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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

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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.

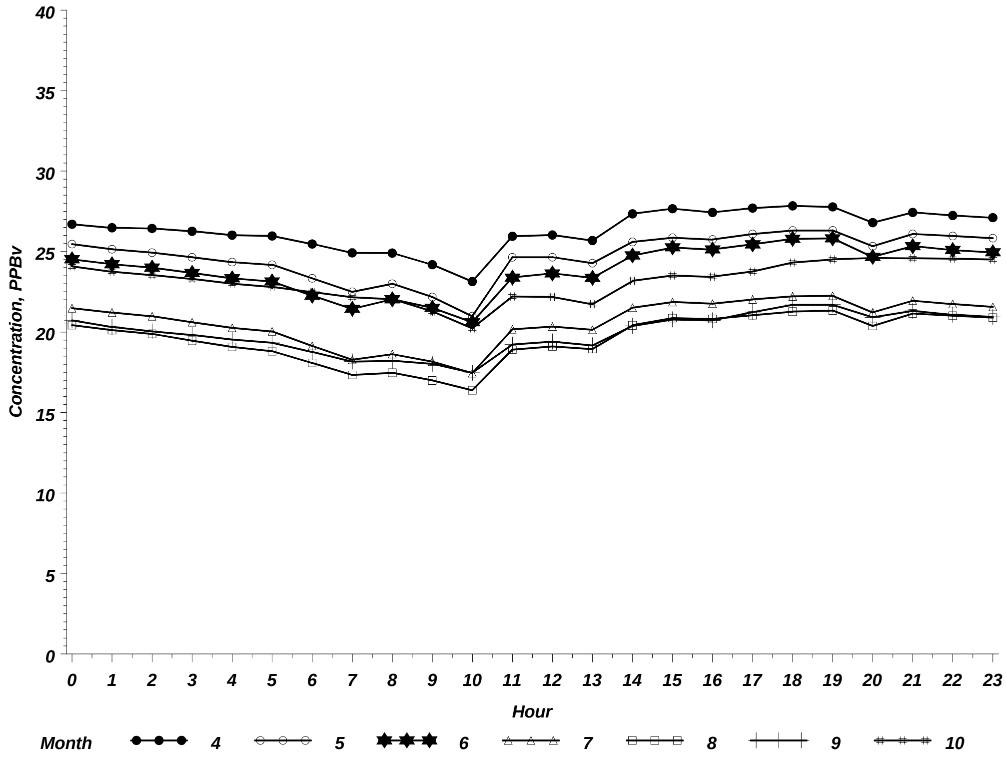


Figure 2A-2. Boston CSA: Diurnal Policy Relevant Background Ozone Patterns.

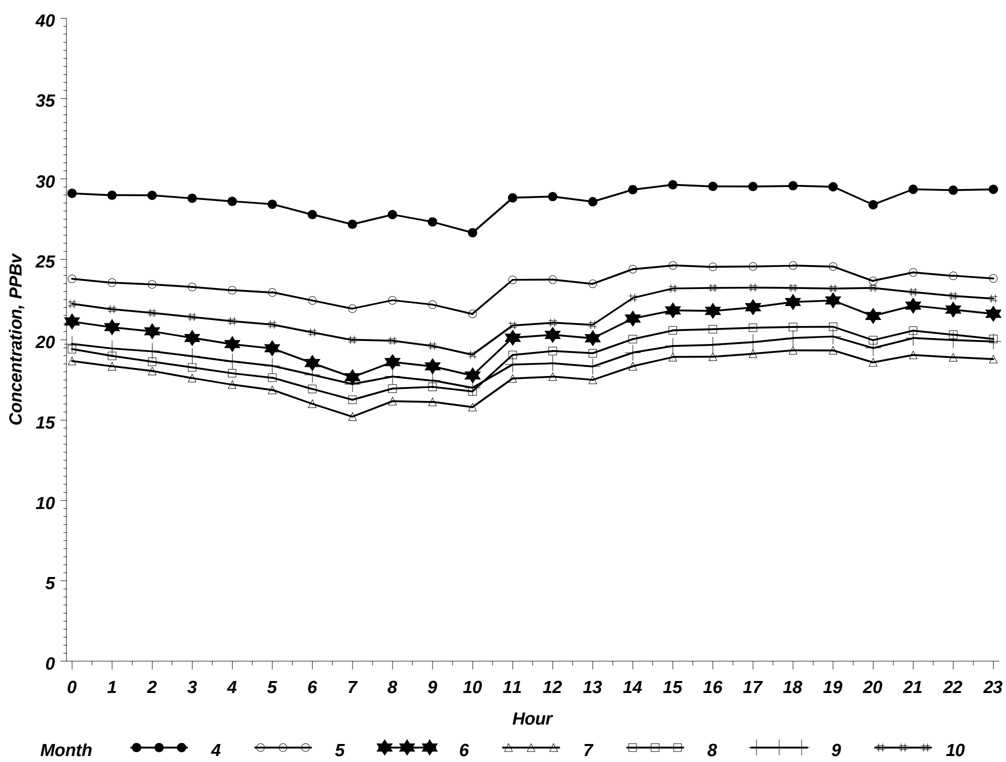


Figure 2A-3. Chicago CSA: Diurnal Policy Relevant Background Ozone Patterns.

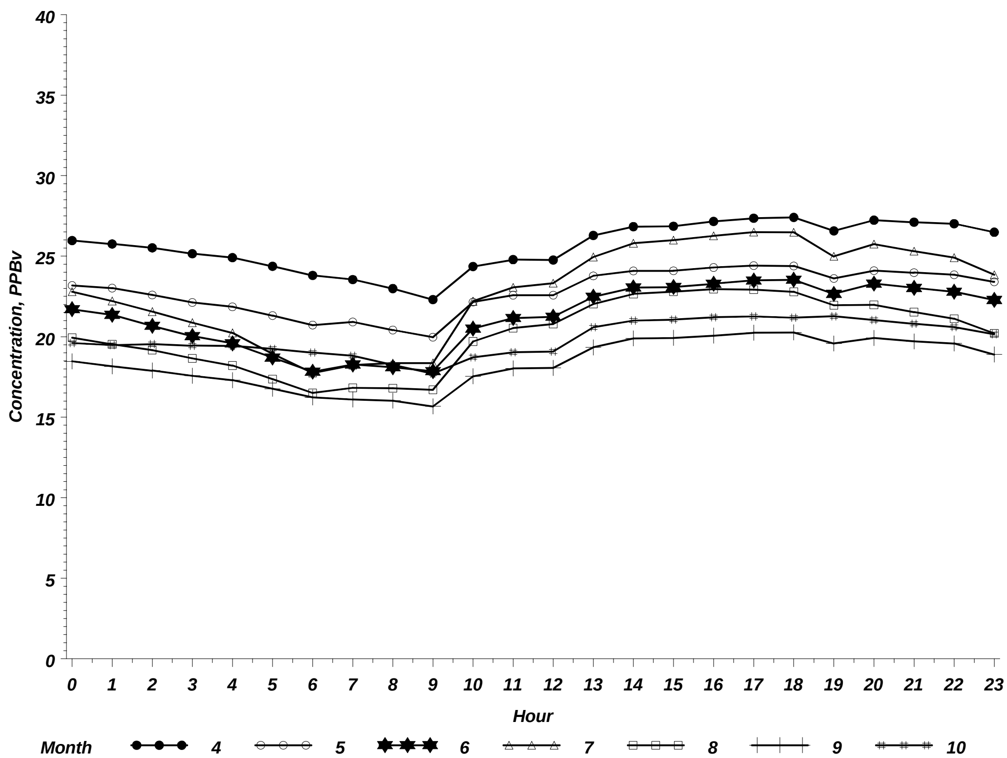


Figure 2A-4. Cleveland CSA: Diurnal Policy Relevant Background Ozone Patterns.

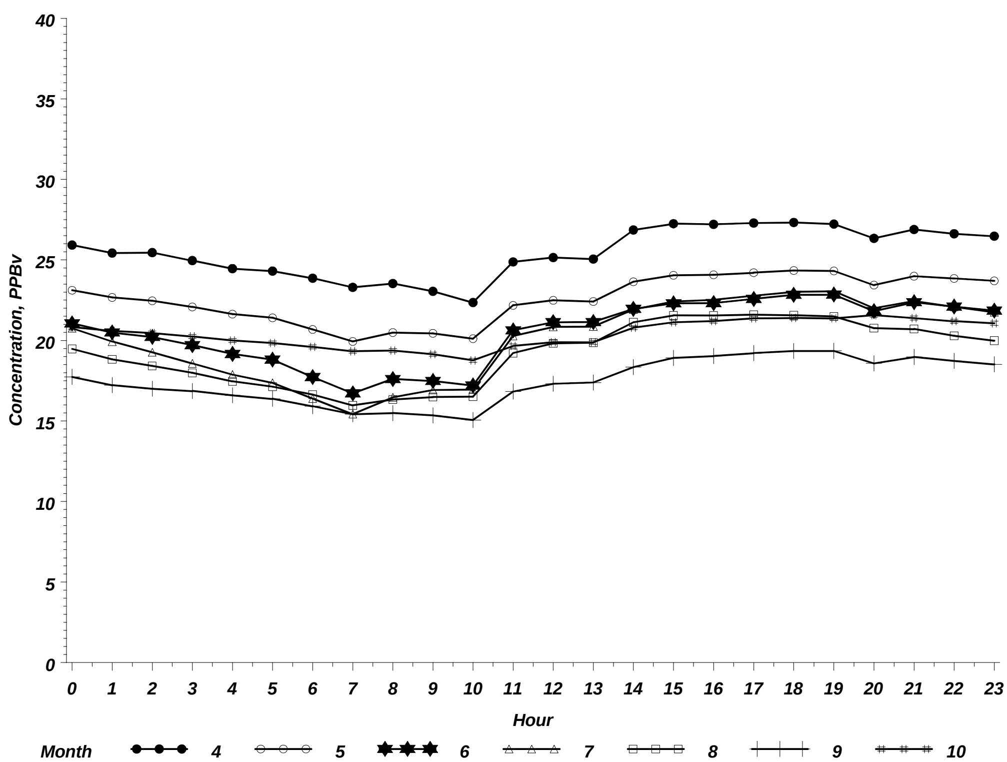


Figure 2A-5. Detroit CSA: Diurnal Policy Relevant Background Ozone Patterns.

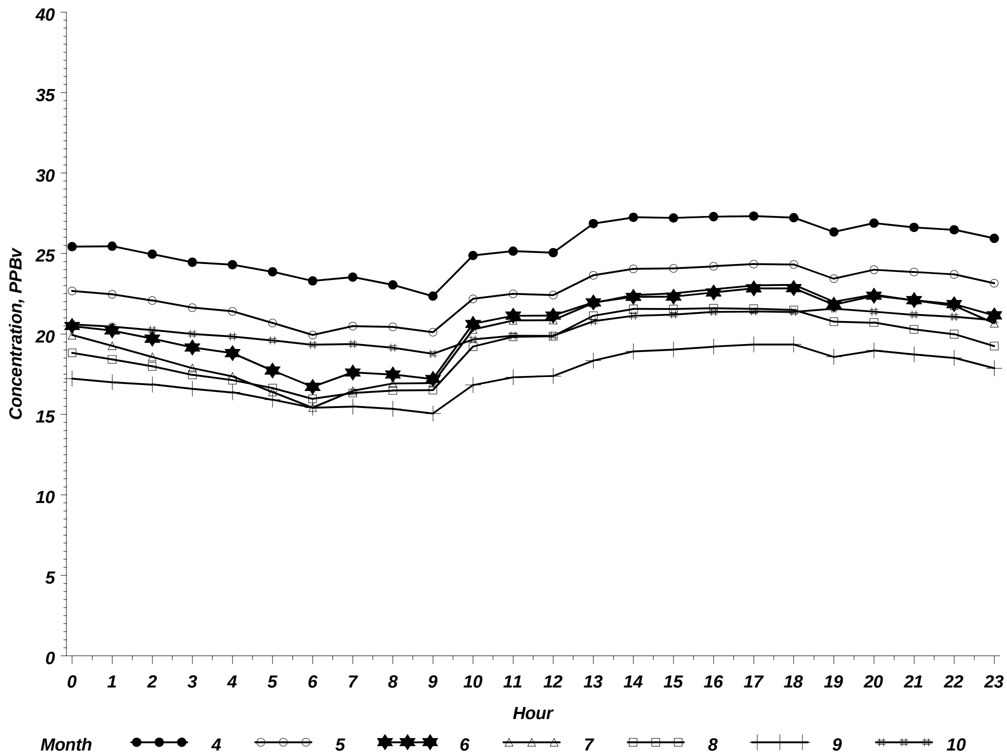


Figure 2A-6. Houston CSA: Diurnal Policy Relevant Background Ozone Patterns.

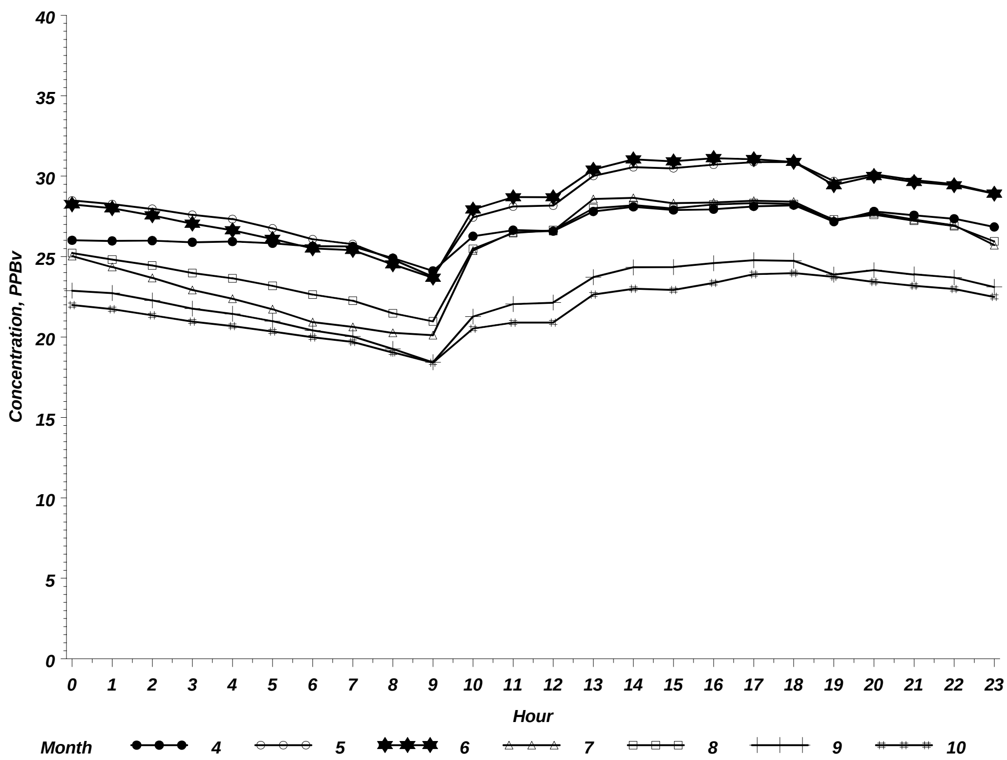


Figure 2A-7. Los Angeles CSA: Diurnal Policy Relevant Background Ozone Patterns.

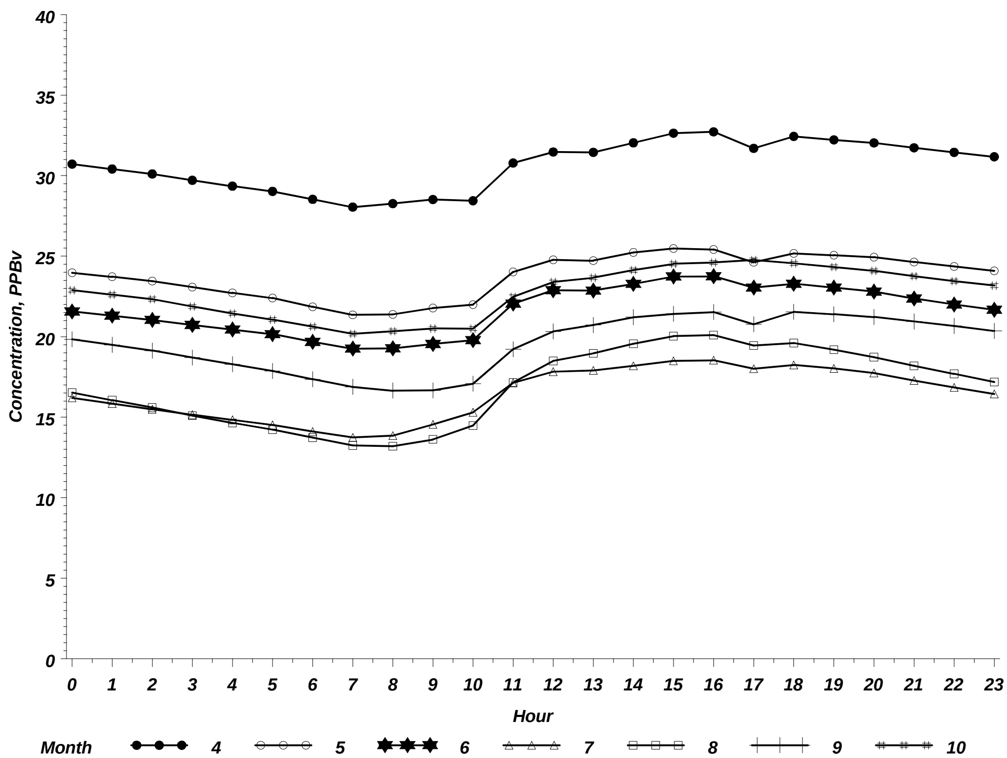


Figure 2A-8. New York CSA: Diurnal Policy Relevant Background Ozone Patterns.

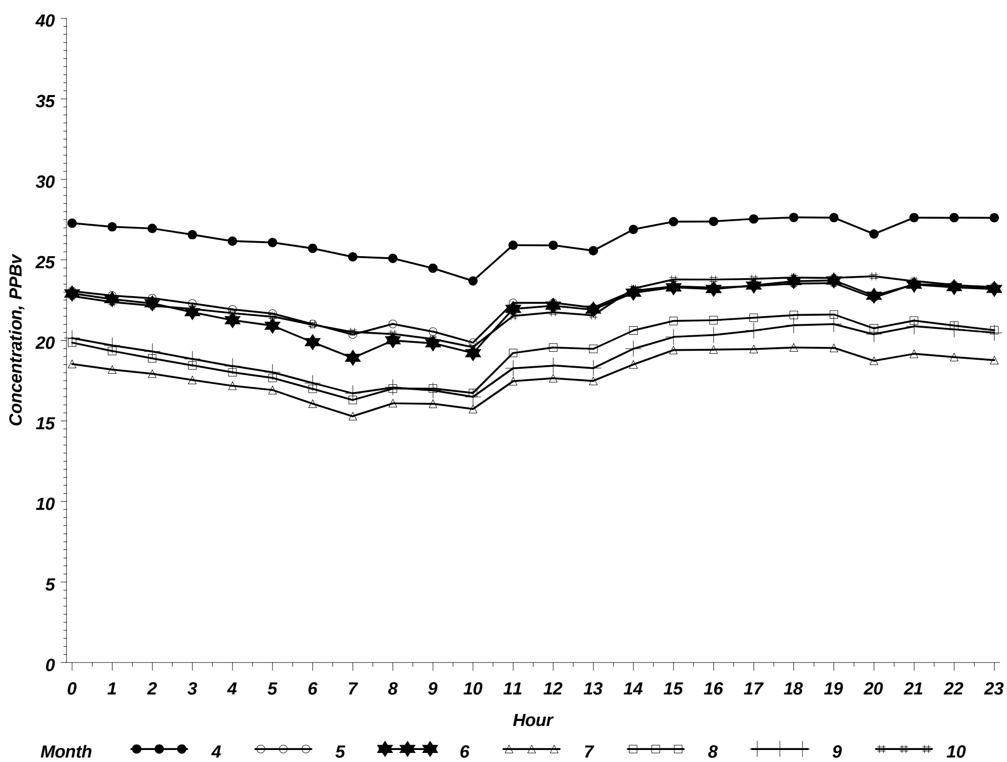


Figure 2A-9. Philadelphia CSA: Diurnal Policy Relevant Background Ozone Patterns.

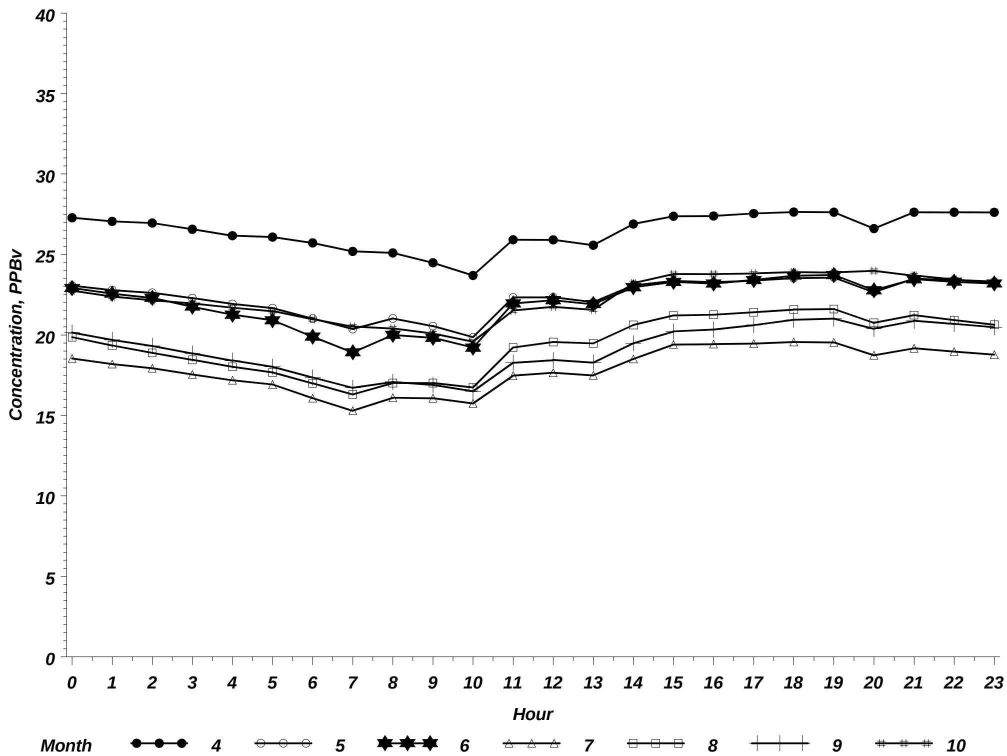


Figure 2A-10. Sacramento CSA: Diurnal Policy Relevant Background Ozone Patterns.

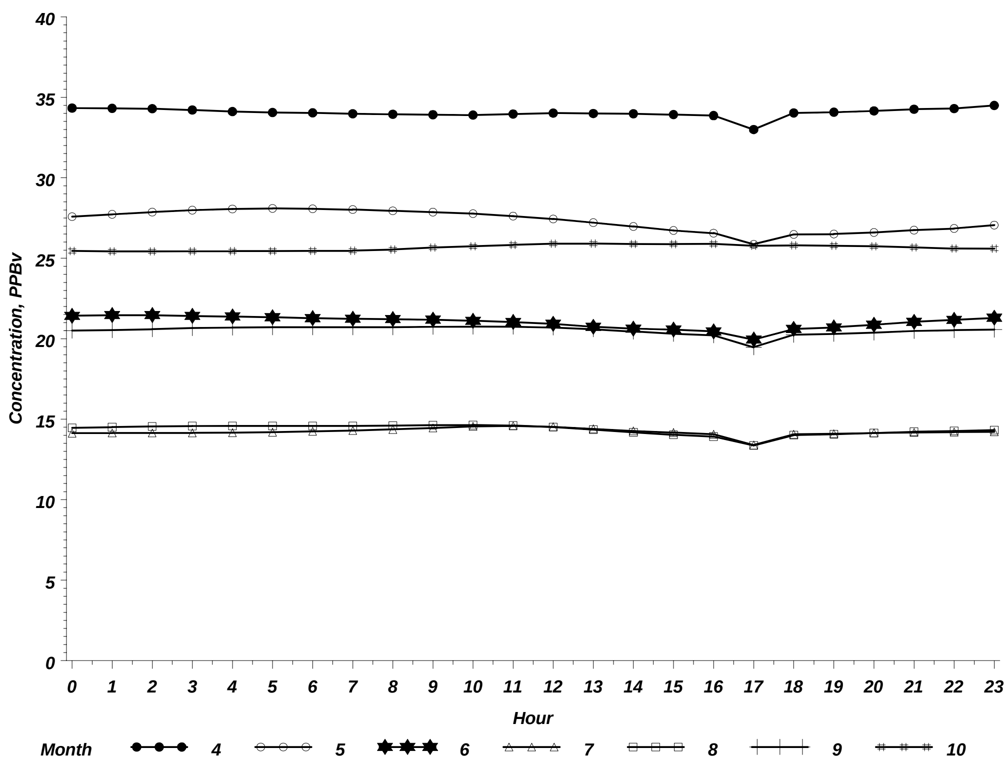


Figure 2A-11. St. Louis CSA: Diurnal Policy Relevant Background Ozone Patterns.

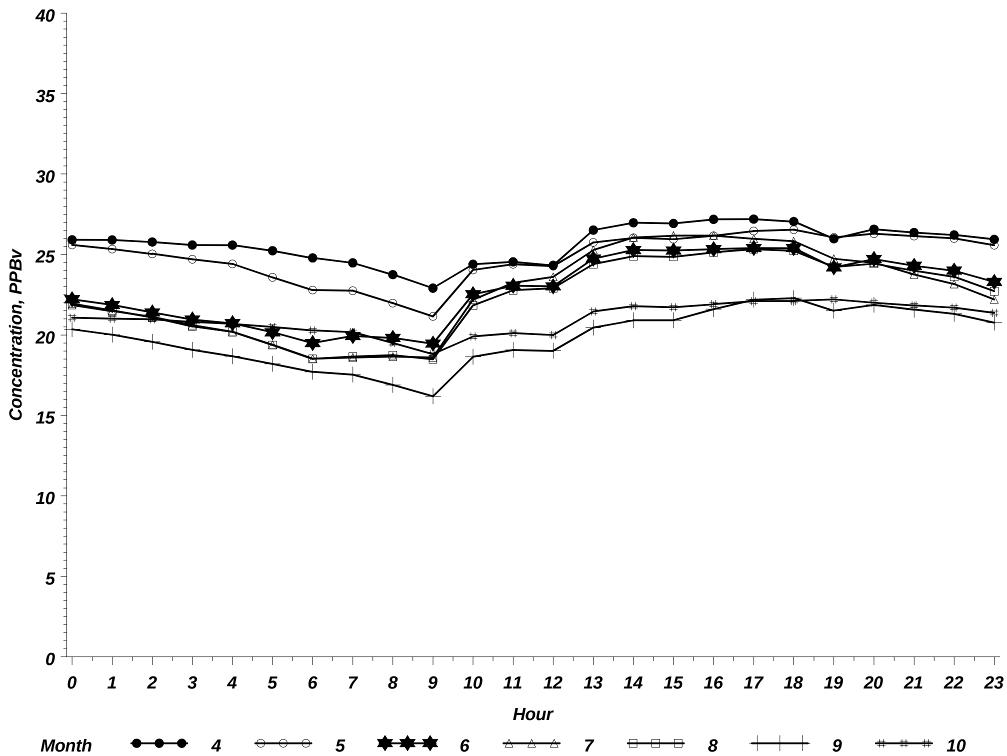
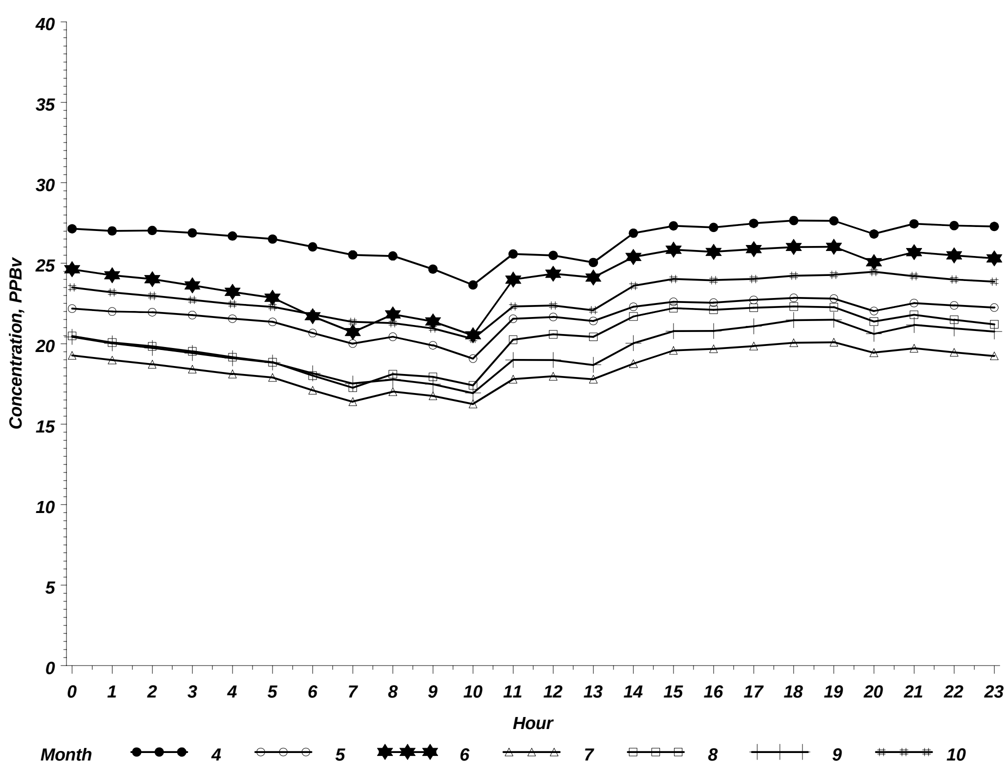


Figure 2A-12. Washington CSA: Diurnal Policy Relevant Background Ozone Patterns.



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	98^{th} %	99^{th} %	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	98^{th} %	99^{th} %	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	98th %	99th %	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	98^{th} %	99^{th} %	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	98th %	99th %	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	98^{th} %	99^{th} %	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/m^3	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/m^2 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/m^2 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/m² 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/m² 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]		Exposure Duration and Activity	Exposure Conditions	Number and Gender of Subjects	Subject Characteristics	Observed Effect(s)	Reference
ppm	μg/m³						
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, children, moderate exertion, 2002

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	64%	47%	47%	38%	29%	24%	23%	13%	3%
Boston	62%	49%	43%	42%	39%	30%	24%	22%	9%
Chicago	67%	49%	44%	40%	32%	25%	20%	15%	3%
Cleveland	74%	61%	56%	54%	44%	40%	32%	29%	12%
Detroit	70%	58%	51%	50%	48%	34%	26%	22%	6%
Houston	55%	23%	18%	16%	9%	8%	6%	4%	1%
Los Angeles	61%	7%	7%	5%	1%	1%	1%	1%	0%
New York	71%	45%	41%	37%	20%	22%	18%	13%	3%
Philadelphia	74%	61%	56%	54%	44%	42%	36%	32%	15%
Sacramento	64%	32%	27%	23%	13%	12%	9%	6%	1%
St. Louis	70%	64%	61%	59%	51%	46%	41%	35%	15%
Washington	72%	56%	49%	49%	40%	35%	28%	25%	10%

Table 4A-2. Percent 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	47%	28%	.	.	.	7%	.	.	0%
Boston	32%	22%	.	.	.	7%	.	.	1%
Chicago	29%	19%	.	.	.	5%	.	.	0%
Cleveland	42%	16%	.	.	.	5%	.	.	0%
Detroit	50%	20%	.	.	.	6%	.	.	0%
Houston	64%	17%	.	.	.	3%	.	.	0%
Los Angeles	71%	8%	.	.	.	2%	.	.	0%
New York	53%	21%	.	.	.	6%	.	.	0%
Philadelphia	55%	31%	.	.	.	11%	.	.	1%
Sacramento	57%	14%	.	.	.	3%	.	.	0%
St. Louis	54%	38%	.	.	.	14%	.	.	1%
Washington	41%	15%	.	.	.	5%	.	.	0%

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, children, moderate exertion, 2004

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	43%	21%	20%	14%	8%	6%	5%	2%	0%
Boston	23%	9%	6%	5%	4%	2%	1%	0%	0%
Chicago	9%	1%	1%	0%	0%	0%	0%	0%	0%
Cleveland	23%	4%	2%	2%	0%	0%	0%	0%	0%
Detroit	20%	7%	4%	3%	2%	0%	0%	0%	0%
Houston	54%	22%	17%	15%	9%	7%	5%	4%	1%
Los Angeles	67%	5%	4%	3%	1%	1%	1%	0%	0%
New York	29%	4%	3%	2%	0%	0%	0%	0%	0%
Philadelphia	41%	12%	8%	7%	2%	1%	1%	0%	0%
Sacramento	40%	5%	4%	2%	1%	0%	0%	0%	0%
St. Louis	18%	7%	4%	3%	1%	0%	0%	0%	0%
Washington	41%	16%	11%	10%	5%	4%	2%	1%	0%

Table 4A-4. Percent 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	34%	15%	13%	8%	4%	3%	3%	1%	0%
Boston	41%	24%	18%	17%	15%	9%	6%	5%	1%
Chicago	40%	18%	14%	10%	5%	3%	2%	0%	0%
Cleveland	57%	31%	23%	22%	10%	8%	3%	2%	0%
Detroit	46%	26%	18%	16%	14%	4%	1%	0%	0%
Houston	26%	6%	3%	3%	1%	1%	0%	0%	0%
Los Angeles	35%	1%	1%	0%	0%	0%	0%	0%	0%
New York	49%	14%	11%	8%	2%	2%	1%	1%	0%
Philadelphia	57%	33%	27%	24%	13%	11%	7%	5%	0%
Sacramento	36%	7%	5%	3%	1%	1%	0%	0%	0%
St. Louis	50%	37%	30%	27%	15%	12%	8%	4%	0%
Washington	50%	26%	18%	17%	11%	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, children, moderate exertion, 2003

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	13%	4%	.	.	.	1%	.	.	0%
Boston	9%	5%	.	.	.	1%	.	.	0%
Chicago	7%	3%	.	.	.	0%	.	.	0%
Cleveland	18%	4%	.	.	.	0%	.	.	0%
Detroit	25%	5%	.	.	.	0%	.	.	0%
Houston	38%	2%	.	.	.	0%	.	.	0%
Los Angeles	48%	1%	.	.	.	0%	.	.	0%
New York	27%	5%	.	.	.	0%	.	.	0%
Philadelphia	30%	10%	.	.	.	2%	.	.	0%
Sacramento	26%	2%	.	.	.	0%	.	.	0%
St. Louis	23%	10%	.	.	.	2%	.	.	0%
Washington	16%	5%	.	.	.	1%	.	.	0%

Table 4A-6. Percent 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	13%	4%	4%	2%	1%	0%	0%	0%	0%
Boston	6%	1%	1%	0%	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	26%	5%	3%	3%	1%	1%	0%	0%	0%
Los Angeles	37%	0%	0%	0%	0%	0%	0%	0%	0%
New York	8%	0%	0%	0%	0%	0%	0%	0%	0%
Philadelphia	11%	1%	0%	0%	0%	0%	0%	0%	0%
Sacramento	9%	0%	0%	0%	0%	0%	0%	0%	0%
St. Louis	1%	0%	0%	0%	0%	0%	0%	0%	0%
Washington	14%	3%	2%	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, children, moderate exertion, 2002

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	11%	3%	2%	1%	0%	0%	0%	0%	0%
Boston	20%	8%	6%	5%	4%	1%	1%	1%	0%
Chicago	15%	2%	1%	1%	0%	0%	0%	0%	0%
Cleveland	31%	6%	2%	1%	0%	0%	0%	0%	0%
Detroit	18%	3%	1%	1%	0%	0%	0%	0%	0%
Houston	11%	1%	1%	0%	0%	0%	0%	0%	0%
Los Angeles	16%	0%	0%	0%	0%	0%	0%	0%	0%
New York	25%	2%	1%	1%	0%	0%	0%	0%	0%
Philadelphia	34%	9%	5%	4%	1%	1%	0%	0%	0%
Sacramento	13%	1%	0%	0%	0%	0%	0%	0%	0%
St. Louis	21%	10%	6%	4%	1%	1%	0%	0%	0%
Washington	25%	7%	3%	3%	1%	0%	0%	0%	0%

Table 4A-8. Percent 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	3%	1%	.	.	.	0%	.	.	0%
Boston	2%	1%	.	.	.	0%	.	.	0%
Chicago	1%	0%	.	.	.	0%	.	.	0%
Cleveland	7%	1%	.	.	.	0%	.	.	0%
Detroit	10%	1%	.	.	.	0%	.	.	0%
Houston	15%	0%	.	.	.	0%	.	.	0%
Los Angeles	25%	0%	.	.	.	0%	.	.	0%
New York	11%	1%	.	.	.	0%	.	.	0%
Philadelphia	13%	3%	.	.	.	0%	.	.	0%
Sacramento	7%	0%	.	.	.	0%	.	.	0%
St. Louis	7%	2%	.	.	.	0%	.	.	0%
Washington	7%	1%	.	.	.	0%	.	.	0%

Numbers are rounded to the nearest percent.

Table 4A-9. Percent 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	3%	0%	0%	0%	0%	0%	0%	0%	0%
Boston	1%	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	9%	1%	0%	0%	0%	0%	0%	0%	0%
Los Angeles	13%	0%	0%	0%	0%	0%	0%	0%	0%
New York	1%	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	4%	0%	0%	0%	0%	0%	0%	0%	0%

Table 4A-10. Percent 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	69%	52%	51%	42%	32%	27%	27%	15%	4%
Boston	65%	51%	45%	44%	41%	31%	24%	22%	10%
Chicago	68%	51%	46%	41%	35%	27%	22%	16%	3%
Cleveland	75%	62%	56%	54%	43%	40%	33%	29%	12%
Detroit	71%	58%	51%	49%	47%	34%	26%	22%	5%
Houston	57%	24%	19%	17%	9%	8%	6%	4%	1%
Los Angeles	63%	7%	6%	5%	2%	1%	1%	1%	0%
New York	75%	47%	43%	39%	22%	25%	20%	15%	3%
Philadelphia	78%	65%	60%	59%	48%	45%	38%	35%	16%
Sacramento	68%	34%	29%	24%	14%	12%	11%	7%	1%
St. Louis	72%	65%	63%	61%	52%	48%	42%	36%	15%
Washington	76%	62%	55%	55%	45%	38%	31%	27%	11%

Numbers are rounded to the nearest percent.

Table 4A-11. Percent 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	51%	28%	.	.	.	9%	.	.	0%
Boston	35%	24%	.	.	.	8%	.	.	1%
Chicago	31%	19%	.	.	.	4%	.	.	0%
Cleveland	41%	16%	.	.	.	5%	.	.	0%
Detroit	50%	20%	.	.	.	6%	.	.	0%
Houston	68%	19%	.	.	.	4%	.	.	0%
Los Angeles	75%	8%	.	.	.	2%	.	.	0%
New York	56%	24%	.	.	.	6%	.	.	0%
Philadelphia	59%	35%	.	.	.	13%	.	.	1%
Sacramento	58%	13%	.	.	.	3%	.	.	0%
St. Louis	54%	37%	.	.	.	14%	.	.	1%
Washington	43%	17%	.	.	.	5%	.	.	0%

Table 4A-12. Percent 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	45%	21%	20%	14%	8%	6%	5%	2%	0%
Boston	24%	9%	6%	6%	5%	2%	1%	0%	0%
Chicago	10%	1%	1%	0%	0%	0%	0%	0%	0%
Cleveland	23%	5%	3%	2%	0%	0%	0%	0%	0%
Detroit	21%	7%	5%	4%	3%	0%	0%	0%	0%
Houston	58%	22%	16%	15%	9%	7%	4%	3%	1%
Los Angeles	67%	6%	5%	3%	1%	1%	1%	0%	0%
New York	31%	5%	4%	3%	0%	0%	0%	0%	0%
Philadelphia	44%	13%	9%	7%	2%	2%	1%	0%	0%
Sacramento	41%	6%	4%	3%	1%	0%	0%	0%	0%
St. Louis	19%	7%	4%	3%	0%	0%	0%	0%	0%
Washington	44%	18%	12%	12%	5%	4%	2%	1%	0%

Table 4A-13. Percent 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	38%	17%	16%	10%	5%	4%	4%	1%	0%
Boston	43%	24%	19%	18%	15%	9%	6%	5%	1%
Chicago	41%	19%	14%	11%	6%	3%	1%	0%	0%
Cleveland	57%	31%	24%	22%	10%	9%	3%	2%	0%
Detroit	44%	25%	17%	16%	13%	4%	1%	0%	0%
Houston	28%	6%	3%	3%	1%	1%	1%	0%	0%
Los Angeles	36%	1%	1%	0%	0%	0%	0%	0%	0%
New York	52%	16%	12%	8%	2%	3%	1%	1%	0%
Philadelphia	61%	35%	28%	25%	14%	12%	8%	6%	1%
Sacramento	39%	8%	5%	4%	2%	1%	0%	0%	0%
St. Louis	51%	38%	32%	27%	16%	13%	8%	5%	0%
Washington	56%	28%	20%	19%	12%	8%	4%	3%	0%

Table 4A-14. Percent 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	15%	5%	.	.	.	1%	.	.	0%
Boston	10%	6%	.	.	.	1%	.	.	0%
Chicago	6%	3%	.	.	.	0%	.	.	0%
Cleveland	18%	4%	.	.	.	0%	.	.	0%
Detroit	25%	5%	.	.	.	1%	.	.	0%
Houston	42%	3%	.	.	.	0%	.	.	0%
Los Angeles	53%	2%	.	.	.	0%	.	.	0%
New York	30%	6%	.	.	.	0%	.	.	0%
Philadelphia	33%	12%	.	.	.	2%	.	.	0%
Sacramento	26%	2%	.	.	.	0%	.	.	0%
St. Louis	22%	11%	.	.	.	2%	.	.	0%
Washington	18%	5%	.	.	.	0%	.	.	0%

Numbers are rounded to the nearest percent.

Table 4A-15. Percent 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	13%	4%	3%	2%	1%	0%	0%	0%	0%
Boston	7%	1%	0%	0%	0%	0%	0%	0%	0%
Chicago	1%	0%	0%	0%	0%	0%	0%	0%	0%
Cleveland	5%	0%	0%	0%	0%	0%	0%	0%	0%
Detroit	4%	0%	0%	0%	0%	0%	0%	0%	0%
Houston	27%	5%	3%	3%	1%	1%	0%	0%	0%
Los Angeles	38%	1%	0%	0%	0%	0%	0%	0%	0%
New York	9%	0%	0%	0%	0%	0%	0%	0%	0%
Philadelphia	12%	1%	1%	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	16%	4%	2%	1%	0%	0%	0%	0%	0%

Table 4A-16. Percent 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	12%	3%	3%	1%	0%	0%	0%	0%	0%
Boston	21%	9%	6%	6%	5%	2%	1%	0%	0%
Chicago	16%	3%	1%	0%	0%	0%	0%	0%	0%
Cleveland	31%	7%	2%	2%	0%	0%	0%	0%	0%
Detroit	18%	3%	1%	0%	0%	0%	0%	0%	0%
Houston	10%	1%	1%	0%	0%	0%	0%	0%	0%
Los Angeles	17%	0%	0%	0%	0%	0%	0%	0%	0%
New York	28%	3%	1%	1%	0%	0%	0%	0%	0%
Philadelphia	36%	10%	6%	5%	1%	1%	0%	0%	0%
Sacramento	14%	1%	0%	0%	0%	0%	0%	0%	0%
St. Louis	21%	10%	6%	4%	2%	1%	0%	0%	0%
Washington	27%	7%	3%	3%	1%	1%	0%	0%	0%

Numbers are rounded to the nearest percent.

Table 4A-17. Percent 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	4%	1%	.	.	.	0%	.	.	0%
Boston	3%	1%	.	.	.	0%	.	.	0%
Chicago	1%	0%	.	.	.	0%	.	.	0%
Cleveland	7%	1%	.	.	.	0%	.	.	0%
Detroit	10%	1%	.	.	.	0%	.	.	0%
Houston	18%	0%	.	.	.	0%	.	.	0%
Los Angeles	28%	0%	.	.	.	0%	.	.	0%
New York	12%	1%	.	.	.	0%	.	.	0%
Philadelphia	15%	3%	.	.	.	0%	.	.	0%
Sacramento	7%	0%	.	.	.	0%	.	.	0%
St. Louis	7%	2%	.	.	.	0%	.	.	0%
Washington	8%	1%	.	.	.	0%	.	.	0%

Table 4A-18. Percent 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	2%	0%	0%	0%	0%	0%	0%	0%	0%
Boston	1%	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	9%	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	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	4%	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	603,000	448,000	439,000	359,000	278,000	222,000	219,000	125,000	31,400
Boston	678,000	536,000	467,000	460,000	427,000	329,000	268,000	238,000	102,000
Chicago	1,300,000	950,000	855,000	772,000	628,000	493,000	400,000	299,000	65,500
Cleveland	441,000	365,000	335,000	323,000	259,000	239,000	193,000	171,000	69,000
Detroit	773,000	642,000	570,000	552,000	530,000	378,000	294,000	249,000	61,900
Houston	597,000	251,000	198,000	178,000	99,700	87,700	65,200	44,400	8,590
Los Angeles	2,250,000	268,000	244,000	171,000	53,800	54,000	47,500	20,200	3,550
New York	2,940,000	1,850,000	1,690,000	1,530,000	826,000	918,000	752,000	530,000	116,000
Philadelphia	876,000	719,000	666,000	645,000	527,000	495,000	428,000	382,000	179,000
Sacramento	266,000	131,000	112,000	94,100	55,100	47,500	37,300	23,200	5,440
St. Louis	408,000	372,000	354,000	341,000	294,000	268,000	236,000	201,000	84,500
Washington	1,070,000	838,000	733,000	726,000	598,000	525,000	411,000	369,000	146,000

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	439,000	262,000	.	.	.	68,500	.	.	3,340
Boston	344,000	233,000	.	.	.	70,600	.	.	7,140
Chicago	573,000	378,000	.	.	.	90,800	.	.	1,090
Cleveland	250,000	94,600	.	.	.	29,800	.	.	933
Detroit	545,000	217,000	.	.	.	69,400	.	.	2,500
Houston	688,000	184,000	.	.	.	36,400	.	.	1,520
Los Angeles	2,550,000	277,000	.	.	.	67,400	.	.	3,550
New York	2,170,000	856,000	.	.	.	240,000	.	.	16,000
Philadelphia	653,000	371,000	.	.	.	128,000	.	.	10,800
Sacramento	234,000	59,000	.	.	.	14,000	.	.	289
St. Louis	314,000	222,000	.	.	.	82,000	.	.	6,750
Washington	607,000	231,000	.	.	.	69,700	.	.	4,670

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	404,000	203,000	190,000	134,000	75,700	54,000	50,900	21,200	1,670
Boston	254,000	97,500	63,100	58,600	46,300	18,700	10,800	5,430	0
Chicago	178,000	16,300	9,780	5,590	3,260	1,090	621	466	0
Cleveland	139,000	26,300	14,600	10,700	2,110	1,030	491	98	0
Detroit	224,000	73,200	42,200	32,700	23,700	3,120	268	179	0
Houston	593,000	242,000	184,000	160,000	92,700	76,400	53,800	39,200	9,070
Los Angeles	2,470,000	170,000	148,000	96,900	28,900	24,300	19,100	5,460	0
New York	1,190,000	169,000	121,000	80,800	4,630	8,190	2,490	356	0
Philadelphia	482,000	146,000	98,600	81,200	23,300	17,000	8,550	4,080	97
Sacramento	165,000	22,300	15,900	10,300	2,570	2,060	1,030	257	0
St. Louis	106,000	41,600	24,300	15,000	3,630	2,390	1,010	321	0
Washington	616,000	243,000	164,000	156,000	75,600	56,700	29,900	20,800	505

Table 4A-22. Number of people with 1 or more 8-hour exposures above 0.06 ppm-8hr, children, moderate exertion, mean over 2002-2004

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	482,000	304,000	.	.	.	115,000	.	.	12,100
Boston	425,000	289,000	.	.	.	139,000	.	.	36,400
Chicago	683,000	448,000	.	.	.	195,000	.	.	22,200
Cleveland	277,000	162,000	.	.	.	90,000	.	.	23,300
Detroit	514,000	311,000	.	.	.	150,000	.	.	21,500
Houston	626,000	226,000	.	.	.	66,800	.	.	6,390
Los Angeles	2,420,000	238,000	.	.	.	48,600	.	.	2,360
New York	2,100,000	960,000	.	.	.	388,000	.	.	44,100
Philadelphia	670,000	412,000	.	.	.	213,000	.	.	63,200
Sacramento	222,000	70,800	.	.	.	21,200	.	.	1,910
St. Louis	276,000	212,000	.	.	.	118,000	.	.	30,400
Washington	764,000	437,000	.	.	.	217,000	.	.	50,300

Numbers are rounded to 3 significant digits.

Table 4A-23. 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	325,000	139,000	127,000	78,800	39,900	26,700	25,800	7,350	0
Boston	445,000	263,000	196,000	190,000	161,000	94,300	64,000	50,200	9,240
Chicago	773,000	354,000	263,000	197,000	105,000	52,300	31,000	9,000	776
Cleveland	341,000	184,000	138,000	128,000	61,200	48,500	17,200	9,130	785
Detroit	514,000	286,000	197,000	177,000	153,000	43,300	12,100	5,450	0
Houston	284,000	66,600	37,800	32,000	11,600	8,100	5,220	2,810	160
Los Angeles	1,290,000	30,600	25,400	13,900	1,910	3,270	3,270	1,640	0
New York	2,030,000	581,000	449,000	321,000	75,500	97,900	55,200	24,200	3,920
Philadelphia	672,000	390,000	315,000	285,000	156,000	127,000	81,000	56,100	4,670
Sacramento	150,000	27,900	19,100	14,100	5,270	3,960	1,900	868	0
St. Louis	292,000	214,000	177,000	155,000	88,800	69,300	44,800	25,800	1,330
Washington	749,000	382,000	266,000	260,000	165,000	112,000	57,500	39,100	2,400

Table 4A-24. 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	122,000	40,800	.	.	.	4,930	.	.	0
Boston	98,700	54,200	.	.	.	9,430	.	.	476
Chicago	132,000	52,800	.	.	.	2,020	.	.	0
Cleveland	108,000	26,100	.	.	.	2,700	.	.	0
Detroit	274,000	52,200	.	.	.	5,090	.	.	0
Houston	405,000	21,200	.	.	.	1,120	.	.	0
Los Angeles	1,750,000	43,700	.	.	.	2,730	.	.	0
New York	1,120,000	204,000	.	.	.	18,200	.	.	0
Philadelphia	352,000	115,000	.	.	.	23,200	.	.	0
Sacramento	109,000	8,300	.	.	.	354	.	.	0
St. Louis	134,000	60,200	.	.	.	10,400	.	.	0
Washington	238,000	69,700	.	.	.	12,500	.	.	0

Numbers are rounded to 3 significant digits.

Table 4A-25. 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	125,000	39,000	34,100	17,900	5,760	3,030	2,350	152	0
Boston	63,400	14,800	5,900	4,950	2,670	286	0	0	0
Chicago	11,900	931	621	0	0	0	0	0	0
Cleveland	22,700	785	344	0	0	0	0	0	0
Detroit	33,300	804	89	89	0	0	0	0	0
Houston	285,000	56,700	37,800	32,200	10,300	8,670	3,370	1,440	0
Los Angeles	1,360,000	14,200	10,600	1,640	0	0	0	0	0
New York	322,000	8,540	1,780	712	0	0	0	0	0
Philadelphia	132,000	10,100	4,860	3,310	583	292	0	0	0
Sacramento	38,300	804	450	161	0	0	0	0	0
St. Louis	6,700	1,290	367	184	0	0	0	0	0
Washington	213,000	45,400	23,100	20,300	2,650	2,020	252	126	0

Table 4A-26. Number of people with 1 or more 8-hour exposures above 0.07 ppm-8hr, children, moderate exertion, mean over 2002-2004

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	191,000	72,800	.	.	.	11,500	.	.	0
Boston	202,000	111,000	.	.	.	34,700	.	.	3,240
Chicago	306,000	136,000	.	.	.	18,100	.	.	259
Cleveland	157,000	70,400	.	.	.	17,100	.	.	262
Detroit	274,000	113,000	.	.	.	16,100	.	.	0
Houston	325,000	48,200	.	.	.	5,960	.	.	54
Los Angeles	1,460,000	29,500	.	.	.	2,000	.	.	0
New York	1,160,000	264,000	.	.	.	38,700	.	.	1,310
Philadelphia	385,000	172,000	.	.	.	50,200	.	.	1,560
Sacramento	99,000	12,300	.	.	.	1,440	.	.	0
St. Louis	144,000	91,700	.	.	.	26,600	.	.	444
Washington	400,000	166,000	.	.	.	42,100	.	.	799

Numbers are rounded to 3 significant digits.

Table 4A-27. 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	99,900	24,200	22,900	10,400	4,170	1,140	1,060	0	0
Boston	221,000	93,000	60,700	57,500	46,600	15,900	7,140	5,520	571
Chicago	292,000	46,900	27,800	9,930	4,030	1,710	1,090	0	0
Cleveland	182,000	37,700	12,400	8,390	1,720	736	196	98	0
Detroit	201,000	31,700	8,660	6,790	4,200	89	0	0	0
Houston	115,000	10,000	6,180	3,850	481	642	80	0	0
Los Angeles	581,000	2,460	2,460	1,910	0	0	0	0	0
New York	1,020,000	90,400	50,500	27,800	5,340	7,480	2,140	356	0
Philadelphia	402,000	103,000	64,200	51,200	14,200	8,360	2,620	680	0
Sacramento	54,000	3,630	1,640	933	97	64	0	0	0
St. Louis	123,000	57,800	36,500	25,200	8,490	4,130	1,420	459	0
Washington	372,000	99,800	42,800	41,600	13,000	5,930	1,510	379	0

Table 4A-28. 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	25,100	6,970	.	.	.	0	.	.	0
Boston	23,800	11,600	.	.	.	1,140	.	.	0
Chicago	12,300	2,640	.	.	.	0	.	.	0
Cleveland	41,500	4,470	.	.	.	0	.	.	0
Detroit	111,000	6,250	.	.	.	0	.	.	0
Houston	159,000	1,120	.	.	.	0	.	.	0
Los Angeles	899,000	1,910	.	.	.	0	.	.	0
New York	443,000	31,000	.	.	.	356	.	.	0
Philadelphia	153,000	33,300	.	.	.	389	.	.	0
Sacramento	29,300	579	.	.	.	0	.	.	0
St. Louis	43,500	12,900	.	.	.	138	.	.	0
Washington	102,000	21,100	.	.	.	252	.	.	0

Table 4A-29. 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	27,500	3,710	3,340	531	0	0	0	0	0
Boston	12,200	952	0	0	0	0	0	0	0
Chicago	1,240	0	0	0	0	0	0	0	0
Cleveland	1,520	0	0	0	0	0	0	0	0
Detroit	268	0	0	0	0	0	0	0	0
Houston	102,000	9,950	4,490	3,290	80	80	0	0	0
Los Angeles	494,000	0	0	0	0	0	0	0	0
New York	55,900	0	0	0	0	0	0	0	0
Philadelphia	18,000	486	0	0	0	0	0	0	0
Sacramento	4,890	0	0	0	0	0	0	0	0
St. Louis	138	0	0	0	0	0	0	0	0
Washington	58,900	2,650	757	883	126	0	0	0	0

Table 4A-30. Number of people with 1 or more 8-hour exposures above 0.08 ppm-8hr, children, moderate exertion, mean over 2002-2004

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	50,800	11,600	.	.	.	379	.	.	0
Boston	85,600	35,200	.	.	.	5,680	.	.	190
Chicago	102,000	16,500	.	.	.	569	.	.	0
Cleveland	74,900	14,100	.	.	.	245	.	.	0
Detroit	104,000	12,600	.	.	.	30	.	.	0
Houston	125,000	7,030	.	.	.	241	.	.	0
Los Angeles	658,000	1,460	.	.	.	0	.	.	0
New York	507,000	40,500	.	.	.	2,610	.	.	0
Philadelphia	191,000	45,700	.	.	.	2,920	.	.	0
Sacramento	29,400	1,400	.	.	.	21	.	.	0
St. Louis	55,500	23,600	.	.	.	1,420	.	.	0
Washington	178,000	41,200	.	.	.	2,060	.	.	0

Numbers are rounded to 3 significant digits.

Table 4A-31. 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	80,300	61,100	60,000	48,700	37,400	31,400	31,000	17,400	5,150
Boston	118,000	93,400	81,800	81,000	74,200	56,000	44,500	39,900	18,200
Chicago	190,000	143,000	129,000	116,000	96,500	75,000	60,800	44,700	9,780
Cleveland	66,900	54,700	49,700	48,300	38,400	35,600	29,300	25,900	10,300
Detroit	114,000	94,400	82,200	79,100	75,500	54,900	41,500	35,700	8,480
Houston	77,400	32,100	25,500	22,800	12,400	11,200	8,180	5,380	883
Los Angeles	289,000	32,200	29,500	21,000	7,090	6,820	6,280	2,460	546
New York	479,000	302,000	278,000	252,000	143,000	161,000	130,000	94,300	21,000
Philadelphia	151,000	126,000	116,000	113,000	91,800	85,700	73,000	66,500	31,400
Sacramento	34,800	17,500	14,800	12,400	7,300	6,400	5,500	3,380	675
St. Louis	59,500	53,800	52,000	50,100	43,000	39,400	34,400	29,500	12,100
Washington	142,000	115,000	103,000	102,000	83,300	71,000	57,200	50,000	19,700

Table 4A-32. 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	56,800	31,400	.	.	.	9,630	.	.	455
Boston	60,500	42,300	.	.	.	13,700	.	.	1,240
Chicago	84,300	52,800	.	.	.	12,100	.	.	155
Cleveland	34,300	13,700	.	.	.	4,220	.	.	49
Detroit	78,400	31,500	.	.	.	9,820	.	.	536
Houston	88,200	25,400	.	.	.	5,780	.	.	321
Los Angeles	338,000	37,900	.	.	.	10,600	.	.	1,090
New York	371,000	156,000	.	.	.	42,000	.	.	1,780
Philadelphia	112,000	65,400	.	.	.	23,700	.	.	2,430
Sacramento	28,500	6,470	.	.	.	1,480	.	.	32
St. Louis	46,000	31,600	.	.	.	12,100	.	.	1,190
Washington	79,800	30,900	.	.	.	9,340	.	.	631

Numbers are rounded to 3 significant digits.

Table 4A-33. 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	53,000	24,100	22,800	16,000	9,780	6,750	5,840	2,120	227
Boston	43,800	17,200	11,400	10,900	8,290	3,050	1,520	762	0
Chicago	27,900	2,640	1,710	1,090	621	155	155	155	0
Cleveland	20,600	4,710	2,500	1,770	393	245	49	49	0
Detroit	34,600	12,100	7,770	5,710	4,550	357	0	0	0
Houston	78,000	29,900	22,300	20,400	11,600	9,630	6,020	3,690	883
Los Angeles	306,000	27,000	24,000	15,600	5,180	4,910	3,550	546	0
New York	200,000	29,900	23,500	17,100	1,420	1,420	1,420	356	0
Philadelphia	84,500	24,800	16,500	14,200	4,570	3,400	1,460	680	0
Sacramento	21,000	2,890	2,090	1,510	257	161	97	0	0
St. Louis	15,700	5,920	3,300	2,200	321	138	46	0	0
Washington	81,100	34,500	22,100	21,700	9,970	7,450	4,040	2,650	0

Table 4A-34. Number of people with 1 or more 8-hour exposures above 0.06 ppm-8hr, asthmatic children, moderate exertion, mean over 2002-2004

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	63,400	38,900	.	.	.	15,900	.	.	1,950
Boston	74,100	51,000	.	.	.	24,300	.	.	6,480
Chicago	101,000	66,200	.	.	.	29,100	.	.	3,310
Cleveland	40,600	24,400	.	.	.	13,400	.	.	3,440
Detroit	75,800	46,000	.	.	.	21,700	.	.	3,010
Houston	81,200	29,100	.	.	.	8,850	.	.	695
Los Angeles	311,000	32,400	.	.	.	7,460	.	.	546
New York	350,000	162,000	.	.	.	68,100	.	.	7,590
Philadelphia	116,000	72,100	.	.	.	37,600	.	.	11,300
Sacramento	28,100	8,960	.	.	.	2,680	.	.	236
St. Louis	40,400	30,500	.	.	.	17,200	.	.	4,440
Washington	101,000	60,100	.	.	.	29,300	.	.	6,770

Numbers are rounded to 3 significant digits.

Table 4A-35. 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	44,900	19,900	18,200	11,200	6,290	4,400	4,400	910	0
Boston	78,100	44,500	34,200	33,200	27,700	17,100	11,700	9,430	1,810
Chicago	116,000	53,200	39,400	31,000	16,600	8,220	3,880	621	310
Cleveland	50,900	27,600	20,900	19,300	9,280	7,900	2,800	1,670	196
Detroit	71,900	41,200	28,000	25,200	21,000	6,340	2,050	625	0
Houston	37,300	8,750	4,570	3,610	1,440	802	722	321	80
Los Angeles	167,000	4,090	3,270	1,360	546	546	546	546	0
New York	334,000	100,000	78,300	54,500	12,800	18,200	8,900	4,980	356
Philadelphia	117,000	66,900	54,700	48,400	26,700	22,800	14,900	11,000	972
Sacramento	19,800	4,050	2,570	1,990	772	611	161	97	0
St. Louis	42,400	31,400	26,200	22,700	13,000	10,600	6,430	3,810	184
Washington	105,000	52,600	36,500	35,100	22,300	14,900	7,570	5,430	505

Table 4A-36. 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	16,100	6,060	.	.	.	758	.	.	0
Boston	18,300	11,000	.	.	.	1,710	.	.	0
Chicago	17,500	7,450	.	.	.	310	.	.	0
Cleveland	15,200	3,580	.	.	.	393	.	.	0
Detroit	40,200	7,500	.	.	.	982	.	.	0
Houston	54,600	3,530	.	.	.	241	.	.	0
Los Angeles	237,000	6,820	.	.	.	546	.	.	0
New York	195,000	38,400	.	.	.	2,490	.	.	0
Philadelphia	62,100	22,400	.	.	.	4,470	.	.	0
Sacramento	12,700	997	.	.	.	32	.	.	0
St. Louis	18,800	9,230	.	.	.	1,610	.	.	0
Washington	32,200	9,090	.	.	.	883	.	.	0

Table 4A-37. 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	15,200	4,320	3,790	2,050	682	455	455	0	0
Boston	11,900	2,190	857	667	286	0	0	0	0
Chicago	2,020	155	155	0	0	0	0	0	0
Cleveland	4,120	98	0	0	0	0	0	0	0
Detroit	6,070	179	0	0	0	0	0	0	0
Houston	36,100	6,580	4,090	3,530	1,040	1,040	160	80	0
Los Angeles	176,000	2,460	1,360	273	0	0	0	0	0
New York	55,900	2,140	712	712	0	0	0	0	0
Philadelphia	22,600	1,940	1,070	583	194	0	0	0	0
Sacramento	5,020	64	0	0	0	0	0	0	0
St. Louis	1,010	138	0	0	0	0	0	0	0
Washington	30,000	6,560	3,150	2,650	379	252	126	0	0

Table 4A-38. Number of people with 1 or more 8-hour exposures above 0.07 ppm-8hr, asthmatic children, moderate exertion, mean over 2002-2004

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	25,400	10,100	.	.	.	1,870	.	.	0
Boston	36,100	19,200	.	.	.	6,290	.	.	603
Chicago	45,100	20,300	.	.	.	2,840	.	.	103
Cleveland	23,400	10,400	.	.	.	2,770	.	.	66
Detroit	39,400	16,300	.	.	.	2,440	.	.	0
Houston	42,700	6,290	.	.	.	695	.	.	27
Los Angeles	193,000	4,460	.	.	.	364	.	.	0
New York	195,000	47,000	.	.	.	6,880	.	.	119
Philadelphia	67,200	30,400	.	.	.	9,110	.	.	324
Sacramento	12,500	1,700	.	.	.	214	.	.	0
St. Louis	20,700	13,600	.	.	.	4,070	.	.	61
Washington	55,700	22,800	.	.	.	5,340	.	.	168

Numbers are rounded to 3 significant digits.

Table 4A-39. 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	14,300	3,790	3,410	1,440	531	152	152	0	0
Boston	38,100	16,100	10,900	10,400	8,670	2,950	1,620	762	95
Chicago	44,200	7,450	3,570	466	310	310	155	0	0
Cleveland	27,100	6,630	2,210	1,470	442	245	49	0	0
Detroit	28,700	4,460	982	714	268	0	0	0	0
Houston	13,900	1,120	722	481	80	80	0	0	0
Los Angeles	76,400	546	546	546	0	0	0	0	0
New York	178,000	16,700	8,900	4,980	1,070	1,070	712	0	0
Philadelphia	68,500	19,100	12,000	10,000	2,820	1,360	583	194	0
Sacramento	7,430	418	161	129	0	0	0	0	0
St. Louis	17,500	8,260	5,280	3,490	1,380	734	275	46	0
Washington	51,100	13,000	5,800	5,800	2,150	1,260	505	126	0

Table 4A-40. 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	4,170	1,140	.	.	.	0	.	.	0
Boston	5,430	2,480	.	.	.	95	.	.	0
Chicago	1,710	466	.	.	.	0	.	.	0
Cleveland	5,650	687	.	.	.	0	.	.	0
Detroit	15,400	1,340	.	.	.	0	.	.	0
Houston	23,100	160	.	.	.	0	.	.	0
Los Angeles	126,000	273	.	.	.	0	.	.	0
New York	80,800	5,340	.	.	.	0	.	.	0
Philadelphia	28,500	6,220	.	.	.	0	.	.	0
Sacramento	3,350	97	.	.	.	0	.	.	0
St. Louis	6,380	2,070	.	.	.	0	.	.	0
Washington	15,400	1,390	.	.	.	126	.	.	0

Numbers are rounded to 3 significant digits.

Table 4A-41. 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	2,800	531	531	76	0	0	0	0	0
Boston	1,810	0	0	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	12,400	1,440	642	401	0	0	0	0	0
Los Angeles	73,700	0	0	0	0	0	0	0	0
New York	11,400	0	0	0	0	0	0	0	0
Philadelphia	3,310	194	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	8,080	505	252	252	0	0	0	0	0

Table 4A-42. Number of people with 1 or more 8-hour exposures above 0.08 ppm-8hr, asthmatic children, moderate exertion, mean over 2002-2004

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	7,100	1,820	.	.	.	51	.	.	0
Boston	15,100	6,190	.	.	.	1,020	.	.	32
Chicago	15,400	2,640	.	.	.	103	.	.	0
Cleveland	11,000	2,440	.	.	.	82	.	.	0
Detroit	14,700	1,930	.	.	.	0	.	.	0
Houston	16,500	909	.	.	.	27	.	.	0
Los Angeles	92,000	273	.	.	.	0	.	.	0
New York	90,200	7,360	.	.	.	356	.	.	0
Philadelphia	33,400	8,490	.	.	.	454	.	.	0
Sacramento	3,800	172	.	.	.	0	.	.	0
St. Louis	7,970	3,440	.	.	.	245	.	.	0
Washington	24,900	4,960	.	.	.	463	.	.	0

Table 4A-43. 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	1,570,000	810,000	782,000	562,000	381,000	285,000	280,000	144,000	32,700
Boston	1,810,000	1,060,000	827,000	808,000	714,000	483,000	365,000	312,000	117,000
Chicago	3,440,000	1,680,000	1,390,000	1,180,000	875,000	634,000	491,000	351,000	68,400
Cleveland	1,760,000	895,000	718,000	675,000	447,000	394,000	288,000	242,000	80,800
Detroit	2,350,000	1,360,000	1,060,000	993,000	919,000	538,000	381,000	306,000	64,800
Houston	1,200,000	317,000	234,000	207,000	110,000	94,900	69,000	46,100	8,670
Los Angeles	8,310,000	359,000	320,000	212,000	59,500	62,500	54,600	20,500	3,550
New York	10,300,000	3,390,000	2,860,000	2,420,000	1,090,000	1,220,000	959,000	639,000	131,000
Philadelphia	3,970,000	1,950,000	1,610,000	1,500,000	1,000,000	890,000	701,000	591,000	222,000
Sacramento	805,000	211,000	169,000	134,000	69,700	58,100	44,000	26,600	5,690
St. Louis	1,320,000	945,000	812,000	737,000	536,000	458,000	372,000	292,000	97,600
Washington	3,680,000	1,820,000	1,390,000	1,370,000	992,000	807,000	573,000	497,000	171,000

Table 4A-44. 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	756,000	350,000	.	.	.	74,100	.	.	3,410
Boston	503,000	296,000	.	.	.	76,200	.	.	7,140
Chicago	802,000	466,000	.	.	.	95,900	.	.	1,090
Cleveland	442,000	113,000	.	.	.	31,500	.	.	982
Detroit	1,070,000	263,000	.	.	.	75,200	.	.	2,500
Houston	1,730,000	218,000	.	.	.	38,300	.	.	1,530
Los Angeles	11,800,000	424,000	.	.	.	81,900	.	.	3,820
New York	4,360,000	1,060,000	.	.	.	262,000	.	.	16,700
Philadelphia	1,430,000	516,000	.	.	.	141,000	.	.	11,200
Sacramento	586,000	78,800	.	.	.	15,700	.	.	290
St. Louis	634,000	333,000	.	.	.	92,100	.	.	6,980
Washington	970,000	273,000	.	.	.	72,900	.	.	4,670

Table 4A-45. 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	649,000	248,000	231,000	153,000	81,800	56,500	53,000	21,800	1,670
Boston	335,000	110,000	68,700	63,200	49,600	19,100	10,800	5,430	0
Chicago	194,000	17,100	10,100	5,900	3,410	1,090	621	466	0
Cleveland	192,000	28,500	15,100	10,900	2,110	1,030	491	98	0
Detroit	267,000	76,500	43,100	33,300	24,000	3,130	268	179	0
Houston	1,260,000	315,000	223,000	191,000	104,000	84,200	57,300	41,000	9,230
Los Angeles	9,480,000	214,000	179,000	111,000	30,300	24,600	19,400	5,460	0
New York	1,690,000	184,000	129,000	84,000	4,630	8,190	2,490	356	0
Philadelphia	810,000	165,000	107,000	86,800	23,500	17,000	8,550	4,080	97
Sacramento	292,000	25,700	17,800	11,200	2,730	2,090	1,030	257	0
St. Louis	130,000	45,600	25,500	15,500	3,720	2,430	1,060	321	0
Washington	983,000	281,000	177,000	168,000	77,600	57,700	30,200	21,000	505

Table 4A-46. Number of person-days with 8-hour exposures above 0.06 ppm-8hr, children, moderate exertion, mean over 2002-2004

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	2,970,000	1,410,000	.	.	.	415,000	.	.	37,800
Boston	2,650,000	1,470,000	.	.	.	578,000	.	.	124,000
Chicago	4,440,000	2,160,000	.	.	.	731,000	.	.	69,500
Cleveland	2,390,000	1,040,000	.	.	.	427,000	.	.	81,800
Detroit	3,690,000	1,700,000	.	.	.	617,000	.	.	67,300
Houston	4,190,000	849,000	.	.	.	217,000	.	.	19,400
Los Angeles	29,600,000	998,000	.	.	.	169,000	.	.	7,370
New York	16,400,000	4,630,000	.	.	.	1,490,000	.	.	147,000
Philadelphia	6,210,000	2,640,000	.	.	.	1,050,000	.	.	233,000
Sacramento	1,680,000	315,000	.	.	.	75,900	.	.	5,980
St. Louis	2,080,000	1,320,000	.	.	.	552,000	.	.	105,000
Washington	5,630,000	2,380,000	.	.	.	937,000	.	.	176,000

Numbers are rounded to 3 significant digits.

Table 4A-47. 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	480,000	161,000	147,000	86,600	42,400	27,500	26,500	7,430	0
Boston	744,000	352,000	242,000	234,000	192,000	106,000	70,100	54,000	9,810
Chicago	1,170,000	422,000	300,000	218,000	111,000	54,300	32,000	9,000	776
Cleveland	750,000	265,000	179,000	163,000	69,800	53,900	18,100	9,670	785
Detroit	869,000	364,000	231,000	203,000	172,000	45,600	12,400	5,630	0
Houston	367,000	70,100	39,100	32,800	11,700	8,110	5,220	2,810	161
Los Angeles	2,850,000	32,500	26,200	14,200	1,910	3,270	3,270	1,640	0
New York	3,970,000	701,000	523,000	359,000	80,100	105,000	58,000	26,700	3,920
Philadelphia	1,630,000	607,000	446,000	390,000	190,000	150,000	91,300	59,600	4,670
Sacramento	253,000	31,800	21,500	15,500	5,530	4,050	1,900	868	0
St. Louis	527,000	316,000	242,000	201,000	102,000	77,300	48,700	26,900	1,330
Washington	1,440,000	511,000	334,000	322,000	192,000	126,000	61,600	41,800	2,400

Table 4A-48. 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	138,000	43,400	.	.	.	4,930	.	.	0
Boston	109,000	56,500	.	.	.	9,430	.	.	476
Chicago	141,000	54,900	.	.	.	2,020	.	.	0
Cleveland	131,000	27,500	.	.	.	2,750	.	.	0
Detroit	355,000	55,800	.	.	.	5,090	.	.	0
Houston	613,000	21,700	.	.	.	1,120	.	.	0
Los Angeles	4,700,000	50,800	.	.	.	3,000	.	.	0
New York	1,490,000	219,000	.	.	.	18,900	.	.	0
Philadelphia	475,000	125,000	.	.	.	23,900	.	.	0
Sacramento	161,000	8,750	.	.	.	354	.	.	0
St. Louis	166,000	64,700	.	.	.	10,700	.	.	0
Washington	279,000	72,700	.	.	.	12,800	.	.	0

Table 4A-49. 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	142,000	40,500	35,300	18,000	5,760	3,030	2,350	152	0
Boston	68,800	14,900	5,910	4,950	2,670	286	0	0	0
Chicago	12,300	931	621	0	0	0	0	0	0
Cleveland	24,100	785	344	0	0	0	0	0	0
Detroit	33,900	804	89	89	0	0	0	0	0
Houston	381,000	59,900	39,400	33,500	10,400	8,830	3,370	1,440	0
Los Angeles	2,770,000	14,200	10,600	1,640	0	0	0	0	0
New York	355,000	8,540	1,780	712	0	0	0	0	0
Philadelphia	147,000	10,100	4,860	3,310	583	292	0	0	0
Sacramento	45,300	804	450	161	0	0	0	0	0
St. Louis	6,840	1,330	367	184	0	0	0	0	0
Washington	238,000	46,100	23,200	20,300	2,650	2,020	252	126	0

Table 4A-50. Number of person-days with 8-hour exposures above 0.07 ppm-8hr, children, moderate exertion, mean over 2002-2004

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	760,000	245,000	.	.	.	35,500	.	.	0
Boston	921,000	423,000	.	.	.	116,000	.	.	10,300
Chicago	1,330,000	478,000	.	.	.	56,300	.	.	776
Cleveland	904,000	293,000	.	.	.	56,600	.	.	785
Detroit	1,260,000	420,000	.	.	.	50,700	.	.	0
Houston	1,360,000	152,000	.	.	.	18,100	.	.	161
Los Angeles	10,300,000	97,400	.	.	.	6,280	.	.	0
New York	5,810,000	928,000	.	.	.	124,000	.	.	3,920
Philadelphia	2,260,000	742,000	.	.	.	174,000	.	.	4,670
Sacramento	459,000	41,400	.	.	.	4,410	.	.	0
St. Louis	700,000	382,000	.	.	.	88,100	.	.	1,330
Washington	1,950,000	630,000	.	.	.	141,000	.	.	2,400

Numbers are rounded to 3 significant digits.

Table 4A-51. 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	111,000	24,900	23,400	10,500	4,170	1,140	1,060	0	0
Boston	278,000	105,000	65,800	62,500	50,100	17,100	7,330	5,620	571
Chicago	336,000	48,300	28,600	10,100	4,040	1,710	1,090	0	0
Cleveland	256,000	40,900	12,900	8,690	1,720	736	196	98	0
Detroit	234,000	32,700	8,840	6,960	4,290	89	0	0	0
Houston	125,000	10,000	6,180	3,850	482	642	80	0	0
Los Angeles	892,000	2,460	2,460	1,910	0	0	0	0	0
New York	1,360,000	94,300	53,000	29,500	5,340	7,830	2,140	356	0
Philadelphia	632,000	120,000	69,500	53,900	14,700	8,360	2,630	681	0
Sacramento	64,900	3,730	1,640	933	97	64	0	0	0
St. Louis	149,000	63,600	38,500	26,100	8,580	4,130	1,420	459	0
Washington	493,000	110,000	45,400	43,800	13,000	5,930	1,510	379	0

Table 4A-52. 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	26,200	6,970	.	.	.	0	.	.	0
Boston	24,400	11,600	.	.	.	1,140	.	.	0
Chicago	12,300	2,640	.	.	.	0	.	.	0
Cleveland	44,800	4,570	.	.	.	0	.	.	0
Detroit	123,000	6,340	.	.	.	0	.	.	0
Houston	182,000	1,120	.	.	.	0	.	.	0
Los Angeles	1,650,000	2,180	.	.	.	0	.	.	0
New York	494,000	32,800	.	.	.	356	.	.	0
Philadelphia	169,000	34,100	.	.	.	389	.	.	0
Sacramento	33,900	579	.	.	.	0	.	.	0
St. Louis	45,400	13,300	.	.	.	138	.	.	0
Washington	109,000	21,300	.	.	.	252	.	.	0

Table 4A-53. 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	28,200	3,710	3,340	531	0	0	0	0	0
Boston	12,400	952	0	0	0	0	0	0	0
Chicago	1,240	0	0	0	0	0	0	0	0
Cleveland	1,520	0	0	0	0	0	0	0	0
Detroit	268	0	0	0	0	0	0	0	0
Houston	113,000	10,100	4,490	3,290	80	80	0	0	0
Los Angeles	705,000	0	0	0	0	0	0	0	0
New York	56,600	0	0	0	0	0	0	0	0
Philadelphia	18,100	486	0	0	0	0	0	0	0
Sacramento	5,080	0	0	0	0	0	0	0	0
St. Louis	138	0	0	0	0	0	0	0	0
Washington	59,800	2,650	757	883	126	0	0	0	0

Table 4A-54. Number of person-days with 8-hour exposures above 0.08 ppm-8hr, children, moderate exertion, mean over 2002-2004

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	165,000	35,500	.	.	.	1,140	.	.	0
Boston	315,000	118,000	.	.	.	18,200	.	.	571
Chicago	349,000	50,900	.	.	.	1,710	.	.	0
Cleveland	302,000	45,500	.	.	.	736	.	.	0
Detroit	357,000	39,000	.	.	.	89	.	.	0
Houston	420,000	21,300	.	.	.	722	.	.	0
Los Angeles	3,250,000	4,640	.	.	.	0	.	.	0
New York	1,910,000	127,000	.	.	.	8,190	.	.	0
Philadelphia	819,000	154,000	.	.	.	8,750	.	.	0
Sacramento	104,000	4,310	.	.	.	64	.	.	0
St. Louis	194,000	76,900	.	.	.	4,270	.	.	0
Washington	662,000	134,000	.	.	.	6,180	.	.	0

Table 4A-55. 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	216,000	113,000	109,000	78,500	53,500	41,200	40,700	20,200	5,150
Boston	326,000	186,000	143,000	140,000	123,000	83,000	62,200	53,800	21,100
Chicago	515,000	247,000	202,000	174,000	131,000	95,000	72,800	51,400	10,200
Cleveland	258,000	132,000	106,000	99,600	65,200	58,400	42,000	35,600	11,800
Detroit	344,000	198,000	155,000	145,000	133,000	80,100	55,700	44,500	9,110
Houston	156,000	39,800	29,400	25,400	13,200	11,800	8,510	5,460	883
Los Angeles	1,050,000	44,200	39,000	25,700	7,640	7,090	6,550	2,460	546
New York	1,720,000	564,000	477,000	406,000	189,000	212,000	165,000	111,000	23,100
Philadelphia	727,000	356,000	291,000	270,000	180,000	160,000	125,000	107,000	39,000
Sacramento	106,000	28,200	22,500	18,100	9,300	7,820	6,430	3,730	708
St. Louis	187,000	135,000	117,000	106,000	76,400	65,500	52,400	41,400	13,900
Washington	508,000	248,000	192,000	189,000	136,000	106,000	78,400	67,500	23,100

Table 4A-56. 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	99,100	43,500	.	.	.	10,600	.	.	455
Boston	90,700	54,800	.	.	.	15,100	.	.	1,240
Chicago	118,000	63,500	.	.	.	12,600	.	.	155
Cleveland	58,700	15,900	.	.	.	4,470	.	.	49
Detroit	149,000	39,200	.	.	.	10,700	.	.	536
Houston	237,000	30,700	.	.	.	6,260	.	.	321
Los Angeles	1,580,000	58,100	.	.	.	12,800	.	.	1,090
New York	775,000	192,000	.	.	.	47,000	.	.	1,780
Philadelphia	257,000	92,200	.	.	.	25,700	.	.	2,430
Sacramento	70,700	8,460	.	.	.	1,610	.	.	32
St. Louis	93,300	48,000	.	.	.	13,500	.	.	1,240
Washington	130,000	35,100	.	.	.	9,720	.	.	631

Table 4A-57. 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	87,000	30,400	28,200	18,500	10,600	6,900	5,990	2,120	227
Boston	57,800	19,100	12,100	11,200	8,480	3,140	1,520	762	0
Chicago	30,400	2,790	1,860	1,240	621	155	155	155	0
Cleveland	28,500	5,200	2,550	1,770	393	245	49	49	0
Detroit	42,100	12,700	8,040	5,890	4,730	357	0	0	0
Houston	168,000	38,700	26,600	23,700	12,800	10,700	6,580	4,090	883
Los Angeles	1,220,000	34,100	28,700	16,900	5,180	4,910	3,550	546	0
New York	289,000	33,500	25,600	18,200	1,420	1,420	1,420	356	0
Philadelphia	149,000	28,200	17,700	14,900	4,670	3,400	1,460	681	0
Sacramento	37,200	3,350	2,380	1,740	257	161	97	0	0
St. Louis	18,500	6,240	3,350	2,250	321	138	46	0	0
Washington	135,000	40,600	24,500	23,900	10,200	7,700	4,290	2,780	0

Table 4A-58. Number of person-days with 8-hour exposures above 0.08 ppm-8hr, asthmatic children, moderate exertion, mean over 2002-2004

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	402,000	187,000	.	.	.	58,700	.	.	5,840
Boston	474,000	260,000	.	.	.	101,000	.	.	22,400
Chicago	663,000	313,000	.	.	.	108,000	.	.	10,400
Cleveland	346,000	153,000	.	.	.	63,100	.	.	11,800
Detroit	534,000	250,000	.	.	.	91,100	.	.	9,640
Houston	560,000	109,000	.	.	.	28,700	.	.	2,090
Los Angeles	3,860,000	136,000	.	.	.	24,800	.	.	1,640
New York	2,780,000	790,000	.	.	.	261,000	.	.	24,900
Philadelphia	1,130,000	476,000	.	.	.	189,000	.	.	41,400
Sacramento	214,000	40,000	.	.	.	9,580	.	.	740
St. Louis	299,000	190,000	.	.	.	79,000	.	.	15,100
Washington	774,000	324,000	.	.	.	124,000	.	.	23,700

Numbers are rounded to 3 significant digits.

Table 4A-59. 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	68,200	23,100	21,300	12,200	6,440	4,400	4,400	910	0
Boston	130,000	59,700	42,300	41,100	33,300	19,100	13,200	10,200	2,100
Chicago	170,000	61,800	43,900	33,700	17,200	8,690	3,880	621	310
Cleveland	110,000	38,600	26,500	24,000	10,500	8,540	3,040	1,870	196
Detroit	125,000	52,800	33,900	30,400	24,600	6,790	2,140	714	0
Houston	46,900	8,910	4,570	3,610	1,440	802	722	321	80
Los Angeles	369,000	4,090	3,270	1,360	546	546	546	546	0
New York	664,000	121,000	89,700	59,800	12,800	18,200	8,900	4,980	356
Philadelphia	295,000	108,000	79,600	67,900	33,300	27,200	16,400	11,700	972
Sacramento	32,900	4,570	2,830	2,120	804	643	161	97	0
St. Louis	75,000	45,000	34,600	28,800	14,800	11,700	6,980	3,950	184
Washington	197,000	69,900	45,200	42,900	26,100	16,800	8,080	5,810	505

Table 4A-60. 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	18,300	6,750	.	.	.	758	.	.	0
Boston	20,400	11,600	.	.	.	1,710	.	.	0
Chicago	19,100	7,450	.	.	.	310	.	.	0
Cleveland	18,100	3,780	.	.	.	393	.	.	0
Detroit	53,300	8,120	.	.	.	982	.	.	0
Houston	86,600	3,770	.	.	.	241	.	.	0
Los Angeles	646,000	7,910	.	.	.	546	.	.	0
New York	265,000	42,700	.	.	.	2,490	.	.	0
Philadelphia	84,500	23,700	.	.	.	4,470	.	.	0
Sacramento	18,900	1,030	.	.	.	32	.	.	0
St. Louis	22,900	9,730	.	.	.	1,650	.	.	0
Washington	37,200	9,340	.	.	.	1,010	.	.	0

Table 4A-61. 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	17,400	4,400	3,870	2,050	682	455	455	0	0
Boston	12,600	2,190	857	667	286	0	0	0	0
Chicago	2,170	155	155	0	0	0	0	0	0
Cleveland	4,270	98	0	0	0	0	0	0	0
Detroit	6,250	179	0	0	0	0	0	0	0
Houston	48,400	7,220	4,490	3,850	1,040	1,040	161	80	0
Los Angeles	367,000	2,460	1,360	273	0	0	0	0	0
New York	61,600	2,140	712	712	0	0	0	0	0
Philadelphia	25,200	1,940	1,070	583	194	0	0	0	0
Sacramento	5,980	64	0	0	0	0	0	0	0
St. Louis	1,010	138	0	0	0	0	0	0	0
Washington	34,000	6,810	3,280	2,650	379	252	126	0	0

Table 4A-62. Number of person-days with 8-hour exposures above 0.07 ppm-8hr, asthmatic children, moderate exertion, mean over 2002-2004

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	104,000	34,300	.	.	.	5,610	.	.	0
Boston	163,000	73,500	.	.	.	20,900	.	.	2,100
Chicago	191,000	69,400	.	.	.	9,000	.	.	310
Cleveland	132,000	42,500	.	.	.	8,930	.	.	196
Detroit	185,000	61,100	.	.	.	7,770	.	.	0
Houston	182,000	19,900	.	.	.	2,090	.	.	80
Los Angeles	1,380,000	14,500	.	.	.	1,090	.	.	0
New York	990,000	166,000	.	.	.	20,600	.	.	356
Philadelphia	405,000	134,000	.	.	.	31,700	.	.	972
Sacramento	57,800	5,660	.	.	.	675	.	.	0
St. Louis	98,900	54,800	.	.	.	13,400	.	.	184
Washington	268,000	86,100	.	.	.	18,000	.	.	505

Table 4A-63. 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	15,900	3,870	3,410	1,440	531	152	152	0	0
Boston	47,200	18,400	12,200	11,700	9,810	3,330	1,620	762	95
Chicago	49,400	7,600	3,570	466	310	310	155	0	0
Cleveland	37,400	7,120	2,310	1,520	442	245	49	0	0
Detroit	34,900	4,640	1,070	804	268	0	0	0	0
Houston	14,700	1,120	722	482	80	80	0	0	0
Los Angeles	113,000	546	546	546	0	0	0	0	0
New York	241,000	16,700	8,900	4,980	1,070	1,070	712	0	0
Philadelphia	111,000	21,800	13,000	10,500	2,820	1,360	583	194	0
Sacramento	9,010	450	161	129	0	0	0	0	0
St. Louis	20,900	9,000	5,460	3,530	1,380	734	275	46	0
Washington	67,600	14,400	6,180	6,060	2,150	1,260	505	126	0

Table 4A-64. 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	4,470	1,140	.	.	.	0	.	.	0
Boston	5,620	2,480	.	.	.	95	.	.	0
Chicago	1,710	466	.	.	.	0	.	.	0
Cleveland	6,040	687	.	.	.	0	.	.	0
Detroit	17,400	1,430	.	.	.	0	.	.	0
Houston	27,800	161	.	.	.	0	.	.	0
Los Angeles	227,000	273	.	.	.	0	.	.	0
New York	89,700	5,340	.	.	.	0	.	.	0
Philadelphia	31,800	6,320	.	.	.	0	.	.	0
Sacramento	3,760	97	.	.	.	0	.	.	0
St. Louis	6,610	2,110	.	.	.	0	.	.	0
Washington	16,300	1,510	.	.	.	126	.	.	0

Numbers are rounded to 3 significant digits.

Table 4A-65. 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	2,810	531	531	76	0	0	0	0	0
Boston	1,810	0	0	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	13,900	1,530	642	401	0	0	0	0	0
Los Angeles	102,000	0	0	0	0	0	0	0	0
New York	12,100	0	0	0	0	0	0	0	0
Philadelphia	3,310	194	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	8,330	505	252	252	0	0	0	0	0

Table 4A-66. Number of person-days with 8-hour exposures above 0.08 ppm-8hr, asthmatic children, moderate exertion, mean over 2002-2004

City	recent base	84/4	84/3	80/4	74/5	74/4	74/3	70/4	64/4
Atlanta	23,200	5,530	.	.	.	152	.	.	0
Boston	54,700	20,900	.	.	.	3,430	.	.	95
Chicago	51,200	8,070	.	.	.	310	.	.	0
Cleveland	43,700	7,810	.	.	.	245	.	.	0
Detroit	52,300	6,070	.	.	.	0	.	.	0
Houston	56,300	2,810	.	.	.	80	.	.	0
Los Angeles	441,000	819	.	.	.	0	.	.	0
New York	343,000	22,100	.	.	.	1,070	.	.	0
Philadelphia	146,000	28,300	.	.	.	1,360	.	.	0
Sacramento	13,400	547	.	.	.	0	.	.	0
St. Louis	27,500	11,100	.	.	.	734	.	.	0
Washington	92,200	16,400	.	.	.	1,390	.	.	0

Table 4A-67. Exposure level=0.06 (ppm-8hr), Group=Asthmatic children, moderate exertion, 12-city totals

Alt std	Year	Persons (percent)	Persons	Person-days
base	2002	70%	1,800,000	6,110,000
base	2003	54%	1,380,000	3,660,000
base	2004	37%	970,000	2,260,000
84/4	2002	44%	1,130,000	2,290,000
84/4	2003	21%	520,000	680,000
84/4	2004	8%	220,000	250,000
84/3	2002	40%	1,020,000	1,880,000
84/3	2004	6%	160,000	180,000
80/4	2002	37%	950,000	1,680,000
80/4	2004	5%	130,000	140,000
74/5	2002	28%	710,000	1,120,000
74/5	2004	2%	60,000	60,000
74/4	2002	25%	630,000	930,000
74/4	2003	6%	150,000	170,000
74/4	2004	1%	40,000	40,000
74/3	2002	20%	520,000	720,000
74/3	2004	1%	20,000	30,000
70/4	2002	16%	420,000	540,000
70/4	2004	0%	10,000	10,000
64/4	2002	5%	140,000	160,000
64/4	2003	0%	10,000	10,000
64/4	2004	0%	1,000	1,000

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

Table 4A-68. Exposure level=0.06 (ppm-8hr), Group=Children, moderate exertion, 12-city totals

Alt std	Year	Persons (percent)	Persons	Person-days
base	2002	67%	12,200,000	40,540,000
base	2003	52%	9,370,000	25,060,000
base	2004	37%	6,810,000	16,280,000
84/4	2002	40%	7,370,000	14,800,000
84/4	2003	19%	3,380,000	4,390,000
84/4	2004	8%	1,450,000	1,710,000
84/3	2002	36%	6,660,000	12,160,000
84/3	2004	6%	1,080,000	1,230,000
80/4	2002	34%	6,150,000	10,790,000
80/4	2004	5%	840,000	930,000
74/5	2002	25%	4,570,000	7,190,000
74/5	2004	2%	380,000	410,000
74/4	2002	22%	4,060,000	5,920,000
74/4	2003	5%	970,000	1,060,000
74/4	2004	1%	260,000	280,000
74/3	2002	18%	3,350,000	4,580,000
74/3	2004	1%	180,000	190,000
70/4	2002	15%	2,650,000	3,470,000
70/4	2004	1%	100,000	100,000
64/4	2002	5%	870,000	1,000,000
64/4	2003	0%	60,000	60,000
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-69. Exposure level=0.07 (ppm-8hr), Group=Asthmatic children, moderate exertion, 12-city totals

Alt std	Year	Persons (percent)	Persons	Person-days
base	2002	46%	1,180,000	2,280,000
base	2003	28%	720,000	1,290,000
base	2004	14%	370,000	590,000
84/4	2002	18%	450,000	600,000
84/4	2003	5%	130,000	140,000
84/4	2004	1%	30,000	30,000
84/3	2002	13%	350,000	430,000
84/3	2004	1%	20,000	20,000
80/4	2002	11%	290,000	350,000
80/4	2004	0%	10,000	10,000
74/5	2002	6%	160,000	180,000
74/5	2004	0%	3,000	3,000
74/4	2002	4%	110,000	120,000
74/4	2003	1%	10,000	10,000
74/4	2004	0%	2,000	2,000
74/3	2002	2%	60,000	70,000
74/3	2004	0%	1,000	1,000
70/4	2002	2%	40,000	40,000
70/4	2004	0%	0	0
64/4	2002	0%	4,000	5,000
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-70. Exposure level=0.07 (ppm-8hr), Group=Children, moderate exertion, 12-city totals

Alt std	Year	Persons (percent)	Persons	Person-days
base	2002	43%	7,860,000	15,040,000
base	2003	27%	4,840,000	8,760,000
base	2004	14%	2,610,000	4,220,000
84/4	2002	16%	2,920,000	3,830,000
84/4	2003	4%	750,000	800,000
84/4	2004	1%	190,000	200,000
84/3	2002	12%	2,210,000	2,730,000
84/3	2004	1%	120,000	120,000
80/4	2002	10%	1,850,000	2,240,000
80/4	2004	0%	80,000	80,000
74/5	2002	6%	1,020,000	1,170,000
74/5	2004	0%	20,000	20,000
74/4	2002	4%	690,000	760,000
74/4	2003	1%	90,000	90,000
74/4	2004	0%	10,000	10,000
74/3	2002	2%	400,000	430,000
74/3	2004	0%	10,000	10,000
70/4	2002	1%	230,000	250,000
70/4	2004	0%	2,000	2,000
64/4	2002	0%	20,000	20,000
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-71. Exposure level=0.08 (ppm-8hr), Group=Asthmatic children, moderate exertion, 12-city totals

Alt std	Year	Persons (percent)	Persons	Person-days
base	2002	22%	570,000	760,000
base	2003	12%	320,000	440,000
base	2004	4%	110,000	150,000
84/4	2002	4%	100,000	110,000
84/4	2003	1%	20,000	20,000
84/4	2004	0%	3,000	3,000
84/3	2002	2%	50,000	60,000
84/3	2004	0%	1,000	1,000
80/4	2002	2%	40,000	40,000
80/4	2004	0%	1,000	1,000
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%	4,000	4,000
74/3	2004	0%	0	0
70/4	2002	0%	1,000	1,000
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.

Table 4A-72. Exposure level=0.08 (ppm-8hr), Group=Children, moderate exertion, 12-city totals

Alt std	Year	Persons (percent)	Persons	Person-days
base	2002	20%	3,660,000	4,930,000
base	2003	11%	2,040,000	2,920,000
base	2004	4%	780,000	1,000,000
84/4	2002	3%	600,000	660,000
84/4	2003	1%	130,000	140,000
84/4	2004	0%	20,000	20,000
84/3	2002	2%	340,000	360,000
84/3	2004	0%	10,000	10,000
80/4	2002	1%	250,000	260,000
80/4	2004	0%	5,000	5,000
74/5	2002	1%	100,000	110,000
74/5	2004	0%	0	0
74/4	2002	0%	50,000	50,000
74/4	2003	0%	2,000	2,000
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%	1,000	1,000
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.

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

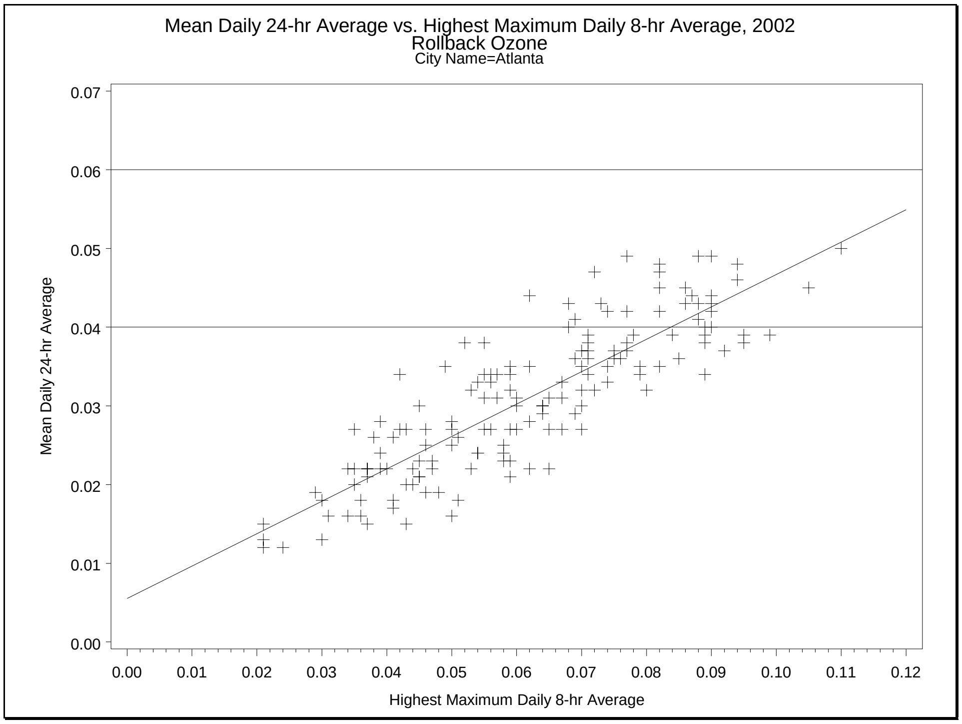
*"Boston 1" denotes Suffolk County; "Boston 2" denotes Essex, Middlesex, Norfolk, Suffolk, and Worcester Counties.

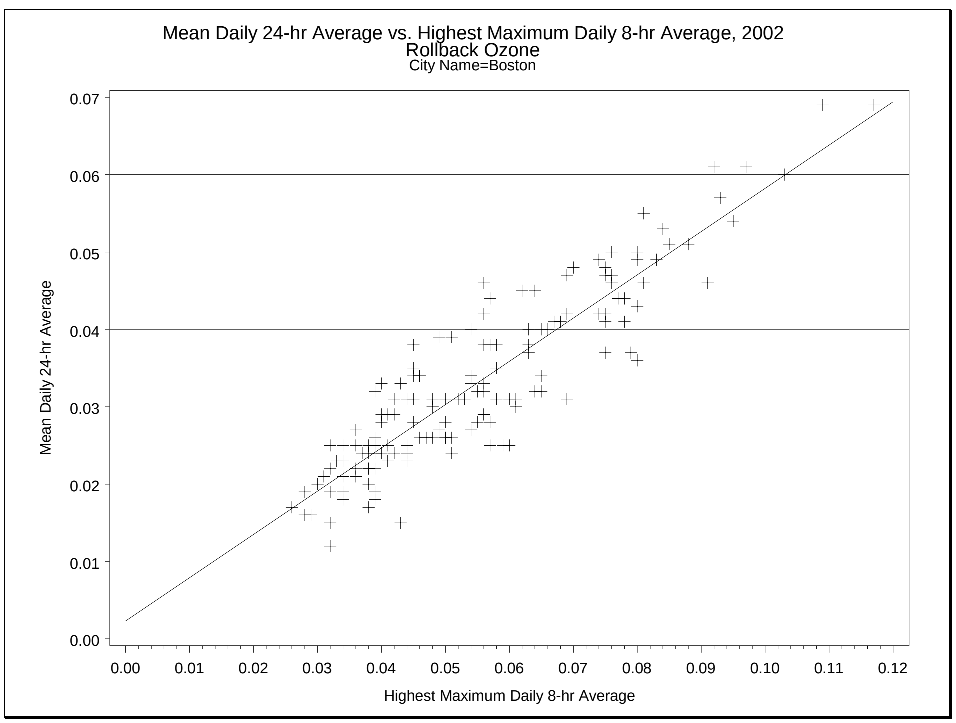
**"Los Angeles 1" denotes Los Angeles County; "Los Angeles 2" denotes Los Angeles, Riverside, San Bernardino, and Orange Counties.

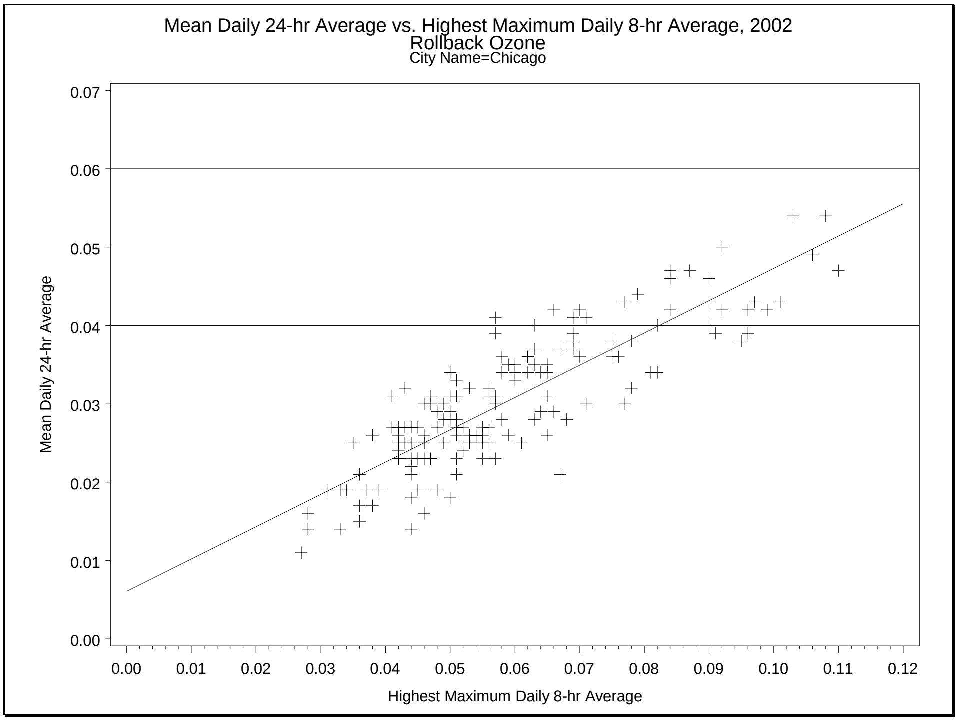
***"New York 1" denotes the 5 boroughs of New York City -- Brooklyn, Queens, Manhattan, Bronx, and Staten Island. "New York 2" denotes the 5 boroughs plus Westchester County.

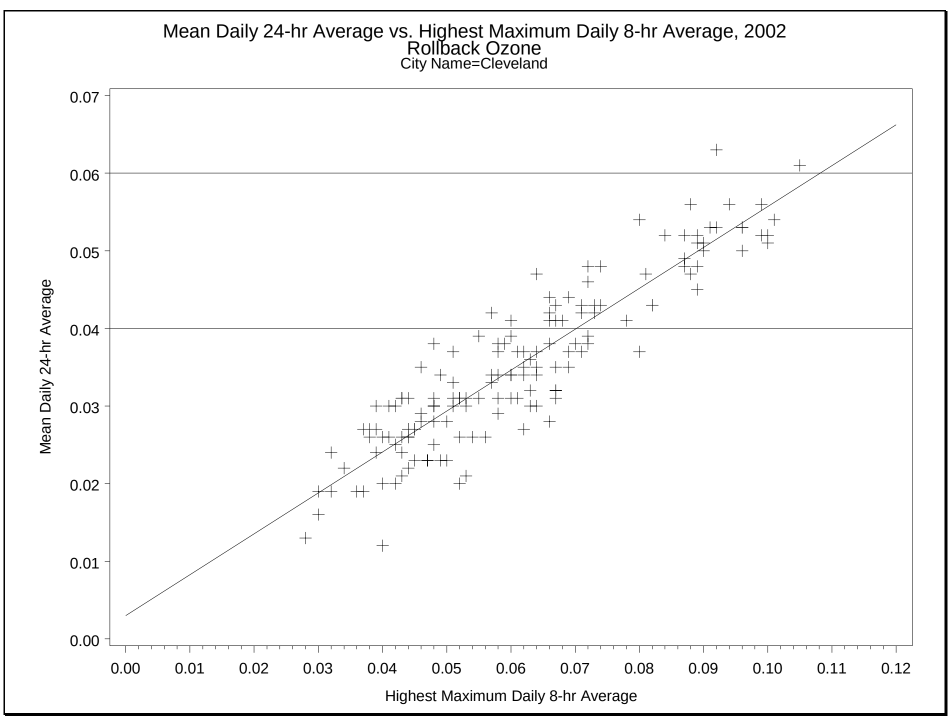
5A.2 Scatter Plots

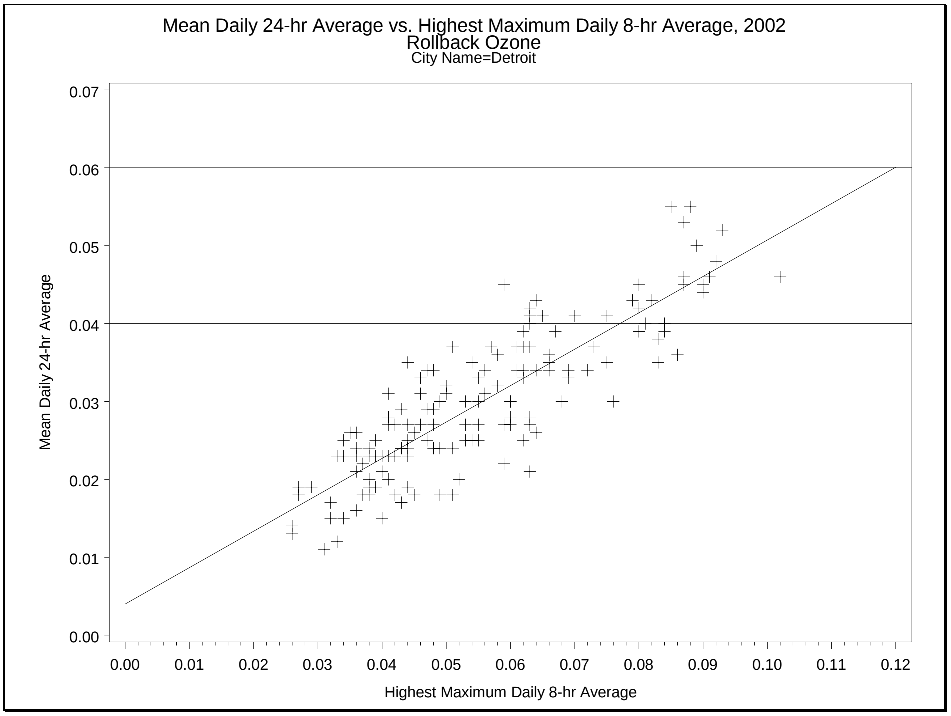
This Appendix provides scatter plots comparing 8-hr daily maximum concentrations at the highest monitor with the average of the 24-hr average over all monitors within each of the 12 urban areas included in the risk assessment.

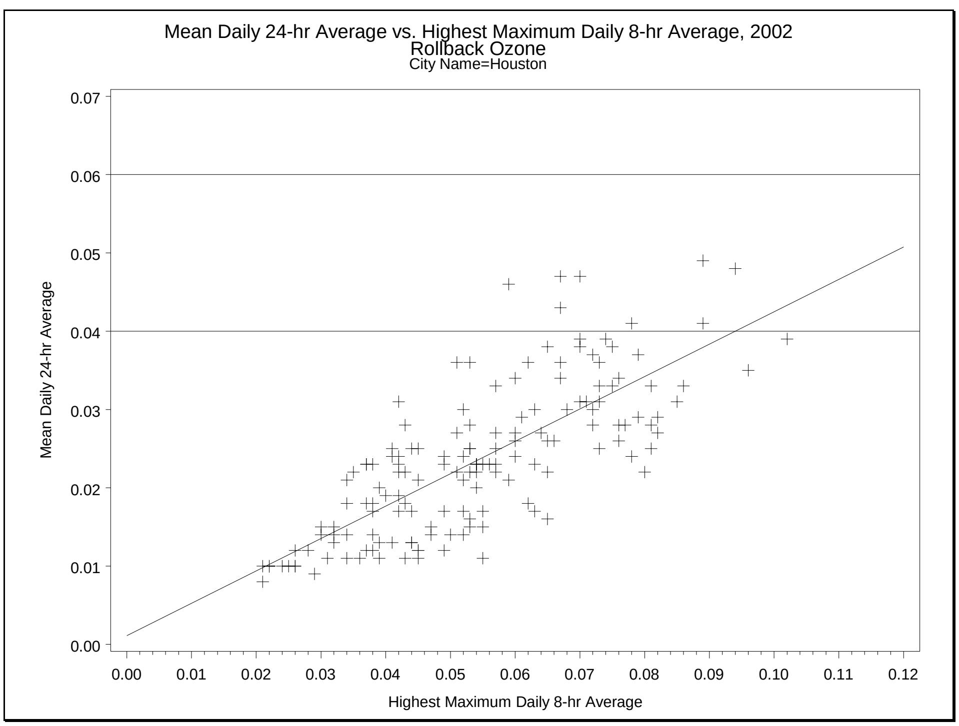

Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2002
Rollback Ozone
City Name=Atlanta
Mean Daily 24-hr Average
Highest Maximum Daily 8-hr Average
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.10
0.11
0.12

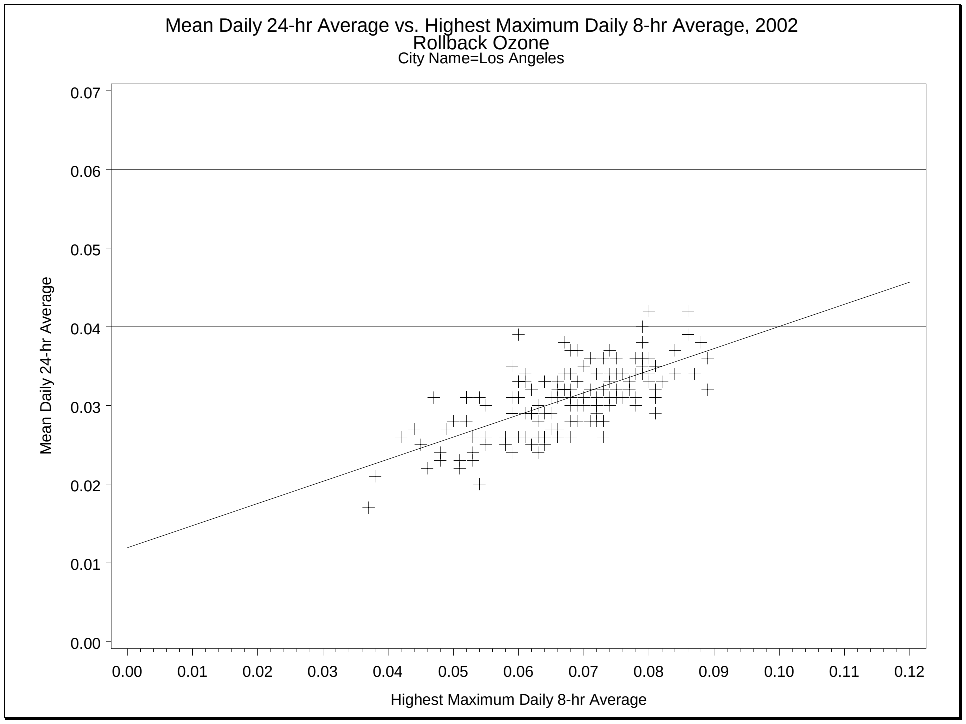

Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2002
Rollback Ozone
City Name=Boston
Mean Daily 24-hr Average
Highest Maximum Daily 8-hr Average
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.10
0.11
0.12

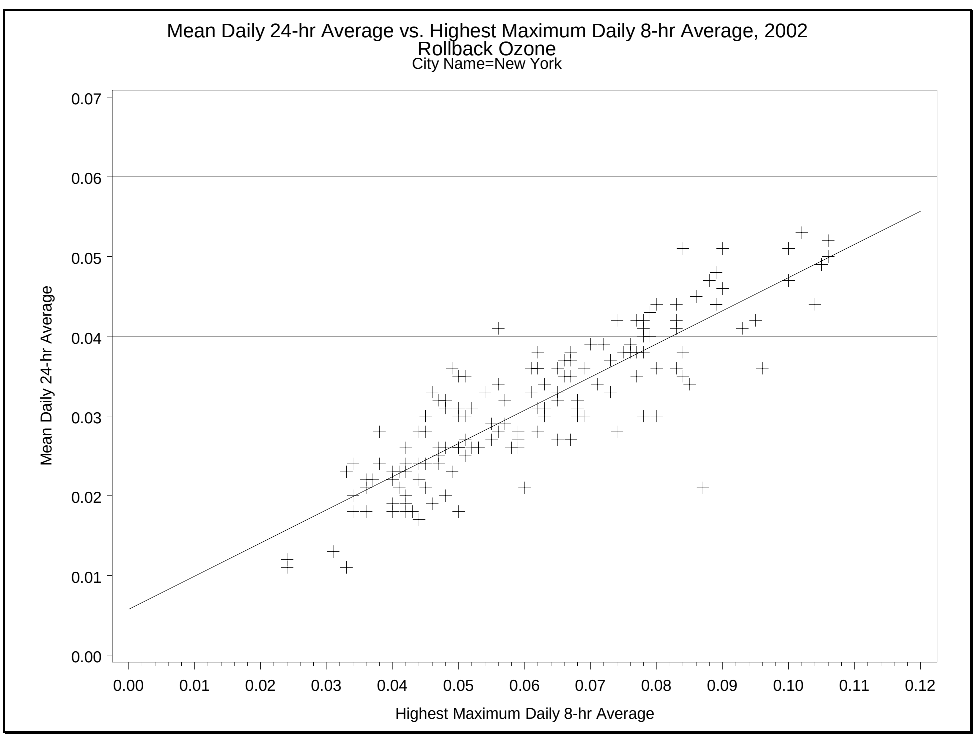

Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2002
Rollback Ozone
City Name=Chicago
Mean Daily 24-hr Average
Highest Maximum Daily 8-hr Average
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.10
0.11
0.12

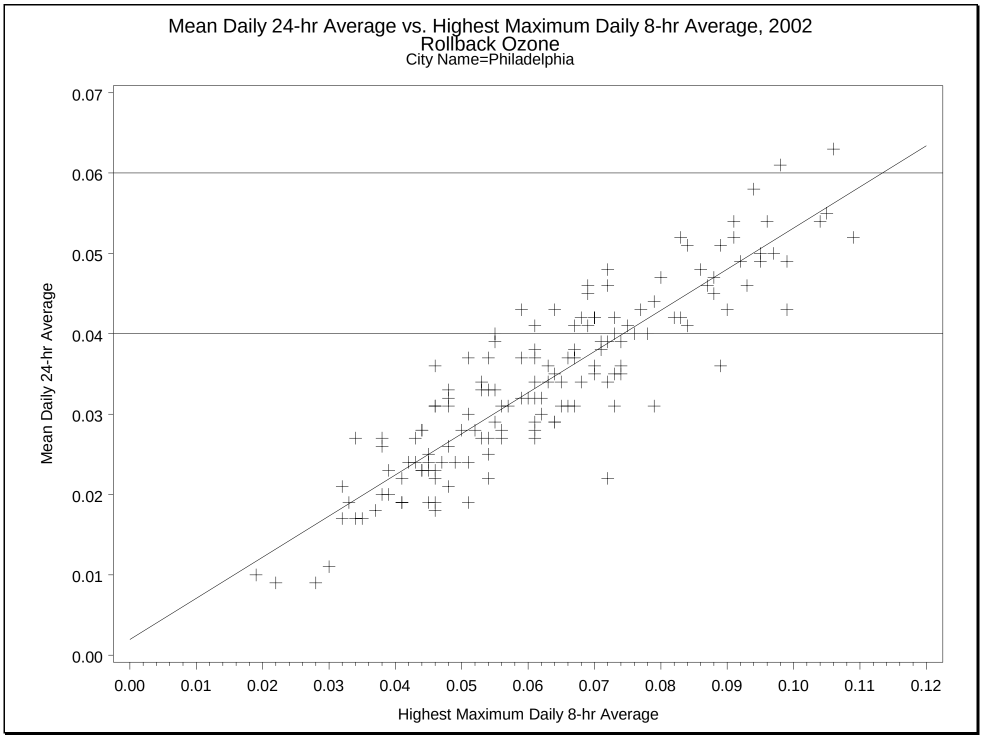

Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2002
Rollback Ozone
City Name=Cleveland
Mean Daily 24-hr Average
Highest Maximum Daily 8-hr Average
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.10
0.11
0.12

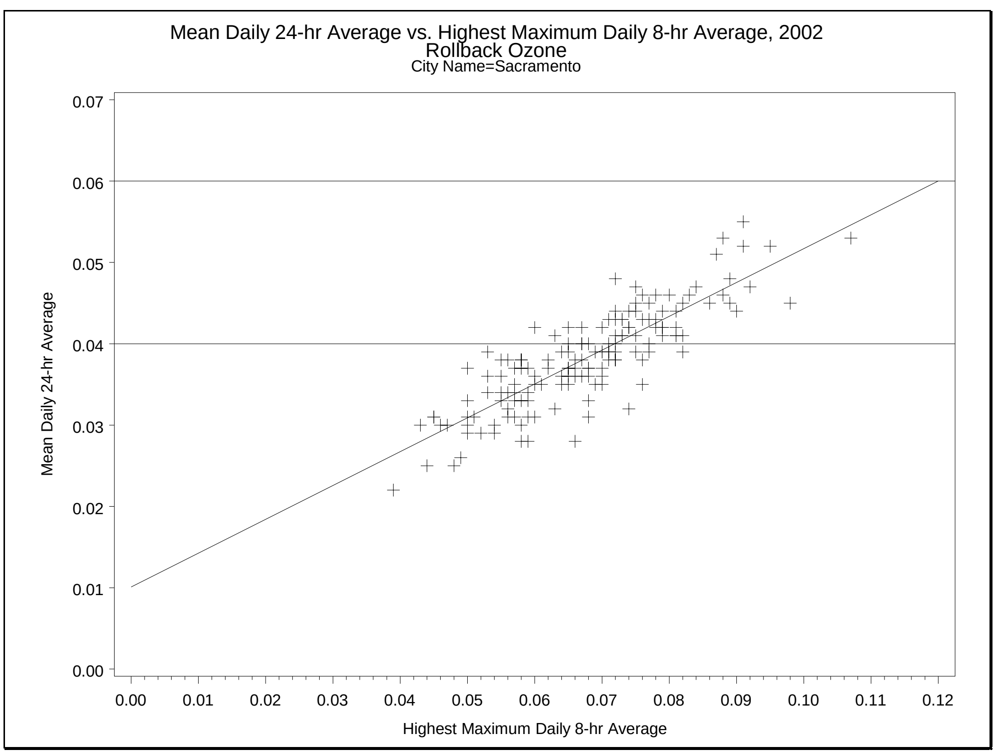

Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2002
Rollback Ozone
City Name=Detroit
Mean Daily 24-hr Average
Highest Maximum Daily 8-hr Average
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.10
0.11
0.12

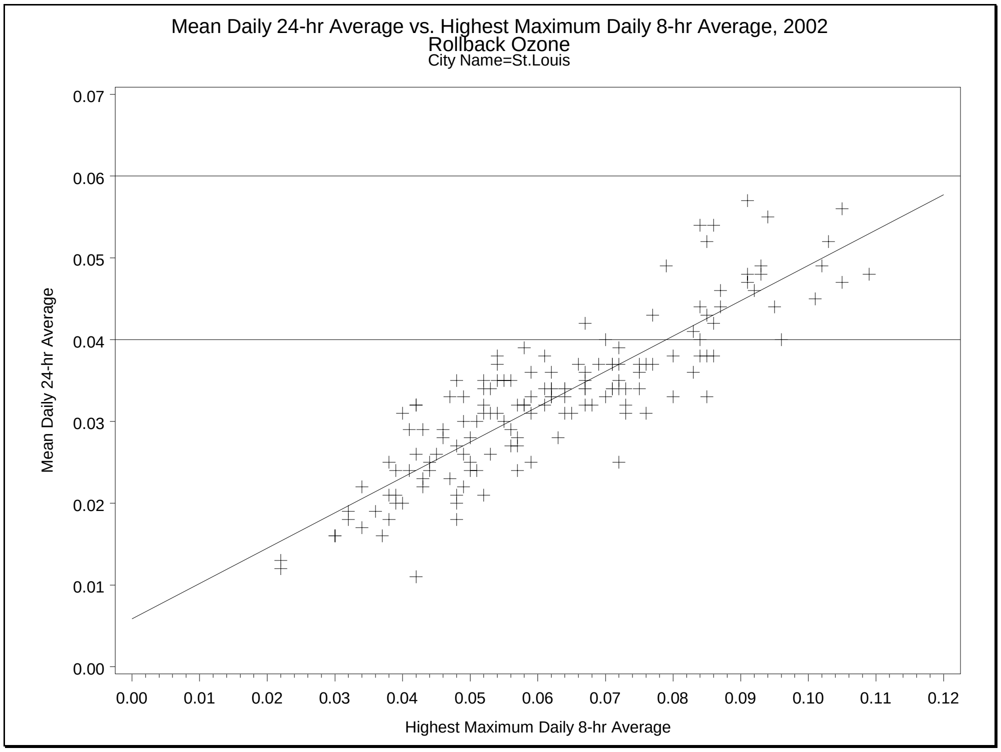

Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2002
Rollback Ozone
City Name=Houston
Mean Daily 24-hr Average
Highest Maximum Daily 8-hr Average
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.10
0.11
0.12

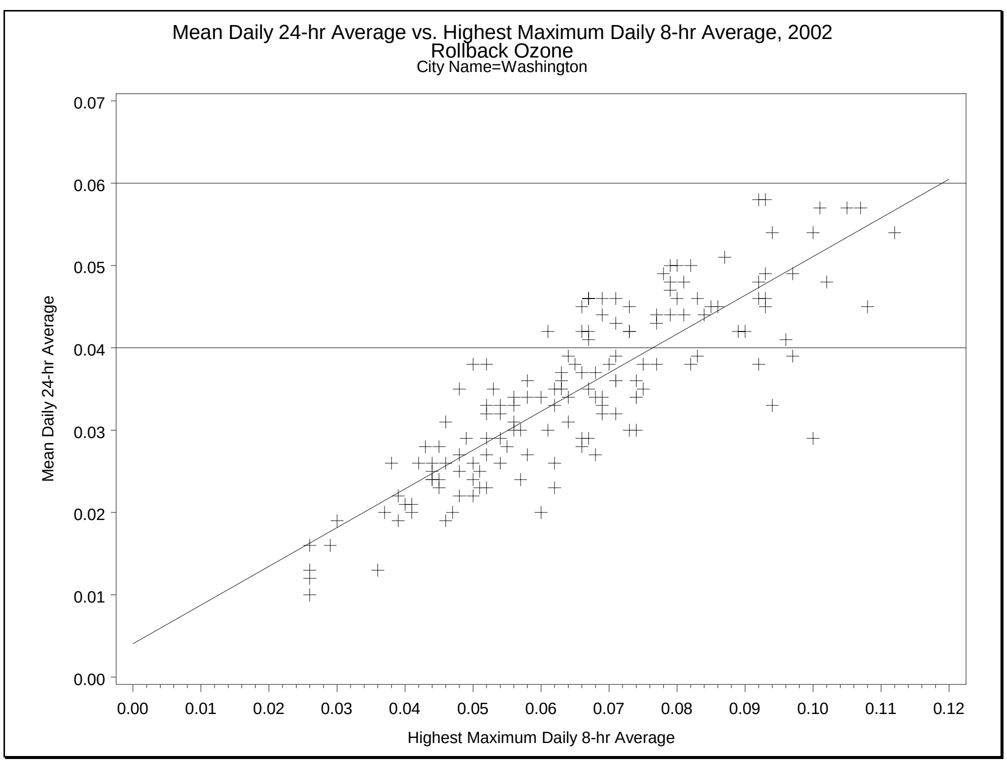

Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2002
Rollback Ozone
City Name=Los Angeles
Mean Daily 24-hr Average
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
Highest Maximum Daily 8-hr Average
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.10
0.11
0.12

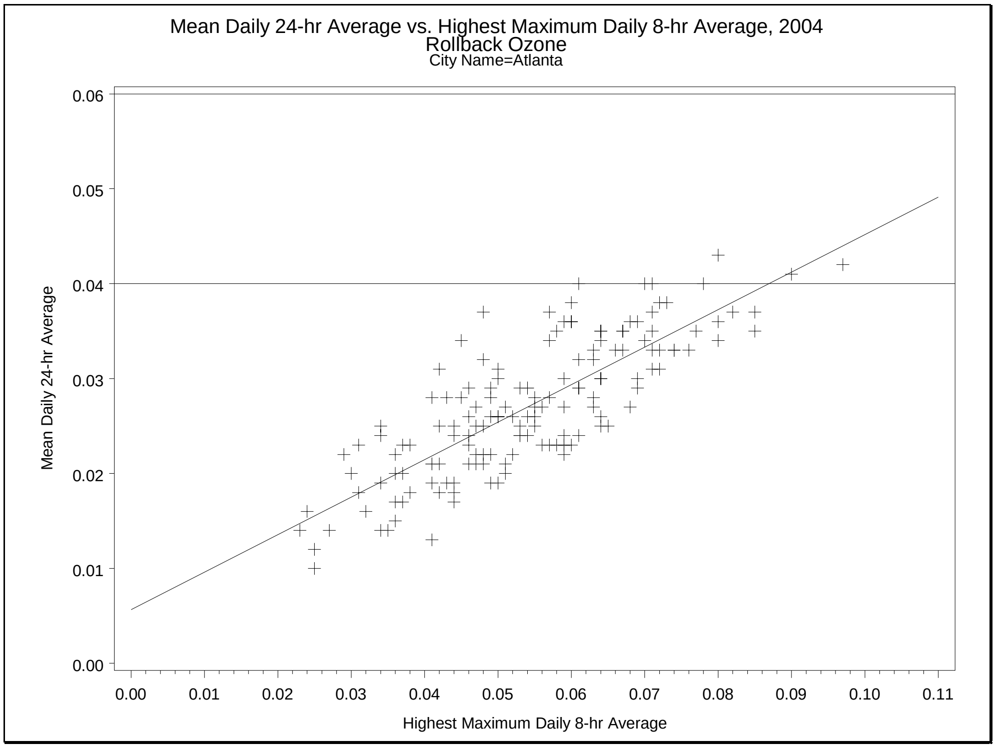

Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2002
Rollback Ozone
City Name=New York
Mean Daily 24-hr Average
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
Highest Maximum Daily 8-hr Average
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.10
0.11
0.12


Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2002
Rollback Ozone
City Name=Philadelphia
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=Sacramento
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=St.Louis
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=Washington
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, 2004
Rollback Ozone
City Name=Atlanta
Mean Daily 24-hr Average
Highest Maximum Daily 8-hr Average
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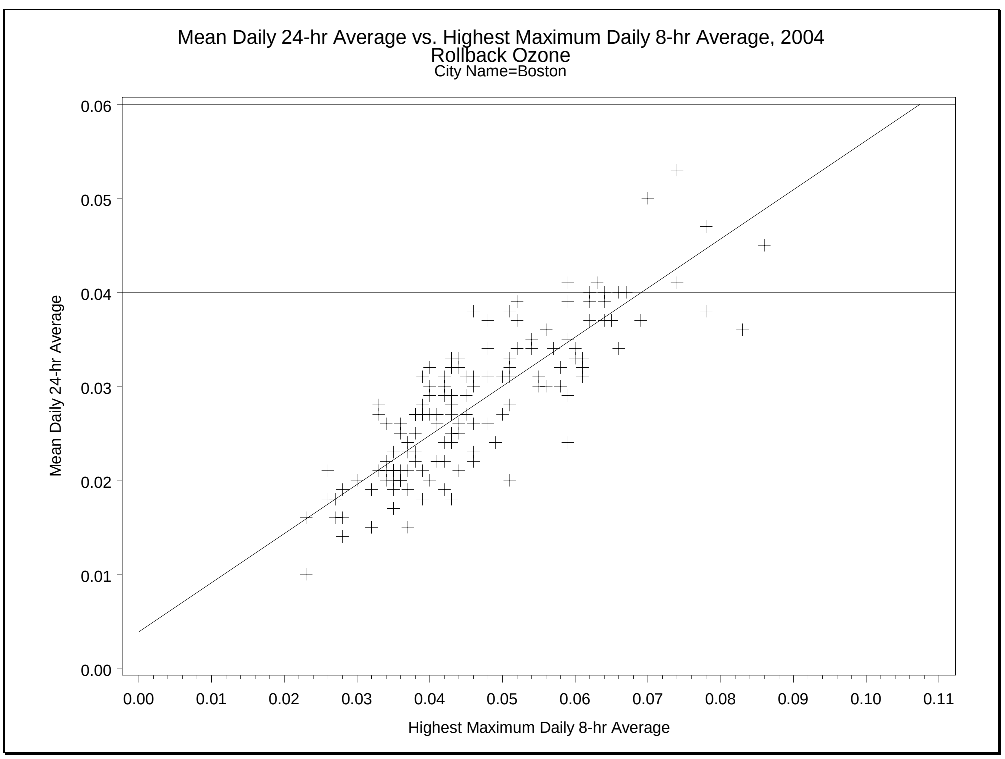
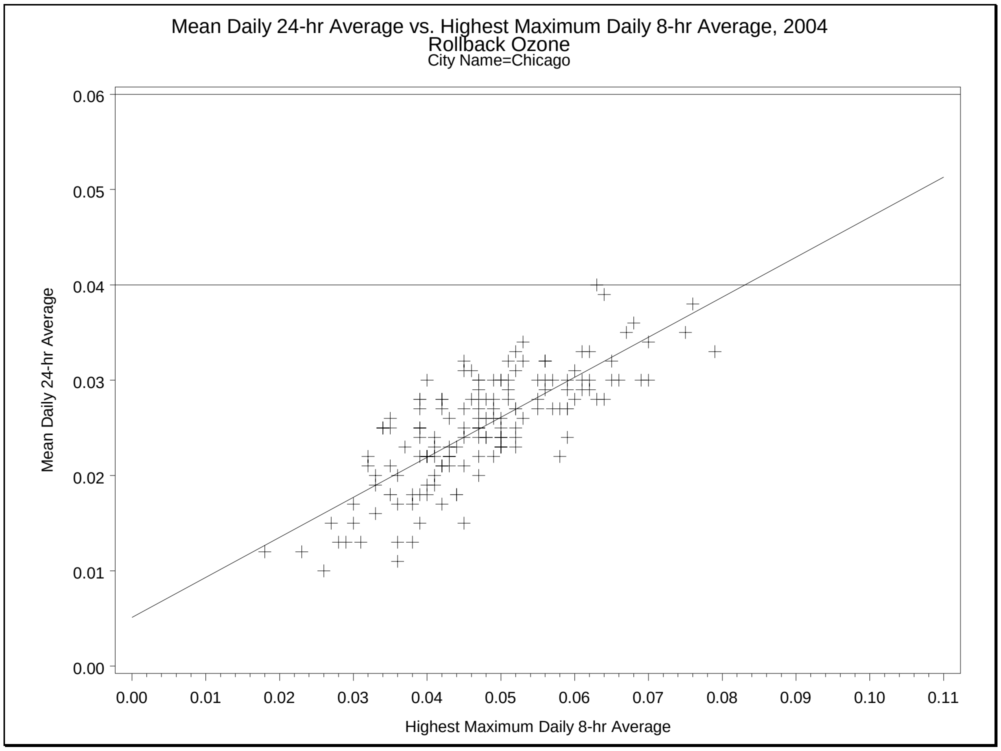
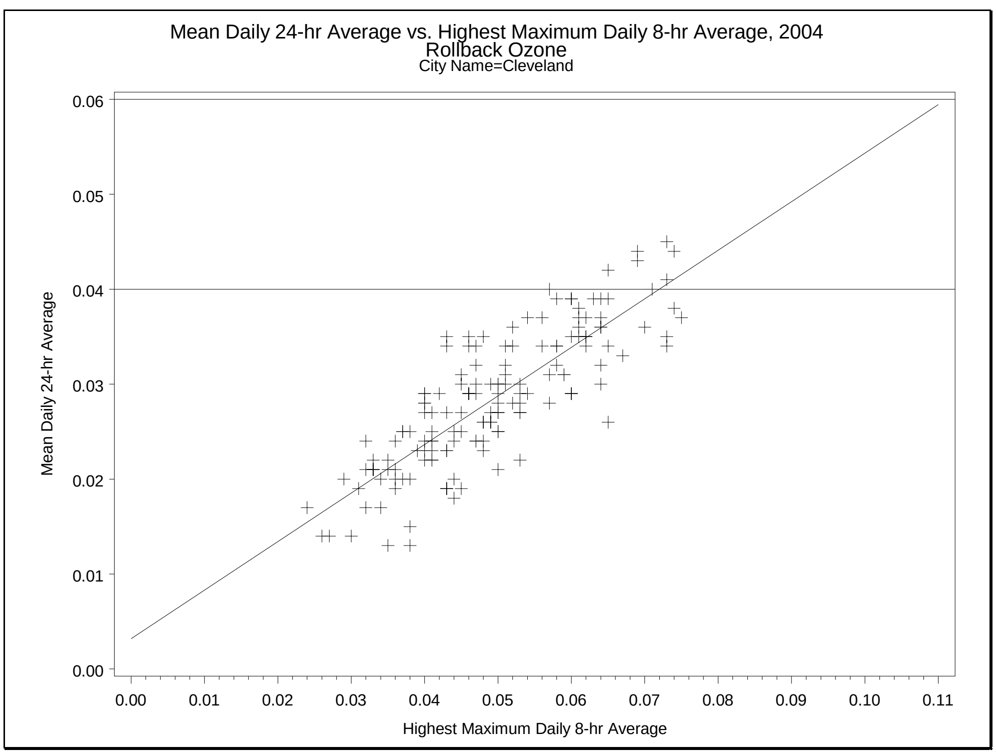
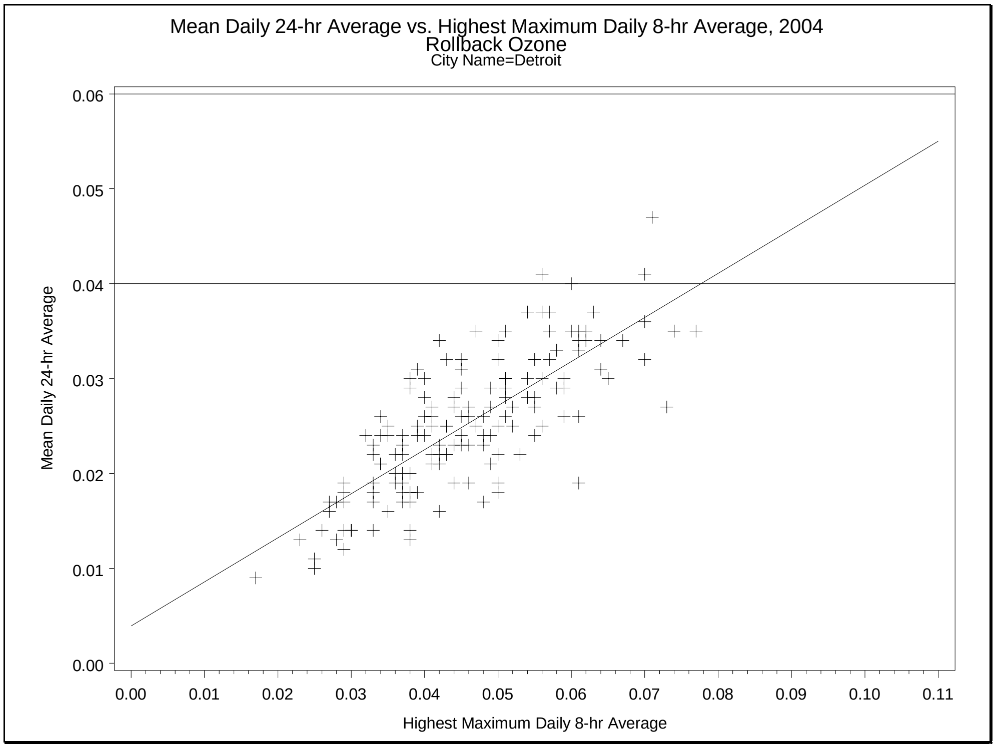
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.10
0.11

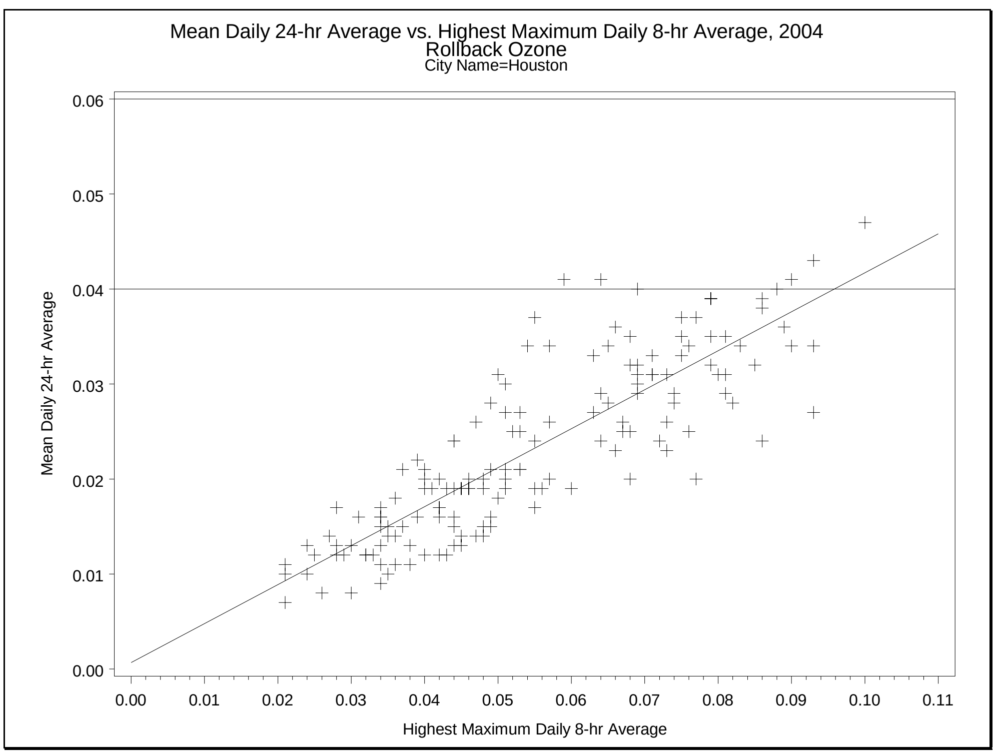

Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2004
Rollback Ozone
City Name=Boston
Mean Daily 24-hr Average
Highest Maximum Daily 8-hr Average
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.10
0.11


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

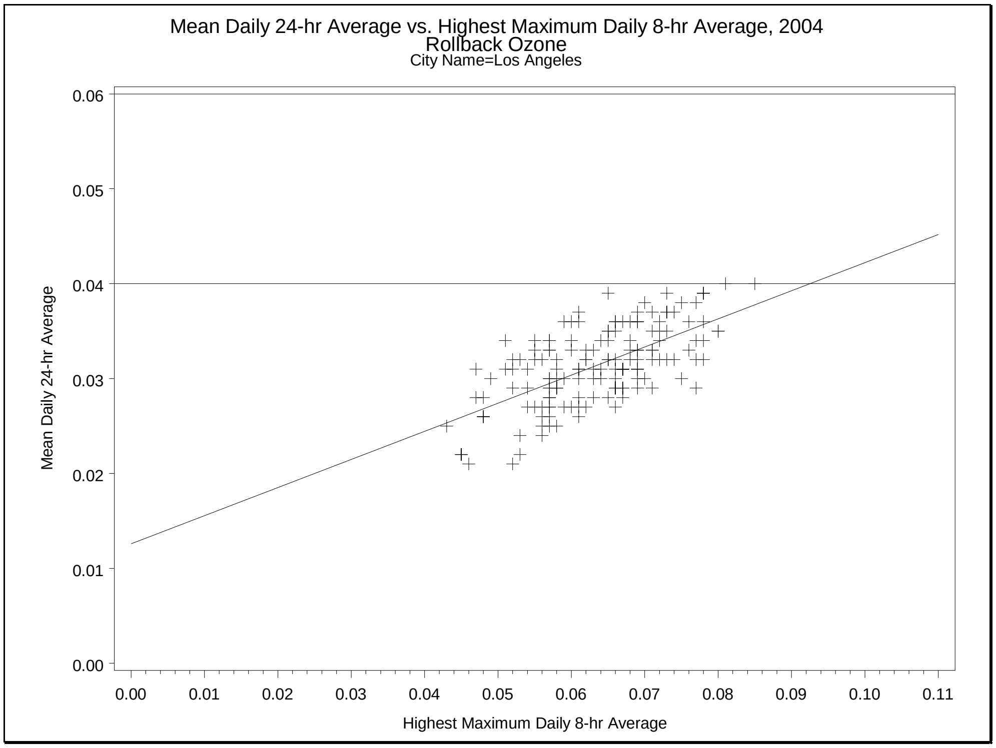

Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2004
Rollback Ozone
City Name=Cleveland
Mean Daily 24-hr Average
Highest Maximum Daily 8-hr Average
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.10
0.11

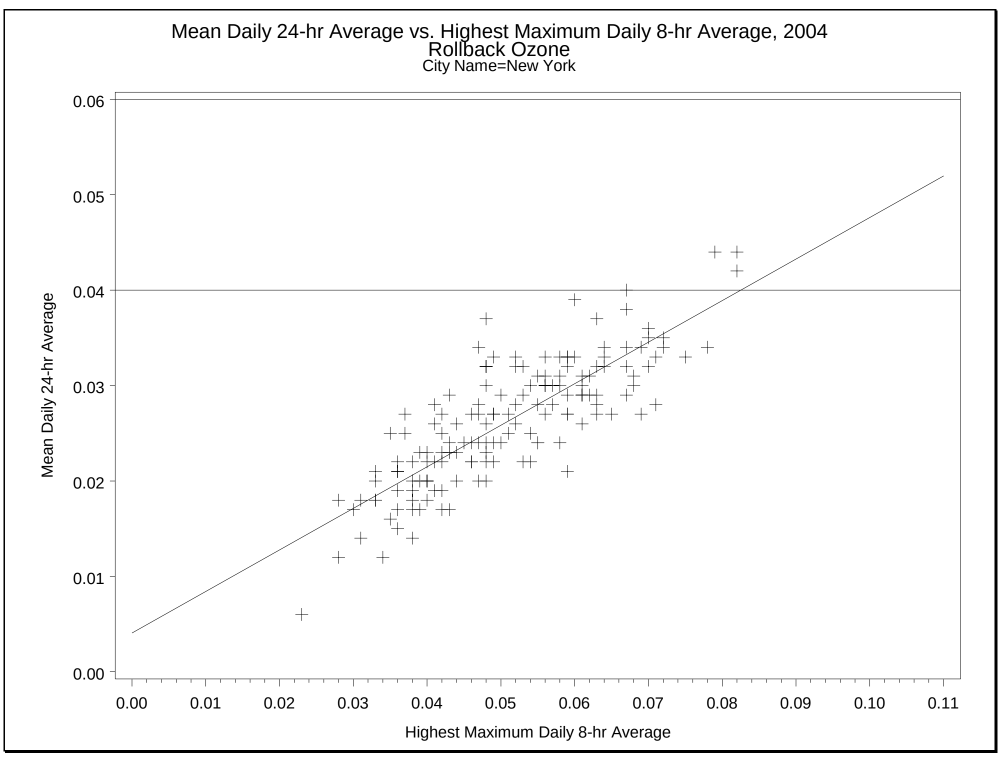


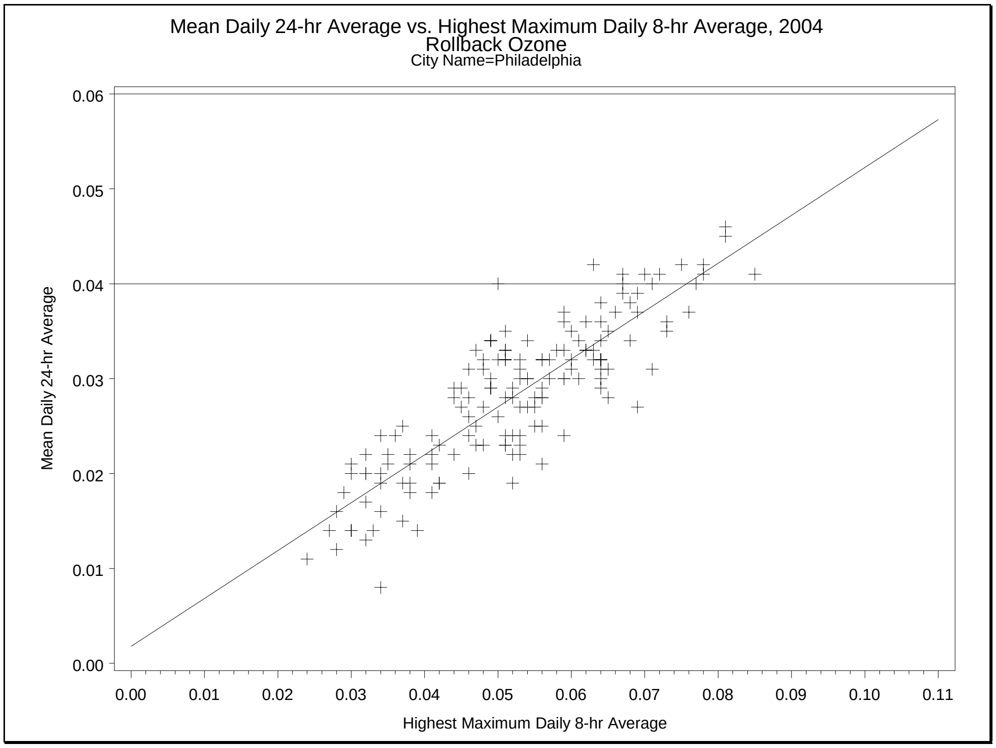
Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2004
Rollback Ozone
City Name=Detroit
Mean Daily 24-hr Average
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.10
0.11
Highest Maximum Daily 8-hr Average

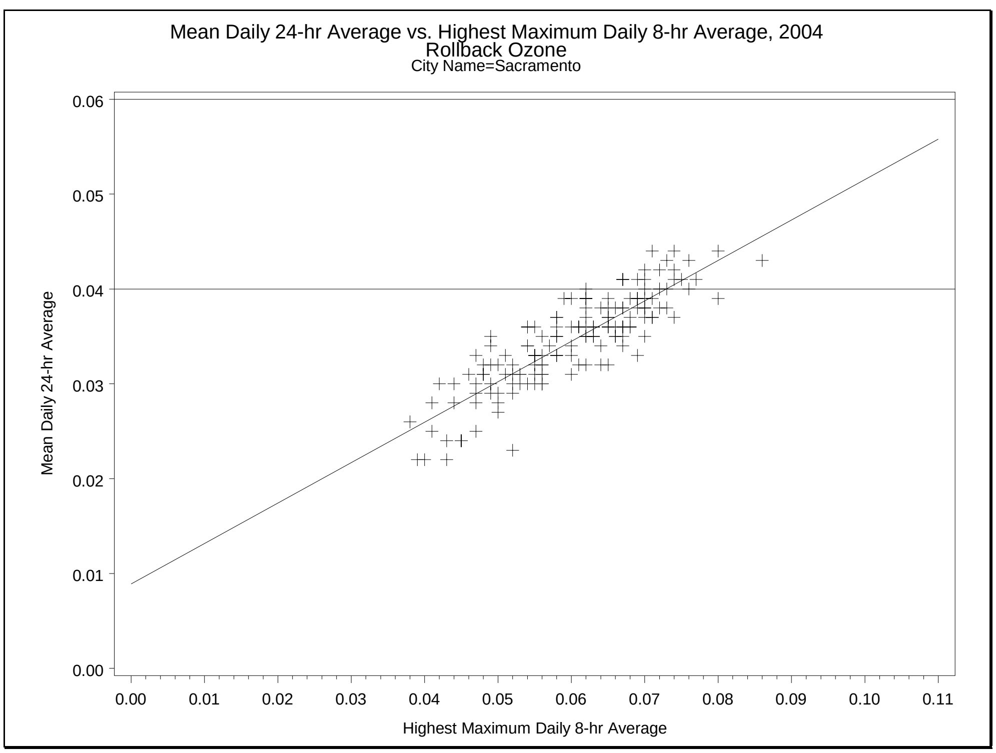


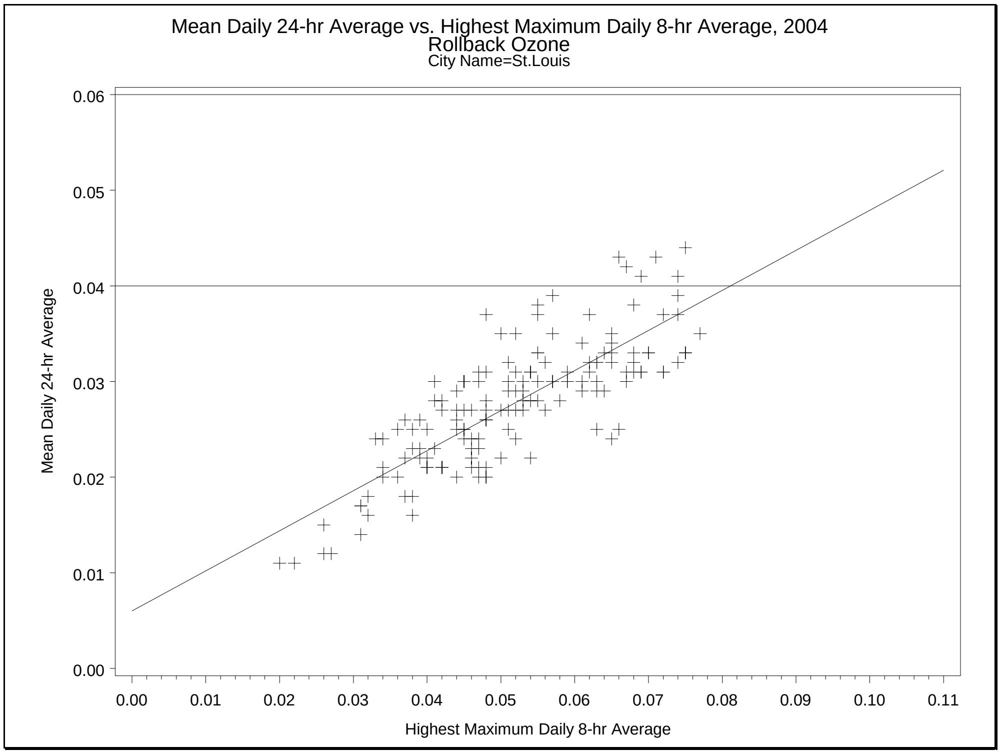
Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2004
Rollback Ozone
City Name=Houston
Mean Daily 24-hr Average
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.10
0.11
Highest Maximum Daily 8-hr Average

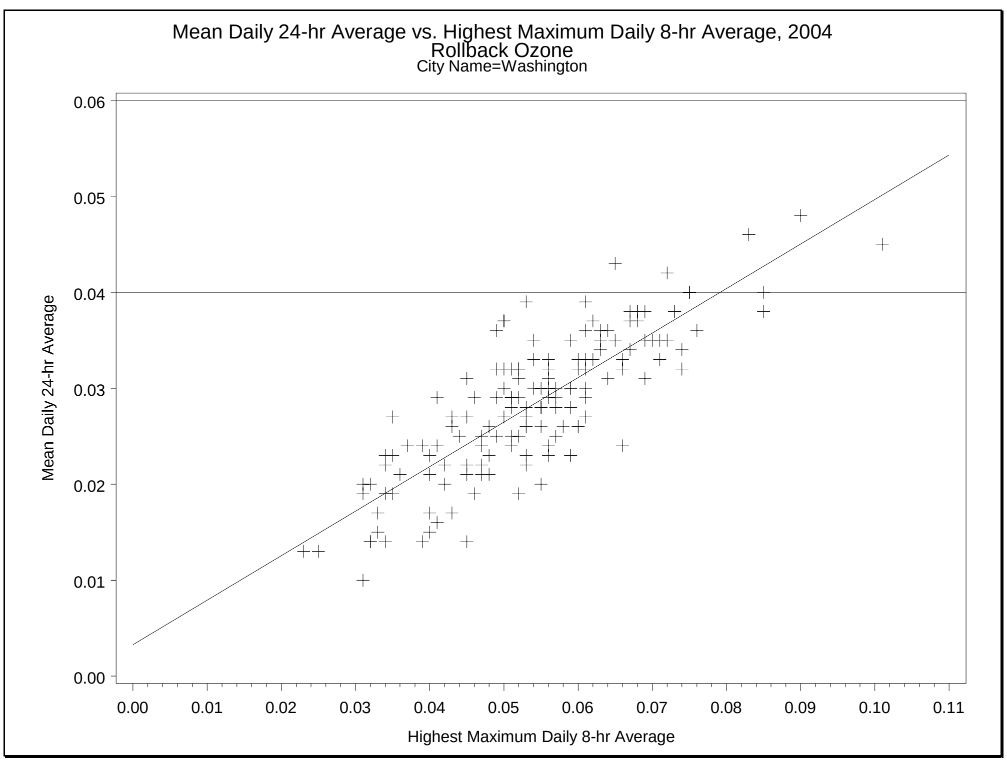

Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2004
Rollback Ozone
City Name=Los Angeles
Mean Daily 24-hr Average
0.06
0.05
0.04
0.03
0.02
0.01
0.00
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.10
0.11
Highest Maximum Daily 8-hr Average


Mean Daily 24-hr Average vs. Highest Maximum Daily 8-hr Average, 2004
Rollback Ozone
City Name=New York
Mean Daily 24-hr Average
0.06
0.05
0.04
0.03
0.02
0.01
0.00
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
0.03
0.04
0.05
0.06
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=Sacramento
Mean Daily 24-hr Average
0.00
0.01
0.02
0.03
0.04
0.05
0.06
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=St.Louis
Mean Daily 24-hr Average
0.00
0.01
0.02
0.03
0.04
0.05
0.06
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=Washington
Mean Daily 24-hr Average
0.00
0.01
0.02
0.03
0.04
0.05
0.06
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

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) 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	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) 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	-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)		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	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) 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
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) 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
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:

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

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

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

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

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

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

$$\Delta y = Be^{\beta x_0} \cdot \left(1 - e^{-\beta \Delta x}\right)$$
$$\Delta y = y_0 \cdot \left(1 - e^{-\beta \Delta x}\right)$$

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 O_3 Concentrations That Just Meet the Current and Alternative Daily Maximum 8-Hour Standards, for Location-Specific O_3 Seasons: Based on Adjusting 2002 O_3 Concentrations*

Location	Number of All Children (in 1000s) Estimated to Experience at Least One Lung Function Response 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
	Response = Decrease in FEV_1 Greater Than or Equal to 10%							
Atlanta	84 (62 - 122)	82 (60 - 120)	72 (51 - 108)	63 (43 - 97)	57 (39 - 90)	57 (39 - 90)	48 (31 - 78)	38 (23 - 61)
Boston	113 (87 - 156)	99 (73 - 140)	97 (72 - 139)	91 (67 - 132)	75 (53 - 113)	67 (46 - 103)	63 (43 - 98)	47 (29 - 76)
Chicago	178 (132 - 257)	163 (119 - 240)	151 (108 - 226)	133 (93 - 206)	119 (81 - 187)	110 (74 - 175)	100 (65 - 161)	75 (45 - 122)
Cleveland	67 (52 - 93)	59 (45 - 85)	58 (43 - 83)	48 (34 - 72)	45 (32 - 69)	40 (27 - 62)	38 (26 - 60)	29 (18 - 47)
Detroit	115 (87 - 162)	101 (75 - 148)	98 (72 - 145)	95 (69 - 141)	76 (53 - 119)	68 (46 - 108)	64 (43 - 103)	49 (30 - 80)
Houston	66 (46 - 100)	58 (40 - 91)	56 (38 - 87)	46 (30 - 72)	44 (28 - 69)	40 (25 - 64)	37 (23 - 58)	26 (15 - 41)
Los Angeles	122 (88 - 190)	117 (84 - 183)	102 (72 - 159)	72 (49 - 111)	71 (49 - 110)	68 (46 - 105)	54 (36 - 84)	29 (18 - 45)
New York	357 (261 - 525)	332 (239 - 495)	308 (218 - 468)	235 (156 - 373)	245 (163 - 386)	228 (149 - 363)	207 (132 - 333)	157 (93 - 256)
Philadelphia	140 (109 - 190)	126 (96 - 175)	121 (91 - 170)	99 (73 - 147)	95 (68 - 142)	86 (61 - 131)	81 (56 - 125)	62 (40 - 100)
Sacramento	27 (20 - 40)	24 (18 - 37)	22 (17 - 34)	18 (13 - 29)	17 (13 - 27)	16 (12 - 26)	14 (10 - 23)	10 (7 - 17)
St. Louis	72 (56 - 96)	65 (51 - 90)	61 (47 - 86)	52 (38 - 75)	48 (35 - 71)	44 (31 - 66)	40 (28 - 62)	30 (20 - 48)
Washington, DC	160 (122 - 223)	138 (103 - 200)	137 (102 - 199)	119 (85 - 177)	109 (77 - 166)	96 (66 - 150)	92 (62 - 144)	71 (44 - 114)
	Response = Decrease in FEV_1 Greater Than or Equal to 15%							
Atlanta	31 (17 - 47)	30 (16 - 46)	25 (12 - 39)	20 (8 - 34)	18 (6 - 31)	18 (6 - 30)	14 (3 - 25)	10 (1 - 19)
Boston	47 (29 - 68)	38 (22 - 57)	38 (21 - 56)	34 (19 - 52)	26 (12 - 42)	22 (9 - 37)	20 (8 - 34)	13 (3 - 25)
Chicago	67 (37 - 100)	59 (31 - 91)	53 (26 - 83)	44 (19 - 72)	38 (14 - 64)	34 (11 - 59)	29 (8 - 53)	20 (2 - 39)
Cleveland	27 (17 - 39)	23 (13 - 34)	22 (13 - 33)	17 (8 - 26)	16 (7 - 25)	13 (5 - 21)	12 (4 - 20)	8 (2 - 15)
Detroit	45 (27 - 66)	37 (21 - 57)	36 (20 - 55)	34 (18 - 53)	25 (11 - 41)	21 (8 - 36)	19 (6 - 34)	13 (2 - 25)
Houston	22 (9 - 36)	18 (6 - 31)	17 (6 - 30)	13 (3 - 24)	12 (2 - 23)	11 (2 - 21)	10 (1 - 19)	6 (0 - 14)
Los Angeles	35 (8 - 63)	33 (7 - 60)	28 (5 - 52)	18 (1 - 36)	18 (1 - 36)	17 (1 - 34)	13 (1 - 27)	7 (0 - 15)

Location	Number of All Children (in 1000s) Estimated to Experience at Least One Lung Function Response 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**
New York	131 (70 - 200)	117 (59 - 184)	105 (49 - 168)	72 (23 - 125)	76 (26 - 130)	68 (20 - 121)	59 (14 - 109)	41 (3 - 82)
Philadelphia	58 (37 - 83)	50 (30 - 73)	47 (28 - 69)	36 (19 - 55)	33 (17 - 52)	29 (13 - 47)	26 (11 - 43)	18 (5 - 33)
Sacramento	9 (4 - 14)	8 (3 - 13)	7 (3 - 12)	6 (2 - 9)	5 (1 - 9)	5 (1 - 8)	4 (1 - 7)	3 (0 - 5)
St. Louis	30 (20 - 43)	27 (17 - 38)	24 (15 - 36)	19 (11 - 29)	17 (9 - 27)	15 (7 - 24)	13 (6 - 22)	9 (2 - 16)
Washington, DC	64 (39 - 93)	52 (29 - 78)	51 (29 - 78)	42 (21 - 65)	37 (17 - 59)	31 (12 - 52)	29 (10 - 49)	20 (4 - 37)
	Response = Decrease in FEV_1 Greater Than or Equal to 20%							
Atlanta	8 (2 - 18)	8 (2 - 17)	6 (1 - 14)	4 (1 - 11)	3 (0 - 10)	3 (0 - 10)	2 (0 - 8)	1 (0 - 6)
Boston	15 (7 - 30)	11 (4 - 23)	11 (4 - 23)	10 (3 - 20)	6 (2 - 15)	5 (1 - 12)	4 (1 - 11)	2 (0 - 8)
Chicago	17 (5 - 38)	14 (4 - 33)	12 (2 - 29)	9 (1 - 24)	7 (1 - 21)	6 (0 - 19)	5 (0 - 16)	3 (0 - 11)
Cleveland	8 (3 - 16)	6 (2 - 13)	6 (2 - 12)	4 (1 - 9)	3 (1 - 9)	3 (0 - 7)	2 (0 - 7)	1 (0 - 5)
Detroit	12 (4 - 25)	9 (2 - 21)	9 (2 - 20)	8 (2 - 19)	5 (0 - 14)	4 (0 - 12)	3 (0 - 11)	2 (0 - 8)
Houston	5 (1 - 12)	4 (1 - 11)	3 (0 - 10)	2 (0 - 7)	2 (0 - 7)	2 (0 - 6)	1 (0 - 6)	1 (0 - 4)
Los Angeles	6 (0 - 20)	6 (0 - 19)	5 (0 - 16)	3 (0 - 11)	3 (0 - 11)	2 (0 - 10)	2 (0 - 8)	1 (0 - 4)
New York	33 (9 - 74)	28 (6 - 66)	23 (4 - 58)	13 (1 - 40)	14 (1 - 42)	12 (1 - 38)	10 (0 - 34)	6 (0 - 24)
Philadelphia	18 (8 - 35)	15 (5 - 29)	13 (5 - 27)	9 (2 - 20)	8 (2 - 18)	6 (1 - 16)	5 (1 - 15)	3 (0 - 10)
Sacramento	2 (0 - 5)	2 (0 - 5)	1 (0 - 4)	1 (0 - 3)	1 (0 - 3)	1 (0 - 3)	1 (0 - 2)	0 (0 - 2)
St. Louis	10 (4 - 19)	8 (3 - 16)	7 (2 - 14)	5 (1 - 11)	4 (1 - 9)	3 (0 - 8)	3 (0 - 7)	1 (0 - 5)
Washington, DC	19 (7 - 38)	14 (4 - 30)	14 (4 - 29)	10 (2 - 23)	8 (1 - 20)	6 (1 - 17)	5 (0 - 16)	3 (0 - 11)

*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-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 O_3 Concentrations That Just Meet the Current and Alternative Daily Maximum 8-Hour Standards, for Location-Specific O_3 Seasons: Based on Adjusting 2002 O_3 Concentrations*

Location	Percent of All Children Estimated to Experience at Least One Lung Function Response 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
	Response = Decrease in FEV_1 Greater Than or Equal to 10%							
Atlanta	8.9% (6.6% - 12.9%)	8.7% (6.4% - 12.7%)	7.6% (5.5% - 11.5%)	6.6% (4.6% - 10.3%)	6.1% (4.1% - 9.6%)	6% (4.1% - 9.5%)	5.1% (3.3% - 8.2%)	4% (2.4% - 6.5%)
Boston	10.3% (7.9% - 14.3%)	9% (6.7% - 12.8%)	8.9% (6.6% - 12.6%)	8.3% (6.1% - 12%)	6.9% (4.8% - 10.3%)	6.1% (4.2% - 9.4%)	5.8% (3.9% - 8.9%)	4.3% (2.7% - 6.9%)
Chicago	9.1% (6.8% - 13.2%)	8.4% (6.1% - 12.3%)	7.7% (5.5% - 11.6%)	6.8% (4.8% - 10.5%)	6.1% (4.1% - 9.6%)	5.7% (3.8% - 9%)	5.1% (3.3% - 8.2%)	3.8% (2.3% - 6.2%)
Cleveland	11.4% (8.7% - 15.7%)	10% (7.5% - 14.3%)	9.7% (7.3% - 14%)	8% (5.8% - 12.1%)	7.6% (5.4% - 11.6%)	6.7% (4.6% - 10.5%)	6.4% (4.3% - 10%)	4.9% (3.1% - 8%)
Detroit	10.3% (7.8% - 14.6%)	9.1% (6.7% - 13.3%)	8.9% (6.5% - 13%)	8.6% (6.2% - 12.7%)	6.9% (4.8% - 10.7%)	6.1% (4.1% - 9.7%)	5.8% (3.8% - 9.3%)	4.4% (2.7% - 7.2%)
Houston	6% (4.3% - 9.2%)	5.4% (3.7% - 8.3%)	5.1% (3.5% - 8%)	4.2% (2.7% - 6.6%)	4% (2.6% - 6.4%)	3.7% (2.3% - 5.9%)	3.4% (2.1% - 5.4%)	2.4% (1.4% - 3.8%)
Los Angeles	3.3% (2.4% - 5.2%)	3.2% (2.3% - 5%)	2.8% (2% - 4.3%)	2% (1.3% - 3%)	1.9% (1.3% - 3%)	1.8% (1.3% - 2.9%)	1.5% (1% - 2.3%)	0.8% (0.5% - 1.2%)
New York	8.6% (6.3% - 12.6%)	8% (5.8% - 11.9%)	7.4% (5.3% - 11.3%)	5.7% (3.8% - 9%)	5.9% (3.9% - 9.3%)	5.5% (3.6% - 8.8%)	5% (3.2% - 8%)	3.8% (2.2% - 6.2%)
Philadelphia	11.8% (9.2% - 16%)	10.6% (8.1% - 14.8%)	10.2% (7.7% - 14.3%)	8.4% (6.1% - 12.4%)	8% (5.7% - 11.9%)	7.2% (5.1% - 11.1%)	6.8% (4.7% - 10.5%)	5.2% (3.4% - 8.4%)
Sacramento	6.4% (5% - 9.7%)	5.9% (4.5% - 9%)	5.5% (4.1% - 8.4%)	4.4% (3.3% - 7%)	4.2% (3.1% - 6.7%)	3.9% (2.8% - 6.2%)	3.5% (2.5% - 5.5%)	2.5% (1.8% - 4%)
St. Louis	12.3% (9.7% - 16.6%)	11.2% (8.7% - 15.4%)	10.6% (8.1% - 14.8%)	8.9% (6.6% - 13%)	8.3% (6% - 12.3%)	7.5% (5.4% - 11.4%)	6.9% (4.8% - 10.6%)	5.2% (3.4% - 8.3%)
Washington, DC	10.8% (8.2% - 15%)	9.3% (6.9% - 13.4%)	9.2% (6.9% - 13.4%)	8% (5.8% - 11.9%)	7.3% (5.2% - 11.2%)	6.5% (4.4% - 10.1%)	6.2% (4.2% - 9.7%)	4.7% (3% - 7.7%)
	Response = Decrease in FEV_1 Greater Than or Equal to 15%							
Atlanta	3.3% (1.8% - 5%)	3.2% (1.7% - 4.9%)	2.6% (1.3% - 4.2%)	2.2% (0.9% - 3.6%)	1.9% (0.7% - 3.2%)	1.9% (0.7% - 3.2%)	1.5% (0.3% - 2.7%)	1% (0.1% - 2.1%)
Boston	4.3% (2.6% - 6.2%)	3.5% (2% - 5.2%)	3.4% (1.9% - 5.1%)	3.1% (1.7% - 4.8%)	2.4% (1.1% - 3.8%)	2% (0.8% - 3.3%)	1.8% (0.7% - 3.1%)	1.2% (0.3% - 2.3%)
Chicago	3.4% (1.9% - 5.2%)	3% (1.6% - 4.7%)	2.7% (1.3% - 4.2%)	2.3% (1% - 3.7%)	1.9% (0.7% - 3.3%)	1.7% (0.6% - 3%)	1.5% (0.4% - 2.7%)	1% (0.1% - 2%)
Cleveland	4.6% (2.9% - 6.6%)	3.8% (2.3% - 5.7%)	3.7% (2.1% - 5.5%)	2.8% (1.4% - 4.4%)	2.6% (1.3% - 4.2%)	2.2% (0.9% - 3.6%)	2% (0.8% - 3.4%)	1.4% (0.3% - 2.6%)
Detroit	4% (2.4% - 5.9%)	3.4% (1.9% - 5.1%)	3.2% (1.8% - 4.9%)	3.1% (1.6% - 4.7%)	2.2% (1% - 3.7%)	1.9% (0.7% - 3.3%)	1.8% (0.6% - 3.1%)	1.2% (0.1% - 2.3%)
Houston	2% (0.8% - 3.3%)	1.7% (0.6% - 2.9%)	1.6% (0.5% - 2.7%)	1.2% (0.3% - 2.2%)	1.1% (0.2% - 2.1%)	1% (0.2% - 1.9%)	0.9% (0.1% - 1.7%)	0.6% (0% - 1.2%)
Los Angeles	1% (0.2% - 1.7%)	0.9% (0.2% - 1.6%)	0.8% (0.1% - 1.4%)	0.5% (0% - 1%)	0.5% (0% - 1%)	0.5% (0% - 0.9%)	0.4% (0% - 0.7%)	0.2% (0% - 0.4%)

Location	Percent of All Children Estimated to Experience at Least One Lung Function Response 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
New York	3.1% (1.7% - 4.8%)	2.8% (1.4% - 4.4%)	2.5% (1.2% - 4.1%)	1.7% (0.6% - 3%)	1.8% (0.6% - 3.1%)	1.6% (0.5% - 2.9%)	1.4% (0.3% - 2.6%)	1% (0.1% - 2%)
Philadelphia	4.9% (3.1% - 7%)	4.2% (2.5% - 6.1%)	4% (2.4% - 5.8%)	3% (1.6% - 4.7%)	2.8% (1.4% - 4.4%)	2.4% (1.1% - 3.9%)	2.2% (0.9% - 3.7%)	1.5% (0.4% - 2.7%)
Sacramento	2.2% (1% - 3.5%)	2% (0.8% - 3.1%)	1.8% (0.7% - 2.9%)	1.3% (0.4% - 2.3%)	1.3% (0.3% - 2.2%)	1.1% (0.2% - 2%)	1% (0.1% - 1.8%)	0.7% (0% - 1.3%)
St. Louis	5.2% (3.4% - 7.4%)	4.6% (2.9% - 6.6%)	4.2% (2.6% - 6.1%)	3.3% (1.8% - 5%)	3% (1.6% - 4.6%)	2.6% (1.3% - 4.1%)	2.3% (1% - 3.7%)	1.5% (0.4% - 2.7%)
Washington, DC	4.3% (2.6% - 6.3%)	3.5% (2% - 5.3%)	3.5% (1.9% - 5.2%)	2.8% (1.4% - 4.4%)	2.5% (1.1% - 4%)	2.1% (0.8% - 3.5%)	1.9% (0.7% - 3.3%)	1.3% (0.2% - 2.5%)
	Response = Decrease in FEV_1 Greater Than or Equal to 20%							
Atlanta	0.9% (0.2% - 1.9%)	0.8% (0.2% - 1.8%)	0.6% (0.1% - 1.5%)	0.4% (0.1% - 1.2%)	0.4% (0% - 1.1%)	0.4% (0% - 1.1%)	0.3% (0% - 0.8%)	0.2% (0% - 0.6%)
Boston	1.4% (0.6% - 2.7%)	1% (0.4% - 2.1%)	1% (0.4% - 2.1%)	0.9% (0.3% - 1.9%)	0.6% (0.1% - 1.4%)	0.4% (0.1% - 1.1%)	0.4% (0.1% - 1%)	0.2% (0% - 0.7%)
Chicago	0.9% (0.3% - 1.9%)	0.7% (0.2% - 1.7%)	0.6% (0.1% - 1.5%)	0.5% (0.1% - 1.2%)	0.4% (0% - 1.1%)	0.3% (0% - 1%)	0.3% (0% - 0.8%)	0.1% (0% - 0.6%)
Cleveland	1.4% (0.5% - 2.7%)	1% (0.3% - 2.1%)	0.9% (0.3% - 2%)	0.6% (0.1% - 1.5%)	0.6% (0.1% - 1.4%)	0.4% (0% - 1.2%)	0.4% (0% - 1.1%)	0.2% (0% - 0.8%)
Detroit	1.1% (0.3% - 2.3%)	0.8% (0.2% - 1.9%)	0.8% (0.2% - 1.8%)	0.7% (0.1% - 1.7%)	0.4% (0% - 1.2%)	0.3% (0% - 1%)	0.3% (0% - 1%)	0.2% (0% - 0.7%)
Houston	0.5% (0.1% - 1.1%)	0.3% (0.1% - 1%)	0.3% (0% - 0.9%)	0.2% (0% - 0.7%)	0.2% (0% - 0.6%)	0.2% (0% - 0.6%)	0.1% (0% - 0.5%)	0.1% (0% - 0.3%)
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	0.8% (0.2% - 1.8%)	0.7% (0.2% - 1.6%)	0.6% (0.1% - 1.4%)	0.3% (0% - 1%)	0.3% (0% - 1%)	0.3% (0% - 0.9%)	0.2% (0% - 0.8%)	0.1% (0% - 0.6%)
Philadelphia	1.6% (0.6% - 3%)	1.2% (0.4% - 2.5%)	1.1% (0.4% - 2.3%)	0.7% (0.2% - 1.7%)	0.6% (0.1% - 1.5%)	0.5% (0.1% - 1.3%)	0.5% (0% - 1.2%)	0.3% (0% - 0.9%)
Sacramento	0.5% (0.1% - 1.2%)	0.4% (0.1% - 1.1%)	0.4% (0% - 1%)	0.2% (0% - 0.8%)	0.2% (0% - 0.7%)	0.2% (0% - 0.6%)	0.2% (0% - 0.6%)	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	1.3% (0.5% - 2.6%)	0.9% (0.3% - 2%)	0.9% (0.3% - 2%)	0.7% (0.1% - 1.6%)	0.5% (0.1% - 1.4%)	0.4% (0% - 1.1%)	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 O_3 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 O_3 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 O_3 Seasons: Based on Adjusting 2002 O_3 Concentrations*

Location	Number of Occurrences (in 1000s) of Lung Function Response 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
	Response = Decrease in FEV_1 Greater Than or Equal to 10%							
Atlanta	660 (237 - 1180)	651 (232 - 1167)	588 (193 - 1068)	528 (158 - 971)	494 (139 - 914)	492 (138 - 911)	435 (108 - 816)	357 (72 - 684)
Boston	724 (275 - 1279)	655 (229 - 1175)	648 (225 - 1165)	620 (207 - 1122)	545 (161 - 1006)	504 (137 - 941)	484 (126 - 909)	401 (82 - 772)
Chicago	1203 (459 - 2123)	1126 (409 - 2005)	1067 (371 - 1915)	972 (313 - 1764)	888 (264 - 1628)	842 (237 - 1553)	780 (204 - 1451)	635 (130 - 1205)
Cleveland	508 (211 - 884)	463 (180 - 818)	453 (173 - 802)	393 (133 - 710)	378 (124 - 688)	348 (106 - 640)	334 (97 - 617)	275 (64 - 520)
Detroit	804 (328 - 1408)	730 (278 - 1296)	714 (267 - 1271)	694 (254 - 1242)	592 (189 - 1081)	542 (160 - 1001)	520 (147 - 964)	424 (95 - 805)
Houston	374 (133 - 640)	336 (114 - 576)	322 (107 - 552)	260 (79 - 445)	248 (74 - 424)	225 (64 - 382)	197 (55 - 331)	103 (30 - 153)
Los Angeles	1641 (349 - 3064)	1584 (329 - 2964)	1398 (268 - 2627)	974 (154 - 1839)	961 (152 - 1814)	905 (139 - 1709)	675 (94 - 1266)	292 (37 - 504)
New York	2824 (1021 - 5042)	2671 (922 - 4806)	2536 (836 - 4597)	2092 (570 - 3884)	2149 (601 - 3977)	2048 (544 - 3812)	1915 (469 - 3593)	1549 (294 - 2970)
Philadelphia	1122 (485 - 1925)	1034 (423 - 1797)	1004 (402 - 1753)	876 (316 - 1559)	845 (296 - 1512)	788 (260 - 1423)	752 (237 - 1365)	624 (162 - 1158)
Sacramento	299 (91 - 546)	282 (82 - 517)	266 (74 - 491)	229 (55 - 429)	221 (51 - 416)	210 (46 - 396)	194 (39 - 368)	155 (24 - 300)
St. Louis	491 (219 - 837)	455 (194 - 785)	434 (180 - 754)	379 (143 - 671)	359 (130 - 639)	336 (116 - 603)	313 (102 - 567)	253 (68 - 469)
Washington, DC	1210 (483 - 2122)	1089 (403 - 1941)	1082 (398 - 1931)	970 (327 - 1755)	912 (291 - 1665)	834 (245 - 1540)	810 (231 - 1502)	672 (156 - 1272)
	Response = Decrease in FEV_1 Greater Than or Equal to 15%							
Atlanta	159 (27 - 376)	156 (25 - 371)	136 (17 - 336)	118 (11 - 303)	108 (8 - 284)	108 (8 - 283)	92 (4 - 252)	73 (1 - 209)
Boston	186 (45 - 419)	161 (33 - 378)	158 (32 - 375)	149 (27 - 358)	124 (16 - 316)	111 (12 - 293)	106 (10 - 282)	82 (3 - 236)
Chicago	298 (58 - 684)	272 (45 - 640)	252 (37 - 607)	223 (25 - 554)	198 (17 - 508)	184 (13 - 483)	167 (9 - 449)	129 (2 - 370)
Cleveland	132 (33 - 290)	116 (24 - 264)	112 (22 - 258)	92 (13 - 224)	87 (11 - 216)	78 (8 - 199)	74 (6 - 191)	57 (2 - 160)
Detroit	205 (47 - 457)	179 (34 - 415)	174 (31 - 406)	167 (28 - 395)	134 (15 - 338)	120 (10 - 311)	113 (8 - 299)	87 (2 - 247)
Houston	90 (11 - 208)	79 (7 - 187)	75 (6 - 179)	59 (3 - 144)	56 (3 - 137)	50 (2 - 124)	44 (1 - 109)	24 (0 - 54)
Los Angeles	342 (10 - 952)	329 (9 - 920)	287 (6 - 815)	196 (2 - 570)	193 (2 - 563)	182 (1 - 531)	136 (1 - 395)	61 (0 - 165)

Location	Number of Occurrences (in 1000s) of Lung Function Response 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
New York	679 (112 - 1607)	629 (90 - 1522)	585 (73 - 1447)	454 (29 - 1205)	469 (34 - 1236)	441 (25 - 1180)	404 (17 - 1109)	312 (3 - 910)
Philadelphia	296 (75 - 636)	264 (58 - 586)	253 (52 - 569)	209 (31 - 496)	199 (27 - 479)	181 (20 - 448)	170 (16 - 428)	133 (6 - 359)
Sacramento	67 (6 - 171)	62 (5 - 162)	58 (4 - 153)	48 (2 - 133)	46 (2 - 128)	43 (1 - 122)	39 (1 - 113)	31 (0 - 92)
St. Louis	133 (37 - 280)	119 (30 - 258)	112 (26 - 246)	93 (17 - 215)	86 (14 - 203)	79 (11 - 191)	72 (8 - 178)	54 (2 - 145)
Washington, DC	307 (68 - 690)	265 (48 - 621)	263 (46 - 617)	226 (31 - 554)	208 (24 - 522)	185 (16 - 479)	178 (14 - 466)	140 (4 - 391)
	Response = Decrease in FEV_1 Greater Than or Equal to 20%							
Atlanta	23 (3 - 97)	22 (2 - 95)	17 (1 - 83)	14 (1 - 73)	12 (0 - 67)	12 (0 - 67)	9 (0 - 58)	7 (0 - 46)
Boston	33 (8 - 115)	26 (5 - 99)	25 (5 - 98)	22 (4 - 92)	16 (2 - 77)	13 (1 - 70)	12 (1 - 66)	8 (0 - 53)
Chicago	45 (6 - 180)	39 (4 - 165)	34 (3 - 153)	28 (1 - 136)	23 (1 - 122)	20 (0 - 115)	18 (0 - 105)	12 (0 - 83)
Cleveland	22 (4 - 79)	18 (2 - 70)	17 (2 - 67)	12 (1 - 56)	11 (1 - 53)	9 (0 - 48)	8 (0 - 46)	6 (0 - 36)
Detroit	33 (5 - 123)	26 (3 - 108)	25 (2 - 105)	23 (2 - 101)	16 (0 - 82)	14 (0 - 74)	12 (0 - 70)	8 (0 - 56)
Houston	12 (1 - 54)	10 (1 - 48)	9 (0 - 46)	7 (0 - 36)	6 (0 - 34)	5 (0 - 31)	5 (0 - 27)	3 (0 - 14)
Los Angeles	33 (0 - 216)	32 (0 - 208)	27 (0 - 183)	17 (0 - 126)	17 (0 - 124)	16 (0 - 117)	11 (0 - 87)	5 (0 - 38)
New York	96 (10 - 413)	84 (7 - 384)	75 (5 - 359)	50 (1 - 283)	52 (1 - 292)	47 (1 - 276)	41 (0 - 255)	28 (0 - 201)
Philadelphia	52 (10 - 179)	43 (7 - 159)	40 (6 - 152)	29 (2 - 127)	26 (2 - 121)	22 (1 - 111)	20 (1 - 104)	14 (0 - 84)
Sacramento	8 (0 - 42)	7 (0 - 39)	6 (0 - 36)	5 (0 - 30)	5 (0 - 29)	4 (0 - 28)	4 (0 - 25)	3 (0 - 20)
St. Louis	25 (5 - 80)	20 (4 - 72)	18 (3 - 67)	13 (1 - 56)	12 (1 - 52)	10 (1 - 48)	9 (0 - 44)	6 (0 - 34)
Washington, DC	50 (9 - 187)	39 (5 - 161)	38 (5 - 160)	30 (2 - 138)	26 (1 - 128)	21 (1 - 114)	20 (0 - 110)	14 (0 - 89)

*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 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-4. Number of Asthmatic Children (Ages 5-18) Engaged in Moderate Exertion Estimated to Experience At Least One Lung Function Response (Change in FEV_1>=10%) Associated with Exposure to O_3 Concentrations That Just Meet the Current and Alternative Daily Maximum 8-Hour Standards, for Five Location-Specific O_3 Seasons, Based on 2002, 2003, and 2004 O_3 Concentrations*

Location	Number of Asthmatic Children (in 1000s) Estimated to Experience at Least One Lung Function Response Associated with O_3 Concentrations that Just Meet the Current and Alternative O_3 Standards**			
	A Recent Year of Air Quality	0.084/4***	0.074/4	0.064/4
	Based on 2002 Air Quality Data			
Atlanta	16 (12 - 21)	11 (8 - 16)	8 (5 - 12)	5 (3 - 8)
Chicago	38 (31 - 51)	26 (20 - 38)	18 (12 - 28)	11 (7 - 18)
Houston	16 (12 - 21)	8 (6 - 13)	6 (4 - 9)	3 (2 - 5)
Los Angeles	60 (50 - 78)	16 (11 - 24)	9 (6 - 14)	4 (2 - 6)
New York	109 (89 - 138)	58 (43 - 85)	40 (27 - 63)	26 (15 - 42)
	Based on 2003 Air Quality Data			
Atlanta	10 (8 - 15)	8 (5 - 12)	5 (3 - 9)	3 (2 - 5)
Chicago	18 (13 - 28)	15 (10 - 24)	10 (6 - 17)	6 (3 - 10)
Houston	19 (15 - 24)	7 (5 - 11)	5 (3 - 8)	3 (1 - 4)
Los Angeles	77 (66 - 95)	16 (12 - 25)	9 (6 - 14)	4 (2 - 5)
New York	80 (63 - 108)	41 (28 - 63)	26 (16 - 43)	16 (8 - 26)
	Based on 2004 Air Quality Data			
Atlanta	10 (8 - 15)	7 (5 - 11)	5 (3 - 8)	3 (2 - 5)
Chicago	13 (8 - 21)	8 (5 - 13)	5 (3 - 9)	3 (1 - 5)
Houston	16 (12 - 21)	8 (6 - 13)	6 (4 - 9)	3 (2 - 5)
Los Angeles	61 (51 - 80)	16 (11 - 25)	9 (6 - 14)	4 (2 - 6)
New York	47 (33 - 70)	24 (14 - 39)	16 (8 - 25)	10 (3 - 16)

*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-5. Percent of Asthmatic Children (Ages 5-18) Engaged in Moderate Exertion Estimated to Experience At Least One Lung Function Response (Change in FEV_1>=10%) Associated with Exposure to O_3 Concentrations That Just Meet the Current and Alternative Daily Maximum 8-Hour Standards, for Five Location-Specific O_3 Seasons, Based on 2002, 2003, and 2004 O_3 Concentrations*

Location	Percent of Asthmatic Children Estimated to Experience at Least One Lung Function Response Associated with O_3 Concentrations that Just Meet the Current and Alternative O_3 Standards**			
	A Recent Year of Air Quality	0.084/4***	0.074/4	0.064/4
	Based on 2002 Air Quality Data			
Atlanta	13.4% (10.7% - 17.9%)	9.6% (7.2% - 13.9%)	6.6% (4.5% - 10.3%)	4.3% (2.6% - 6.9%)
Chicago	13.8% (11% - 18.1%)	9.4% (7% - 13.5%)	6.3% (4.3% - 9.9%)	4% (2.4% - 6.5%)
Houston	11.5% (9% - 15.5%)	6.2% (4.4% - 9.5%)	4.1% (2.6% - 6.5%)	2.5% (1.4% - 3.9%)
Los Angeles	13.2% (11% - 17.1%)	3.4% (2.5% - 5.3%)	2% (1.4% - 3.1%)	0.8% (0.5% - 1.3%)
New York	17% (13.8% - 21.4%)	9.1% (6.7% - 13.3%)	6.3% (4.2% - 9.8%)	4% (2.4% - 6.5%)
	Based on 2003 Air Quality Data			
Atlanta	9.4% (7% - 13.6%)	6.9% (4.8% - 10.6%)	4.8% (3% - 7.7%)	3% (1.7% - 4.8%)
Chicago	6.8% (4.7% - 10.4%)	5.6% (3.7% - 8.8%)	3.7% (2.2% - 6.1%)	2.4% (1.2% - 3.8%)
Houston	14.4% (11.7% - 18.7%)	5.6% (3.9% - 8.8%)	3.8% (2.4% - 6%)	2.1% (1.1% - 3.3%)
Los Angeles	17.1% (14.6% - 21.2%)	3.6% (2.6% - 5.5%)	2% (1.4% - 3%)	0.8% (0.5% - 1.2%)
New York	12.2% (9.5% - 16.4%)	6.2% (4.2% - 9.5%)	4% (2.4% - 6.5%)	2.5% (1.2% - 4%)
	Based on 2004 Air Quality Data			
Atlanta	8.9% (6.5% - 13.1%)	6.2% (4.2% - 9.8%)	4.3% (2.6% - 6.9%)	2.7% (1.5% - 4.3%)
Chicago	4.6% (2.9% - 7.3%)	3% (1.7% - 4.8%)	2% (0.9% - 3.2%)	1.1% (0.3% - 1.9%)
Houston	11.5% (9% - 15.7%)	6.1% (4.3% - 9.4%)	4.1% (2.7% - 6.6%)	2.5% (1.4% - 4%)
Los Angeles	13.4% (11.2% - 17.4%)	3.4% (2.4% - 5.4%)	2% (1.4% - 3.1%)	0.8% (0.5% - 1.2%)
New York	7.3% (5.1% - 10.9%)	3.7% (2.2% - 6%)	2.5% (1.2% - 4%)	1.5% (0.5% - 2.5%)

*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 O_3 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 FEV_1>=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 O_3 Concentrations*

Location	Number of Occurrences (in 1000s) of Lung Function Response Associated with O_3 Concentrations that Just Meet the Current and Alternative O_3 Standards**			
	A Recent Year of Air Quality	0.084/4***	0.074/4	0.064/4
	Based on 2002 Air Quality Data			
Atlanta	121 (52 - 209)	91 (33 - 163)	68 (19 - 127)	49 (10 - 95)
Chicago	241 (112 - 406)	175 (67 - 308)	129 (39 - 237)	92 (19 - 175)
Houston	89 (40 - 148)	49 (17 - 84)	32 (10 - 55)	13 (4 - 20)
Los Angeles	602 (271 - 1015)	201 (45 - 372)	117 (19 - 220)	36 (5 - 61)
New York	762 (377 - 1260)	469 (170 - 837)	358 (101 - 661)	257 (49 - 493)
	Based on 2003 Air Quality Data			
Atlanta	90 (31 - 161)	70 (20 - 130)	52 (11 - 99)	37 (5 - 73)
Chicago	142 (44 - 257)	120 (33 - 221)	88 (17 - 167)	61 (7 - 121)
Houston	121 (57 - 200)	52 (16 - 92)	31 (8 - 54)	8 (3 - 10)
Los Angeles	751 (378 - 1226)	194 (47 - 354)	96 (19 - 173)	15 (5 - 14)
New York	487 (198 - 845)	294 (79 - 546)	220 (42 - 423)	153 (17 - 305)
	Based on 2004 Air Quality Data			
Atlanta	98 (31 - 178)	73 (18 - 138)	55 (10 - 106)	40 (4 - 79)
Chicago	113 (25 - 214)	79 (11 - 155)	57 (4 - 115)	38 (1 - 79)
Houston	103 (45 - 173)	58 (20 - 100)	39 (11 - 68)	18 (4 - 29)
Los Angeles	671 (305 - 1133)	226 (48 - 423)	141 (20 - 269)	52 (4 - 97)
New York	374 (110 - 685)	228 (38 - 442)	171 (17 - 341)	118 (5 - 245)

*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 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-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 5-18 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	30 (16 - 46)	18 (6 - 31)	10 (1 - 20)	6 (0 - 13)	50 (33 - 71)	31 (17 - 47)	18 (6 - 31)	10 (1 - 19)
Atlanta - with lower PRB	31 (16 - 48)	19 (6 - 34)	11 (1 - 23)	7 (0 - 16)	51 (33 - 73)	32 (17 - 50)	19 (6 - 33)	11 (1 - 22)
Atlanta - with higher PRB	29 (16 - 43)	17 (6 - 28)	10 (1 - 18)	5 (0 - 11)	49 (33 - 68)	30 (17 - 44)	17 (6 - 28)	9 (1 - 17)
Los Angeles	215 (145 - 292)	33 (5 - 61)	17 (1 - 35)	6 (0 - 14)	220 (149 - 297)	35 (8 - 63)	18 (1 - 36)	7 (0 - 15)
Los Angeles - with lower PRB	219 (145 - 305)	38 (5 - 74)	22 (1 - 48)	11 (0 - 27)	224 (149 - 310)	40 (8 - 75)	23 (1 - 49)	11 (0 - 28)
Los Angeles - with higher PRB	213 (145 - 287)	31 (5 - 56)	15 (1 - 30)	4 (0 - 9)	218 (149 - 292)	33 (8 - 57)	16 (1 - 31)	5 (0 - 10)
New York	97 (43 - 156)	39 (4 - 77)	23 (0 - 52)	13 (0 - 33)	316 (220 - 426)	131 (70 - 200)	76 (26 - 130)	41 (3 - 82)
New York - with lower PRB	99 (43 - 164)	41 (4 - 85)	25 (0 - 60)	15 (0 - 41)	318 (220 - 434)	133 (70 - 208)	78 (26 - 138)	43 (3 - 89)
New York - with higher PRB	95 (43 - 151)	37 (4 - 72)	21 (0 - 46)	11 (0 - 28)	314 (220 - 420)	129 (70 - 195)	74 (26 - 125)	39 (3 - 76)

*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)

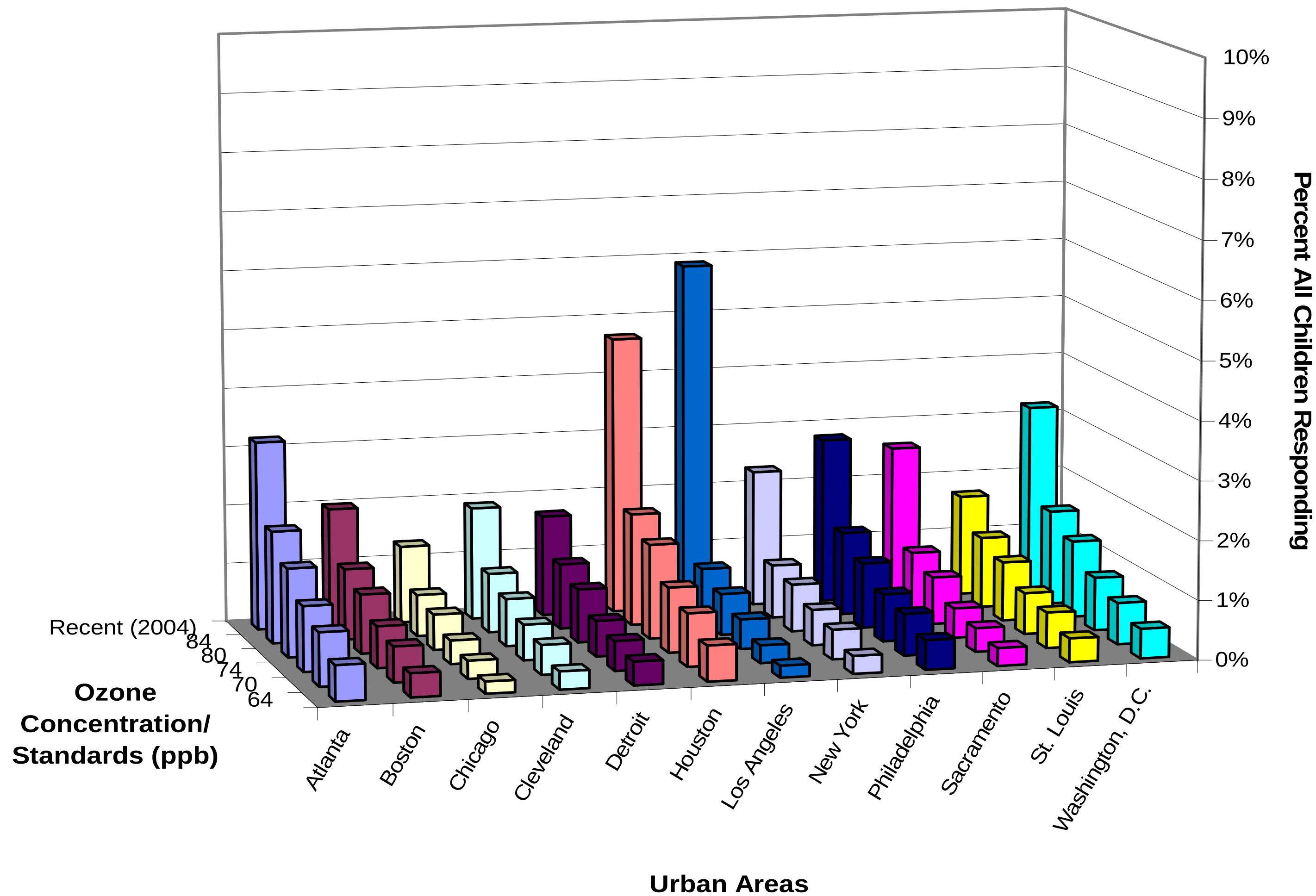
*All results are for mortality (among all ages) associated with short-term exposures to O_3. All results are based on single-pollutant models.

**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-Highest 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-x 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

FFigure 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-Highest Daily Maximum 8-Hour Standards, for Location-Specific O_3 Seasons (Based on Adjusting 2004 Air Quality)*

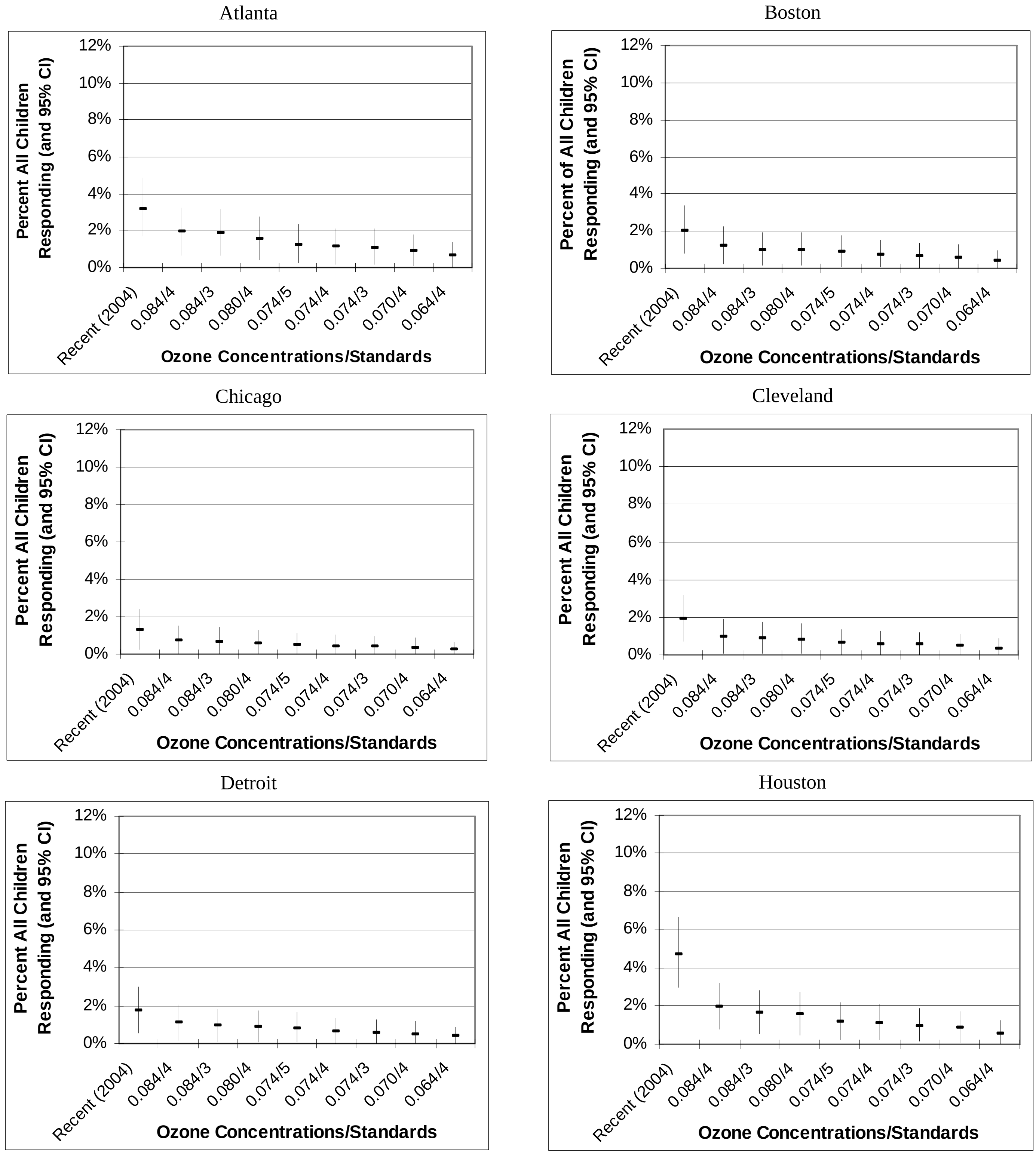
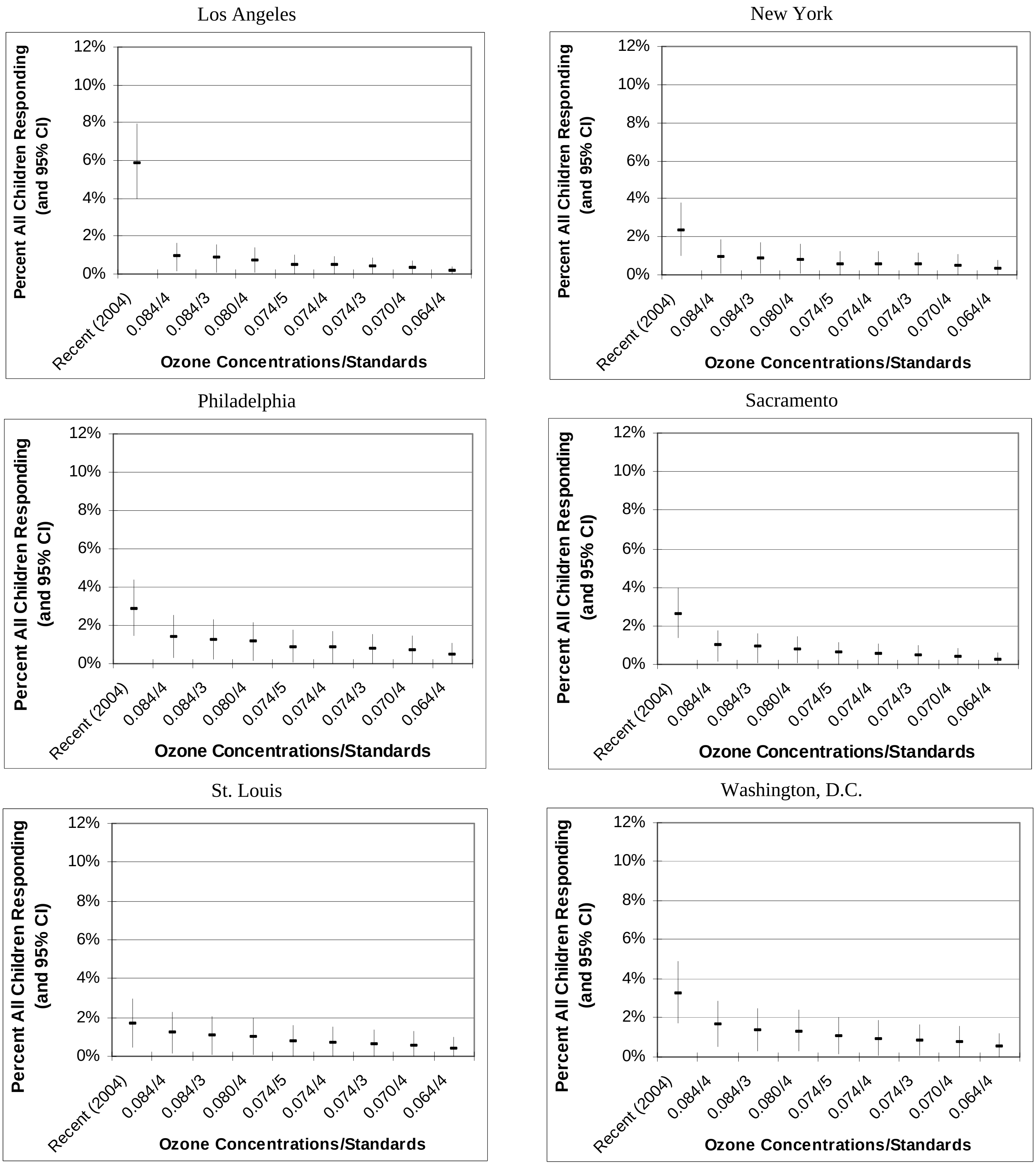
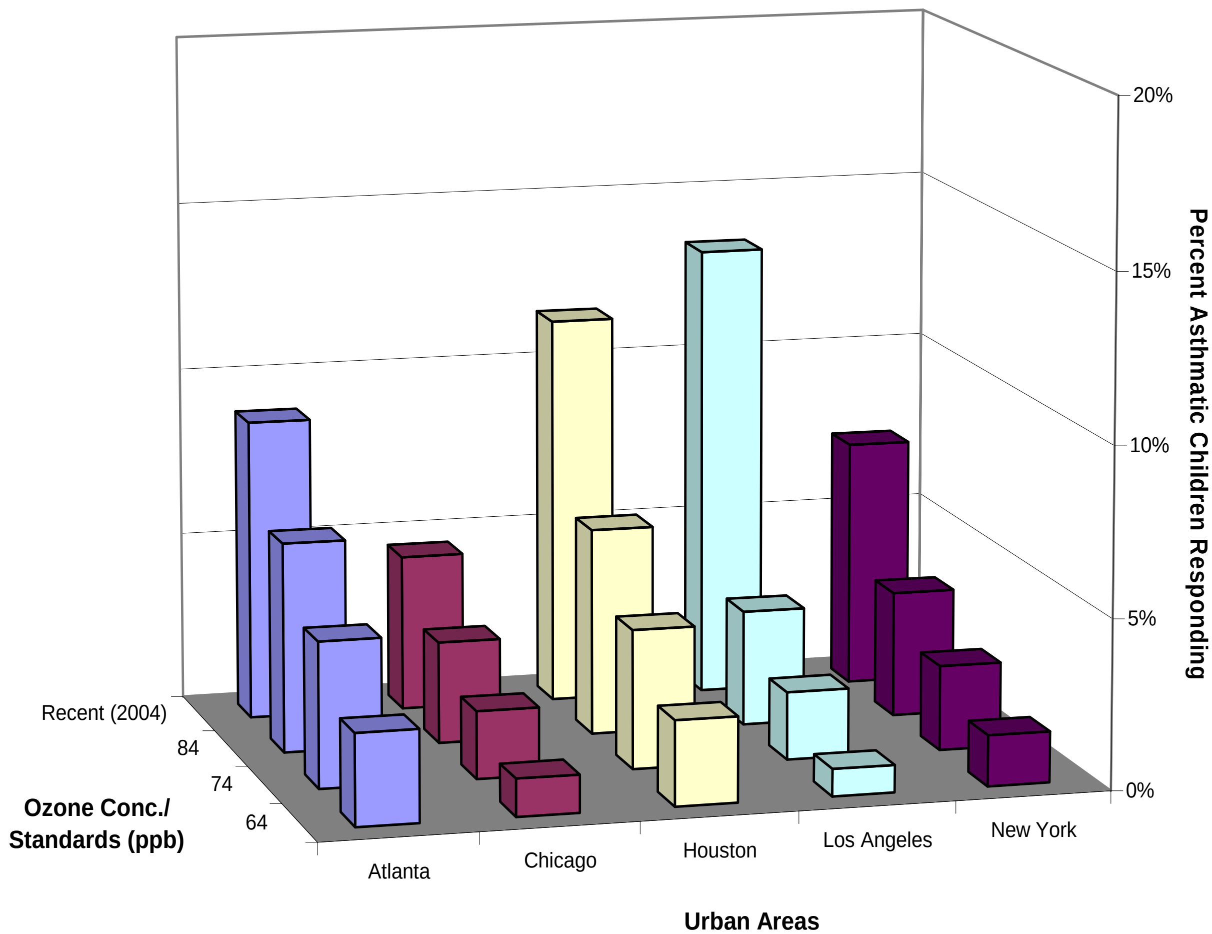


Figure 5C-2. (Continued)



* 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-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.

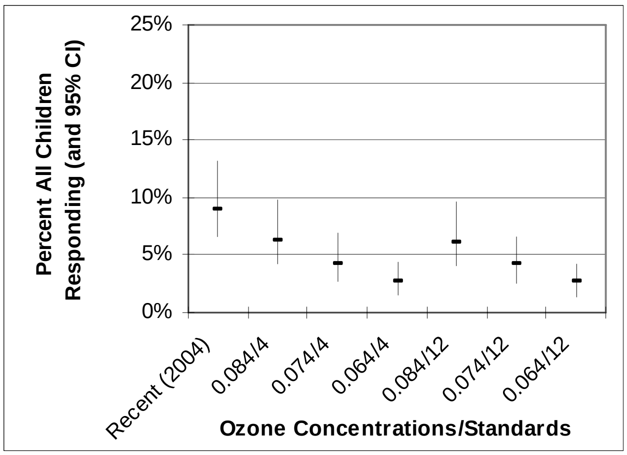
Figure 5C-3. Percent of Asthmatic Children (Ages 5-18) Engaged in Moderate Exertion Estimated to Experience At Least One Lung Function Response (Decrement in $FEV_1 \geq 10\%$) Associated with Exposure to O_3 Concentrations That Just Meet the Current and Alternative Average 4th-Highest Daily Maximum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



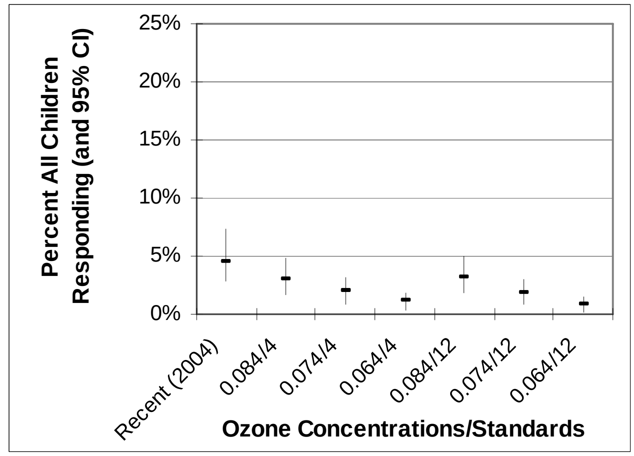
*95% confidence intervals associated with these risk estimates are provided in Table 5C-x of this Appendix. An 8-hr average standard, denoted m/n is characterized by a concentration of m ppm and an nth-highest daily maximum. So, for example, the current standard is 0.084/4 – 0.084 ppm, 4th-highest daily 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-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*

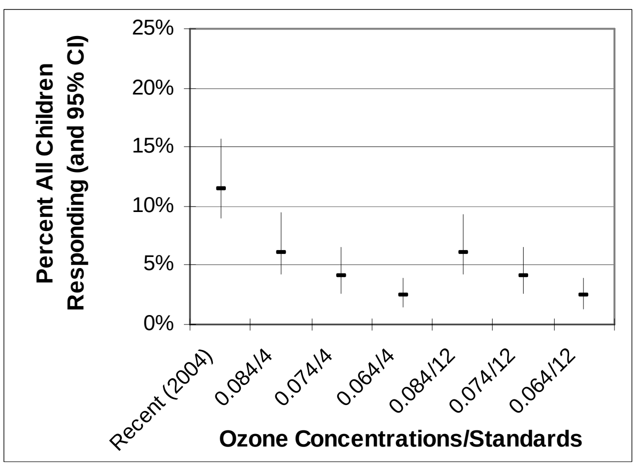
Atlanta



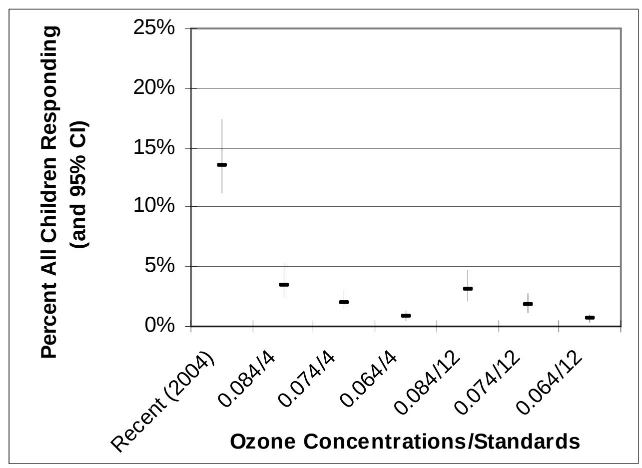
Chicago



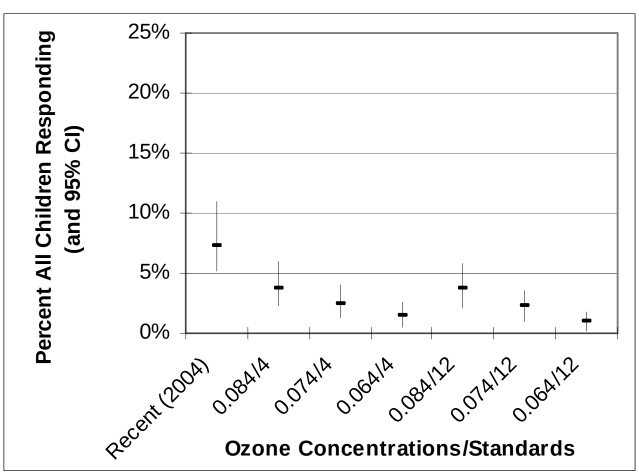
Houston



Los Angeles

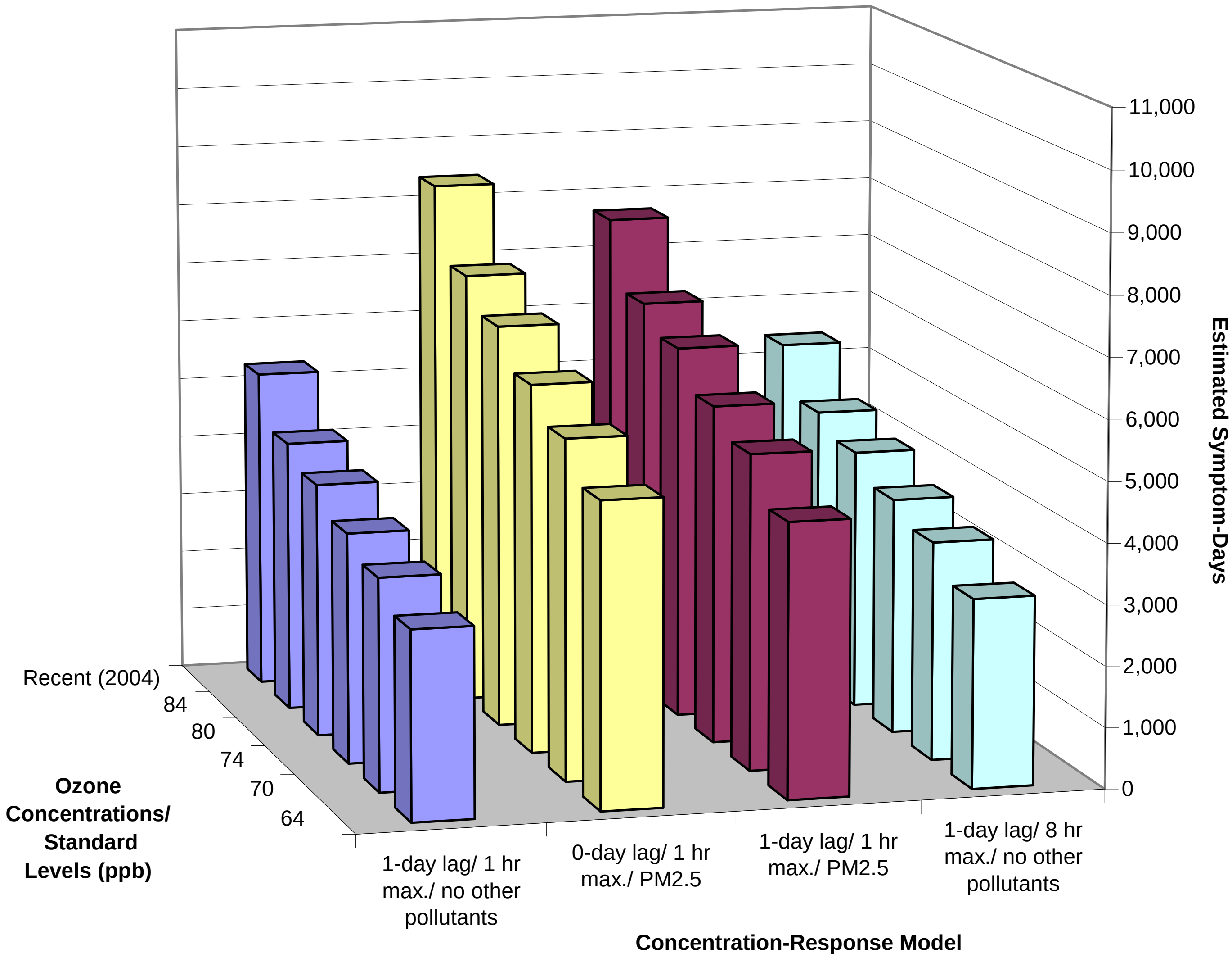


New York



* 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, 4^{th}-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 (e.g., 0.084 ppm).

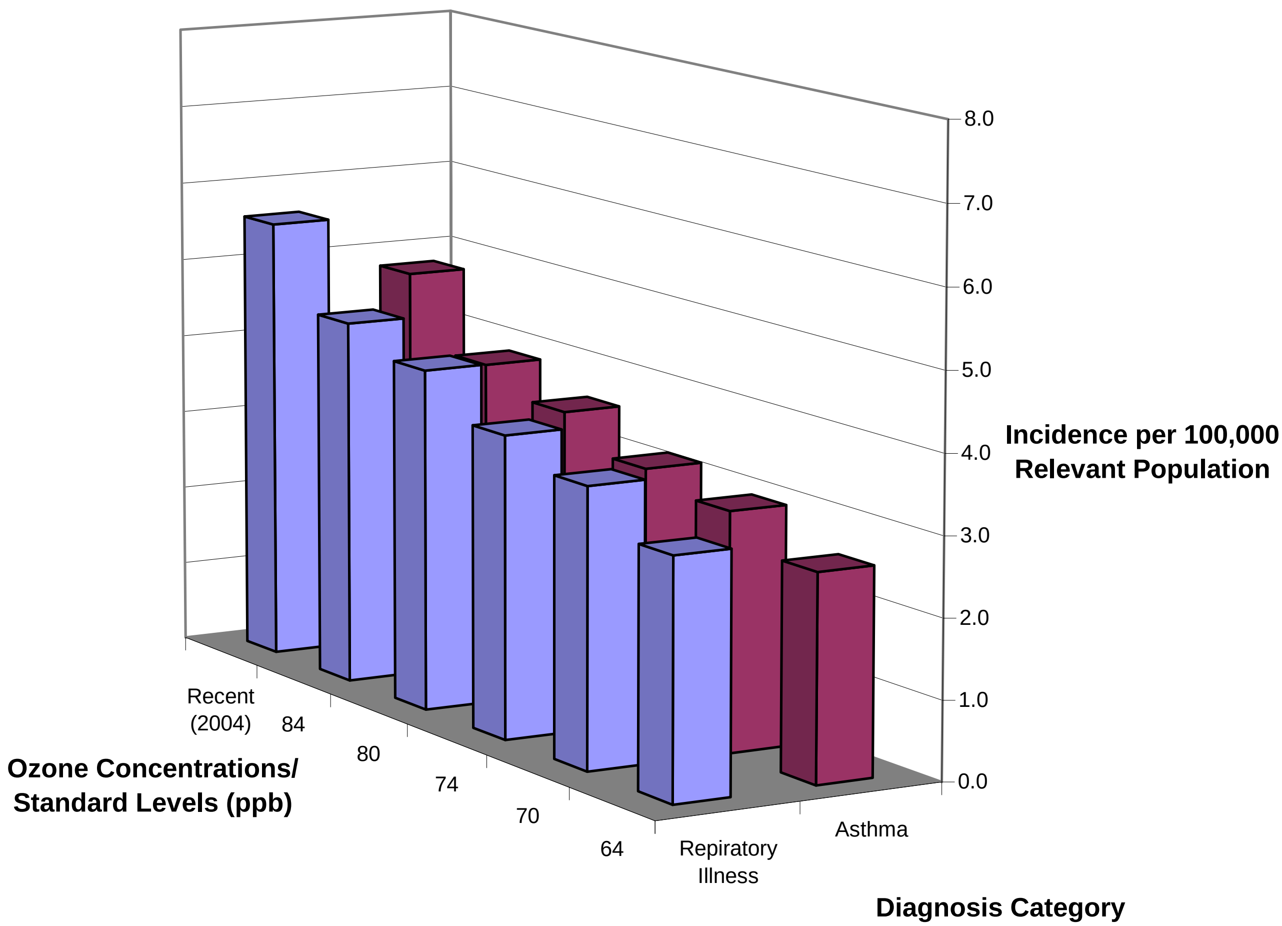
Figure 5C-5. Estimated Symptom-Days for Chest Tightness Among Moderate/Severe Asthmatic Children (Ages 0 – 12) in Boston Associated with Recent (April-September 2004) O_3 Levels and with Levels Just Meeting Alternative Average 4th-HighestDaily Maximum 8-Hour Ozone Standards*
Based on Gent et al., 2003)



*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

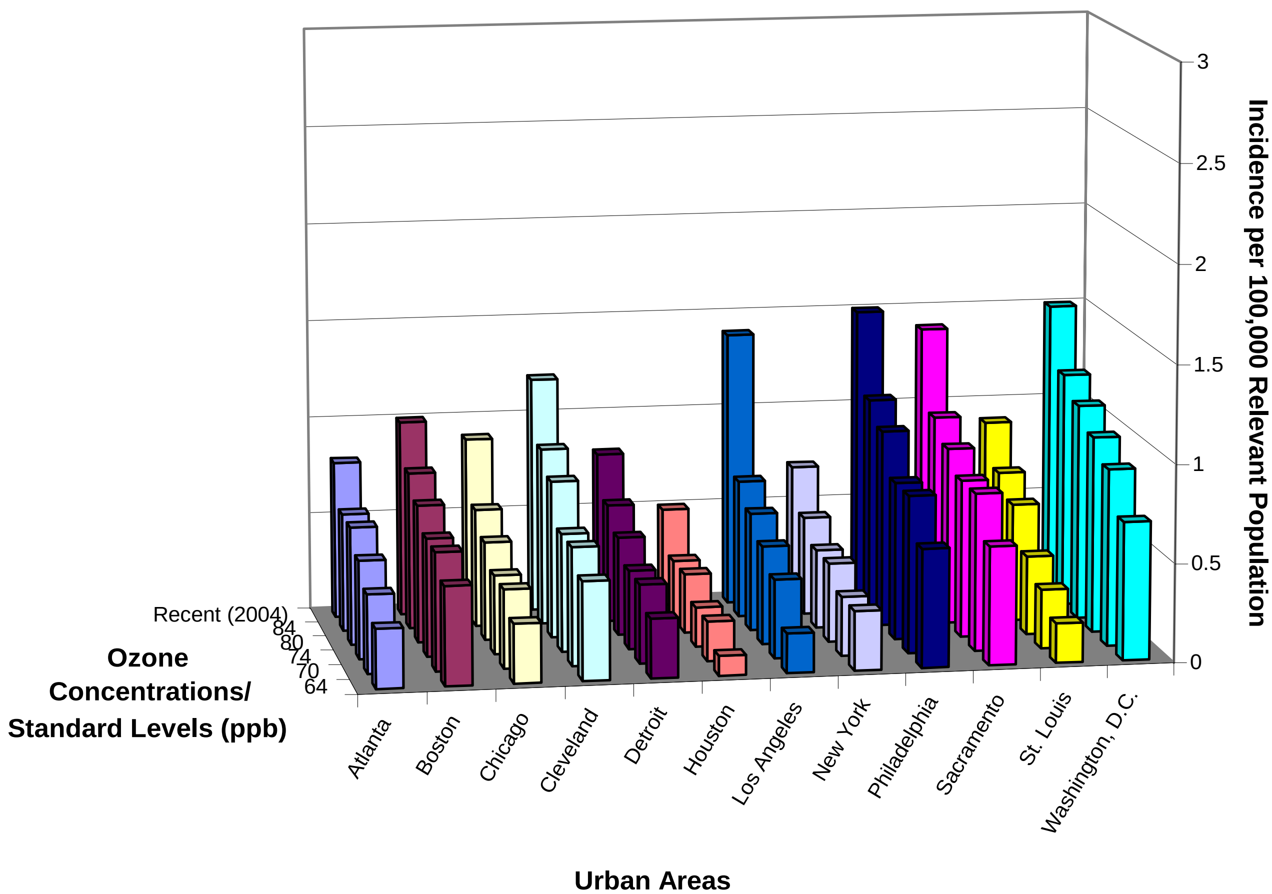
Figure 5C-6. Estimated Incidence of (Unscheduled) Respiratory Hospital Admissions per 100,000 Relevant Population in New York Associated with Recent (April – September, 2004) O_3 Levels and with O_3 Levels Just Meeting Alternative Average 4th-Highest Daily Maximum 8-Hour Standards

(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)

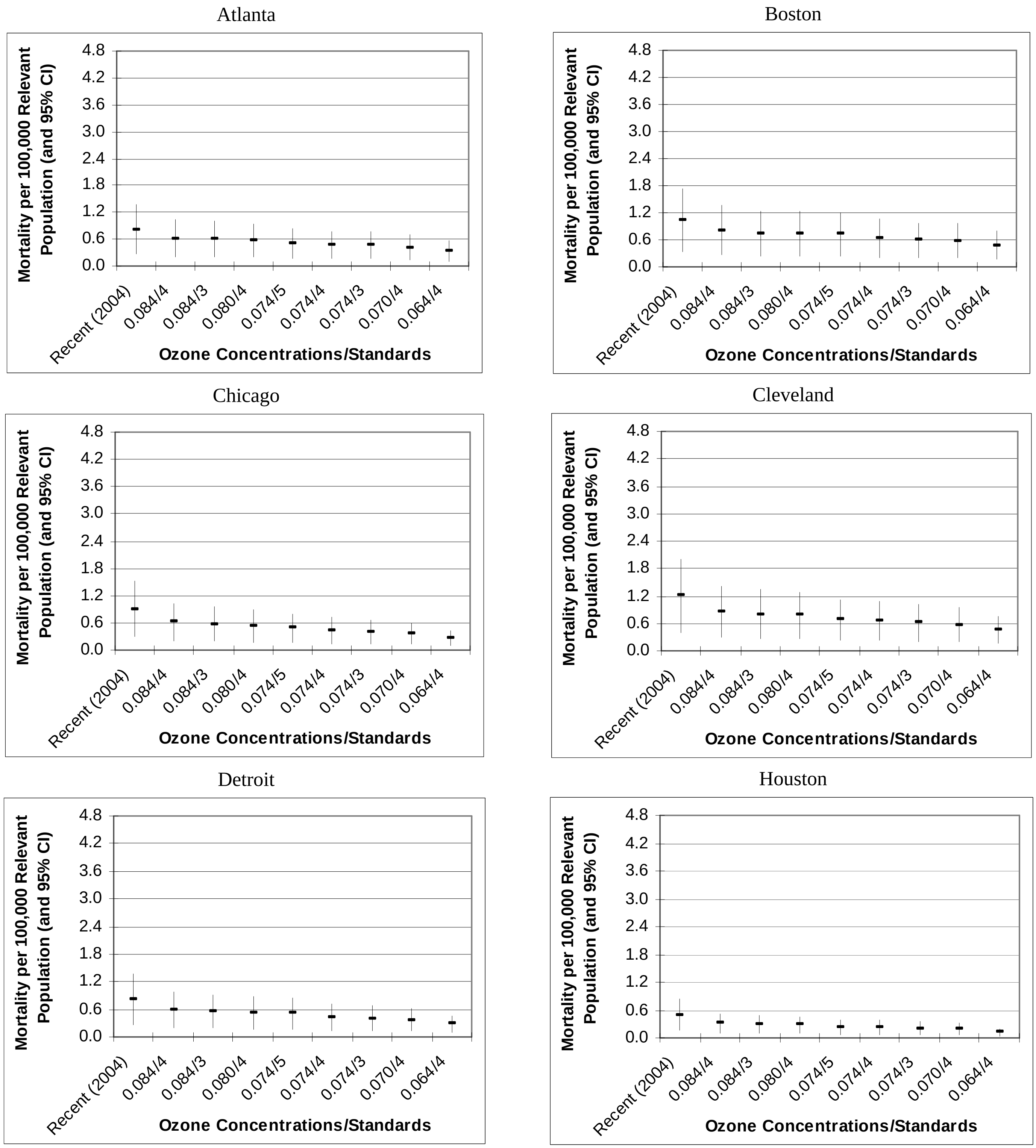
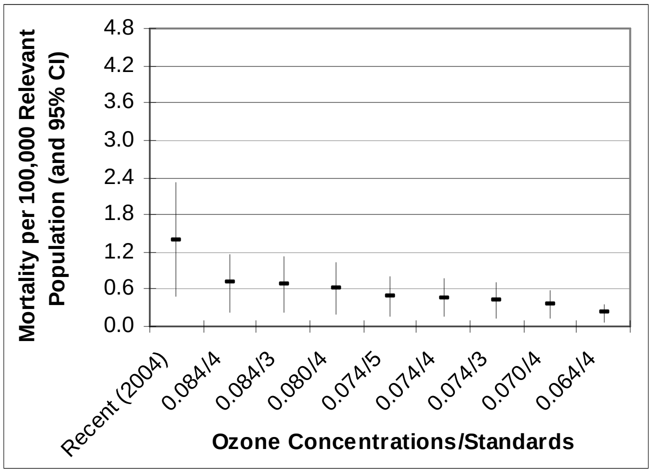
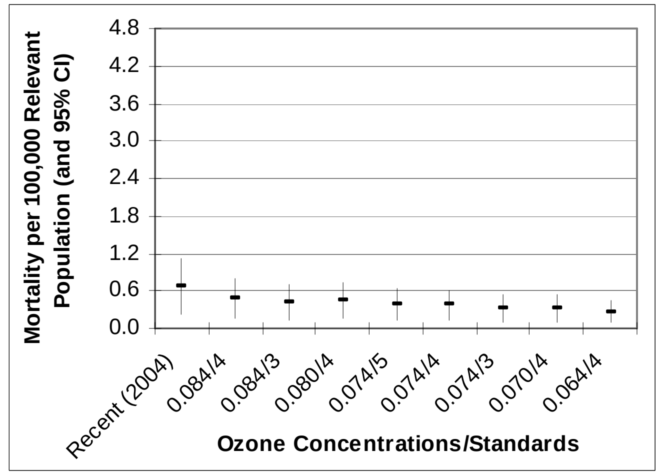


Figure 5C-8 (continued)

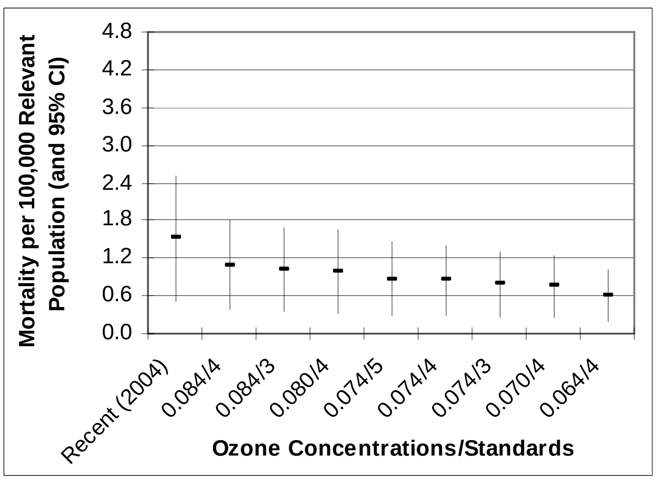
Los Angeles



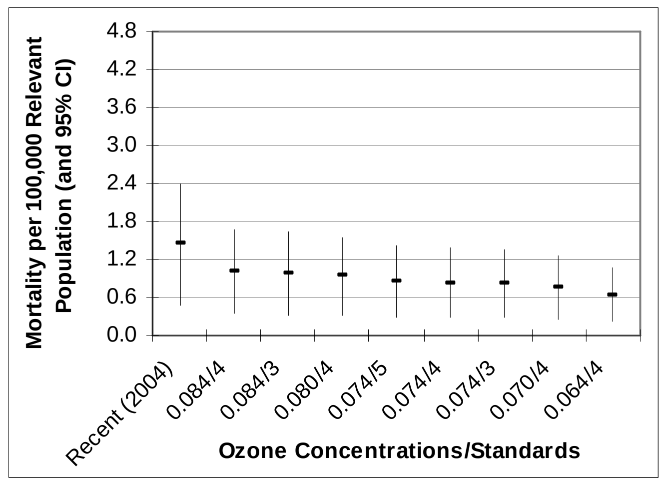
New York



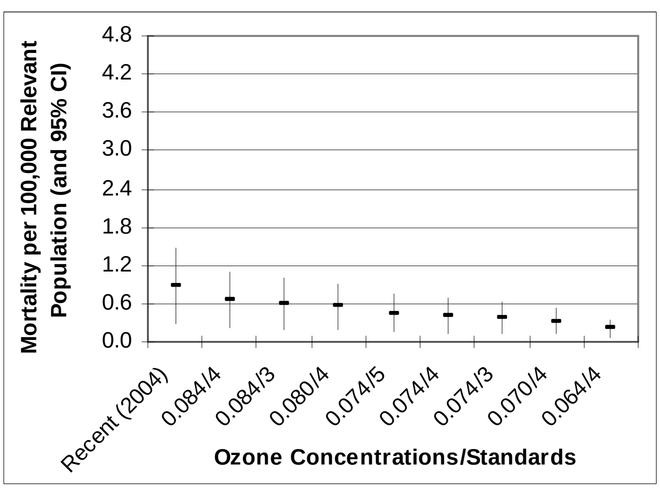
Philadelphia



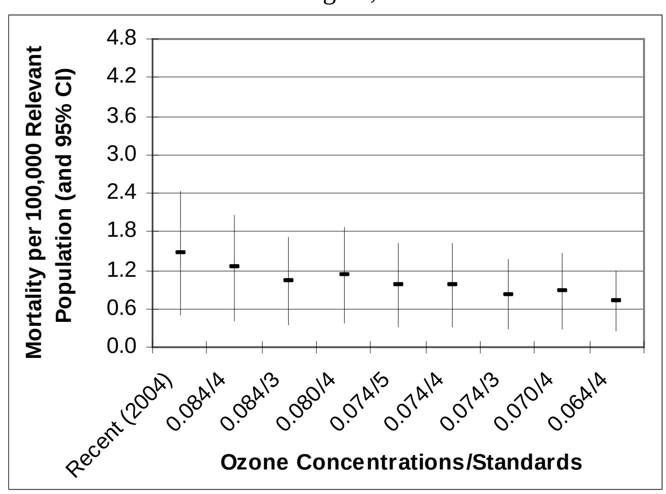
Sacramento



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).

References

Ashmore, M.; Emberson, L.; Karlsson, P. E.; Pleijel, H. (2004a) New directions: a new generation of ozone critical levels for the protection of vegetation in Europe (correspondence). Atmos. Environ. 38: 2213-2214.

Ashmore, M. E.; Karlsson, P. E.; Pleijel, H. (2004b) Introduction for ozone deposition special issue. Atmos. Environ. 38: 2211-2212.

Dämmgen, U.; Grünhage, L.; Kusters, A.; Jäger, H. J. (1994) Response of a grassland ecosystem to air pollutants:--II the chemical climate: fluxes of sedimenting airborne matter. Environ. Pollut. 85: 35-42.

Fuhrer, J.; Skärby, L.; Ashmore, M. R. (1997) Critical levels for ozone effects on vegetation in Europe. Environ. Pollution 97: 91-106.

Grennfelt, P. (2004) New directions: recent research findings may change ozone control policies. Atmos. Environ. 38: 2215-2216.

Grulke, N. E.; Preisler, H. K.; Rose, C.; Kirsch, J.; Balduman, L. (2002) O3 uptake and drought stress effects on carbon acquisition of ponderosa pine in natural stands. New Phytol. 154: 621-631.

Grünhage, L.; Jäger, H. J. (2003) From critical levels to critical loads for ozone: a discussion of a new experimental and modelling approach for establishing flux-response relationships for agricultural crops and native plant species. Environ. Pollut. 125: 99-110.

Grünhage, L.; Krupa, S. V.; Legge, A. H.; Jäger, H. J. (2004) Ambient flux-based critical values of ozone for protecting vegetation: differing spatial scales and uncertainties in risk assessment. Atmos. Environ. 38: 2433-2437.

Hanson, P., Samuelson, L., Wullschleger, S., Tabberer, T. and Edwards, G. (1994) "Seasonal patterns of light-saturated photosynthesis and leaf conductance for mature and seedling *Quercus rubra* L. foliage: differential sensitivity to ozone exposure." *Tree Physiology* 14:1351-1366

Heck, W. W.; Cowling, E. B. (1997) The need for a long term cumulative secondary ozone standard - an ecological perspective. EM (January): 23-33

Kärenlampi, L.; Skärby, L. (1996) Critical levels for ozone in Europe: testing and finalizing the concepts UN-ECE workshop report. In: Proceedings of UN-ECE convention on long-range transboundary air pollution workshop; April; Kuopio, Finland. Kupio, Finland: University of Kuopio, Department of Ecology and Environmental Science.

Karlsson, P. E.; Selldén, G.; Pleijel, H. (2003) Establishing ozone critical levels II. Gothenburg, Sweden: IVL Swedish Environmental Research Institute; IVL Report B 1523.

Lee, E. H.; Tingey, D. T.; Hogsett, W. E. (1989) Interrelation of experimental exposure and ambient air quality data for comparison of ozone exposure indices and estimating agricultural losses. Corvallis, OR: U.S. Environmental Protection Agency, Environmental Research Laboratory; EPA report no. EPA-600/3-89-047. Available from: NTIS, Springfield, VA; PB89-195036.

Musselman, R. C.; Minnick, T. J. (2000) Nocturnal stomatal conductance and ambient air quality standards for ozone. Atmos. Environ. 34: 719-733.

United Nations Economic Commission for Europe (UNECE). (1988) ECE Critical Levels Workshop; Bad Harzburg, Germany [final report]. Geneva, Switzerland: United Nations Economic Commission for Europe.

U.S. Environmental Protection Agency (2006) Air Quality Criteria for Ozone and Related Photochemical Oxidants (Final). Office of Research and Development, National Center for Environmental Assessment, Research Triangle Park, NC. EPA/600/R-05/004aF-cF, 2006.

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.

References

Lee, E. H.; Hogsett, W. E. (1996) Methodology for calculating inputs for ozone secondary standard benefits analysis: part II. Report prepared for Office of Air Quality Planning and Standards, Air Quality Strategies and Standards Division, U.S. Environmental Protection Agency, Research Triangle Park, N.C., March.

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

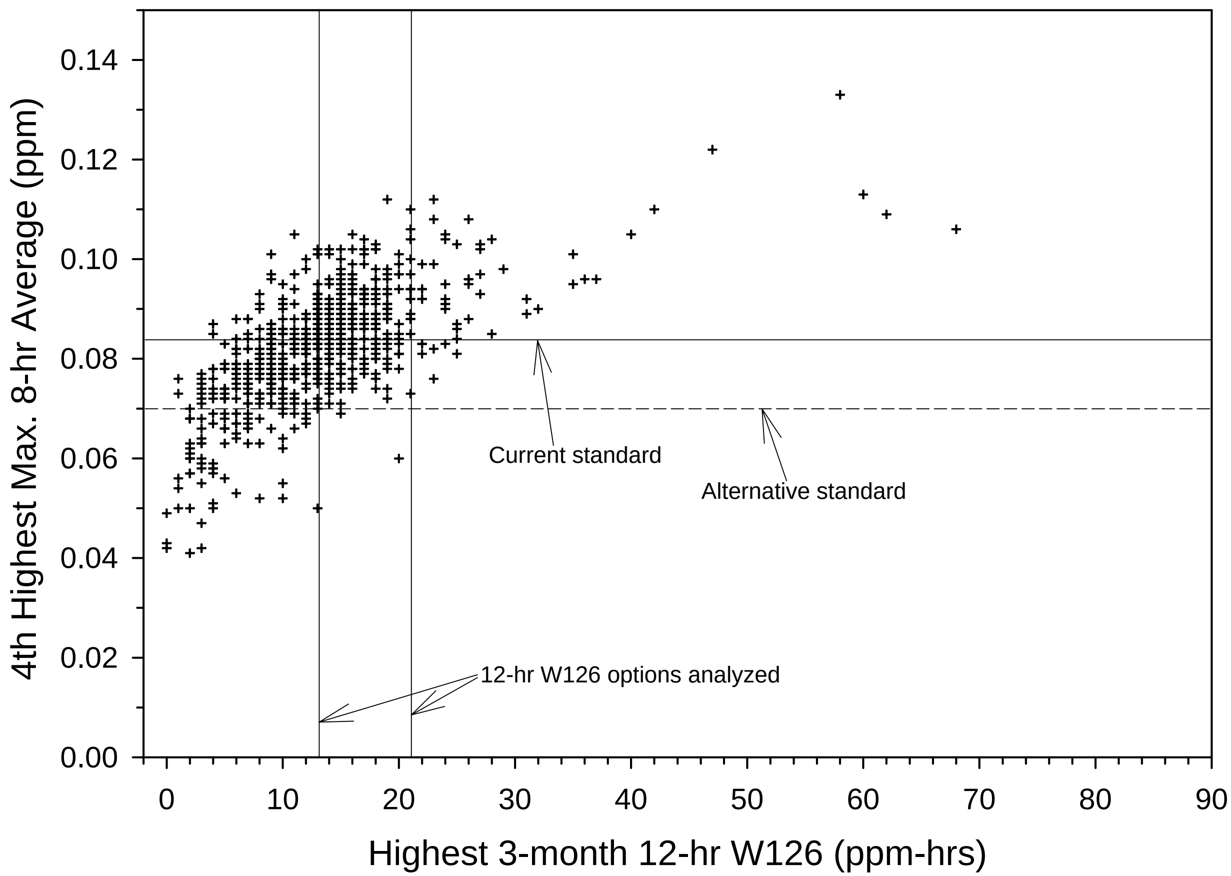
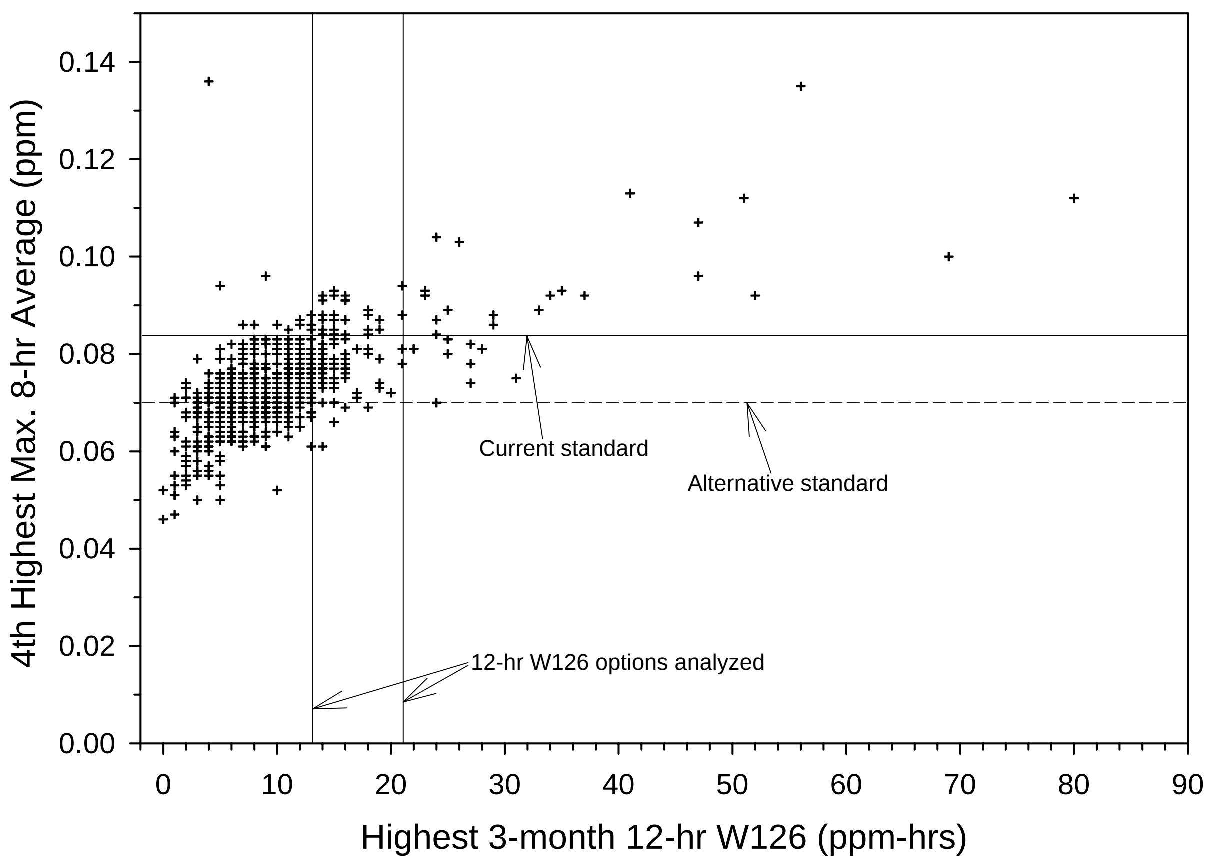


Figure 7B-2. The 2004 4th highest maximum 8-hr average versus the highest 3-month 12-hr W126, by county



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.

References

Amar, P., D. Chock, A. Hansen, M. Moran, A. Russell, D. Steyn, and W. Stockwell, (2005): Final Report: Second Peer Review of the CMAQ Model. Report submitted to Community Modeling and Analysis System Center, University of North Carolina at Chapel Hill, May, 28 pp. (http://www.cmascenter.org/PDF/CMAQ_Scd_Peer_Rev_July_5.pdf)

Amar, P., R. Bornstein, H. Feldman, H. Jeffries, D. Steyn, R. Yamartino, and Y. Zhang, (2004): Final Report: December 2003 Peer Review of the CMAQ Model. Report submitted to Community Modeling and Analysis System Center, University of North Carolina at Chapel Hill, July, 24 pp.

Appel, K.W.; A. Gilliland; B. Eder (2005) An Operational Evaluation of the 2005 Release of Models-3 CMAQ Version 4.5. National Oceanic and Atmospheric Administration – Air Resources

Laboratory, Atmospheric Sciences Modeling Division; In partnership with the National Exposure Research Laboratory, U.S. Environmental Protection Agency, Research Triangle Park, NC

Arnold J.R.; R. L. Dennis; G. S. Tonnesen, (2003) Diagnostic evaluation of numerical air quality models with specialized ambient observations: testing the Community Multiscale Air Quality modeling system (CMAQ) at selected SOS 95 ground sites, Atmospheric Environment 37: 1185-1198.

Byun, D.W., Ching, J.K.S. (Eds.), 1999. Science Algorithms of the EPA Models-3 Community Multiscale Air Quality Model (CMAQ) Modeling System. EPA/600/R-99/030, US Environmental Protection Agency, Office of Research and Development, Washington, DC 20460.

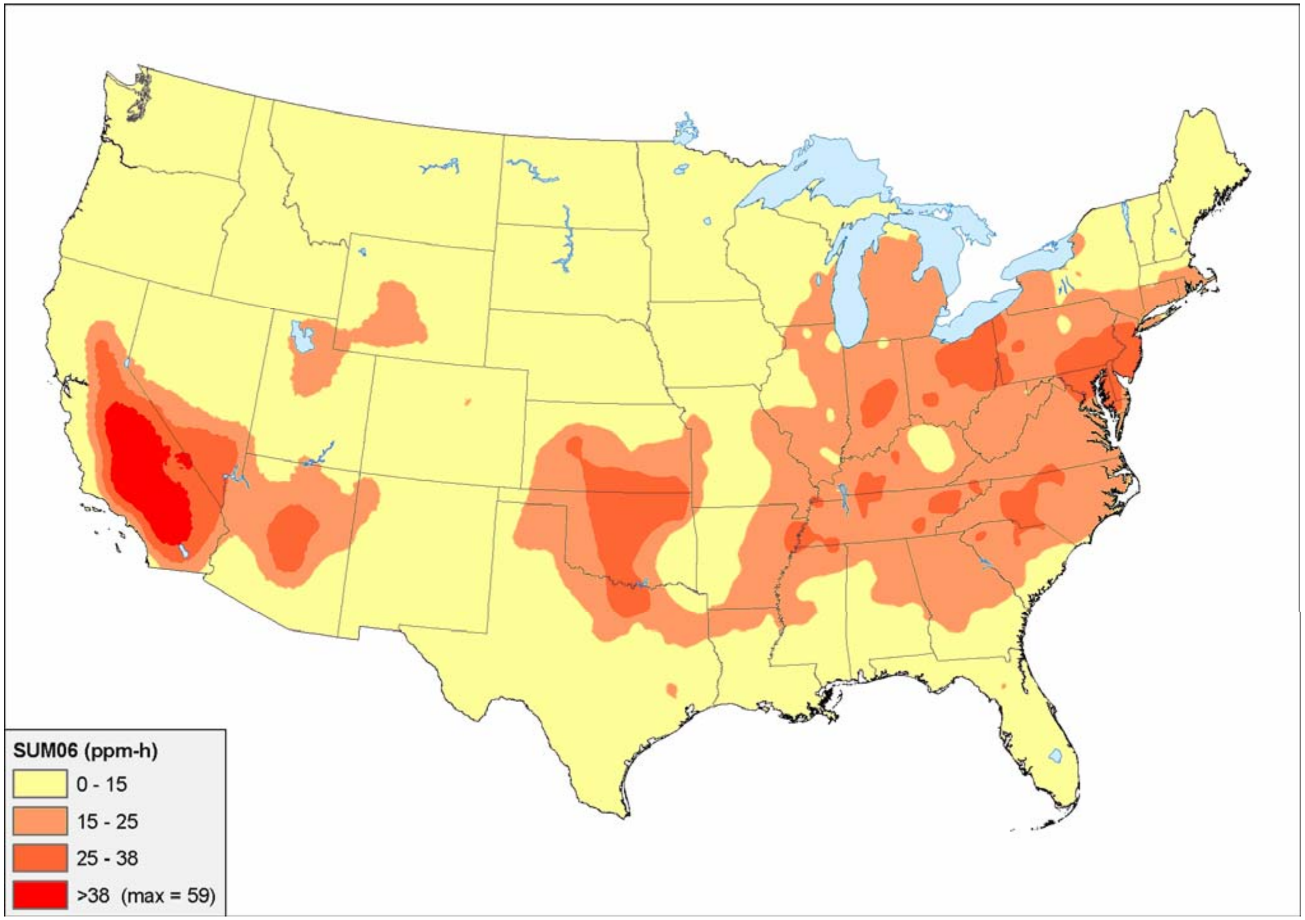
Eder, B. and S. Yu, 2005: A performance evaluation of the 2004 release of Models-3 CMAQ, *Atmos. Environ.*, in press

Fuentes, M and Raftery, AE (2005). Model evaluation and spatial interpolation by Bayesian combination of observations with outputs from numerical models. *Biometrics*, 61, 36-45.

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

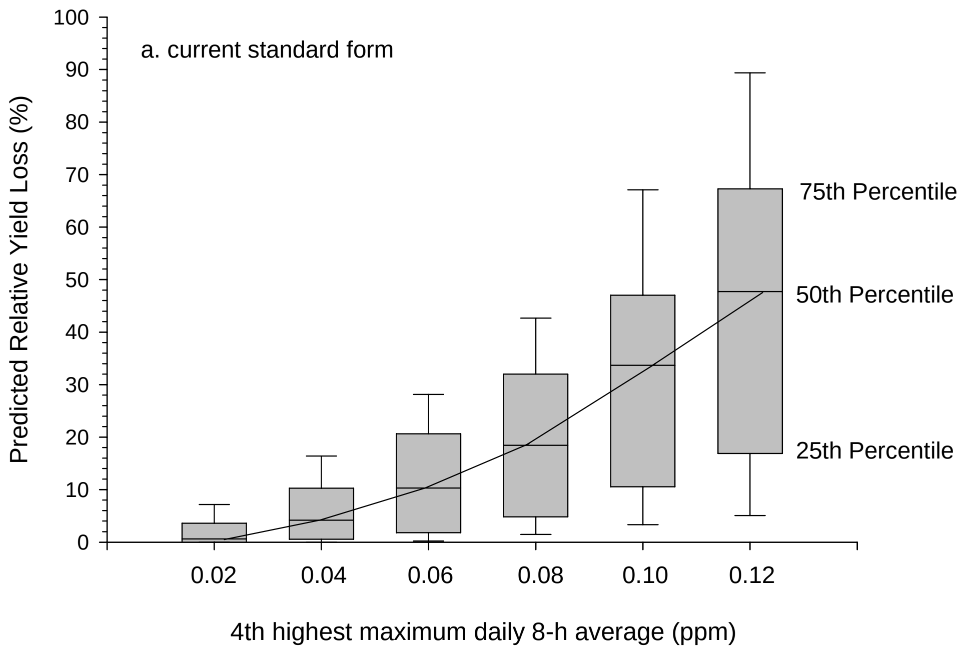
Figure 7D-1. Estimated 12-Hr SUM06 Ozone Exposure – Max 3-months for 2001

"As Is" scenario



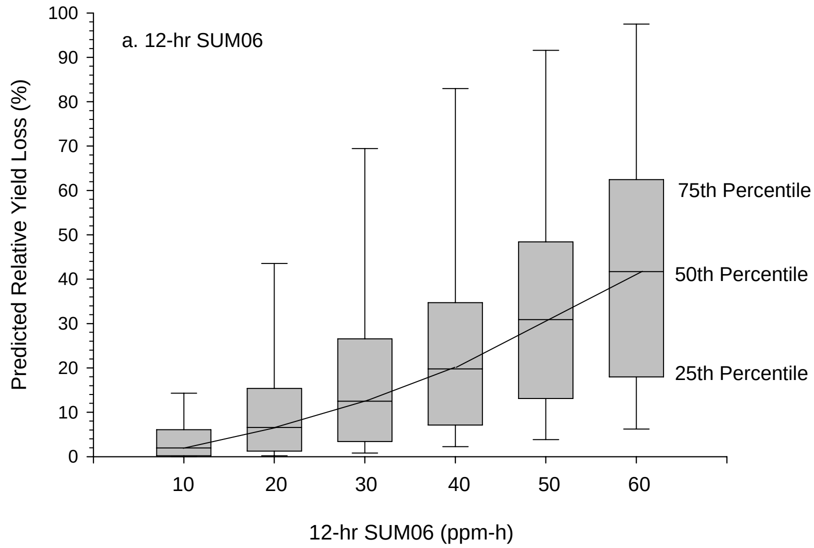
APPENDIX 7E. NCLAN C-R ANALYSIS USING THE 8-HR AVERAGE AND SUM06 METRIC

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



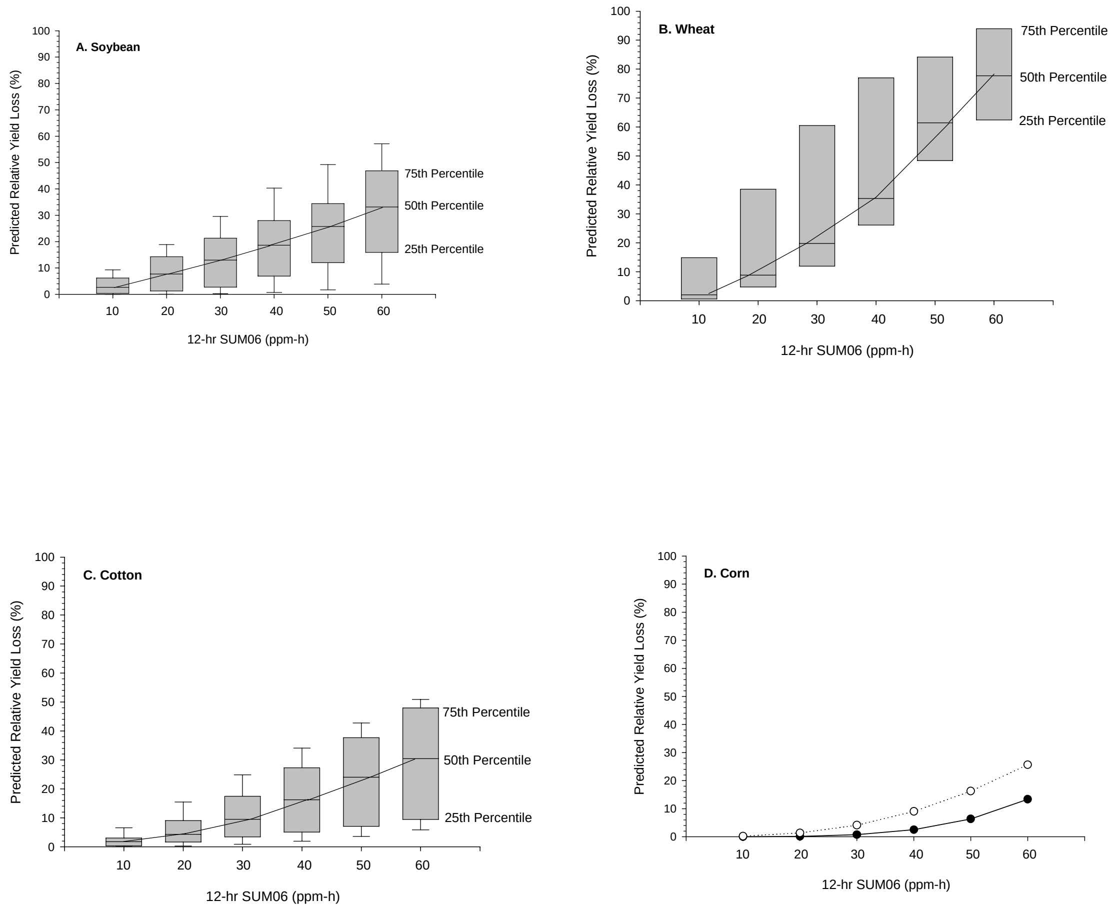
Distribution of biomass loss predictions from Weibull exposure-response models that relate yield to O_3 exposure characterized with the 4th highest max. 8-hr average statistic using data from 31 crop studies from National Crop Loss Assessment Network (NCLAN). Separate regressions were calculated for 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.)

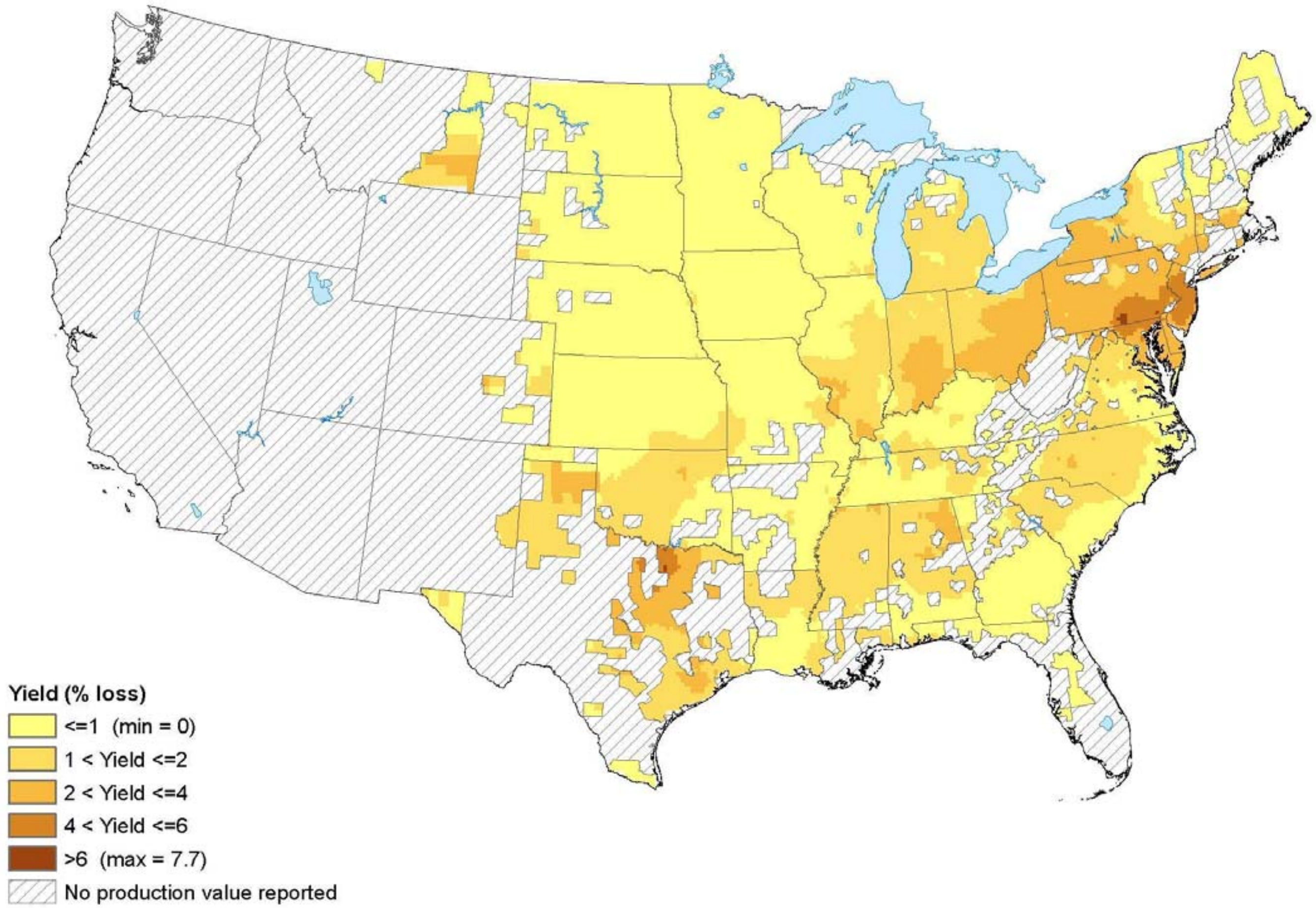


Figure 7G-2. Estimated corn yield loss based on interpolated 2001 3-month 12-hr W126. (With and without a 10% reduction in exposure.)

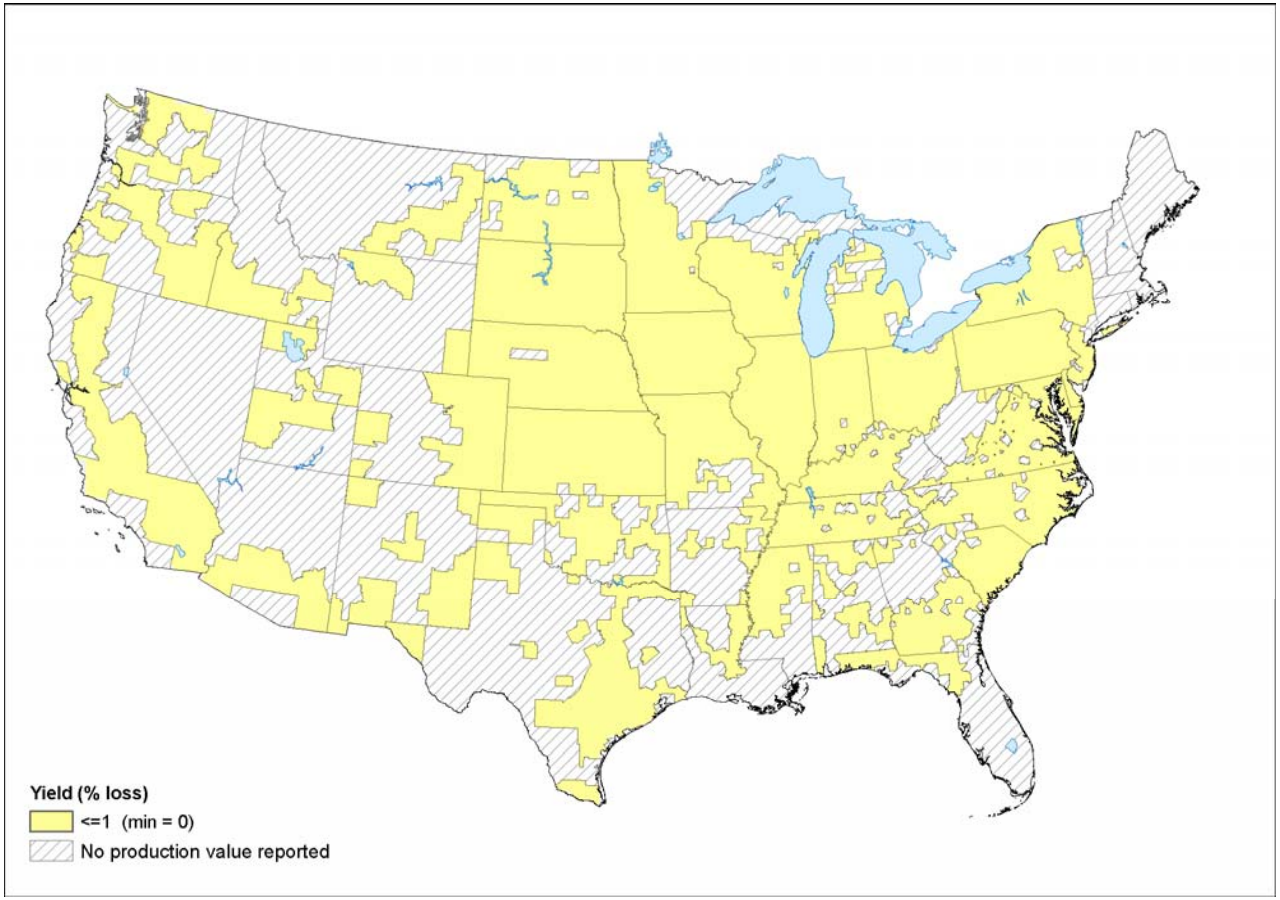


Figure 7G-3. Estimated cotton yield loss based on interpolated 2001 3-month 12-hr W126. (With a 10% reduction in exposure.)

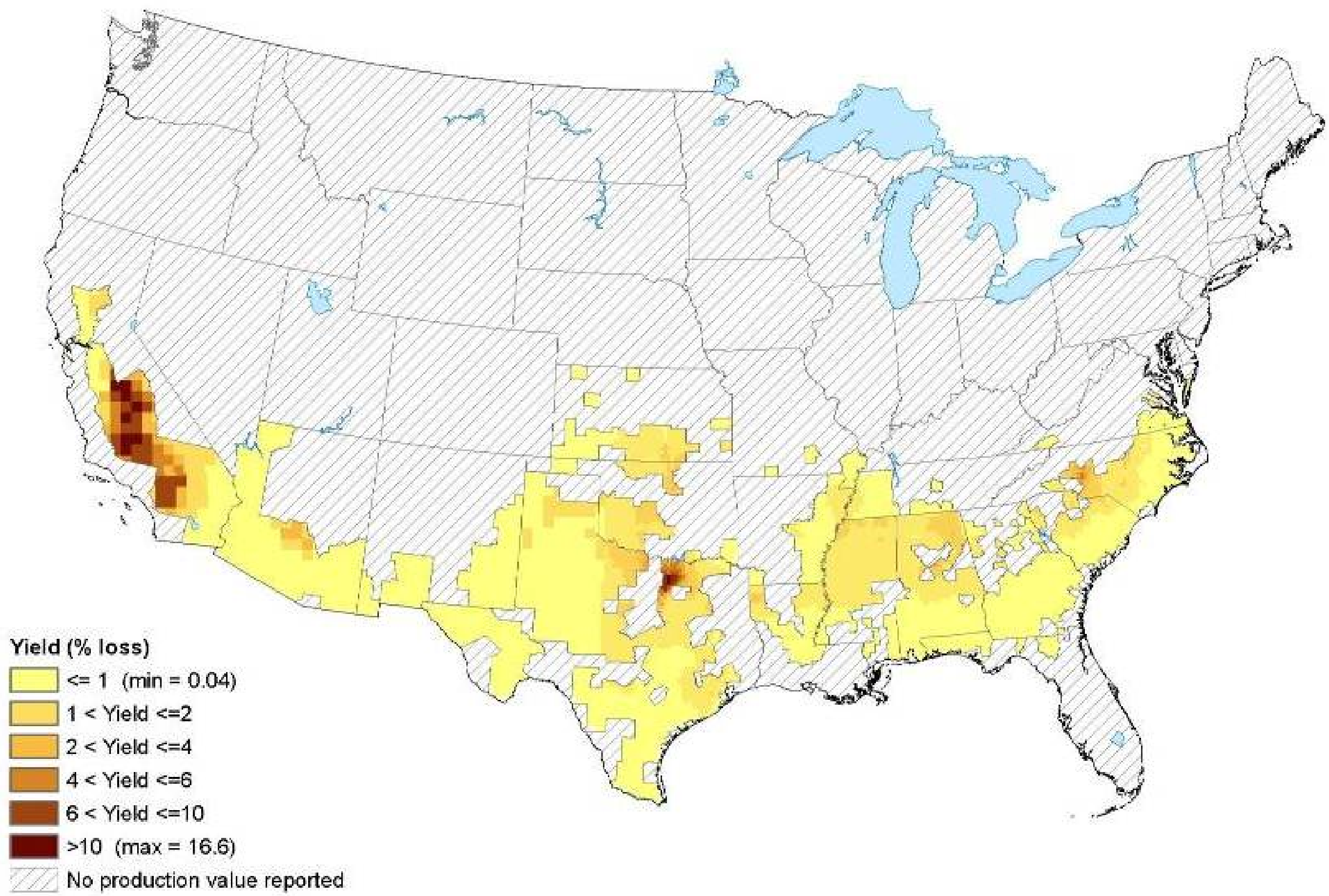


Figure 7G-4. Estimated cotton yield loss based on interpolated 2001 3-month 12-hr W126. (Without a 10% reduction in exposure.)

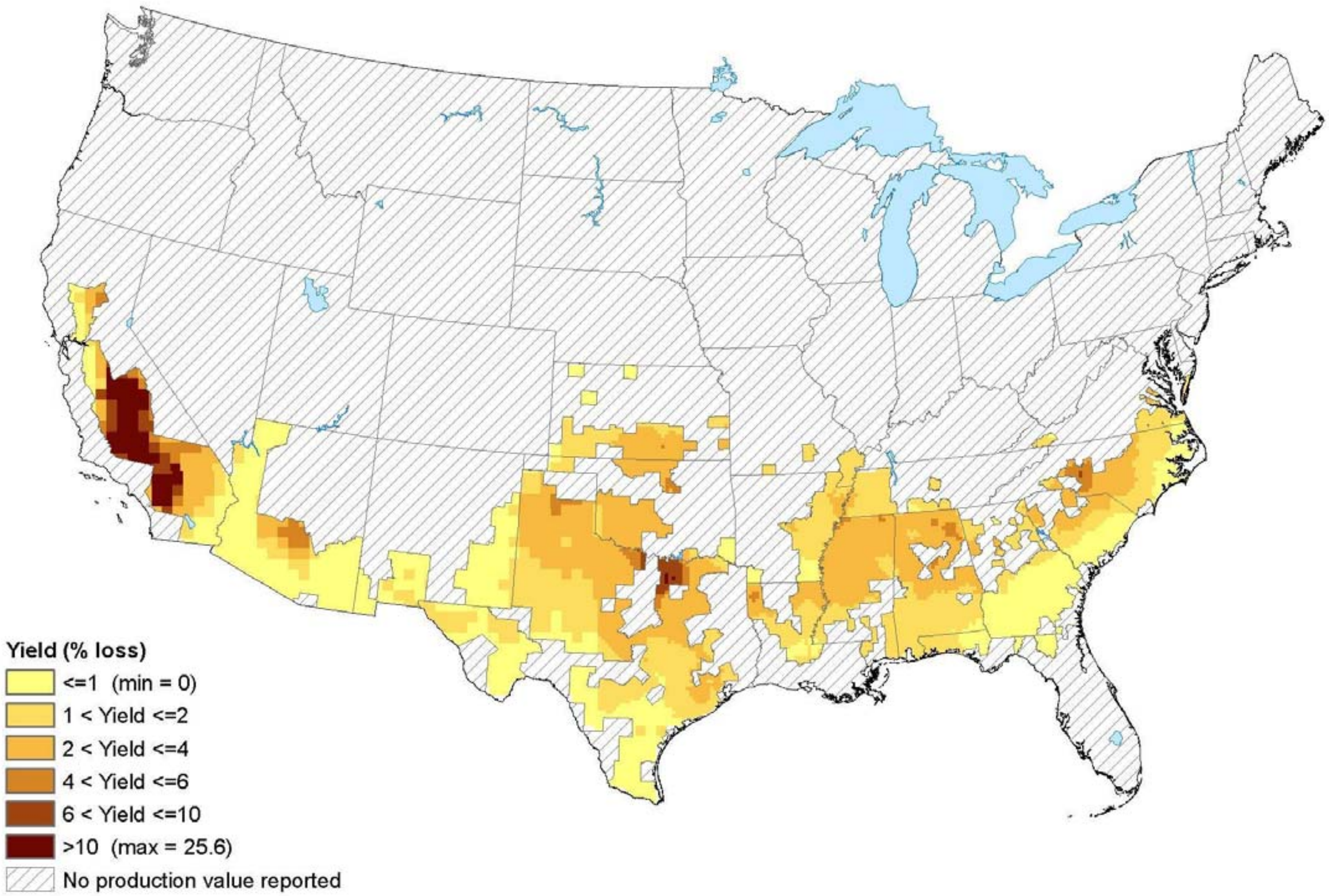


Figure 7G-5. Estimated winter wheat yield loss based on interpolated 2001 3-month 12-hr W126. (With a 10% reduction in exposure.)

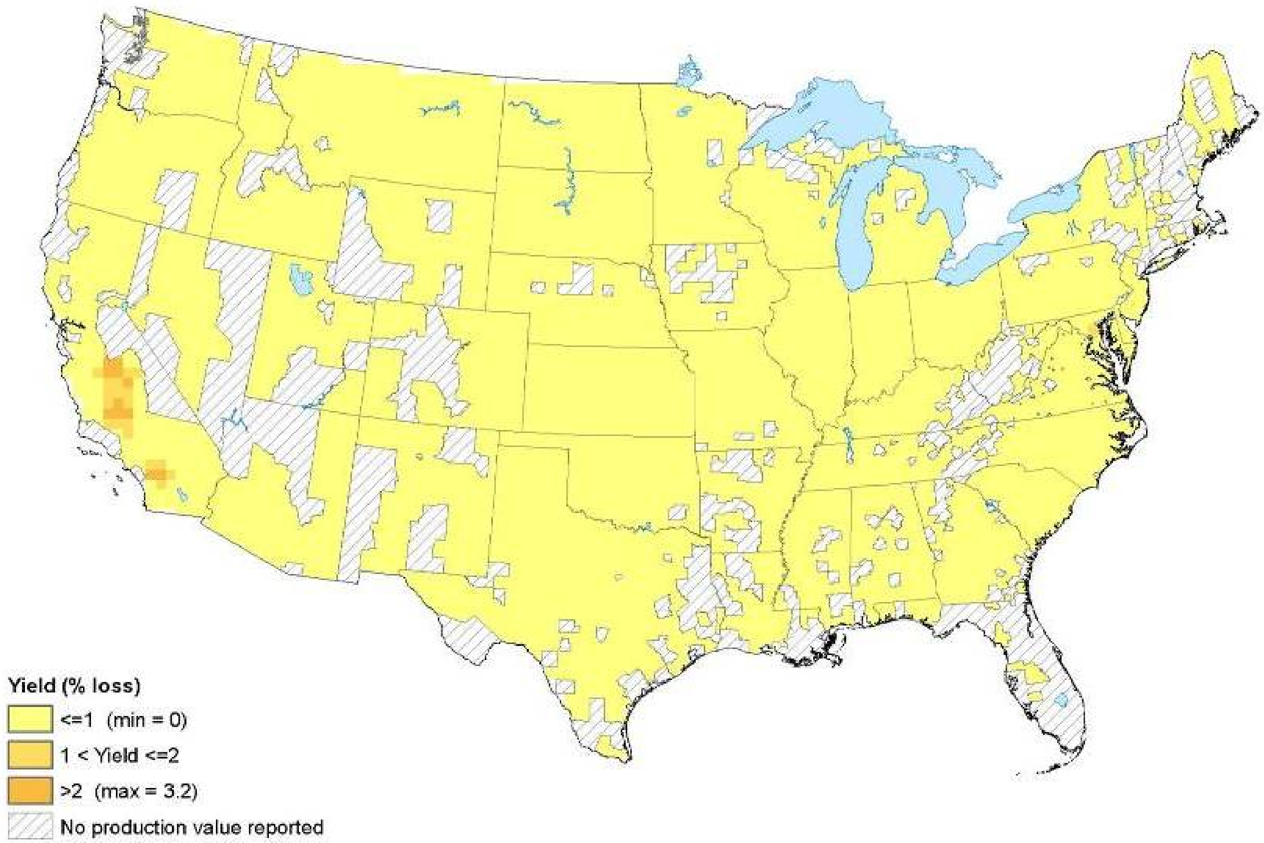
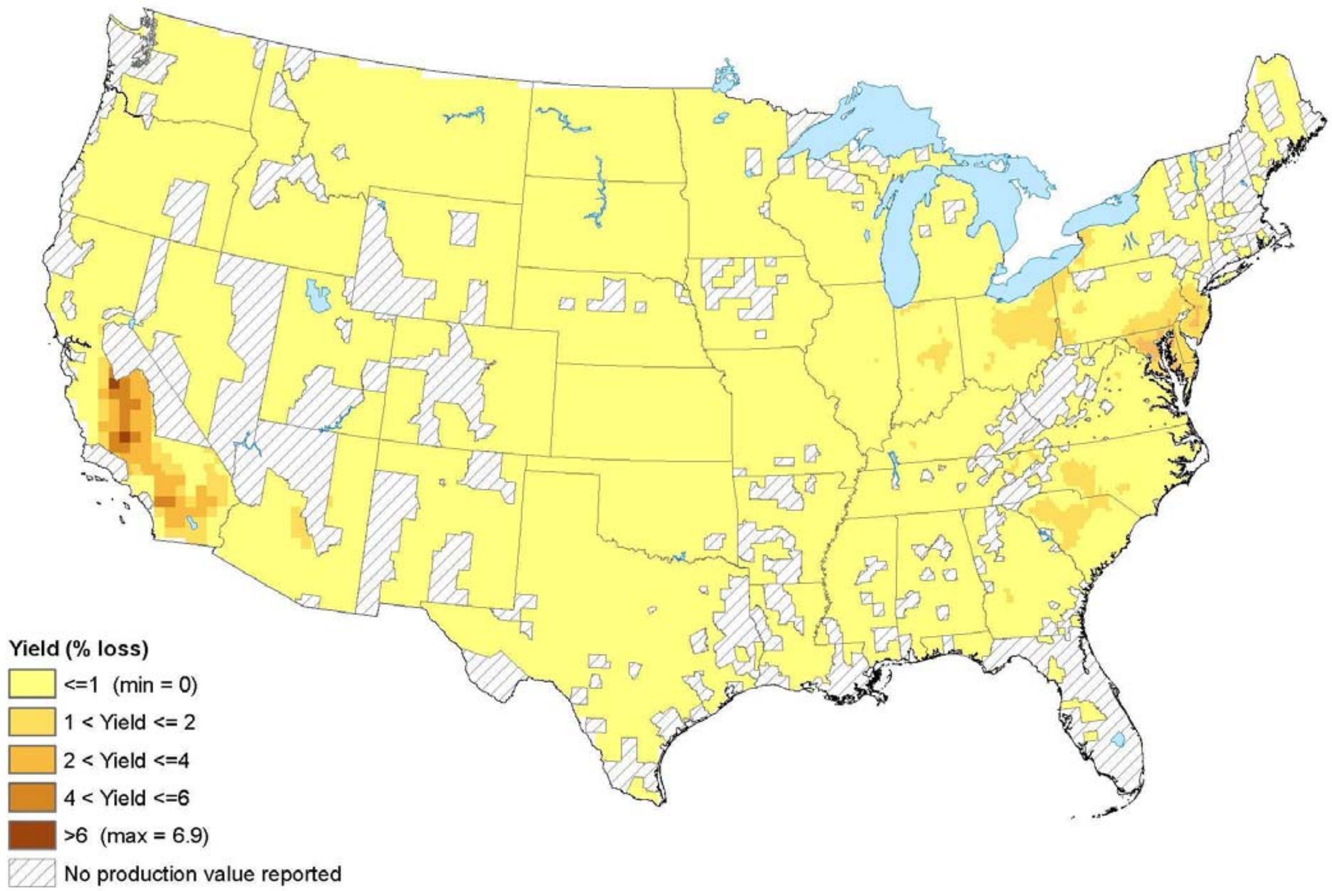


Figure 7G-6. Estimated winter wheat yield loss based on interpolated 2001 3-month 12-hr W126. (Without a 10% reduction in exposure.)



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.

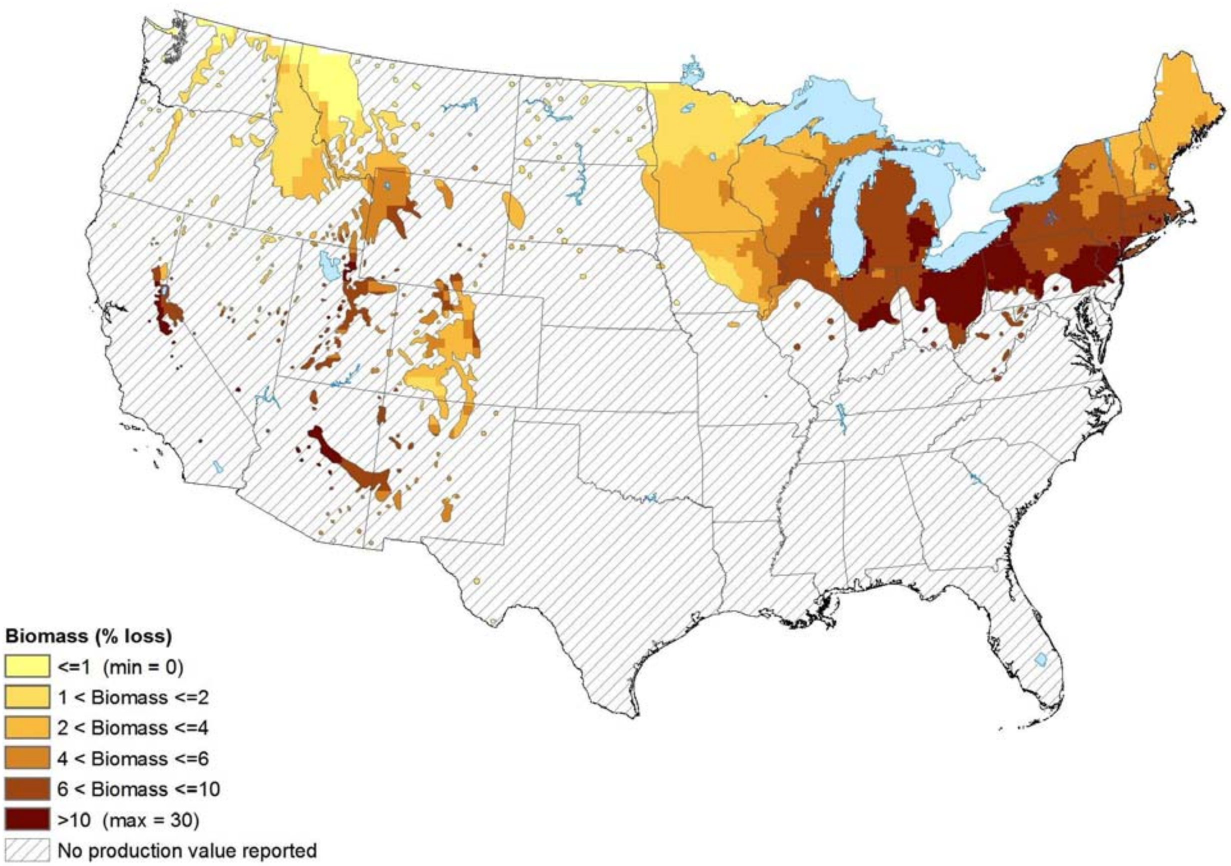


Figure 7H-2. . Estimated black cherry annual biomass loss based on interpolated 2001 maximum 3-month 12-hr W126 **with** a 10% downward adjustment of hourly O_3 concentrations. This map indicates the geographic range for black cherry (*Prunus serotina)*, but it does not necessarily indicate that black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

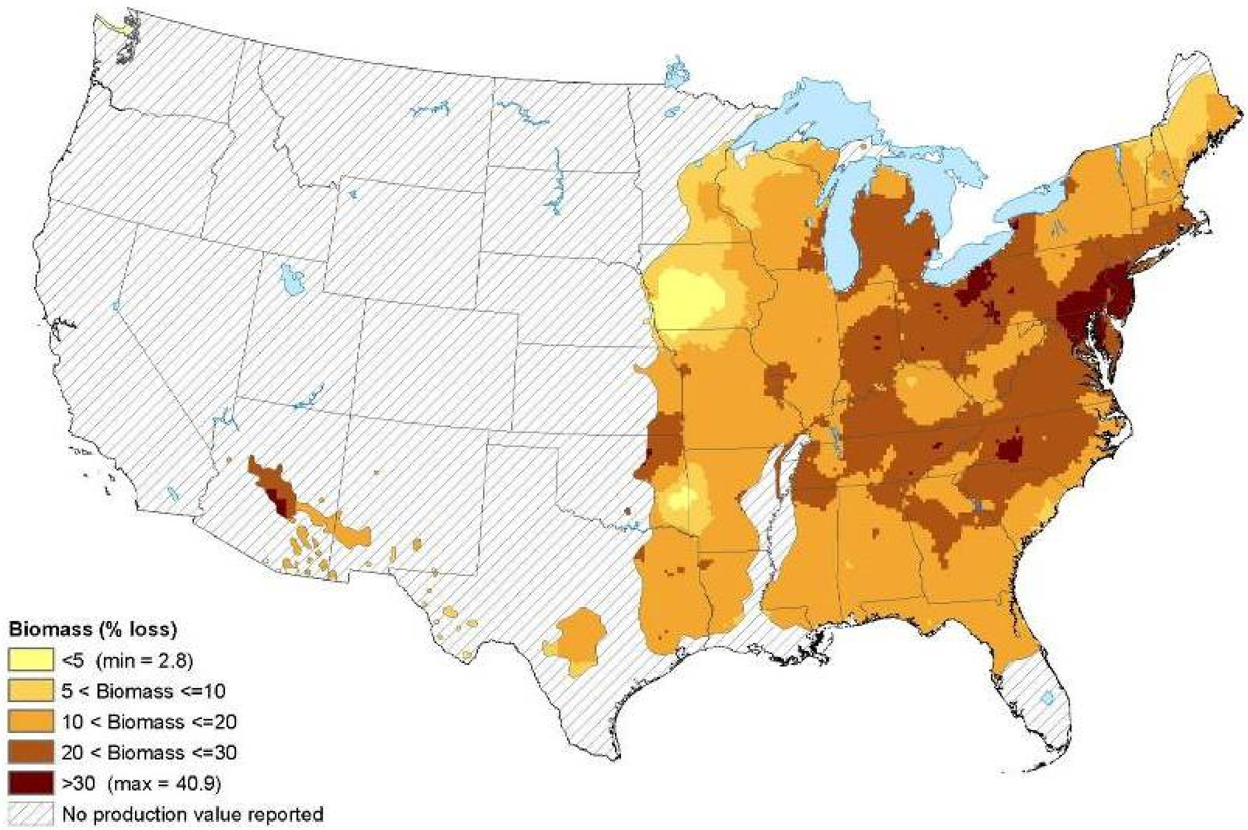


Figure 7H-3. Estimated black cherry annual biomass loss based on interpolated 2001 maximum 3-month 12-hr W126 **without** a 10% downward adjustment of hourly O_3 concentrations. This map indicates the geographic range for black cherry (*Prunus serotina)*, but it does not necessarily indicate that black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

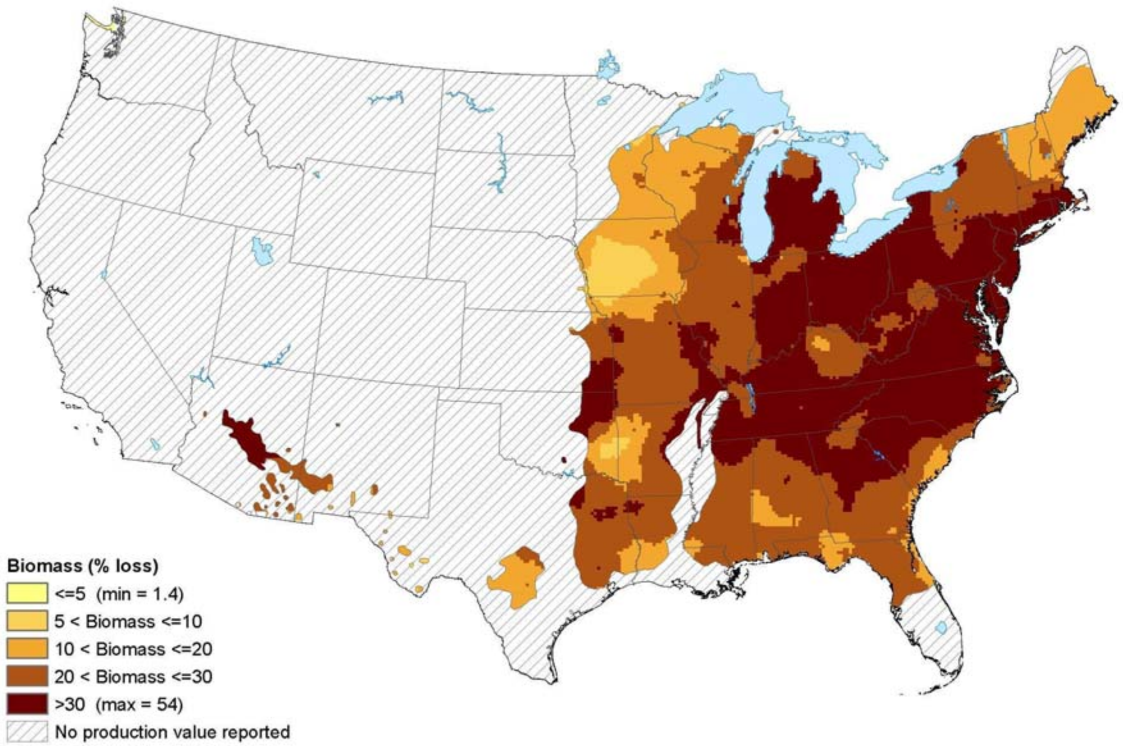


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Figure 7H-4. Estimated ponderosa pine annual biomass loss based on interpolated 2001 maximum 3-month 12-hr W126 **with** a 10% downward adjustment of hourly O_3 concentrations. This map indicates the geographic range for ponderosa pine (*Pinus ponderosa)*,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

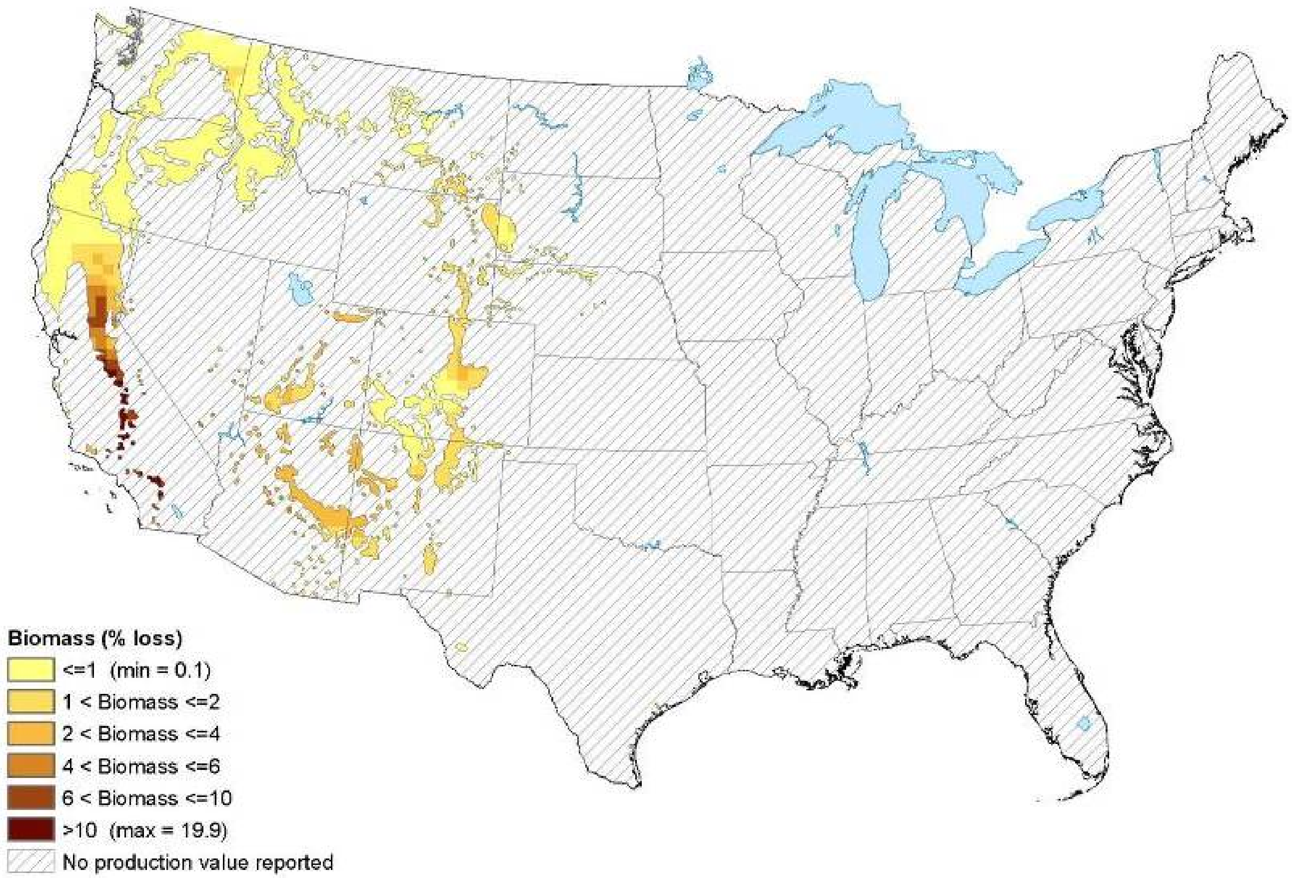
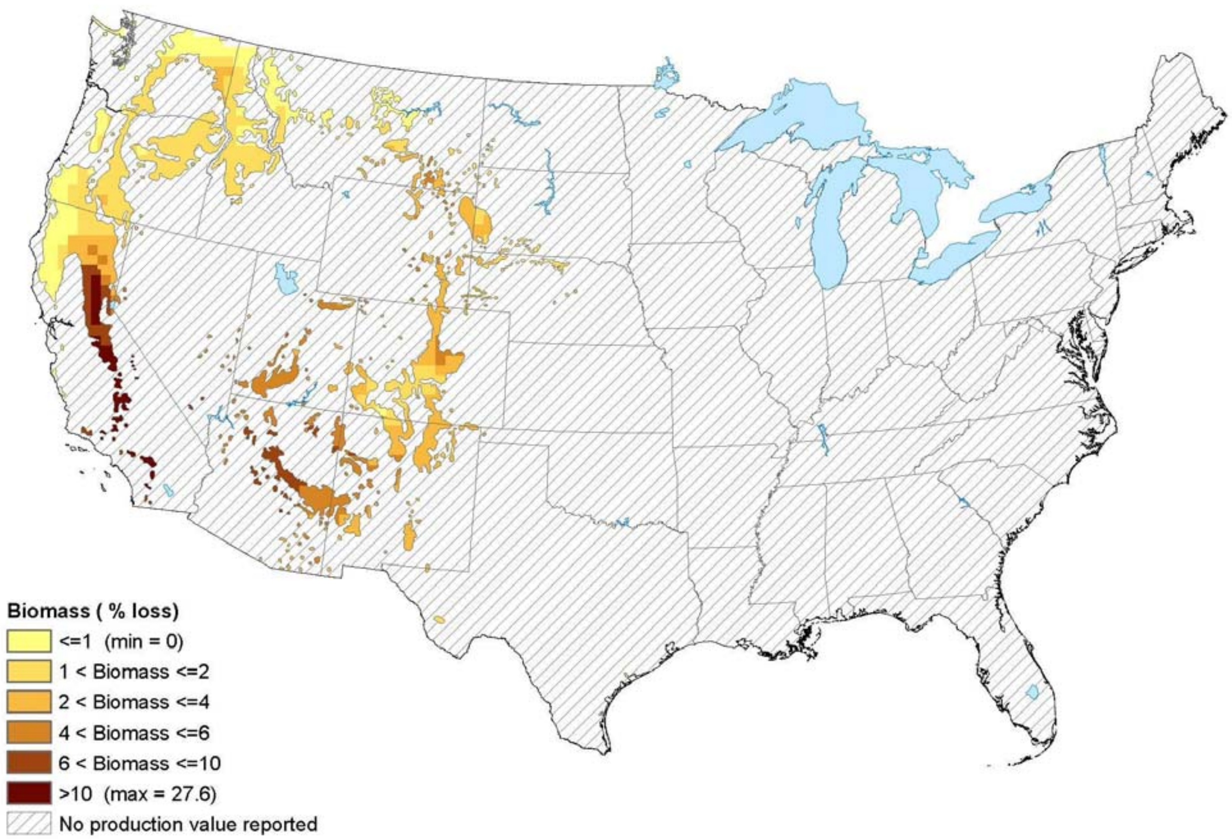
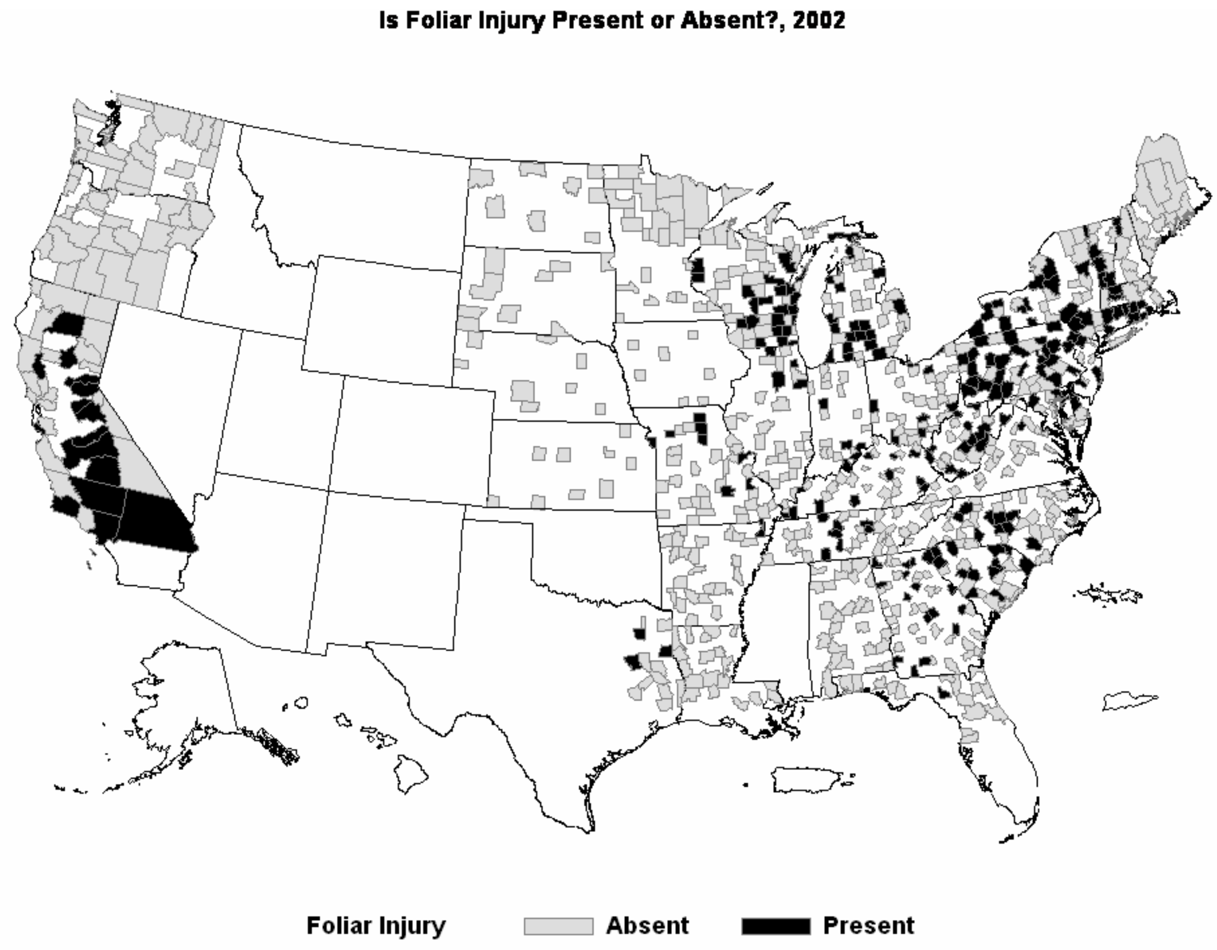


Figure 7H-5 Estimated ponderosa pine annual biomass loss based on interpolated 2001 maximum 3-month 12-hr W126 **without** a 10% downward adjustment of hourly O_3 concentrations. This map indicates the geographic range for ponderosa pine (*Pinus ponderosa)*, but it does not necessarily indicate that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

Sequoia NP
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*

Yosemite 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*

Colorado
Arches NP
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

Acadia NP

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

Glacier NP

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

Bandelier NM

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*

Carlsbad Caverns NP

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
<u>Big Bend NP</u>
Silver wormwood *Artemisia ludoviciana*
Swamp milkweed *Asclepias incarnata*
Ponderosa pine *Pinus ponderosa*
Skunkbush *Rhus trilobata*

<u>Guadalupe Mountains NP</u>
Silver wormwood *Artemisia ludoviciana*
Ponderosa pine *Pinus ponderosa*
Quaking aspen *Populus tremuloides*
Chokecherry *Prunus virginiana*

Utah
<u>Arches NP</u>
Cottonwood *Populus fremontii*
Single-leaf ash *Fraxinus anomala*
Skunkbush *Rhus trilobata*
White stem blazingstar *Mentzelia albicaulis*

<u>Bryce Canyon NP</u>
Spreading dogbane *Apocynum androsaemifolium*
Silver wormwood *Artemisia ludoviciana*
Ponderosa pine *Pinus ponderosa*
Quaking aspen *Populus tremuloides*
Choke cherry *Prunus virginiana*
Skunkbush *Rhus trilobata*

<u>Canyonlands NP</u>
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*

Capitol Reef NP
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*

Zion NP
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
Shenandoah NP
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

Mount Rainier NP

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*

North Cascades NP
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*

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

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

Yellowstone NP
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*

Sensitive Crops
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*

Sensitive Crops
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*

<u>Sensitive Crops</u>
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*

<u>Sensitive Crops</u>
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*

Sensitive Crops
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*

<u>Sensitive Crops</u>
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*

<u>Sensitive Crops</u>
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*

Sensitive Crops
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*

Sensitive Crops
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*

<u>Sensitive Crops</u>
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*

Sensitive Crops
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*

<u>Sensitive Crops</u>
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*

Sensitive Crops
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*

<u>Sensitive Crops</u>
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*

<u>Sensitive Crops</u>
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*

Sensitive Crops
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
Soybeans
Cotton
Potatoes

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
Peanuts
Soybeans
Cotton
Tobacco
Potatoes

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*

<u>Sensitive Crops</u>
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*

<u>Sensitive Crops</u>
Winter Wheat

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