemosa*
Black cherry *Prunus serotina*
Cutleaf coneflower *Rudbeckia laciniata*
Spreading dogbane *Apocynum androsaemifolium*
Sweetgum *Liquidambar styraciflua*
Yellow-poplar *Liriodendron tulipifera*
Tall milkweed *Asclepias exaltata*
Goldenrod *Solidago altissima*
Common milkweed *Asclepias syriaca*
Black locust *Robinia pseudoacacia*
Choke cherry *Prunus virginiana*
Speckled alder *Alnus rugosa*
Whorled aster *Aster acuminatus*
Big-leaf aster *Aster macrophyllus*
White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*
American elder *Sambucus canadensis*

<u>Sensitive Crops</u>
Potatoes

South Carolina
Virginia creeper *Parthenocissus quinquefolia*
Black cherry *Prunus serotina*
Cutleaf coneflower *Rudbeckia laciniata*
Sweetgum *Liquidambar styraciflua*
Yellow-poplar *Liriodendron tulipifera*
Loblolly pine *Pinus taeda*
Tall milkweed *Asclepias exaltata*
Goldenrod *Solidago altissima*
Common milkweed *Asclepias syriaca*
Thornless blackberry *Rubus canadensis*
Black locust *Robinia pseudoacacia*
Allegheny blackberry *Rubus allegheniensis*
Big-leaf aster *Aster macrophyllus*
Redbud *Cercis Canadensis*
White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*
American elder *Sambucus canadensis*
Virginia pine *Pinus virginiana*

Sensitive Crops

Winter Wheat
Peanuts
Soybeans
Cotton
Tobacco

South Dakota

Dogbane, Indian hemp *Apocynum cannibinum*
Silver wormwood *Artemisia ludoviciana*
Green ash *Fraxinus pennsylvanica*
Ponderosa pine *Pinus ponderosa*
Chokecherry *Prunus virginiana*
Skunkbush *Rhus trilobata*
Snowberry *Symphoricarpos albus*
Saskatoon serviceberry *Amelanchier alnifolia*
Swamp milkweed *Asclepias incarnata*
Common milkweed *Asclepias syriaca*
Virginia creeper *Parthenocissus quinquefolia*
Quaking aspen *Populus tremuloides*
Red elderberry *Sambucus racemosa*
Common snowberry *Symphoricarpos albus*
Thimbleberry *Rubus parviflorus*
Scouler's willow *Salix scouleriana*
Cutleaf coneflower *Rudbeckia laciniata*
Goldenrod *Solidago altissima*
Black locust *Robinia pseudoacacia*
American elder *Sambucus canadensis*

Sensitive Crops

Winter Wheat
Soybeans
Potatoes

Tennessee

Tree-of-heaven *Ailanthus altissima*
Groundnut *Apios americana*
Spreading dogbane *Apocynum androsaemifolium*
Dogbane, Indian hemp *Apocynum cannibinum*
Silver wormwood *Artemisia ludoviciana*

Tall milkweed *Asclepias exaltata*
Swamp milkweed *Asclepias incarnata*
Common milkweed Asclepias syriaca
Whorled aster *Aster acuminatus*
Big-leaf aster *Aster macrophyllus*
Redbud *Cercis canadensis*
Virgin's bower *Clematis virginiana*
American hazelnut *Corylus americana*
White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*
Black huckleberry *Gaylussacia baccata*
Mountain dandelion *Krigia montana*
Sweetgum *Liquidambar styraciflua*
Yellow-poplar *Liriodendron tulipifera*
Maleberry *Lyonia ligustrina*
Virginia creeper *Parthenocissus quinquefolia*
Table-mountain pine *Pinus pungens*
Pitch pine *Pinus rigida*
Loblolly pine *Pinus taeda*
Virginia pine *Pinus virginiana*
American sycamore *Platanus occidentalis*
Black cherry *Prunus serotina*
Choke cherry *Prunus virginiana*
Black locust *Robinia pseudoacacia*
Allegheny blackberry *Rubus allegheniensis*
Thornless blackberry *Rubus canadensis*
Cutleaf coneflower *Rudbeckia laciniata*
American elder *Sambucus canadensis*
Sassafras Sassafras albidum
Goldenrod *Solidago altissima*
Crown-beard *Verbesina occidentalis*
Northern fox grape *Vitis labrusca*
Red elderberry *Sambucus racemosa*

Sensitive Crops
Winter Wheat
Soybeans
Cotton
Tobacco

Texas
Silver wormwood *Artemisia ludoviciana*

Swamp milkweed *Asclepias incarnata*
Ponderosa pine *Pinus ponderosa*
Skunkbush *Rhus trilobata*
Quaking aspen *Populus tremuloides*
Chokecherry *Prunus virginiana*
Virginia creeper Parthenocissus quinquefolia
Black cherry *Prunus serotina*
Cutleaf coneflower *Rudbeckia laciniata*
Spreading dogbane *Apocynum androsaemifolium*
Sweetgum *Liquidambar styraciflua*
Yellow-poplar *Liriodendron tulipifera*
Loblolly pine *Pinus taeda*
Goldenrod *Solidago altissima*
Black locust *Robinia pseudoacacia*
Redbud *Cercis Canadensis*
White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*
Evening primrose *Oenothera elata*
American elder *Sambucus canadensis*

<u>Sensitive Crops</u>
Winter Wheat
Peanuts
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Utah
Cottonwood *Populus fremontii*
Single-leaf ash *Fraxinus anomala*
Skunkbush *Rhus trilobata*
White stem blazingstar *Mentzelia albicaulis*
Spreading dogbane *Apocynum androsaemifolium*
Silver wormwood *Artemisia ludoviciana*
Ponderosa pine *Pinus ponderosa*
Quaking aspen *Populus tremuloides*
Choke cherry *Prunus virginiana*
Skunkbush *Rhus trilobata*
Dogbane, Indian hemp *Apocynum cannibinum*
Gooding’s willow *Salix goodingii*
Tree-of-heaven *Ailanthus altissima*
Saskatoon serviceberry *Amelanchier alnifolia*

White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*
Black locust *Robinia pseudoacacia*
Northern fox grape *Vitis labrusca*
American sycamore *Platanus occidentalis*
Scouler's willow *Salix scouleriana*
Red elderberry *Sambucus racemosa*
Virginia creeper *Parthenocissus quinquefolia*
Thimbleberry *Rubus parviflorus*
Cutleaf coneflower *Rudbeckia laciniata*
Evening primrose *Oenothera elata*

Sensitive Crops
Winter Wheat
Potatoes

Vermont
Virginia creeper *Parthenocissus quinquefolia*
Quaking aspen *Populus tremuloides*
Red elderberry *Sambucus racemosa*
Black cherry *Prunus serotina*
Cutleaf coneflower *Rudbeckia laciniata*
Spreading dogbane *Apocynum androsaemifolium*
Yellow-poplar *Liriodendron tulipifera*
Tall milkweed *Asclepias exaltata*
Goldenrod *Solidago altissima*
Common milkweed *Asclepias syriaca*
Thornless blackberry *Rubus canadensis*
Black locust *Robinia pseudoacacia*
Choke cherry *Prunus virginiana*
Allegheny blackberry *Rubus allegheniensis*
Speckled alder *Alnus rugosa*
Whorled aster *Aster acuminatus*
Big-leaf aster *Aster macrophyllus*
White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*
American elder *Sambucus canadensis*

Virginia
Tree-of-heaven *Ailanthus altissima*
Speckled alder *Alnus rugosa*

Groundnut *Apios americana*
Spreading dogbane *Apocynum androsaemifolium*
Dogbane, Indian hemp *Apocynum cannibinum*
Tall milkweed *Asclepias exaltata*
Swamp milkweed *Asclepias incarnata*
Common milkweed *Asclepias syriaca*
Whorled aster *Aster acuminatus*
Big-leaf aster *Aster macrophyllus*
Redbud *Cercis canadensis*
Virgin's bower *Clematis virginiana*
American hazelnut *Corylus americana*
White snakeroot *Eupatorium rugosum*
White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*
Black huckleberry *Gaylussacia baccata*
Sweetgum *Liquidambar styraciflua*
Yellow-poplar *Liriodendron tulipifera*
Maleberry *Lyonia ligustrina*
Virginia creeper *Parthenocissus quinquefolia*
Sweet mock orange *Philadelphus coronarius*
Table-mountain pine *Pinus pungens*
Pitch pine *Pinus rigida*
Loblolly pine *Pinus taeda*
Virginia pine *Pinus virginiana*
American sycamore *Platanus occidentalis*
Quaking aspen *Populus tremuloides*
Black cherry *Prunus serotina*
Choke cherry *Prunus virginiana*
Winged sumac *Rhus copallina*
Black locust *Robinia pseudoacacia*
Allegheny blackberry *Rubus allegheniensis*
Sand blackberry *Rubus cuneifolius*
Cutleaf coneflower *Rudbeckia laciniata*
American elder *Sambucus canadensis*
Red elderberry *Sambucus racemosa*
Sassafras *Sassafras albidum*
Goldenrod *Solidago altissima*
Common snowberry *Symphoricarpos albus*
Crownbeard *Verbesina occidentalis*
Northern fox grape *Vitis labrusca*
Thornless blackberry *Rubus canadensis*

Sensitive Crops

Winter Wheat
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Washington

Red alder *Alnus rubra*
Serviceberry *Amelanchier alnifolia*
Spreading dogbane *Apocynum androsaemifolium*
Dogbane, Indian hemp *Apocynum cannibinum*
Mugwort *Artemisia douglasiana*
Silver wormwood *Artemisia ludoviciana*
Virginia creeper *Parthenocissus quinquefolia*
Ninebark *Physocarpus capitatus*
Ponderosa pine *Pinus ponderosa*
Quaking aspen *Populus tremuloides*
Thimbleberry *Rubus parviflorus*
Cutleaf coneflower *Rudbeckia laciniata*
Scouler's willow *Salix scouleriana*
Snowberry *Symphoricarpos albus*
Huckleberry *Vaccinium membranaceum*
Black poplar *Populus balsamifera trichocarpa*
Paper birch *Betula papyrifera*
Box elder *Acer negundo*
Twinberry *Lonicera involucrata*
Black locust *Robinia pseudoacacia*
Red elderberry *Sambucus racemosa*
Choke cherry *Prunus virginiana*
Evening primrose *Oenothera elata*

<u>Sensitive Crops</u>
Winter Wheat
Potatoes

Wisconsin

Virginia creeper *Parthenocissus quinquefolia*
Quaking aspen *Populus tremuloides*
Thimbleberry *Rubus parviflorus*
Red elderberry *Sambucus racemosa*

Black cherry *Prunus serotina*
Cutleaf coneflower *Rudbeckia laciniata*
Spreading dogbane *Apocynum androsaemifolium*
Tall milkweed *Asclepias exaltata*
Goldenrod *Solidago altissima*
Common milkweed *Asclepias syriaca*
Thornless blackberry *Rubus canadensis*
Black locust *Robinia pseudoacacia*
Choke cherry *Prunus virginiana*
Allegheny blackberry *Rubus allegheniensis*
Speckled alder *Alnus rugosa*
Big-leaf aster *Aster macrophyllus*
Redbud *Cercis Canadensis*
White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*
American elder *Sambucus canadensis*

<u>Sensitive Crops</u>
Winter Wheat
Soybeans
Potatoes

West Virginia
Virginia creeper *Parthenocissus quinquefolia*
Quaking aspen *Populus tremuloides*
Red elderberry *Sambucus racemosa*
Black cherry *Prunus serotina*
Cutleaf coneflower *Rudbeckia laciniata*
Spreading dogbane *Apocynum androsaemifolium*
Sweetgum *Liquidambar styraciflua*
Yellow-poplar *Liriodendron tulipifera*
Tall milkweed *Asclepias exaltata*
Goldenrod *Solidago altissima*
Common milkweed *Asclepias syriaca*
Thornless blackberry *Rubus canadensis*
Black locust *Robinia pseudoacacia*
Choke cherry *Prunus virginiana*
Allegheny blackberry *Rubus allegheniensis*
Speckled alder *Alnus rugosa*
Whorled aster *Aster acuminatus*
Big-leaf aster *Aster macrophyllus*
Redbud *Cercis Canadensis*

White ash *Fraxinus americana*
Green ash *Fraxinus pennsylvanica*
American elder *Sambucus canadensis*
Virginia pine *Pinus virginiana*

Sensitive Crops
Winter Wheat
Soybeans
Tobacco

Wyoming
Spreading dogbane *Apocynum androsaemifolium*
Pacific ninebark *Physocarpus malvaceum*
Quaking aspen *Populus tremuloides*
Scouler's willow *Salix scouleriana*
Dogbane, Indian hemp *Apocynum cannibinum*
Green ash *Fraxinus pennsylvanica*
Skunkbush *Rhus trilobata*
Thimbleberry *Rubus parviflorus*
Huckleberry *Vaccinium membranaceum*
Choke cherry *Prunus virginiana*
Saskatoon serviceberry *Amelanchier alnifolia*
Red elderberry *Sambucus racemosa*
Ponderosa pine *Pinus ponderosa*
Cutleaf coneflower *Rudbeckia laciniata*
Black locust *Robinia pseudoacacia*
Evening primrose *Oenothera elata*
American elder *Sambucus canadensis*

Sensitive Crops
Winter Wheat

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