Ozone Health Risk Assessment for Selected Urban Areas: Draft Report

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1 INTRODUCTION

The U.S. Environmental Protection Agency (EPA) is presently conducting a review of the national ambient air quality standards (NAAQS) for ozone (O_3). Sections 108 and 109 of the Clean Air Act (Act) govern the establishment and periodic review of the NAAQS. These standards are established for pollutants that may reasonably be anticipated to endanger public health and welfare, and whose presence in the ambient air results from numerous or diverse mobile or stationary sources. The NAAQS are to be based on air quality criteria, which are to accurately reflect the latest scientific knowledge useful in indicating the kind and extent of identifiable effects on public health or welfare that may be expected from the presence of the pollutant in ambient air. The EPA Administrator is to promulgate and periodically review, at five-year intervals, "primary" (health-based) and "secondary" (welfare-based) NAAQS for such pollutants.[1] Based on periodic reviews of the air quality criteria and standards, the Administrator is to make revisions in the criteria and standards, and promulgate any new standards, as may be appropriate. The Act also requires that an independent scientific review committee advise the Administrator as part of this NAAQS review process, a function performed by the Clean Air Scientific Advisory Committee (CASAC).

EPA's overall plan and schedule for this O_3 NAAQS review is presented in a *Plan for Review of the National Ambient Air Quality Standards for Ozone* (EPA, 2005a), which is available at: http://www.epa.gov/ttn/naaqs/standards/ozone/s_o3_cr_pd.html . That plan discusses the preparation of two key documents in the NAAQS review process: an Air Quality Criteria Document (hereafter cited as CD) and a Staff Paper. The CD provides a critical assessment of the latest available scientific information upon which the NAAQS are to be based, and the Staff Paper evaluates the policy implications of the information contained in the CD and presents staff conclusions and recommendations for standard-setting options for the Administrator to consider. In conjunction with preparation of the Staff Paper, staff in EPA's Office of Air Quality Planning and Standards (OAQPS) conducts various policy-relevant assessments, including in this review a quantitative exposure analysis and a human health risk assessment. Both the exposure analysis and the risk assessment require a quantitative analysis of O_3 air quality. The methods and results of this analysis are described in Chapters 2 and 4 of the draft Staff Paper (EPA, 2006b) (hereafter "draft Staff Paper") and in Fitz-Simons et al. (2005) and Rizzo (2005, 2006). The methods and results of the modeling of personal exposures are discussed in Chapter 4 of the draft Staff Paper and in an accompanying technical support document (EPA, 2006c). The methods and results of the human health risk assessment are described in this draft document.

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[1]Section 109(b)(1) [42 U.S.C. 7409] of the Act defines a primary standard as one "the attainment and maintenance of which in the judgment of the Administrator, based on such criteria and allowing an adequate margin of safety, are requisite to protect the public health."

As part of the last O_3 NAAQS review, EPA conducted exposure analyses for the general population; children, who spend more time outdoors; and outdoor workers. Exposure estimates were generated for 9 urban areas for existing (referred to as "as is") air quality and for just meeting the existing 1-hour standard and several alternative 8-hour standards. Several reports (Johnson et al., 1996a,b,c; Johnson, 1997) that describe these analyses can be found at: http://www.epa.gov/ttn/naaqs/standards/ozone/s_o3_pr_td.html. EPA also conducted a health risk assessment that produced risk estimates for the number and percent of children experiencing lung function and respiratory symptoms associated with the exposures estimated for these same 9 urban areas. This portion of the risk assessment was based on exposure-response relationships developed from analysis of data from several controlled human exposure studies. The risk assessment for the last review also included risk estimates for excess respiratory-related hospital admissions related to O_3 concentrations for New York City based on a concentration-response relationship reported in an epidemiology study. Risk estimates for lung function decrements, respiratory symptoms, and hospital admissions were developed for "as is" air quality and for just meeting the existing 1-hour standard and several alternative 8-hour standards. Reports describing the health risk assessment (Whitfield et al., 1996; Whitfield, 1997) can be found at: http://www.epa.gov/ttn/naaqs/standards/ozone/s_o3_pr_td.html.

The health risk assessment described in this report builds upon the methodology and lessons learned from the exposure and risk work conducted for the last review. The current draft of this report is also based on the information and evaluation contained in the final O_3 CD (EPA, 2006a) (hereafter O_3 CD). The general approach used in the current risk assessment was described in the draft Health Assessment Plan (EPA, 2005a), that was released to the CASAC and general public in April 2005 for review and comment and was the subject of a consultation with the CASAC O_3 Panel on May 5, 2005. The approach used in the current risk assessment reflects consideration of the comments offered by CASAC members and the public on the draft Health Assessment Plan, comments offered on the first draft Staff Paper and draft Risk Assessment TSD at and subsequent to a consultation with CASAC on December 8, 2005, and CASAC comments provided to the EPA in letters on February 16, 2006 (Henderson, 2006a) and June 5, 2006 (Henderson, 2006b).

The O_3 health risk assessment described in this document estimates the health effects associated with short-term exposures to O_3 under recent ("as is") air quality levels and upon just meeting the current and several alternative O_3 primary NAAQS in selected sample urban areas. These assessments cover a variety of health effects for which there is adequate information to develop quantitative risk estimates. However, there are several health endpoints for which there currently is insufficient information to develop quantitative risk estimates. These additional health endpoints are discussed qualitatively in the draft Staff Paper. The risk assessment is intended as a tool that, together with other information on these health endpoints and other health effects evaluated in the O_3 CD and draft Staff Paper, can aid the Administrator in judging whether the current primary standard protects public health with an adequate margin of safety, or whether revisions to the standard are appropriate.

The basic structure of the risk assessment reflects the two different types of studies on which the health risk assessment for O_3 is based: controlled human exposure studies, and epidemiological studies. This basic structure is described in Section 2. Section 3 describes the methods and results of that portion of the risk assessment based on controlled human exposure studies. Section 4 describes the methods and results of that portion of the risk assessment based on epidemiological studies.

2 BASIC STRUCTURE OF THE RISK ASSESSMENT

The health risk assessment described in this report estimated various health effects associated with O_3 exposures for recent ("as is") O_3 levels, based on both 2002 and 2004 air quality data, as well as the reduced risks for one O_3 season associated with just meeting the current 8-hour daily maximum O_3 NAAQS and several alternative 8-hour daily maximum standards. Risk estimates were developed for 12 urban areas located throughout the U.S. Health endpoints examined in the risk assessment include: lung function decrements, respiratory-related hospital admissions, and mortality. In addition, estimates of respiratory symptoms in asthmatic children were developed for one urban area.

At this time, two general types of human studies are particularly relevant for deriving quantitative relationships between O_3 levels and human health effects: controlled human exposure studies and epidemiological studies. Controlled human exposure studies involve volunteer subjects who are exposed while engaged in different exercise regimens to specified levels of O_3 under controlled conditions for specified amounts of time. The responses measured in such studies have included measures of lung function, such as forced expiratory volume in one second (FEV_1), respiratory symptoms, airway hyperresponsiveness, and inflammation. As noted above, prior EPA risk assessments for O_3 have included risk estimates for lung function decrements and respiratory symptoms based on analysis of individual data from controlled human exposure studies. For the current health risk assessment, we used exposure-response relationships based on analysis of individual data that describes the relationship between a measure of personal exposure to O_3 and the measure(s) of lung function recorded in several studies. The measure of personal exposure to ambient O_3 is typically some function of hourly exposures – e.g., 1-hour maximum or 8-hour maximum. Therefore, a risk assessment based on exposure-response relationships derived from controlled human exposure study data requires estimates of personal exposure to O_3, typically on a 1-hour or multi-hour basis. Because data on personal hourly O_3 exposures are not available, estimates of personal exposures to varying ambient concentrations were derived through exposure modeling, as described in the draft exposure analysis technical support document (EPA, 2006c).

In contrast to the exposure-response relationships derived from controlled human exposure studies, epidemiological studies provide estimated concentration-response (C-R) relationships based on data collected in real world settings. Ambient O_3 concentration is typically measured as the average of monitor-specific measurements. Population health responses for O_3 have included respiratory symptoms in moderate to severe asthmatic children, respiratory-related hospital admissions and premature mortality. As described more fully below, a risk assessment based on epidemiological studies requires baseline incidence rates and population data for the risk assessment locations.

The characteristics that are relevant to carrying out a risk assessment based on controlled human exposure studies versus one based on epidemiology studies can be summarized as follows:

- A risk assessment based on controlled human exposure studies uses exposure-response functions, and therefore requires as input (modeled) personal exposures to O_3. A risk assessment based on epidemiology studies uses C-R functions, and therefore requires as input (monitored) ambient O_3 concentrations.

- Epidemiological studies are carried out in specific real world locations (e.g., specific urban areas). A risk assessment focused on locations in which the epidemiologic studies providing the C-R functions were carried out will minimize uncertainties. Controlled human exposure studies, carried out in laboratory settings, are generally not specific to any particular real world location. A controlled human exposure studies-based risk assessment can therefore appropriately be carried out for any location for which there are adequate air quality data on which to base the modeling of personal exposures.

- The adequate modeling of hourly personal exposures associated with ambient concentrations requires more complete ambient monitoring data than are necessary to estimate average ambient concentrations used to calculate risks based on C-R relationships. Therefore, there may be some locations in which an epidemiological studies-based risk assessment could appropriately be carried out but a controlled human exposure studies-based risk assessment would introduce significant additional uncertainty.

- To derive estimates of risk from C-R relationships estimated in epidemiological studies, it is usually necessary to have estimates of the baseline incidences of the health effects involved. Such baseline incidence estimates are not needed in a controlled human exposure studies-based risk assessment.

The methods and results for the two parts of the risk assessment – the part based on controlled human exposure studies and the part based on epidemiological studies – are discussed in Sections 3 and 4 below. Both parts of the risk assessment were implemented within a new probabilistic version of TRIM.Risk, the component of EPA's Total Risk Integrated Methodology (TRIM) model that estimates human health risks.

3 ASSESSMENT OF RISK BASED ON CONTROLLED HUMAN EXPOSURE STUDIES

3.1 Methods

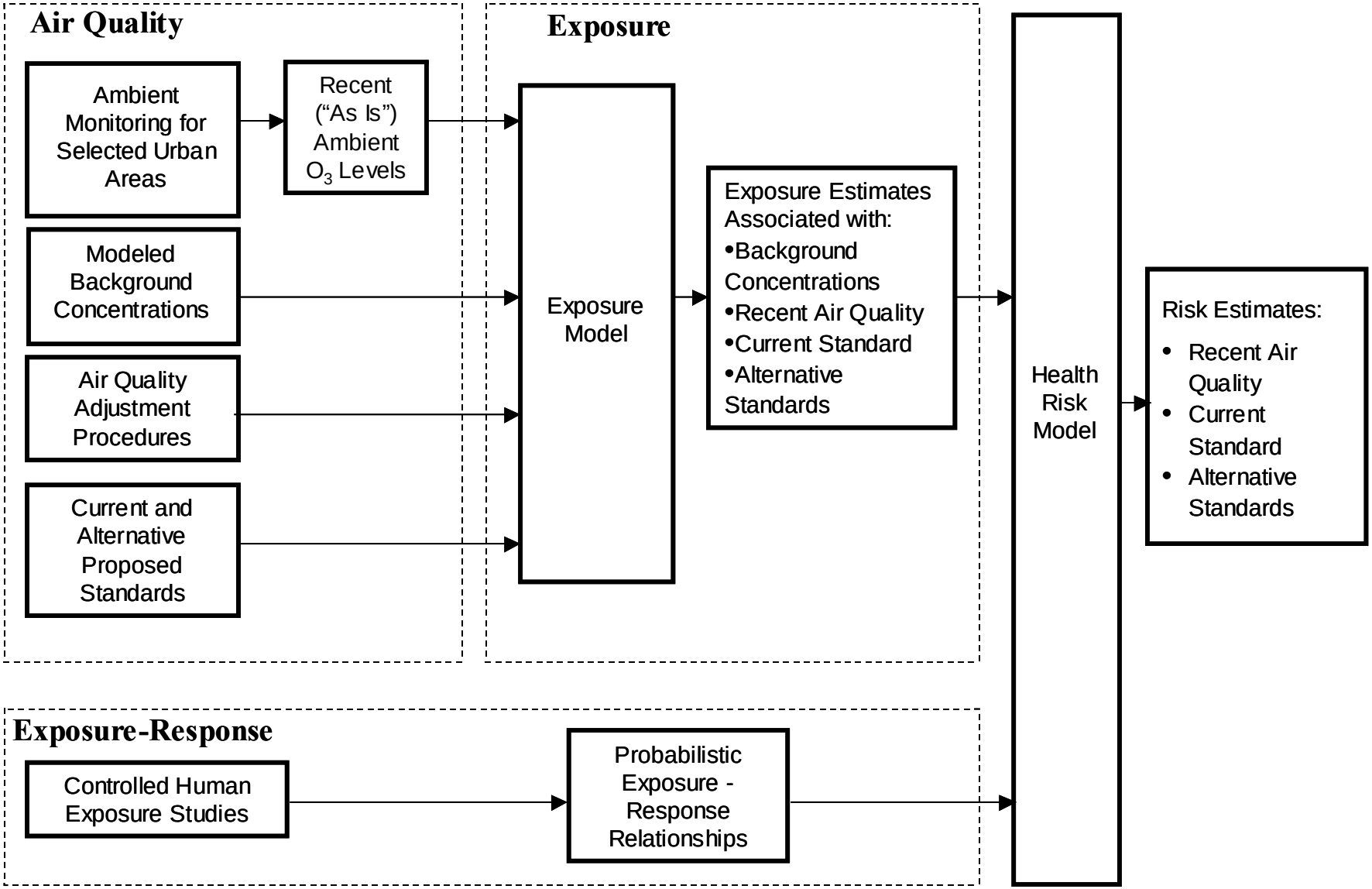
The major components of the part of the health risk assessment based on data from controlled human exposure studies are illustrated in Figure 3-1. The air quality and exposure analysis components that are integral to this part of the risk assessment are discussed in Chapters 2 and 4, respectively, of the draft Staff Paper. As described in the O_3 CD, there are numerous controlled human exposure studies reporting lung function decrements (as measured by changes in FEV_1), other measures of lung function, airway responsiveness, respiratory symptoms, and various markers of inflammation. Most of these studies have involved voluntary exposures with healthy adults, although a few studies have been conducted with mild and moderate asthmatics and one study reported lung function decrements for children 8-11 years old (McDonnell et al., 1985a) at a single exposure level.

3.1.1 Selection of health endpoints

In the last review, the health risk assessment estimated both lung function decrements ($\geq$10, $\geq$15, and $\geq$20% changes in FEV_1) and respiratory symptoms in children 6-18 years old associated with 1-hour exposures at moderate and heavy exertion and 8-hour exposures at moderate exertion. At that time EPA staff and the CASAC O_3 Panel judged that it was reasonable to estimate the exposure-response relationships for children 6-18 years old based on data from adult subjects (18-35 years old). As discussed in the 1996 O_3 Staff Paper (EPA, 1996a) and 1996 O_3 CD (EPA, 1996b), findings from other chamber studies (McDonnell et al., 1985a) for children 8-11 years old for a single exposure level and summer camp field studies involving children exposed to ambient O_3 in at least six different locations in the United States and Canada found lung function changes in healthy children similar to those observed in healthy adults exposed to O_3 under controlled chamber conditions. We are using the same approach in this assessment.

In the prior risk assessment, EPA estimated risk for lung function decrements associated with 1-hour heavy exertion, 1-hour moderate exertion, and 8-hour moderate exertion exposures. Since the 8-hour moderate exertion exposure scenario clearly resulted in the greatest health risks in terms of lung function decrements, EPA staff has chosen to include only the 8-hour moderate exertion exposures in the current risk assessment for this health endpoint. As discussed in Chapter 4 of the draft Staff Paper, levels of physical activity were categorized by a daily Physical Activity Index (PAI). Children were characterized as active if their median daily PAI over the period modeled was 1.75 or higher, a level characterized by exercise physiologists as being "moderately active" or "active."

Figure 3-1. Components of Ozone Health Risk Assessment Based on Controlled Human Exposure Studies



Although respiratory symptoms in healthy children were estimated in the last review, EPA staff has decided not to estimate respiratory symptoms in healthy children given the lack of symptoms found in field studies examining responses in healthy children published since the prior review. The O_3 CD concludes that "collectively, these studies indicate that there is no consistent evidence of an association between O_3 and respiratory symptoms among healthy children" (p. 7-55). While a number of controlled human exposure studies have been published since the last review reporting various other acute effects, including airway responsiveness and increases in inflammatory indicators, none of these studies were conducted at multiple concentration levels within the range of greatest interest (i.e., below 0.12 ppm). Thus, EPA staff has decided to limit this portion of the risk assessment to lung function decrements in children and to again base the exposure-response relationships on data obtained for 18-35 year old subjects.

3.1.2 Development of exposure-response functions

We used a similar methodology to that used in the prior risk assessment (see Appendices A and B in Whitfield et al., 1996) to estimate probabilistic exposure-response relationships for lung function decrements associated with 8-hour moderate exertion exposures. The combined data set from the Folinsbee et al. (1988), Horstman et al. (1990), and McDonnell et al. (1991) studies provide three data points – lung function decrements associated with each of three O_3 concentrations (0.08, 0.10, and 0.12 ppm) – for each of the three measures of lung function decrement listed above ($\geq$10, $\geq$15, and $\geq$20% changes in FEV_1). In addition, we now have three studies by Adams (Adams 2002, 2003, and 2006) that provide data for O_3 concentrations of 0.04 and 0.06 ppm as well as additional data for 0.08 and 0.12 ppm. In total, then, we have data for five O_3 concentrations – 0.04, 0.06, 0.08, 0.10, and 0.12 ppm. All of these studies were conducted for 6.6 hours under moderate exertion.

Before being used to estimate exposure-response relationships for 8-hour exposures, the data from these controlled human exposure studies were corrected for the effect of exercise in clean air to remove any systematic bias that might be present in the data attributable to an exercise effect. Generally, this correction for exercise in clean air is small relative to the total effects measures in the O_3-exposed cases. After we made corrections for the effect of exercise in clean air, we averaged individual responses to the same O_3 concentration under different exposure protocols within the same study. For example, in Adams (2006) subjects were exposed to O_3 concentrations of 0.08 ppm in a square-wave pattern in Protocol 2 and averaging 0.08 ppm in a triangular pattern in Protocol 3. If a subject's percent change in FEV_1, adjusted for exercise in clean air, was 2.92% under Protocol 2 exposure and 0.00% under Protocol 3 exposure, his average percent change in FEV_1, adjusted for exercise in clean air, when exposed to O_3 concentrations of 0.08 ppm, 8-hr average is estimated to be (2.92% + 0.00%)/2 = 1.46%.

Nonlinear regression techniques were then used to fit the following 3-parameter logistic function to the data for each of the three measures of lung function decrement:[2,3]

[2] As noted in Whitfield et al., 1996, the response data point in the combined dataset from the Folinsbee, Horstman, and McDonnell studies associated with 0.12 ppm for the response measure FEV1 $\geq$ 15% appeared to be inconsistent with the other data points (see Whitfield et al., 1996, Table 10, footnote c). Because of this, we estimated the probability of a response of FEV1 $\geq$ 15% at an O_3 concentration of 0.12 ppm by interpolating between the FEV1 $\geq$ 10% and FEV1 $\geq$ 20% response rates at that O_3 concentration.

$$y = \frac{\alpha * e^{\gamma}(1 - e^{\beta x})}{(1 + e^{\gamma})(1 + e^{\beta x + \gamma})}, \qquad (3\text{-}1)$$

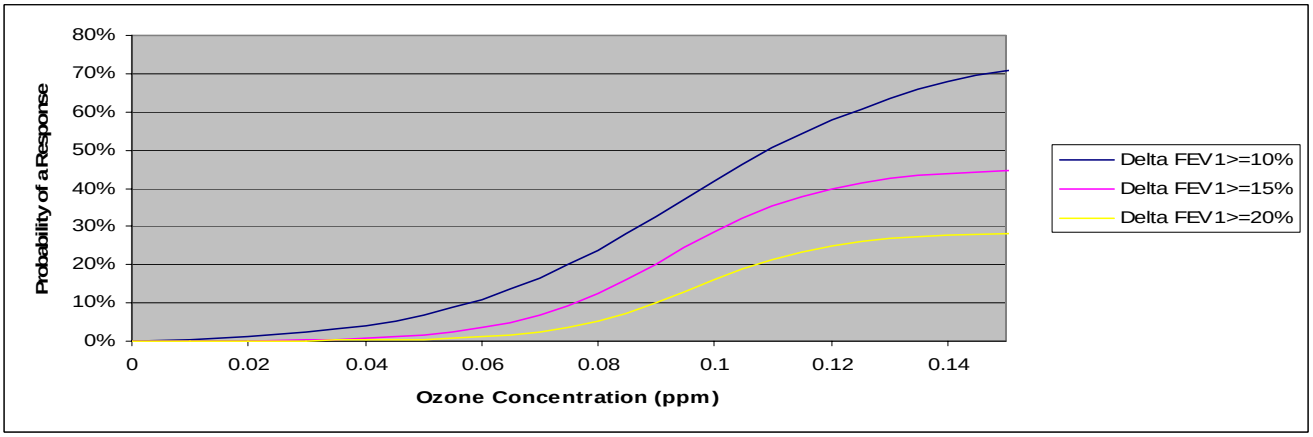
where x denotes the O_3 concentration (in ppm) to which the individual is exposed, y denotes the corresponding response (decrement in $FEV_1 \geq 10\%$, $\geq 15\%$ or $\geq 20\%$), and α, β, and γ are the three parameters whose values are estimated in the nonlinear regression. The three 3-parameter logistic functions for changes in $FEV_1 \geq 10\%$, $\geq 15\%$ and $\geq 20\%$ are shown together in Figure 3-2. The three curves are shown separately, along with the response data to which they were fit, in Figures 3-3, 3-4, and 3-5, respectively. All regressions were run in SAS.

3.1.3 Approach to calculating risk estimates

We have generated several risk measures for this portion of the risk assessment. In addition to the estimates of the number of school age children and active children experiencing 1 or more occurrences of a lung function decrement $\geq 10\%$, $\geq 15\%$ and $\geq 20\%$ in an O_3 season, risk estimates have been developed for the total number of occurrences of these lung function decrements in school age children and active school age children. The mean number of occurrences per child has been calculated to provide an indicator of the average number of times that a responder would experience the specified effect during an O_3 season.

A headcount risk estimate for a given lung function decrement (e.g., ≥20% change in FEV_1) is an estimate of the expected number of people who will experience that lung function decrement. To obtain risk estimates associated with ozone concentrations in excess of policy relevant background (PRB) concentrations, we have (1) estimated expected risk, given the personal exposures associated with "as is" ambient O_3 concentrations, (2) estimated expected risk, given the personal exposures associated with estimated background ambient O_3 concentrations, and (3) subtracted the latter from the former. The headcount risk is then calculated by multiplying the resulting expected risk by the number of people in the relevant population. Because response rates are calculated for 21 fractiles, estimated headcount risks are similarly fractile-specific.

Figure 3-2. Logistic Exposure-Response Functions: Change in $FEV_1 \geq 10\%$, 15%, and 20%



[3] The 3-parameter logistic function is a special case of the 4-parameter logistic, in which the function is forced to go through the origin, so that the probability of response to 0.00 ppm is 0.

Figure 3-3. Logistic Exposure-Response Function for Change in $FEV_1 \geq 10\%$

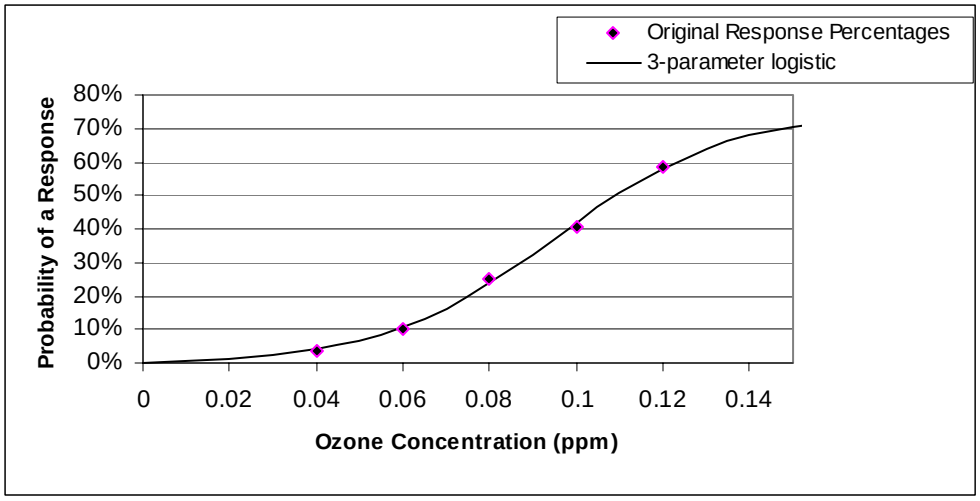


Figure 3-4. Logistic Exposure-Response Function for Change in $FEV_1 \geq 15\%$

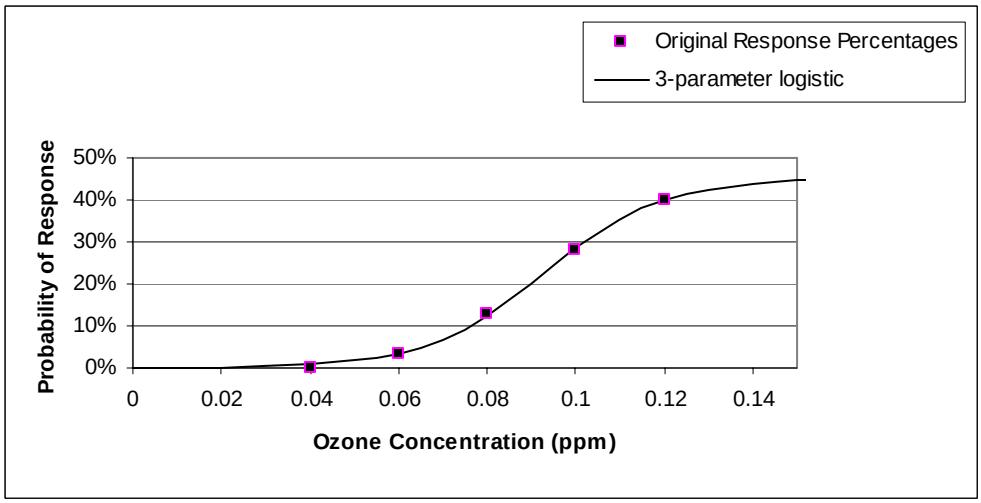
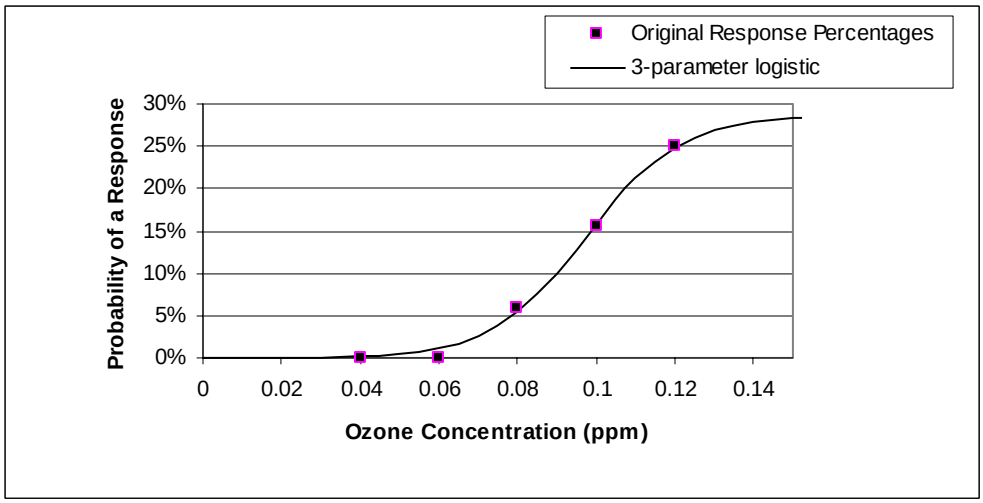


Figure 3-5. Logistic Exposure-Response Function for Change in $FEV_1 \geq 20\%$



The risk (i.e., expected fractional response rate) for the k^{th} fractile, R_k is:

$$R_k = \sum_{j=1}^{N} P_j \; x \; (RR_k \mid e_j) \quad - \quad \sum_{i=1}^{N_b} P_i^b \; x \; (RR_k \mid e_i^b) \qquad \text{(Equation 3-1)}$$

where:

e_j = (the midpoint of) the jth category of personal exposure to ozone, given "as is" ambient O_3 concentrations;

e_i^b = (the midpoint of) the ith category of personal exposure to ozone, given background ambient O_3 concentrations;

P_j = the fraction of the population having personal exposures to O_3 concentration of e_j ppm, given "as is" ambient O_3 concentrations;

P_i^b = the fraction of the population having personal exposures to O_3 concentration of e_i^b ppm, given background ambient O_3 concentrations;

$RR_k \mid e_j$ = k-fractile response rate at O_3 concentration e_j;

$RR_k \mid e_i^b$ = k-fractile response rate at O_3 concentration e_i^b; and

N = number of intervals (categories) of O_3 personal exposure concentration, given "as is" ambient O_3 concentrations; and

N_b = number of intervals of O_3 personal exposure concentration, given background ambient O_3 concentrations.

For example, if the median expected response rate given "as is" ambient concentrations is 0.065 (i.e., the median expected fraction of the population responding is 6.5%) and the median expected response rate given background ambient concentrations is 0.001 (i.e., the median expected fraction of the population responding is 0.1%), then the median expected response rate associated with "as is" ambient concentrations above PRB concentrations is 0.065 – 0.001 = 0.064. If there are 300,000 people in the relevant population, then the headcount risk is 0.064 x 300,000 = 19,200.

An artifact of the method used is that the population numbers associated with PRB concentrations were not identical to those associated with "as is" concentrations (or concentrations rolled back to simulate just meeting current or alternative standards) in the same location. Before calculating risk estimates associated with ozone concentrations in excess of PRB concentrations, we therefore first normalized the number of responders (or the number of occurrences of response) given personal exposures associated with "as is" ambient O_3

concentrations (or concentrations rolled back to simulate just meeting a standard) by multiplying by the ratio of the population associated with PRB concentrations to the population associated with "as is" concentrations (or concentrations rolled back to simulate just meeting current or alternative standards in the same location). For example, the number of person-days for all children in St. Louis associated with PRB concentrations was 39,500,000; the number of person-days for all children in St. Louis associated with "as is" concentrations was 42,310,000. The ratio of the former to the latter is 0.9336. The number of person-days with a decrease in FEV_1 $\geq$10% given personal exposures associated with "as is" ambient O_3 concentrations was 391,011. After normalizing to the background population of person-days, this becomes 365,042. The number of person-days with a decrease in FEV_1 $\geq$10% given personal exposures associated with PRB O_3 concentrations was 50,183. The number of occurrences of a decrease in FEV_1 $\geq$10% associated with "as is" ambient O_3 concentrations over PRB concentrations was therefore calculated to be 365,042 - 50,183 = 314,859, or about 315,000.

3.1.4 Selection of urban areas

EPA staff chose to develop lung function decrement risk estimates for school age children and active school age children living in 12 urban areas in the U.S. Since the exposure-response functions for lung function decrements based on the controlled human exposure studies were based on controlled laboratory conditions, the location of these studies played no role in selecting urban locations for the risk assessment. Instead, several criteria and considerations guided the selection of urban areas for the risk assessment, including the following:

- The overall set of urban locations should represent a range of geographic areas, urban population demographics, and climatology, and be focused on areas that do not meet the current 8-hour O_3 NAAQS.
- The largest areas with major O_3 nonattainment problems should be included.
- There must be sufficient air quality data for the three-year period (2002 - 2004).

Several additional criteria, which apply to the epidemiology-based portion of the risk assessment, are discussed below in Section 4.1.4. Because the same 12 urban areas were used in both the controlled human studies- and the epidemiological studies-based portions of the risk assessment, these additional criteria were used to further narrow the choice of urban areas for which lung function decrement risk estimates were developed.

For the purposes of estimating population exposure and the risk of lung function decrements associated with these population exposure estimates, the 12 urban areas were defined based on consolidated statistical areas (CSAs). In contrast, for the risk estimates for premature mortality and excess hospital admissions based on C-R relationships estimated in epidemiological studies, the urban areas were defined to be generally consistent with the geographic boundaries used in those studies. While risk estimates in the epidemiology-based portion of the O_3 risk assessment are based on the months of April through September, risk estimates in the controlled human studies-based portion are based on the actual location-specific O_3 seasons. The CSAs and their O_3 seasons are shown in Table 3-1. Throughout the rest of this report, the urban area in bold is used as a short-hand name representing the entire CSA for the

lung function part of the risk assessment. The populations of school age and active school age children in these areas are shown in Table 3-2.

3.1.5 Addressing variability and uncertainty

Any estimation of risk and reduced risks associated with just meeting the current O_3 standards should address both the variability and uncertainty that generally underlie such an analysis. *Uncertainty* refers to the lack of knowledge regarding the actual values of model input variables (parameter uncertainty) and of physical systems or relationships (model uncertainty – e.g., the shapes of exposure-response and concentration-response functions). The goal of the analyst is to reduce uncertainty to the maximum extent possible. Uncertainty can be reduced by improved measurement and improved model formulation. In a health risk assessment, however, significant uncertainty often remains.

Table 3-1. Urban Areas Used in the Controlled Human Studies-Portion of the O_3 Risk Assessment and Their O_3 Seasons

Urban Area (CSA)	O_3 Season
Atlanta-Sandy Springs-Gainesville, GA-AL	March 1 to Oct. 31
Boston-Worcester-Manchester, MA-NH	April 1 to Sept. 30
Chicago-Naperville-Michigan City, IL-IN-WI	April 1 to Sept. 30
Cleveland-Akron-Elyria, OH	April 1 to Oct. 31
Detroit-Warren-Flint, MI	April 1 to Sept. 30
Houston-Baytown-Huntsville, TX	Jan. 1 to Dec. 30
Los Angeles-Long Beach-Riverside, CA	Jan. 1 to Dec. 30
New York-Newark-Bridgeport, NY-NJ-CT-PA	April 1 to Sept. 30
Philadelphia-Camden-Vineland, PA-NJ-DE-MD	April 1 to Oct. 31
Sacramento--Arden-Arcade--Truckee, CA-NV	Jan. 1 to Dec. 30
St. Louis-St. Charles-Farmington, MO-IL	April 1 to Oct. 31
Washington-Baltimore-N. Virginia, **DC**-MD-VA-WV	April 1 to Oct. 31

Table 3-2. Population Coverage of Modeled Areas

Urban Area (CSA)	Modeled population (thousands)	Modeled children (thousands)	Active children (thousands)
Atlanta	4,548	942	519
Boston	5,714	1,098	529
Chicago	9,311	1,946	933
Cleveland	2,945	582	295
Detroit	5,357	1,110	553
Houston	4,815	1,076	598
Los Angeles	16,349	3,594	1,951
New York	21,357	4,084	2,009
Philadelphia	5,832	1,179	609
Sacramento	1,930	418	226
St. Louis	2,754	572	309
Washington, DC	7,572	1,473	759

The degree of uncertainty can be characterized, sometimes quantitatively. For example, the statistical uncertainty surrounding the estimated O_3 coefficients in the exposure-response functions is reflected in confidence or credible intervals provided for the risk estimates.

A Bayesian approach was used to characterize uncertainty attributable to sampling error based on sample size considerations. In this approach, for any given O_3 concentration, we specify a prior probability distribution describing our prior beliefs about the probability that the rate of response to exposure to that O_3 concentration will fall in any specified range. Given this prior distribution and the actual data – a sample size, N (the number of subjects exposed to the specified O_3 concentration), and a number of responders, X – the Bayesian approach calculates a posterior distribution, which provides a description of the uncertainty about the response rate corresponding to the specified O_3 concentration. If the prior distribution is a Beta distribution with parameters α and β, the posterior distribution is also a Beta distribution, but with parameters $(\alpha+X)$ and $(\beta+N-X)$. For prior distributions we used diffuse Beta distributions, in which $\alpha = \beta = 0$. The resulting posterior distributions are therefore Beta distributions with parameters X and (N-X).

We have actual samples (and therefore actual sample sizes and numbers of responders), however, for only five O_3 concentrations – 0.04, 0.06, 0.08, 0.10, and 0.12 ppm. Therefore a true Bayesian approach can be carried out for only these five O_3 concentrations. As an alternative, we approximated this approach by setting N=30 (the smallest of the five sample sizes) for all O_3 concentrations and calculating X for any given O_3 concentration as the number of responders (out of 30 subjects) predicted by the estimated logistic exposure-response function. For

example, the estimated logistic exposure-response function for response defined as ΔFEV1 ≥ 10% predicts a probability of response to 0.05 ppm O_3 to be 0.067475. The predicted number of responders to 0.05 ppm O_3 is thus 0.067475 x 30 = 2.024. Applying the inverse Beta function with parameters X = 2.024 and (N-X) = (30 – 2.024), the predicted response rate associated with any percentile of the posterior distribution for an O_3 concentration of 0.05 ppm can be calculated. The 1st percentile response rate is 0.005, the 2.5th percentile response rate is 0.034, the 50th percentile response rate is 0.058, and so forth.

Because we don't actually have samples for every possible O_3 concentration, there is no perfect method to characterize the uncertainty associated with sampling error for the entire logistic exposure-response function. By using the smallest of the actual five sample sizes, we maximize the estimated uncertainty associated with sample size considerations. Because other sources of uncertainty about the exposure-response function cannot easily be quantified, we believe this conservative approach is reasonable. The 2.5th percentile, 50th percentile (median), and 97.5th percentile curves thus derived are shown for the three response definitions in Figures 3-6a, b, and c.

In addition to uncertainties arising from sample size considerations, other uncertainties associated with the use of the exposure-response relationships for lung function responses are briefly summarized below. Additional uncertainties with respect to the exposure inputs to the risk assessment are described in Chapter 4 of the draft Staff Paper and in the draft Exposure Assessment TSD (EPA 2006c). The main additional uncertainties with respect to the approach used to estimate exposure-response relationships include:

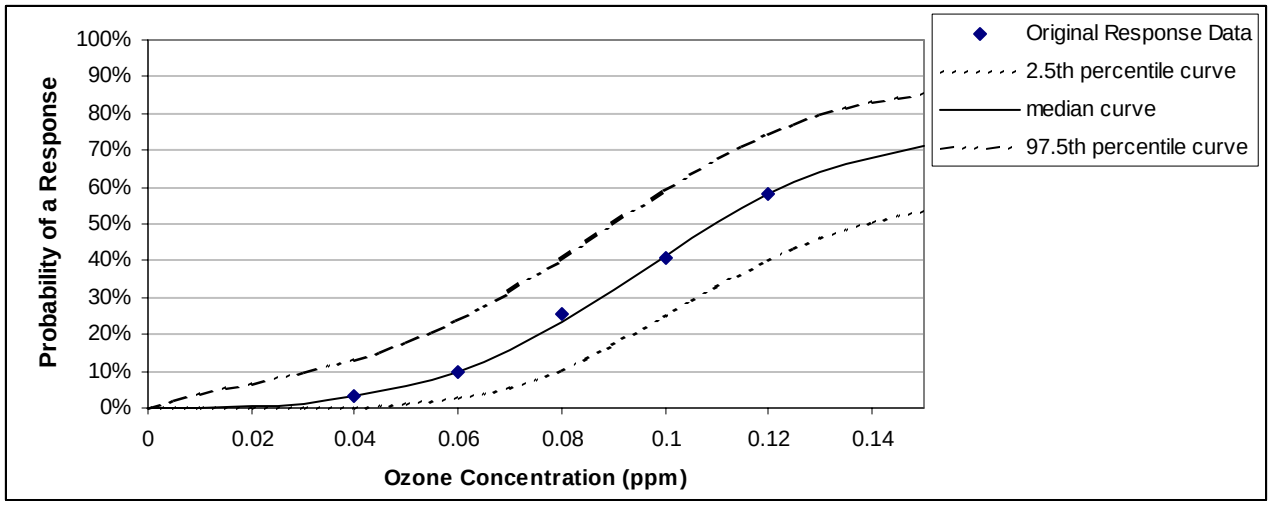
- Length of exposure. The 8-hour moderate exertion risk estimates are based on a combined data set from six controlled human exposure studies conducted using 6.6-hr exposures. The use of these data to estimate responses associated with an 8-hour exposure seem reasonable, however, because lung function response appears to level off after exposure for 6 hours. It is unlikely that the exposure-response relationships would have been appreciably different had the studies been conducted over an 8-hour period.

- Extrapolation of exposure-response relationships. It was necessary to estimate responses at O_3 levels below the lowest exposure levels used in the controlled human studies (i.e., 0.04 ppm). In both the prior review and the current assessment, the response has been extrapolated down to background levels.

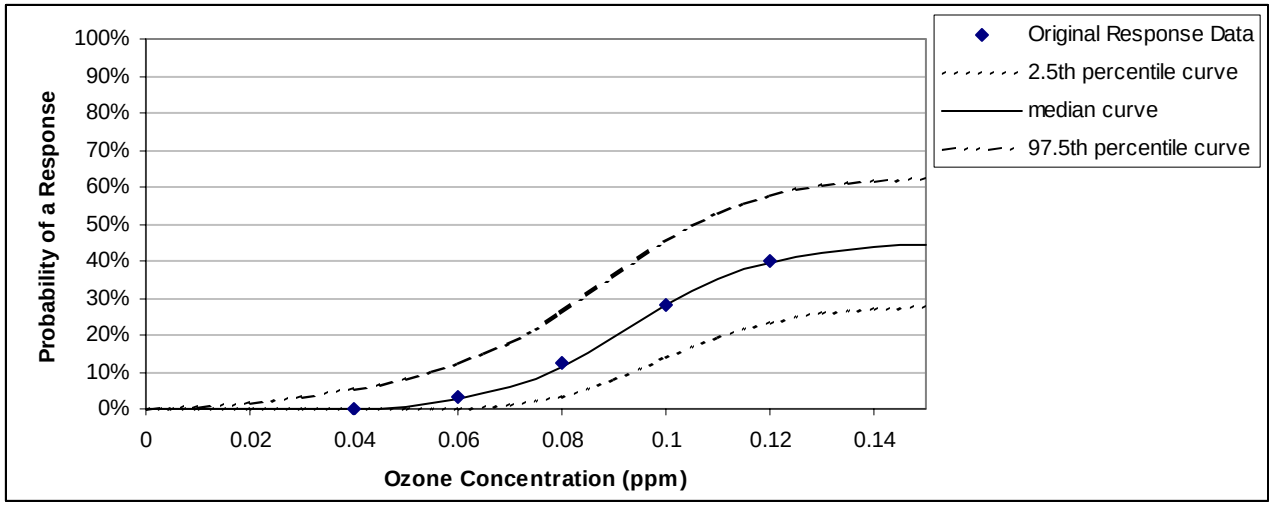
- Reproducibility of O_3 induced responses. The risk assessment assumed that the O_3-induced responses for individuals are reproducible. This assumption is supported by the evaluation in the O_3 CD (see section AX6.4), which cites studies by McDonnell et al. (1985b) and Hazucha et al. (2003) as showing significant reproducibility of response.

Figure 3-6. a, b, c. Probabilistic Exposure-Response Relationships for FEV_1 Decrement ≥ 10%, ≥ 15%, and ≥ 20% for 8-Hour Exposures Under Moderate Exertion (Sources: derived from Folinsbee et al., 1988; Horstman et al. 1990; McDonnell et al., 1991; Adams 2002, 2003, 2006)

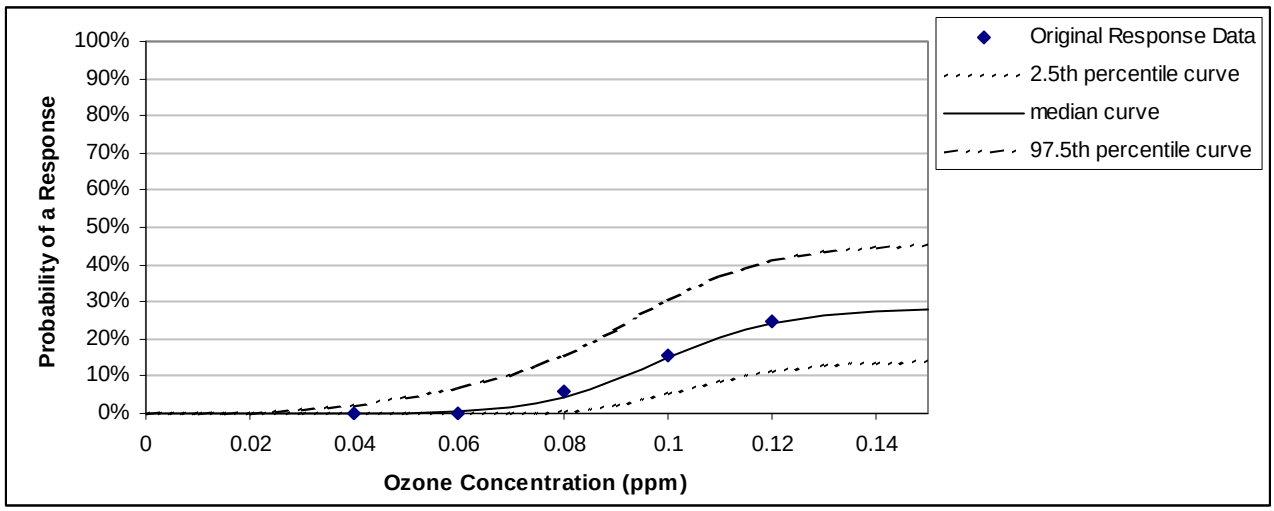
a) FEV_1 Decrement ≥ 10%



b) FEV_1 Decrement ≥ 15%



c) FEV_1 Decrement ≥ 20%



- Age and lung function response. As in the prior review, exposure-response relationships based on controlled human exposure studies involving 18-35 year old subjects were used in the risk assessment to estimate responses for school age children (ages 5-18). This approach is supported by the findings of McDonnell et al. (1985a) who reported that children 8-11 year old experienced FEV_1 responses similar to those observed in adults 18-35 years old when both groups were exposed to concentrations of 0.12 ppm at an EVR of 35 L/min/m^2. In addition, a number of summer camp studies of school age children exposed in outdoor environments in the Northeast also showed O_3-induced lung function changes similar in magnitude to those observed in controlled human exposure studies.

- Exposure history. The risk assessment assumed that the O_3-induced response on any given day is independent of previous O_3 exposures. As discussed in Chapter 3 of the draft Staff Paper and in the O_3 CD, O_3-induced responses can be enhanced or attenuated as a result of recent prior exposures. The possible impact of exposure history on the risk estimates is an additional source of uncertainty that is not quantified in this assessment.

- Interaction between O_3 and other pollutants. Because the controlled human exposure studies used in the risk assessment involved only O_3 exposures, it was assumed that estimates of O_3-induced health responses would not be affected by the presence of other pollutants (e.g., SO_2, $PM_{2.5}$, etc). Some evidence exists that other pollutants may enhance the respiratory effects associated with exposure to O_3, but the evidence is not consistent across studies.

Variability refers to the heterogeneity in a population or parameter. Even if there is no uncertainty surrounding inputs to the analysis, there may still be variability. For example, there may be variability among exposure-response functions describing the relationship between O_3 and lung function across urban areas. Similarly, there may be variability among C-R functions describing the relationship between O_3 and mortality across urban areas. This variability does not imply uncertainty about the exposure-response or C-R function in any of the urban areas, but only that these functions are different in the different locations, reflecting differences in the populations and/or other factors that may affect the relationship between O_3 and the associated health endpoint. In general, it is possible to have uncertainty but no variability (if, for instance, there is a single parameter whose value is uncertain) or variability but little or no uncertainty (for example, people's heights vary considerably but can be accurately measured with little uncertainty).

The current controlled human exposure studies portion of the risk assessment incorporates some of the variability in key inputs to the analysis by using location-specific inputs for the exposure analysis (e.g., location-specific population data, air exchange rates, air quality and temperature data). Although spatial variability in these key inputs across all U.S. locations has not been fully characterized, variability across the selected locations is imbedded in the analysis by using, to the extent possible, inputs specific to each urban area. Temporal variability is more difficult to address, because the risk assessment focuses on some unspecified time in the future. To minimize the degree to which values of inputs to the analysis may be different from the values of those inputs at that unspecified time, we have used relatively recent inputs – for example, year 2002 and 2004 air quality data for all of the urban locations, and the most recent

available population data (from the 2000 Census). However, future changes in inputs have not been predicted (e.g., future population levels).

3.2 Results

Section 3.2.1 presents the results of the assessment of lung function decrement associated with exposure to "as is" O_3 concentrations (representing levels measured in 2004 and 2002 for all of the assessment locations) over PRB levels, based on controlled human exposure studies. The corresponding results when O_3 concentrations just meet the current and alternative 8-hour daily maximum standards are presented in Section 3.2.2. All estimated numbers (of children and of occurrences) were rounded to the nearest 1000, and all percentages were rounded to one decimal place. These rounding conventions are not intended to imply confidence in that level of precision, but rather to avoid the confusion that can result when a greater amount of rounding is used.

3.2.1 Assessment of lung function decrement associated with exposure to "as is" O_3 concentrations in excess of policy relevant background levels

The estimated number and percent of occurrences of lung function decrement associated with exposure to "as is" O_3 concentrations over PRB concentrations among all school age children (ages 5 – 18) engaged in moderate exercise for at least one 8-hour period during the O_3 season in 2004 is given in Table 3-3; the corresponding table for 2002 is Table 3-4. The numbers and percents of these children estimated to experience at least one lung function decrement associated with exposure to "as is" O_3 concentrations over PRB concentrations is given in Tables 3-5 and 3-6, for 2004 and 2002, respectively. Tables 3-7 through 3-10 give the corresponding results for active children. Results for all three measures of lung function decrement being considered in this analysis – decrements in FEV_1 of $\geq$10%, $\geq$15%, and $\geq$20% -- are shown in each table.

Table 3-3. Estimated Number and Percent of Occurrences of Lung Function Response Associated with Exposure to "As Is" O_3 Concentrations Over Background O_3 Concentrations Among All Children (Ages 5-18) Engaged in Moderate Exertion, for Location-Specific O_3 Seasons: 2004 O_3 Concentrations*

Location	Response = Decrease in FEV_1 Greater Than or Equal to:					
	10%		15%		20%	
	Number (1000s)	Percent	Number (1000s)	Percent	Number (1000s)	Percent
Atlanta	809 (92 - 2734)	1% (0.1% - 3.2%)	84 (6 - 1407)	0.1% (0% - 1.7%)	12 (1 - 586)	0% (0% - 0.7%)
Boston	578 (54 - 2105)	0.8% (0.1% - 3%)	48 (3 - 1068)	0.1% (0% - 1.5%)	6 (0 - 418)	0% (0% - 0.6%)
Chicago	913 (65 - 3300)	0.7% (0.1% - 2.6%)	54 (1 - 1702)	0% (0% - 1.3%)	3 (0 - 669)	0% (0% - 0.5%)
Cleveland	357 (33 - 1252)	0.8% (0.1% - 2.8%)	29 (1 - 647)	0.1% (0% - 1.5%)	3 (0 - 260)	0% (0% - 0.6%)
Detroit	580 (49 - 2094)	0.8% (0.1% - 2.9%)	43 (2 - 1072)	0.1% (0% - 1.5%)	4 (0 - 421)	0% (0% - 0.6%)
Houston	894 (144 - 2208)	0.6% (0.1% - 1.6%)	137 (17 - 1287)	0.1% (0% - 0.9%)	27 (3 - 657)	0% (0% - 0.5%)
Los Angeles	6206 (1019 - 16867)	1.3% (0.2% - 3.4%)	977 (116 - 9338)	0.2% (0% - 1.9%)	191 (17 - 4502)	0% (0% - 0.9%)
New York	2586 (262 - 8798)	0.9% (0.1% - 3.2%)	234 (15 - 4574)	0.1% (0% - 1.7%)	29 (1 - 1881)	0% (0% - 0.7%)
Philadelphia	948 (109 - 2961)	1.1% (0.1% - 3.4%)	99 (6 - 1582)	0.1% (0% - 1.8%)	13 (0 - 692)	0% (0% - 0.8%)
Sacramento	401 (45 - 1264)	0.8% (0.1% - 2.5%)	40 (2 - 668)	0.1% (0% - 1.3%)	5 (0 - 294)	0% (0% - 0.6%)
St. Louis	340 (30 - 1173)	0.8% (0.1% - 2.7%)	26 (1 - 606)	0.1% (0% - 1.4%)	2 (0 - 249)	0% (0% - 0.6%)
Washington, DC	1076 (129 - 3612)	1% (0.1% - 3.2%)	119 (10 - 1864)	0.1% (0% - 1.7%)	18 (1 - 779)	0% (0% - 0.7%)

*Numbers are median (0.5 fractile) numbers of occurrences. Numbers in parentheses below the median are 95% confidence intervals based on statistical uncertainty surrounding the O_3 coefficient. Numbers are rounded to the nearest 1000. Percents are rounded to the nearest tenth.

Table 3-4. Estimated Number and Percent of Occurrences of Lung Function Response Associated with Exposure to "As Is" O_3 Concentrations Over Background O_3 Concentrations Among All Children (Ages 5-18) Engaged in Moderate Exertion, for Location-Specific O_3 Seasons: 2002 O_3 Concentrations*

Location	Response = Decrease in FEV_1 Greater Than or Equal to:					
	10%		15%		20%	
	Number (1000s)	Percent	Number (1000s)	Percent	Number (1000s)	Percent
Atlanta	977 (159 - 2868)	1.2% (0.2% - 3.4%)	154 (19 - 1538)	0.2% (0% - 1.8%)	31 (3 - 702)	0% (0% - 0.8%)
Boston	1043 (194 - 3048)	1.5% (0.3% - 4.3%)	192 (36 - 1643)	0.3% (0.1% - 2.3%)	51 (8 - 746)	0.1% (0% - 1%)
Chicago	1840 (333 - 5054)	1.5% (0.3% - 4%)	326 (46 - 2788)	0.3% (0% - 2.2%)	72 (6 - 1319)	0.1% (0% - 1%)
Cleveland	793 (168 - 2104)	1.8% (0.4% - 4.8%)	169 (30 - 1170)	0.4% (0.1% - 2.6%)	44 (5 - 564)	0.1% (0% - 1.3%)
Detroit	1160 (220 - 3197)	1.6% (0.3% - 4.5%)	217 (31 - 1753)	0.3% (0% - 2.5%)	49 (4 - 827)	0.1% (0% - 1.2%)
Houston	788 (131 - 1902)	0.6% (0.1% - 1.4%)	126 (17 - 1122)	0.1% (0% - 0.8%)	27 (3 - 579)	0% (0% - 0.4%)
Los Angeles	5558 (926 - 15061)	1.1% (0.2% - 3.1%)	894 (127 - 8392)	0.2% (0% - 1.7%)	193 (23 - 4037)	0% (0% - 0.8%)
New York	5044 (1015 - 13477)	1.9% (0.4% - 5%)	1008 (171 - 7485)	0.4% (0.1% - 2.8%)	252 (31 - 3603)	0.1% (0% - 1.3%)
Philadelphia	1776 (390 - 4457)	2% (0.4% - 5%)	392 (74 - 2537)	0.4% (0.1% - 2.9%)	105 (14 - 1269)	0.1% (0% - 1.4%)
Sacramento	561 (90 - 1625)	1.1% (0.2% - 3.3%)	86 (10 - 873)	0.2% (0% - 1.8%)	17 (1 - 405)	0% (0% - 0.8%)
St. Louis	654 (128 - 1742)	1.5% (0.3% - 4%)	127 (20 - 967)	0.3% (0% - 2.2%)	30 (3 - 468)	0.1% (0% - 1.1%)
Washington, DC	1870 (373 - 5136)	1.7% (0.3% - 4.6%)	370 (63 - 2809)	0.3% (0.1% - 2.5%)	93 (12 - 1336)	0.1% (0% - 1.2%)

*Numbers are median (0.5 fractile) numbers of occurrences. Numbers in parentheses below the median are 95% confidence intervals based on statistical uncertainty surrounding the O_3 coefficient. Numbers are rounded to the nearest 1000. Percents are rounded to the nearest tenth.

Table 3-5. Number and Percent of All Children (Ages 5-18) Engaged in Moderate Exertion Estimated to Experience At Least One Lung Function Response Associated with Exposure to "As Is" O_3 Concentrations Over Background O_3 Concentrations, for Location-Specific O_3 Seasons: 2004 O_3 Concentrations*

Location	Response = Decrease in FEV_1 Greater Than or Equal to:					
	10%		15%		20%	
	Number (1000s)	Percent	Number (1000s)	Percent	Number (1000s)	Percent
Atlanta	85 (28 - 141)	9% (3% - 15%)	29 (5 - 91)	3% (0.5% - 9.7%)	7 (1 - 58)	0.8% (0.1% - 6.2%)
Boston	72 (20 - 130)	6.6% (1.8% - 11.8%)	20 (2 - 81)	1.8% (0.2% - 7.4%)	4 (0 - 51)	0.4% (0% - 4.6%)
Chicago	98 (22 - 185)	5% (1.1% - 9.5%)	21 (1 - 112)	1.1% (0.1% - 5.7%)	3 (0 - 71)	0.1% (0% - 3.6%)
Cleveland	38 (10 - 69)	6.4% (1.7% - 11.6%)	10 (1 - 43)	1.7% (0.2% - 7.2%)	2 (0 - 27)	0.3% (0% - 4.5%)
Detroit	68 (17 - 123)	6.1% (1.6% - 11.1%)	17 (1 - 76)	1.5% (0.1% - 6.8%)	3 (0 - 48)	0.3% (0% - 4.3%)
Houston	122 (48 - 189)	11.2% (4.4% - 17.4%)	51 (13 - 129)	4.7% (1.2% - 11.9%)	17 (3 - 84)	1.6% (0.3% - 7.7%)
Los Angeles	467 (205 - 687)	12.7% (5.6% - 18.7%)	218 (59 - 484)	5.9% (1.6% - 13.2%)	78 (13 - 317)	2.1% (0.3% - 8.6%)
New York	303 (89 - 531)	7.3% (2.1% - 12.8%)	89 (12 - 335)	2.2% (0.3% - 8.1%)	20 (1 - 212)	0.5% (0% - 5.1%)
Philadelphia	99 (31 - 169)	8.4% (2.6% - 14.2%)	32 (4 - 108)	2.7% (0.4% - 9.1%)	8 (0 - 68)	0.6% (0% - 5.8%)
Sacramento	31 (11 - 49)	7.5% (2.6% - 12%)	11 (1 - 32)	2.6% (0.3% - 7.7%)	2 (0 - 21)	0.6% (0% - 5%)
St. Louis	35 (9 - 64)	6.1% (1.5% - 11%)	9 (1 - 39)	1.5% (0.1% - 6.7%)	1 (0 - 25)	0.2% (0% - 4.3%)
Washington, DC	133 (45 - 222)	8.9% (3% - 14.9%)	46 (8 - 144)	3.1% (0.6% - 9.7%)	13 (1 - 92)	0.8% (0.1% - 6.2%)

*Numbers are median (0.5 fractile) numbers of children. Numbers in parentheses below the median are 95% confidence intervals based on statistical uncertainty surrounding the O_3 coefficient. Numbers are rounded to the nearest 1000. Percents are rounded to the nearest tenth.

Table 3-6. Number and Percent of All Children (Ages 5-18) Engaged in Moderate Exertion Estimated to Experience At Least One Lung Function Response Associated with Exposure to "As Is" O_3 Concentrations Over Background O_3 Concentrations, for Location-Specific O_3 Seasons: 2002 O_3 Concentrations*

Location	Response = Decrease in FEV_1 Greater Than or Equal to:					
	10%		15%		20%	
	Number (1000s)	Percent	Number (1000s)	Percent	Number (1000s)	Percent
Atlanta	118 (47 - 183)	12.5% (5% - 19.5%)	50 (12 - 125)	5.3% (1.3% - 13.3%)	17 (2 - 81)	1.8% (0.2% - 8.6%)
Boston	158 (70 - 237)	14.4% (6.4% - 21.7%)	75 (25 - 169)	6.9% (2.2% - 15.4%)	30 (7 - 110)	2.8% (0.6% - 10%)
Chicago	260 (107 - 399)	13.3% (5.5% - 20.5%)	114 (30 - 276)	5.9% (1.5% - 14.2%)	40 (5 - 178)	2% (0.3% - 9.1%)
Cleveland	101 (47 - 149)	17% (7.8% - 25.1%)	51 (16 - 108)	8.5% (2.7% - 18.2%)	20 (4 - 70)	3.4% (0.6% - 11.7%)
Detroit	157 (66 - 241)	14.1% (5.9% - 21.7%)	71 (19 - 168)	6.4% (1.7% - 15.1%)	25 (3 - 107)	2.2% (0.3% - 9.7%)
Houston	122 (49 - 189)	11.2% (4.5% - 17.3%)	51 (13 - 129)	4.7% (1.2% - 11.8%)	18 (3 - 84)	1.6% (0.3% - 7.7%)
Los Angeles	465 (208 - 678)	12.7% (5.7% - 18.5%)	222 (66 - 482)	6.1% (1.8% - 13.1%)	84 (16 - 318)	2.3% (0.4% - 8.7%)
New York	653 (294 - 974)	15.7% (7.1% - 23.5%)	317 (100 - 696)	7.6% (2.4% - 16.8%)	125 (24 - 451)	3% (0.6% - 10.9%)
Philadelphia	211 (100 - 306)	17.8% (8.5% - 25.8%)	109 (38 - 224)	9.2% (3.2% - 18.9%)	46 (10 - 147)	3.9% (0.8% - 12.4%)
Sacramento	50 (22 - 75)	12.2% (5.3% - 18.1%)	23 (6 - 52)	5.6% (1.5% - 12.7%)	8 (1 - 34)	2% (0.3% - 8.3%)
St. Louis	87 (38 - 130)	15% (6.6% - 22.4%)	41 (12 - 92)	7% (2% - 15.9%)	15 (2 - 60)	2.6% (0.4% - 10.3%)
Washington, DC	240 (109 - 355)	16.1% (7.4% - 23.9%)	118 (38 - 255)	7.9% (2.5% - 17.2%)	47 (9 - 166)	3.2% (0.6% - 11.2%)

*Numbers are median (0.5 fractile) numbers of children. Numbers in parentheses below the median are 95% confidence intervals based on statistical uncertainty surrounding the O_3 coefficient. Numbers are rounded to the nearest 1000. Percents are rounded to the nearest tenth.

Table 3-7. Estimated Number and Percent of Occurrences of Lung Function Response Associated with Exposure to "As Is" O_3 Concentrations Over Background O_3 Concentrations Among Active Children (Ages 5-18) Engaged in Moderate Exertion, for Location-Specific O_3 Seasons: 2004 O_3 Concentrations*

Location	Response = Decrease in FEV_1 Greater Than or Equal to:					
	10%		15%		20%	
	Number (1000s)	Percent	Number (1000s)	Percent	Number (1000s)	Percent
Atlanta	439 (53 - 1389)	1.1% (0.1% - 3.5%)	48 (3 - 732)	0.1% (0% - 1.8%)	7 (0 - 320)	0% (0% - 0.8%)
Boston	272 (27 - 934)	0.9% (0.1% - 3.1%)	24 (1 - 485)	0.1% (0% - 1.6%)	3 (0 - 198)	0% (0% - 0.7%)
Chicago	453 (35 - 1536)	0.8% (0.1% - 2.8%)	29 (1 - 811)	0.1% (0% - 1.5%)	2 (0 - 334)	0% (0% - 0.6%)
Cleveland	166 (16 - 548)	0.9% (0.1% - 3%)	14 (1 - 290)	0.1% (0% - 1.6%)	1 (0 - 122)	0% (0% - 0.7%)
Detroit	288 (26 - 978)	0.9% (0.1% - 3.1%)	23 (1 - 513)	0.1% (0% - 1.6%)	2 (0 - 211)	0% (0% - 0.7%)
Houston	449 (75 - 1037)	0.7% (0.1% - 1.7%)	72 (9 - 620)	0.1% (0% - 1%)	14 (2 - 332)	0% (0% - 0.5%)
Los Angeles	3093 (525 - 7966)	1.5% (0.2% - 3.7%)	503 (56 - 4496)	0.2% (0% - 2.1%)	95 (8 - 2247)	0% (0% - 1.1%)
New York	1288 (137 - 4116)	1.1% (0.1% - 3.5%)	124 (8 - 2191)	0.1% (0% - 1.9%)	16 (1 - 941)	0% (0% - 0.8%)
Philadelphia	481 (59 - 1419)	1.2% (0.1% - 3.6%)	53 (3 - 774)	0.1% (0% - 2%)	7 (0 - 352)	0% (0% - 0.9%)
Sacramento	165 (20 - 486)	0.9% (0.1% - 2.8%)	18 (1 - 263)	0.1% (0% - 1.5%)	2 (0 - 122)	0% (0% - 0.7%)
St. Louis	184 (17 - 591)	0.9% (0.1% - 2.8%)	15 (0 - 313)	0.1% (0% - 1.5%)	1 (0 - 135)	0% (0% - 0.6%)
Washington, DC	562 (71 - 1758)	1.1% (0.1% - 3.5%)	66 (6 - 933)	0.1% (0% - 1.8%)	10 (1 - 409)	0% (0% - 0.8%)

*Numbers are median (0.5 fractile) numbers of occurrences. Numbers in parentheses below the median are 95% confidence intervals based on statistical uncertainty surrounding the O_3 coefficient. Numbers are rounded to the nearest 1000. Percents are rounded to the nearest tenth.

Table 3-8. Estimated Number and Percent of Occurrences of Lung Function Response Associated with Exposure to "As Is" O_3 Concentrations Over Background O_3 Concentrations Among Active Children (Ages 5-18) Engaged in Moderate Exertion, for Location-Specific O_3 Seasons: 2002 O_3 Concentrations*

Location	Response = Decrease in FEV_1 Greater Than or Equal to:					
	10%		15%		20%	
	Number (1000s)	Percent	Number (1000s)	Percent	Number (1000s)	Percent
Atlanta	527 (91 - 1457)	1.3% (0.2% - 3.7%)	88 (11 - 800)	0.2% (0% - 2%)	18 (2 - 380)	0% (0% - 1%)
Boston	488 (94 - 1357)	1.6% (0.3% - 4.6%)	93 (18 - 747)	0.3% (0.1% - 2.5%)	25 (4 - 350)	0.1% (0% - 1.2%)
Chicago	889 (171 - 2315)	1.7% (0.3% - 4.4%)	168 (25 - 1304)	0.3% (0% - 2.5%)	39 (4 - 638)	0.1% (0% - 1.2%)
Cleveland	353 (79 - 890)	2% (0.5% - 5.1%)	80 (15 - 506)	0.5% (0.1% - 2.9%)	22 (3 - 252)	0.1% (0% - 1.5%)
Detroit	556 (111 - 1456)	1.8% (0.4% - 4.8%)	110 (17 - 815)	0.4% (0.1% - 2.7%)	26 (2 - 397)	0.1% (0% - 1.3%)
Houston	389 (68 - 870)	0.7% (0.1% - 1.5%)	66 (9 - 529)	0.1% (0% - 0.9%)	14 (2 - 287)	0% (0% - 0.5%)
Los Angeles	2811 (482 - 7212)	1.3% (0.2% - 3.3%)	465 (62 - 4100)	0.2% (0% - 1.9%)	97 (10 - 2046)	0% (0% - 0.9%)
New York	2487 (521 - 6315)	2.1% (0.4% - 5.4%)	519 (90 - 3580)	0.4% (0.1% - 3.1%)	131 (16 - 1779)	0.1% (0% - 1.5%)
Philadelphia	900 (206 - 2159)	2.3% (0.5% - 5.4%)	207 (40 - 1252)	0.5% (0.1% - 3.2%)	56 (8 - 643)	0.1% (0% - 1.6%)
Sacramento	229 (38 - 623)	1.3% (0.2% - 3.6%)	37 (4 - 342)	0.2% (0% - 2%)	7 (1 - 166)	0% (0% - 1%)
St. Louis	335 (69 - 845)	1.7% (0.4% - 4.3%)	69 (11 - 479)	0.4% (0.1% - 2.4%)	17 (2 - 240)	0.1% (0% - 1.2%)
Washington, DC	983 (205 - 2541)	1.9% (0.4% - 5%)	204 (36 - 1425)	0.4% (0.1% - 2.8%)	52 (7 - 704)	0.1% (0% - 1.4%)

*Numbers are median (0.5 fractile) numbers of occurrences. Numbers in parentheses below the median are 95% confidence intervals based on statistical uncertainty surrounding the O_3 coefficient. Numbers are rounded to the nearest 1000. Percents are rounded to the nearest tenth.

Table 3-9. Number and Percent of Active Children (Ages 5-18) Engaged in Moderate Exertion Estimated to Experience At Least One Lung Function Response Associated with Exposure to "As Is" O_3 Concentrations Over Background O_3 Concentrations, for Location-Specific O_3 Seasons: 2004 O_3 Concentrations*

Location	Response = Decrease in FEV_1 Greater Than or Equal to:					
	10%		15%		20%	
	Number (1000s)	Percent	Number (1000s)	Percent	Number (1000s)	Percent
Atlanta	44 (15 - 73)	9.8% (3.3% - 16.2%)	15 (3 - 47)	3.4% (0.6% - 10.5%)	4 (0 - 30)	0.9% (0.1% - 6.7%)
Boston	34 (9 - 59)	7% (2% - 12.4%)	9 (1 - 37)	2% (0.2% - 7.7%)	2 (0 - 23)	0.4% (0% - 4.9%)
Chicago	48 (11 - 89)	5.5% (1.2% - 10.2%)	10 (1 - 54)	1.2% (0.1% - 6.2%)	1 (0 - 35)	0.2% (0% - 3.9%)
Cleveland	17 (5 - 31)	6.9% (1.9% - 12.2%)	5 (0 - 19)	1.9% (0.2% - 7.6%)	1 (0 - 12)	0.4% (0% - 4.8%)
Detroit	33 (9 - 59)	6.7% (1.8% - 11.9%)	9 (1 - 37)	1.7% (0.1% - 7.4%)	2 (0 - 23)	0.3% (0% - 4.7%)
Houston	59 (24 - 91)	12.2% (4.9% - 18.7%)	25 (6 - 62)	5.2% (1.3% - 12.8%)	9 (1 - 41)	1.8% (0.3% - 8.3%)
Los Angeles	223 (99 - 323)	13.8% (6.1% - 20%)	105 (28 - 229)	6.5% (1.7% - 14.1%)	37 (6 - 150)	2.3% (0.3% - 9.2%)
New York	148 (45 - 255)	8.1% (2.4% - 13.9%)	45 (6 - 162)	2.5% (0.3% - 8.8%)	11 (1 - 103)	0.6% (0% - 5.6%)
Philadelphia	49 (16 - 82)	9.2% (3% - 15.4%)	16 (2 - 53)	3% (0.4% - 9.9%)	4 (0 - 34)	0.7% (0% - 6.3%)
Sacramento	12 (4 - 19)	7.9% (2.8% - 12.5%)	4 (1 - 12)	2.9% (0.4% - 8.1%)	1 (0 - 8)	0.7% (0% - 5.3%)
St. Louis	18 (5 - 33)	6.6% (1.7% - 11.8%)	5 (0 - 20)	1.7% (0.1% - 7.2%)	1 (0 - 13)	0.3% (0% - 4.6%)
Washington, DC	68 (24 - 111)	9.9% (3.5% - 16.2%)	24 (5 - 73)	3.6% (0.7% - 10.6%)	7 (1 - 47)	1% (0.1% - 6.8%)

*Numbers are median (0.5 fractile) numbers of children. Numbers in parentheses below the median are 95% confidence intervals based on statistical uncertainty surrounding the O_3 coefficient. Numbers are rounded to the nearest 1000. Percents are rounded to the nearest tenth.

Table 3-10. Number and Percent of Active Children (Ages 5-18) Engaged in Moderate Exertion Estimated to Experience At Least One Lung Function Response Associated with Exposure to "As Is" O_3 Concentrations Over Background O_3 Concentrations, for Location-Specific O_3 Seasons: 2002 O_3 Concentrations*

Location	Response = Decrease in FEV_1 Greater Than or Equal to:					
	10%		15%		20%	
	Number (1000s)	Percent	Number (1000s)	Percent	Number (1000s)	Percent
Atlanta	62 (25 - 94)	13.8% (5.7% - 21.1%)	27 (7 - 65)	6% (1.5% - 14.6%)	9 (1 - 42)	2.1% (0.3% - 9.4%)
Boston	72 (33 - 108)	15.2% (6.9% - 22.7%)	35 (12 - 77)	7.4% (2.4% - 16.2%)	14 (3 - 50)	3% (0.7% - 10.6%)
Chicago	125 (54 - 190)	14.8% (6.3% - 22.3%)	58 (16 - 133)	6.8% (1.9% - 15.7%)	21 (3 - 86)	2.5% (0.4% - 10.1%)
Cleveland	45 (21 - 65)	18.3% (8.7% - 26.6%)	23 (8 - 48)	9.5% (3.2% - 19.5%)	10 (2 - 31)	3.9% (0.8% - 12.7%)
Detroit	74 (32 - 111)	15.4% (6.7% - 23.2%)	34 (10 - 79)	7.2% (2% - 16.4%)	13 (2 - 50)	2.6% (0.3% - 10.5%)
Houston	58 (24 - 89)	12.3% (5% - 18.7%)	25 (7 - 61)	5.3% (1.4% - 12.9%)	9 (1 - 40)	1.8% (0.3% - 8.4%)
Los Angeles	225 (103 - 324)	13.8% (6.3% - 19.9%)	110 (32 - 232)	6.7% (1.9% - 14.2%)	41 (7 - 153)	2.5% (0.5% - 9.4%)
New York	312 (144 - 459)	17.3% (8% - 25.4%)	155 (50 - 331)	8.6% (2.8% - 18.3%)	62 (12 - 216)	3.4% (0.7% - 11.9%)
Philadelphia	104 (51 - 149)	19.5% (9.5% - 27.9%)	55 (20 - 110)	10.4% (3.7% - 20.7%)	23 (5 - 72)	4.4% (1% - 13.6%)
Sacramento	20 (9 - 29)	13.2% (5.9% - 19.2%)	9 (2 - 21)	6.3% (1.7% - 13.6%)	3 (0 - 13)	2.2% (0.3% - 8.9%)
St. Louis	44 (20 - 64)	16.2% (7.3% - 24%)	21 (6 - 46)	7.8% (2.4% - 17.2%)	8 (1 - 30)	3% (0.5% - 11.1%)
Washington, DC	121 (57 - 177)	17.8% (8.3% - 26%)	61 (20 - 129)	9% (3% - 18.9%)	25 (5 - 84)	3.7% (0.8% - 12.3%)

*Numbers are median (0.5 fractile) numbers of children. Numbers in parentheses below the median are 95% confidence intervals based on statistical uncertainty surrounding the O_3 coefficient. Numbers are rounded to the nearest 1000. Percents are rounded to the nearest tenth.

The estimated occurrence of lung function decrement among all school age children exercising moderately while exposed to "as is" O_3 concentrations (Tables 3-3 and 3-4) varied across the locations in each year for each of the three lung function response measures (decrements in $FEV_1 \geq 10\%$, $\geq 15\%$, and $\geq 20\%$). For all three lung function response measures, there was a greater occurrence of lung function decrement in 2002 than in 2004 in all locations except Los Angeles and Houston. In 2004, Los Angeles had the greatest percentage of child-days with occurrences of lung function response defined as decrements in $FEV_1 \geq 10\%$ and $FEV_1 \geq 15\%$. For decrements in $FEV_1 \geq 20\%$, there were no discernable differences across locations after rounding. Not surprisingly, absolute numbers of occurrences of lung function decrement were also largest in Los Angeles. They were smallest in Sacramento (at about 252,000) for decrements in $FEV_1 \geq 10\%$ and smallest in St. Louis, at about 24,000 and 2,000, for decrements in $FEV_1 \geq 15\%$ and $\geq 20\%$, respectively. In 2002, New York had the greatest absolute numbers of occurrences of lung function for all three lung function response measures and Sacramento had the smallest. However, Philadelphia had the greatest percentages of child-days with occurrences of lung function response defined as decrements in $FEV_1 \geq 10\%$ and $\geq 15\%$, at 2% and 0.5%, respectively. The percentages of child-days with occurrences of decrements in $FEV_1 \geq 20\%$ rounded to 0.1% in most locations.

The patterns were similar for occurrences of lung function decrement among active school age children (Table 3-7 and 3-8). Once again, for all three lung function response measures, there was a greater occurrence of lung function decrement in 2002 than in 2004 in all locations except Los Angeles and Houston. In 2004, the percentage of child-days (for active children) on which decrements of $FEV_1 \geq 10\%$ were estimated to occur ranged from 0.7% in Houston to 1.5% in Los Angeles. The corresponding percentages for decrements of $FEV_1 \geq 15\%$ rounded to 0.1% in all locations except Los Angeles, where it was 0.2%. For decrements of $FEV_1 \geq 20\%$, the percentages rounded to 0.0% in all locations. The absolute numbers of occurrences were greatest in Los Angeles for all three lung function response measures. In 2002, the percentage of child-days (for active children) on which decrements of $FEV_1 \geq 10\%$ were estimated to occur ranged from 0.6% in Houston to 2.3% in Philadelphia; the corresponding percentages for decrements of $FEV_1 \geq 15\%$ ranged from 0.1% in Houston to 0.5% in Cleveland and Philadelphia; and for decrements of $FEV_1 \geq 20\%$, the percentages rounded to 0.1% in most locations.

When we considered the number of children experiencing at least one lung function response during the O_3 season (Tables 3-5 and 3-9 for 2004, and Tables 3-6 and 3-10 for 2002), the patterns were similar to those observed when occurrence of lung function responses was estimated. In 2004, among all school age children and among active school age children, the percentages experiencing at least one lung function response were largest in Los Angeles and smallest in Chicago – for each of the three lung function response measures. For example, 13.3% of all school age children and 14.3% of active school age children in Los Angeles experienced at least one decrement in $FEV_1 \geq 10\%$ during the O_3 season. The corresponding percentages for Chicago were 5.1% and 5.5% for all school age and active school age children, respectively. In 2002, among all school age children and among active school age children, the percentages experiencing at least one lung function response were largest in Philadelphia and smallest in Houston – for each of the three lung function response measures. For example,

18.1% of all school age children and 19.6% of active school age children in Philadelphia experienced at least one decrement in $FEV_1 \geq 10\%$ during the ozone season. The corresponding percentages for Houston for all school age and active school age children were 11.4% and 12.3%, respectively.

3.2.2 Assessment of lung function decrement associated with exposure to O_3 concentrations that just meet the current and alternative daily maximum 8-hour standards

The 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 school age children (ages 5 – 18) engaged in moderate exercise for at least one 8-hour period during the O_3 season, is given in Table 3-11, for estimates based on 2004 O_3 concentrations, and Table 3-12, for estimates based on 2002 O_3 concentrations. The corresponding estimated percents of occurrences are given in Tables 3-13 and 3-14, for estimates based on 2004 and 2002 O_3 concentrations, respectively. The numbers of these children estimated to experience at least one lung function response associated with exposure to O_3 concentrations that just meet the current and alternative standards are given in Tables 3-15 and 3-16, for estimates based on 2004 and 2002 O_3 concentrations, respectively. The corresponding estimated percents of children are given in Tables 3-17 and 3-18. Tables 3-19 through 3-26 give the corresponding results for active school age children. Results for all three measures of lung function response being considered in this analysis – decrements in FEV_1 of $\geq$10%, $\geq$15%, and $\geq$20% -- are shown in each table.

The percent changes in numbers of occurrences and in numbers of school age children experiencing at least one occurrence of lung function response when O_3 concentrations are reduced from those just meeting the current standard to those that would just meet each alternative standard are summarized for active school age children in Figures 3-7 through 3-10 below. Figure 3-7 shows the percent changes in the aggregate numbers (across all locations) of occurrences of lung function response, for each of the three definitions of response, based on 2004 data (Figure 3-7a) and 2002 data (Figure 3-7b). Figure 3-8 shows the percent changes of occurrences of decrement in $FEV_1 \geq$15%, separately for each location, based on 2004 data (Figure 3-8a) and 2002 data (Figure 3-8b). Figure 3-9 shows the percent changes in the aggregate numbers (across all locations) of active children experiencing at least one occurrence of lung function response, for each of the three definitions of response, based on 2004 data (Figure 3-9a) and 2002 data (Figure 3-9b). Finally, Figure 3-10 shows the percent changes of numbers of active children experiencing at least one occurrence of decrement in $FEV_1 \geq$15%, separately for each location, based on 2004 data (Figure 3-10a) and 2002 data (Figure 3-10b). The corresponding figures for all school age children (ages 5-18) are given in Appendix F.

Table 3-11. 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 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**							
	0.084/4***	0.084/3	0.080/4****	0.074/5	0.074/4	0.074/3	0.070/4****	0.064/4
	Response = Decrease in FEV1 Greater Than or Equal to 10%							
Atlanta	613 (53 - 2259)	602 (51 - 2233)	548 (42 - 2095)	486 (32 - 1932)	457 (28 - 1852)	452 (27 - 1838)	403 (21 - 1696)	329 (14 - 1471)
Boston	436 (30 - 1735)	394 (24 - 1622)	389 (23 - 1610)	373 (21 - 1564)	326 (15 - 1427)	301 (12 - 1350)	287 (11 - 1308)	232 (7 - 1131)
Chicago	644 (31 - 2553)	600 (27 - 2421)	566 (23 - 2321)	508 (18 - 2139)	460 (15 - 1982)	430 (13 - 1884)	392 (10 - 1753)	303 (6 - 1427)
Cleveland	247 (15 - 963)	228 (12 - 910)	220 (11 - 888)	189 (8 - 797)	182 (7 - 774)	170 (6 - 736)	159 (5 - 700)	127 (3 - 591)
Detroit	441 (27 - 1728)	404 (22 - 1627)	393 (21 - 1596)	379 (19 - 1558)	326 (14 - 1401)	300 (11 - 1323)	284 (10 - 1271)	227 (6 - 1079)
Houston	531 (58 - 1303)	484 (49 - 1179)	466 (46 - 1133)	389 (33 - 914)	376 (31 - 874)	342 (27 - 773)	313 (23 - 671)	201 (13 - 226)
Los Angeles	2212 (140 - 7712)	2118 (129 - 7446)	1935 (108 - 6904)	1460 (68 - 5296)	1402 (63 - 5088)	1293 (56 - 4681)	1044 (41 - 3714)	567 (17 - 1632)
New York	1591 (90 - 6312)	1510 (79 - 6091)	1423 (69 - 5849)	1162 (42 - 5082)	1192 (45 - 5172)	1142 (40 - 5019)	1050 (33 - 4727)	822 (19 - 3914)
Philadelphia	650 (49 - 2271)	604 (42 - 2155)	582 (39 - 2100)	500 (27 - 1888)	486 (26 - 1850)	456 (22 - 1768)	428 (19 - 1687)	348 (12 - 1449)
Sacramento	228 (15 - 826)	215 (14 - 789)	200 (12 - 746)	169 (8 - 655)	160 (8 - 628)	153 (7 - 605)	136 (6 - 551)	101 (3 - 427)
St. Louis	279 (21 - 1011)	257 (17 - 954)	245 (16 - 920)	209 (11 - 818)	199 (10 - 791)	185 (9 - 748)	171 (7 - 705)	133 (4 - 581)
Washington, DC	754 (61 - 2840)	680 (49 - 2651)	674 (48 - 2635)	598 (36 - 2432)	563 (32 - 2333)	513 (26 - 2191)	496 (24 - 2138)	400 (14 - 1840)
	Response = Decrease in FEV1 Greater Than or Equal to 15%							
Atlanta	46 (2 - 1139)	44 (2 - 1124)	35 (1 - 1047)	26 (0 - 958)	22 (0 - 914)	22 (0 - 906)	16 (0 - 830)	10 (0 - 711)
Boston	25 (1 - 863)	19 (0 - 801)	19 (0 - 794)	17 (0 - 770)	11 (0 - 696)	9 (0 - 655)	8 (0 - 632)	4 (0 - 539)
Chicago	23 (0 - 1295)	20 (0 - 1224)	17 (0 - 1170)	13 (0 - 1073)	10 (0 - 990)	8 (0 - 938)	6 (0 - 870)	3 (0 - 703)
Cleveland	12 (0 - 487)	10 (0 - 458)	9 (0 - 446)	6 (0 - 397)	5 (0 - 385)	4 (0 - 365)	4 (0 - 346)	2 (0 - 290)
Detroit	22 (0 - 870)	18 (0 - 814)	17 (0 - 798)	15 (0 - 777)	10 (0 - 692)	8 (0 - 651)	7 (0 - 623)	4 (0 - 523)
Houston	51 (3 - 784)	42 (2 - 716)	39 (1 - 691)	28 (1 - 574)	26 (1 - 553)	21 (0 - 501)	18 (0 - 450)	10 (0 - 236)
Los Angeles	111 (1 - 4064)	101 (1 - 3919)	83 (1 - 3630)	49 (0 - 2802)	46 (0 - 2696)	40 (0 - 2492)	28 (0 - 2013)	11 (0 - 1013)

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	71 (1 - 3178)	62 (1 - 3056)	53 (1 - 2924)	29 (0 - 2510)	32 (0 - 2558)	28 (0 - 2476)	22 (0 - 2321)	11 (0 - 1902)
Philadelphia	41 (1 - 1187)	35 (1 - 1122)	31 (1 - 1091)	21 (0 - 973)	20 (0 - 952)	17 (0 - 907)	14 (0 - 863)	8 (0 - 735)
Sacramento	12 (0 - 425)	11 (0 - 405)	9 (0 - 382)	6 (0 - 333)	6 (0 - 319)	5 (0 - 307)	4 (0 - 279)	2 (0 - 215)
St. Louis	17 (0 - 517)	14 (0 - 486)	12 (0 - 468)	8 (0 - 413)	8 (0 - 398)	6 (0 - 375)	5 (0 - 352)	3 (0 - 287)
Washington, DC	53 (2 - 1426)	41 (1 - 1321)	40 (1 - 1313)	29 (0 - 1201)	25 (0 - 1148)	20 (0 - 1071)	18 (0 - 1043)	10 (0 - 886)
	Response = Decrease in FEV1 Greater Than or Equal to 20%							
Atlanta	4 (0 - 445)	4 (0 - 438)	3 (0 - 398)	2 (0 - 353)	1 (0 - 332)	1 (0 - 328)	1 (0 - 292)	0 (0 - 237)
Boston	2 (0 - 315)	1 (0 - 284)	1 (0 - 281)	1 (0 - 269)	0 (0 - 234)	0 (0 - 215)	0 (0 - 205)	0 (0 - 165)
Chicago	1 (0 - 470)	0 (0 - 438)	0 (0 - 412)	0 (0 - 369)	0 (0 - 332)	0 (0 - 310)	0 (0 - 282)	0 (0 - 215)
Cleveland	1 (0 - 180)	0 (0 - 165)	0 (0 - 160)	0 (0 - 137)	0 (0 - 131)	0 (0 - 122)	0 (0 - 114)	0 (0 - 91)
Detroit	1 (0 - 320)	1 (0 - 293)	1 (0 - 285)	1 (0 - 275)	0 (0 - 235)	0 (0 - 216)	0 (0 - 204)	0 (0 - 161)
Houston	6 (0 - 400)	4 (0 - 366)	3 (0 - 354)	2 (0 - 298)	2 (0 - 288)	1 (0 - 264)	1 (0 - 243)	0 (0 - 162)
Los Angeles	5 (0 - 1639)	4 (0 - 1570)	3 (0 - 1434)	1 (0 - 1082)	1 (0 - 1038)	1 (0 - 958)	0 (0 - 775)	0 (0 - 428)
New York	4 (0 - 1157)	3 (0 - 1097)	2 (0 - 1032)	1 (0 - 838)	1 (0 - 860)	0 (0 - 822)	0 (0 - 754)	0 (0 - 583)
Philadelphia	3 (0 - 477)	2 (0 - 443)	2 (0 - 427)	1 (0 - 367)	1 (0 - 356)	0 (0 - 334)	0 (0 - 313)	0 (0 - 253)
Sacramento	1 (0 - 168)	0 (0 - 159)	0 (0 - 147)	0 (0 - 124)	0 (0 - 118)	0 (0 - 112)	0 (0 - 100)	0 (0 - 73)
St. Louis	1 (0 - 205)	1 (0 - 189)	1 (0 - 180)	0 (0 - 153)	0 (0 - 146)	0 (0 - 135)	0 (0 - 125)	0 (0 - 97)
Washington, DC	5 (0 - 547)	3 (0 - 494)	3 (0 - 489)	2 (0 - 434)	1 (0 - 408)	1 (0 - 371)	1 (0 - 358)	0 (0 - 287)

*Numbers are median (0.5 fractile) numbers of occurrences. Numbers in parentheses below the median are 95% confidence 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.

***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.

Table 3-12. 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 FEV1 Greater Than or Equal to 10%							
Atlanta	748 (95 - 2377)	739 (93 - 2358)	671 (76 - 2208)	605 (61 - 2057)	567 (54 - 1968)	565 (53 - 1962)	501 (41 - 1807)	414 (27 - 1578)
Boston	808 (118 - 2583)	734 (96 - 2435)	727 (94 - 2420)	697 (86 - 2357)	617 (65 - 2184)	572 (55 - 2084)	550 (50 - 2034)	458 (32 - 1811)
Chicago	1369 (188 - 4115)	1286 (165 - 3947)	1224 (148 - 3817)	1121 (123 - 3596)	1029 (102 - 3391)	978 (91 - 3280)	909 (77 - 3117)	745 (49 - 2718)
Cleveland	569 (89 - 1691)	522 (74 - 1602)	511 (71 - 1580)	447 (53 - 1451)	432 (49 - 1418)	399 (41 - 1349)	383 (37 - 1314)	318 (24 - 1165)
Detroit	903 (136 - 2704)	825 (113 - 2550)	807 (108 - 2516)	787 (102 - 2474)	677 (73 - 2245)	622 (61 - 2125)	598 (56 - 2071)	491 (35 - 1820)
Houston	462 (53 - 1066)	420 (45 - 955)	404 (42 - 910)	336 (31 - 712)	323 (28 - 671)	297 (25 - 591)	266 (21 - 480)	164 (12 - 58)
Los Angeles	1970 (135 - 6581)	1904 (127 - 6389)	1690 (104 - 5701)	1204 (62 - 3970)	1189 (61 - 3907)	1126 (56 - 3668)	865 (39 - 2600)	439 (18 - 657)
New York	3213 (409 - 10048)	3049 (365 - 9716)	2903 (328 - 9421)	2417 (217 - 8373)	2480 (230 - 8517)	2367 (206 - 8263)	2219 (177 - 7929)	1803 (111 - 6872)
Philadelphia	1265 (203 - 3544)	1173 (174 - 3375)	1142 (164 - 3316)	1006 (125 - 3053)	974 (116 - 2988)	912 (101 - 2862)	872 (91 - 2779)	731 (61 - 2473)
Sacramento	344 (35 - 1147)	325 (31 - 1100)	307 (28 - 1058)	266 (21 - 953)	256 (19 - 928)	243 (17 - 894)	225 (15 - 844)	180 (9 - 713)
St. Louis	549 (93 - 1539)	512 (81 - 1468)	490 (75 - 1425)	432 (58 - 1307)	410 (52 - 1261)	385 (46 - 1209)	360 (40 - 1155)	294 (26 - 1003)
Washington, DC	1354 (200 - 4153)	1227 (163 - 3900)	1220 (161 - 3885)	1099 (129 - 3632)	1036 (114 - 3499)	951 (94 - 3310)	925 (88 - 3253)	771 (59 - 2888)
	Response = Decrease in FEV1 Greater Than or Equal to 15%							
Atlanta	88 (7 - 1248)	86 (6 - 1236)	69 (4 - 1149)	55 (2 - 1063)	47 (2 - 1012)	47 (2 - 1009)	35 (1 - 922)	22 (0 - 796)
Boston	113 (15 - 1355)	90 (10 - 1264)	89 (10 - 1255)	80 (8 - 1217)	59 (4 - 1115)	49 (3 - 1056)	44 (2 - 1027)	27 (1 - 901)
Chicago	176 (15 - 2214)	153 (11 - 2112)	136 (8 - 2035)	110 (5 - 1904)	90 (4 - 1786)	79 (3 - 1721)	67 (2 - 1628)	40 (0 - 1403)
Cleveland	85 (9 - 907)	70 (6 - 852)	66 (5 - 838)	49 (3 - 761)	45 (2 - 741)	36 (1 - 700)	33 (1 - 680)	21 (0 - 594)
Detroit	129 (12 - 1446)	105 (8 - 1352)	100 (7 - 1331)	95 (6 - 1306)	66 (3 - 1170)	54 (2 - 1101)	49 (1 - 1069)	29 (0 - 927)
Houston	47 (3 - 662)	39 (2 - 601)	36 (2 - 577)	26 (1 - 473)	24 (1 - 451)	20 (0 - 410)	17 (0 - 355)	9 (0 - 156)
Los Angeles	110 (2 - 3538)	103 (2 - 3434)	83 (1 - 3076)	47 (0 - 2200)	46 (0 - 2169)	42 (0 - 2050)	29 (0 - 1531)	12 (0 - 613)

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	379 (28 - 5327)	335 (22 - 5127)	297 (16 - 4949)	189 (6 - 4335)	201 (7 - 4417)	178 (5 - 4271)	150 (3 - 4078)	90 (1 - 3490)
Philadelphia	195 (22 - 1947)	165 (16 - 1841)	155 (14 - 1804)	115 (7 - 1642)	106 (6 - 1603)	91 (4 - 1528)	81 (3 - 1479)	52 (1 - 1300)
Sacramento	31 (1 - 595)	27 (1 - 569)	24 (1 - 545)	18 (0 - 487)	16 (0 - 474)	14 (0 - 455)	12 (0 - 428)	7 (0 - 358)
St. Louis	90 (11 - 841)	78 (8 - 796)	71 (7 - 770)	54 (4 - 699)	48 (3 - 671)	41 (2 - 640)	36 (2 - 609)	22 (0 - 522)
Washington, DC	190 (19 - 2196)	152 (12 - 2042)	150 (12 - 2033)	118 (7 - 1882)	103 (5 - 1804)	83 (3 - 1694)	78 (3 - 1661)	49 (1 - 1454)
	Response = Decrease in FEV1 Greater Than or Equal to 20%							
Atlanta	13 (1 - 542)	12 (1 - 535)	9 (0 - 487)	6 (0 - 440)	4 (0 - 413)	4 (0 - 412)	2 (0 - 366)	1 (0 - 303)
Boston	23 (2 - 580)	17 (1 - 528)	16 (1 - 523)	14 (1 - 502)	8 (0 - 445)	6 (0 - 413)	5 (0 - 398)	2 (0 - 331)
Chicago	28 (1 - 991)	22 (1 - 933)	18 (0 - 889)	13 (0 - 816)	9 (0 - 751)	7 (0 - 715)	5 (0 - 665)	2 (0 - 546)
Cleveland	16 (1 - 409)	11 (0 - 376)	11 (0 - 368)	6 (0 - 324)	6 (0 - 313)	4 (0 - 290)	3 (0 - 278)	1 (0 - 231)
Detroit	22 (1 - 649)	16 (0 - 594)	15 (0 - 582)	13 (0 - 568)	7 (0 - 491)	5 (0 - 452)	4 (0 - 435)	2 (0 - 358)
Houston	6 (0 - 348)	4 (0 - 319)	4 (0 - 307)	2 (0 - 258)	2 (0 - 249)	1 (0 - 230)	1 (0 - 208)	0 (0 - 135)
Los Angeles	7 (0 - 1460)	6 (0 - 1412)	4 (0 - 1254)	2 (0 - 897)	2 (0 - 886)	1 (0 - 840)	1 (0 - 651)	0 (0 - 344)
New York	55 (2 - 2327)	45 (1 - 2212)	36 (1 - 2110)	16 (0 - 1764)	18 (0 - 1809)	15 (0 - 1728)	11 (0 - 1621)	4 (0 - 1318)
Philadelphia	37 (2 - 912)	28 (1 - 849)	26 (1 - 827)	15 (0 - 732)	13 (0 - 710)	10 (0 - 666)	8 (0 - 638)	4 (0 - 537)
Sacramento	3 (0 - 252)	3 (0 - 238)	2 (0 - 225)	1 (0 - 195)	1 (0 - 188)	1 (0 - 179)	1 (0 - 165)	0 (0 - 132)
St. Louis	18 (1 - 395)	15 (1 - 369)	12 (1 - 354)	8 (0 - 313)	7 (0 - 298)	5 (0 - 280)	4 (0 - 263)	2 (0 - 216)
Washington, DC	34 (2 - 975)	23 (1 - 887)	23 (1 - 881)	15 (0 - 796)	12 (0 - 752)	8 (0 - 692)	7 (0 - 673)	3 (0 - 562)

*Numbers are median (0.5 fractile) numbers of occurrences. Numbers in parentheses below the median are 95% confidence 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.

***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.

Table 3-13. Estimated Percent 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 2004 O_3 Concentrations*

Location	Percent of Occurrences 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 FEV1 Greater Than or Equal to 10%							
Atlanta	0.7% (0.1% - 2.7%)	0.7% (0.1% - 2.7%)	0.7% (0% - 2.5%)	0.6% (0% - 2.3%)	0.5% (0% - 2.2%)	0.5% (0% - 2.2%)	0.5% (0% - 2%)	0.4% (0% - 1.7%)
Boston	0.6% (0% - 2.4%)	0.6% (0% - 2.3%)	0.5% (0% - 2.3%)	0.5% (0% - 2.2%)	0.5% (0% - 2%)	0.4% (0% - 1.9%)	0.4% (0% - 1.8%)	0.3% (0% - 1.6%)
Chicago	0.5% (0% - 2%)	0.5% (0% - 1.9%)	0.4% (0% - 1.8%)	0.4% (0% - 1.7%)	0.4% (0% - 1.6%)	0.3% (0% - 1.5%)	0.3% (0% - 1.4%)	0.2% (0% - 1.1%)
Cleveland	0.6% (0% - 2.2%)	0.5% (0% - 2%)	0.5% (0% - 2%)	0.4% (0% - 1.8%)	0.4% (0% - 1.7%)	0.4% (0% - 1.7%)	0.4% (0% - 1.6%)	0.3% (0% - 1.3%)
Detroit	0.6% (0% - 2.4%)	0.6% (0% - 2.2%)	0.5% (0% - 2.2%)	0.5% (0% - 2.1%)	0.4% (0% - 1.9%)	0.4% (0% - 1.8%)	0.4% (0% - 1.8%)	0.3% (0% - 1.5%)
Houston	0.4% (0% - 0.9%)	0.3% (0% - 0.8%)	0.3% (0% - 0.8%)	0.3% (0% - 0.7%)	0.3% (0% - 0.6%)	0.2% (0% - 0.6%)	0.2% (0% - 0.5%)	0.1% (0% - 0.2%)
Los Angeles	0.5% (0% - 1.6%)	0.4% (0% - 1.5%)	0.4% (0% - 1.4%)	0.3% (0% - 1.1%)	0.3% (0% - 1%)	0.3% (0% - 1%)	0.2% (0% - 0.8%)	0.1% (0% - 0.3%)
New York	0.6% (0% - 2.3%)	0.6% (0% - 2.2%)	0.5% (0% - 2.1%)	0.4% (0% - 1.9%)	0.4% (0% - 1.9%)	0.4% (0% - 1.8%)	0.4% (0% - 1.7%)	0.3% (0% - 1.4%)
Philadelphia	0.7% (0.1% - 2.6%)	0.7% (0% - 2.4%)	0.7% (0% - 2.4%)	0.6% (0% - 2.1%)	0.6% (0% - 2.1%)	0.5% (0% - 2%)	0.5% (0% - 1.9%)	0.4% (0% - 1.6%)
Sacramento	0.5% (0% - 1.7%)	0.4% (0% - 1.6%)	0.4% (0% - 1.5%)	0.3% (0% - 1.3%)	0.3% (0% - 1.3%)	0.3% (0% - 1.2%)	0.3% (0% - 1.1%)	0.2% (0% - 0.9%)
St. Louis	0.6% (0% - 2.3%)	0.6% (0% - 2.2%)	0.6% (0% - 2.1%)	0.5% (0% - 1.9%)	0.5% (0% - 1.8%)	0.4% (0% - 1.7%)	0.4% (0% - 1.6%)	0.3% (0% - 1.3%)
Washington, DC	0.7% (0.1% - 2.5%)	0.6% (0% - 2.4%)	0.6% (0% - 2.3%)	0.5% (0% - 2.2%)	0.5% (0% - 2.1%)	0.5% (0% - 1.9%)	0.4% (0% - 1.9%)	0.4% (0% - 1.6%)
	Response = Decrease in FEV1 Greater Than or Equal to 15%							
Atlanta	0.1% (0% - 1.4%)	0.1% (0% - 1.3%)	0% (0% - 1.2%)	0% (0% - 1.1%)	0% (0% - 1.1%)	0% (0% - 1.1%)	0% (0% - 1%)	0% (0% - 0.8%)
Boston	0% (0% - 1.2%)	0% (0% - 1.1%)	0% (0% - 1.1%)	0% (0% - 1.1%)	0% (0% - 1%)	0% (0% - 0.9%)	0% (0% - 0.9%)	0% (0% - 0.8%)
Chicago	0% (0% - 1%)	0% (0% - 1%)	0% (0% - 0.9%)	0% (0% - 0.8%)	0% (0% - 0.8%)	0% (0% - 0.7%)	0% (0% - 0.7%)	0% (0% - 0.6%)
Cleveland	0% (0% - 1.1%)	0% (0% - 1%)	0% (0% - 1%)	0% (0% - 0.9%)	0% (0% - 0.9%)	0% (0% - 0.8%)	0% (0% - 0.8%)	0% (0% - 0.7%)
Detroit	0% (0% - 1.2%)	0% (0% - 1.1%)	0% (0% - 1.1%)	0% (0% - 1.1%)	0% (0% - 1%)	0% (0% - 0.9%)	0% (0% - 0.9%)	0% (0% - 0.7%)
Houston	0% (0% - 0.6%)	0% (0% - 0.5%)	0% (0% - 0.5%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.3%)	0% (0% - 0.2%)
Los Angeles	0% (0% - 0.8%)	0% (0% - 0.8%)	0% (0% - 0.7%)	0% (0% - 0.6%)	0% (0% - 0.6%)	0% (0% - 0.5%)	0% (0% - 0.4%)	0% (0% - 0.2%)

Location	Percent of Occurrences 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	0% (0% - 1.2%)	0% (0% - 1.1%)	0% (0% - 1.1%)	0% (0% - 0.9%)	0% (0% - 0.9%)	0% (0% - 0.9%)	0% (0% - 0.8%)	0% (0% - 0.7%)
Philadelphia	0% (0% - 1.3%)	0% (0% - 1.3%)	0% (0% - 1.2%)	0% (0% - 1.1%)	0% (0% - 1.1%)	0% (0% - 1%)	0% (0% - 1%)	0% (0% - 0.8%)
Sacramento	0% (0% - 0.9%)	0% (0% - 0.8%)	0% (0% - 0.8%)	0% (0% - 0.7%)	0% (0% - 0.6%)	0% (0% - 0.6%)	0% (0% - 0.6%)	0% (0% - 0.4%)
St. Louis	0% (0% - 1.2%)	0% (0% - 1.1%)	0% (0% - 1.1%)	0% (0% - 0.9%)	0% (0% - 0.9%)	0% (0% - 0.9%)	0% (0% - 0.8%)	0% (0% - 0.7%)
Washington, DC	0% (0% - 1.3%)	0% (0% - 1.2%)	0% (0% - 1.2%)	0% (0% - 1.1%)	0% (0% - 1%)	0% (0% - 1%)	0% (0% - 0.9%)	0% (0% - 0.8%)
	Response = Decrease in FEV1 Greater Than or Equal to 20%							
Atlanta	0% (0% - 0.5%)	0% (0% - 0.5%)	0% (0% - 0.5%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.3%)	0% (0% - 0.3%)
Boston	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.2%)
Chicago	0% (0% - 0.4%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.2%)	0% (0% - 0.2%)	0% (0% - 0.2%)
Cleveland	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.2%)
Detroit	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.2%)
Houston	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.2%)	0% (0% - 0.2%)	0% (0% - 0.2%)	0% (0% - 0.2%)	0% (0% - 0.1%)
Los Angeles	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.2%)	0% (0% - 0.2%)	0% (0% - 0.2%)	0% (0% - 0.2%)	0% (0% - 0.1%)
New York	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.2%)
Philadelphia	0% (0% - 0.5%)	0% (0% - 0.5%)	0% (0% - 0.5%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.3%)
Sacramento	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.2%)	0% (0% - 0.2%)	0% (0% - 0.2%)	0% (0% - 0.2%)	0% (0% - 0.1%)
St. Louis	0% (0% - 0.5%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.2%)
Washington, DC	0% (0% - 0.5%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.3%)

*Numbers are median (0.5 fractile) percents of occurrences. Numbers in parentheses below the median are 95% confidence 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.

***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.

Table 3-14. Estimated Percent 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	Percent of Occurrences 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 FEV1 Greater Than or Equal to 10%							
Atlanta	0.9% (0.1% - 2.8%)	0.9% (0.1% - 2.8%)	0.8% (0.1% - 2.6%)	0.7% (0.1% - 2.4%)	0.7% (0.1% - 2.3%)	0.7% (0.1% - 2.3%)	0.6% (0% - 2.1%)	0.5% (0% - 1.9%)
Boston	1.1% (0.2% - 3.6%)	1% (0.1% - 3.4%)	1% (0.1% - 3.4%)	1% (0.1% - 3.3%)	0.9% (0.1% - 3.1%)	0.8% (0.1% - 2.9%)	0.8% (0.1% - 2.9%)	0.6% (0% - 2.5%)
Chicago	1.1% (0.1% - 3.3%)	1% (0.1% - 3.1%)	1% (0.1% - 3%)	0.9% (0.1% - 2.9%)	0.8% (0.1% - 2.7%)	0.8% (0.1% - 2.6%)	0.7% (0.1% - 2.5%)	0.6% (0% - 2.2%)
Cleveland	1.3% (0.2% - 3.8%)	1.2% (0.2% - 3.6%)	1.2% (0.2% - 3.6%)	1% (0.1% - 3.3%)	1% (0.1% - 3.2%)	0.9% (0.1% - 3.1%)	0.9% (0.1% - 3%)	0.7% (0.1% - 2.6%)
Detroit	1.3% (0.2% - 3.8%)	1.2% (0.2% - 3.6%)	1.1% (0.2% - 3.5%)	1.1% (0.1% - 3.5%)	0.9% (0.1% - 3.1%)	0.9% (0.1% - 3%)	0.8% (0.1% - 2.9%)	0.7% (0% - 2.5%)
Houston	0.3% (0% - 0.8%)	0.3% (0% - 0.7%)	0.3% (0% - 0.7%)	0.2% (0% - 0.5%)	0.2% (0% - 0.5%)	0.2% (0% - 0.4%)	0.2% (0% - 0.3%)	0.1% (0% - 0%)
Los Angeles	0.4% (0% - 1.3%)	0.4% (0% - 1.3%)	0.3% (0% - 1.2%)	0.2% (0% - 0.8%)	0.2% (0% - 0.8%)	0.2% (0% - 0.8%)	0.2% (0% - 0.5%)	0.1% (0% - 0.1%)
New York	1.2% (0.2% - 3.7%)	1.1% (0.1% - 3.6%)	1.1% (0.1% - 3.5%)	0.9% (0.1% - 3.1%)	0.9% (0.1% - 3.1%)	0.9% (0.1% - 3%)	0.8% (0.1% - 2.9%)	0.7% (0% - 2.5%)
Philadelphia	1.4% (0.2% - 4%)	1.3% (0.2% - 3.8%)	1.3% (0.2% - 3.7%)	1.1% (0.1% - 3.4%)	1.1% (0.1% - 3.4%)	1% (0.1% - 3.2%)	1% (0.1% - 3.1%)	0.8% (0.1% - 2.8%)
Sacramento	0.7% (0.1% - 2.3%)	0.7% (0.1% - 2.2%)	0.6% (0.1% - 2.1%)	0.5% (0% - 1.9%)	0.5% (0% - 1.9%)	0.5% (0% - 1.8%)	0.5% (0% - 1.7%)	0.4% (0% - 1.4%)
St. Louis	1.3% (0.2% - 3.5%)	1.2% (0.2% - 3.4%)	1.1% (0.2% - 3.3%)	1% (0.1% - 3%)	0.9% (0.1% - 2.9%)	0.9% (0.1% - 2.8%)	0.8% (0.1% - 2.6%)	0.7% (0.1% - 2.3%)
Washington, DC	1.2% (0.2% - 3.7%)	1.1% (0.1% - 3.5%)	1.1% (0.1% - 3.4%)	1% (0.1% - 3.2%)	0.9% (0.1% - 3.1%)	0.8% (0.1% - 2.9%)	0.8% (0.1% - 2.9%)	0.7% (0.1% - 2.6%)
	Response = Decrease in FEV1 Greater Than or Equal to 15%							
Atlanta	0.1% (0% - 1.5%)	0.1% (0% - 1.5%)	0.1% (0% - 1.4%)	0.1% (0% - 1.3%)	0.1% (0% - 1.2%)	0.1% (0% - 1.2%)	0% (0% - 1.1%)	0% (0% - 0.9%)
Boston	0.2% (0% - 1.9%)	0.1% (0% - 1.8%)	0.1% (0% - 1.8%)	0.1% (0% - 1.7%)	0.1% (0% - 1.6%)	0.1% (0% - 1.5%)	0.1% (0% - 1.4%)	0% (0% - 1.3%)
Chicago	0.1% (0% - 1.8%)	0.1% (0% - 1.7%)	0.1% (0% - 1.6%)	0.1% (0% - 1.5%)	0.1% (0% - 1.4%)	0.1% (0% - 1.4%)	0.1% (0% - 1.3%)	0% (0% - 1.1%)
Cleveland	0.2% (0% - 2.1%)	0.2% (0% - 1.9%)	0.2% (0% - 1.9%)	0.1% (0% - 1.7%)	0.1% (0% - 1.7%)	0.1% (0% - 1.6%)	0.1% (0% - 1.5%)	0% (0% - 1.3%)
Detroit	0.2% (0% - 2%)	0.1% (0% - 1.9%)	0.1% (0% - 1.9%)	0.1% (0% - 1.8%)	0.1% (0% - 1.6%)	0.1% (0% - 1.5%)	0.1% (0% - 1.5%)	0% (0% - 1.3%)
Houston	0% (0% - 0.5%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.1%)
Los Angeles	0% (0% - 0.7%)	0% (0% - 0.7%)	0% (0% - 0.6%)	0% (0% - 0.5%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.3%)	0% (0% - 0.1%)

Location	Percent of Occurrences 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	0.1% (0% - 2%)	0.1% (0% - 1.9%)	0.1% (0% - 1.8%)	0.1% (0% - 1.6%)	0.1% (0% - 1.6%)	0.1% (0% - 1.6%)	0.1% (0% - 1.5%)	0% (0% - 1.3%)
Philadelphia	0.2% (0% - 2.2%)	0.2% (0% - 2.1%)	0.2% (0% - 2%)	0.1% (0% - 1.9%)	0.1% (0% - 1.8%)	0.1% (0% - 1.7%)	0.1% (0% - 1.7%)	0.1% (0% - 1.5%)
Sacramento	0.1% (0% - 1.2%)	0.1% (0% - 1.1%)	0% (0% - 1.1%)	0% (0% - 1%)	0% (0% - 1%)	0% (0% - 0.9%)	0% (0% - 0.9%)	0% (0% - 0.7%)
St. Louis	0.2% (0% - 1.9%)	0.2% (0% - 1.8%)	0.2% (0% - 1.8%)	0.1% (0% - 1.6%)	0.1% (0% - 1.5%)	0.1% (0% - 1.5%)	0.1% (0% - 1.4%)	0.1% (0% - 1.2%)
Washington, DC	0.2% (0% - 1.9%)	0.1% (0% - 1.8%)	0.1% (0% - 1.8%)	0.1% (0% - 1.7%)	0.1% (0% - 1.6%)	0.1% (0% - 1.5%)	0.1% (0% - 1.5%)	0% (0% - 1.3%)
	Response = Decrease in FEV1 Greater Than or Equal to 20%							
Atlanta	0% (0% - 0.6%)	0% (0% - 0.6%)	0% (0% - 0.6%)	0% (0% - 0.5%)	0% (0% - 0.5%)	0% (0% - 0.5%)	0% (0% - 0.4%)	0% (0% - 0.4%)
Boston	0% (0% - 0.8%)	0% (0% - 0.7%)	0% (0% - 0.7%)	0% (0% - 0.7%)	0% (0% - 0.6%)	0% (0% - 0.6%)	0% (0% - 0.6%)	0% (0% - 0.5%)
Chicago	0% (0% - 0.8%)	0% (0% - 0.7%)	0% (0% - 0.7%)	0% (0% - 0.6%)	0% (0% - 0.6%)	0% (0% - 0.6%)	0% (0% - 0.5%)	0% (0% - 0.4%)
Cleveland	0% (0% - 0.9%)	0% (0% - 0.9%)	0% (0% - 0.8%)	0% (0% - 0.7%)	0% (0% - 0.7%)	0% (0% - 0.7%)	0% (0% - 0.6%)	0% (0% - 0.5%)
Detroit	0% (0% - 0.9%)	0% (0% - 0.8%)	0% (0% - 0.8%)	0% (0% - 0.8%)	0% (0% - 0.7%)	0% (0% - 0.6%)	0% (0% - 0.6%)	0% (0% - 0.5%)
Houston	0% (0% - 0.3%)	0% (0% - 0.2%)	0% (0% - 0.2%)	0% (0% - 0.2%)	0% (0% - 0.2%)	0% (0% - 0.2%)	0% (0% - 0.2%)	0% (0% - 0.1%)
Los Angeles	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.2%)	0% (0% - 0.2%)	0% (0% - 0.2%)	0% (0% - 0.1%)	0% (0% - 0.1%)
New York	0% (0% - 0.9%)	0% (0% - 0.8%)	0% (0% - 0.8%)	0% (0% - 0.6%)	0% (0% - 0.7%)	0% (0% - 0.6%)	0% (0% - 0.6%)	0% (0% - 0.5%)
Philadelphia	0% (0% - 1%)	0% (0% - 1%)	0% (0% - 0.9%)	0% (0% - 0.8%)	0% (0% - 0.8%)	0% (0% - 0.8%)	0% (0% - 0.7%)	0% (0% - 0.6%)
Sacramento	0% (0% - 0.5%)	0% (0% - 0.5%)	0% (0% - 0.5%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.3%)	0% (0% - 0.3%)
St. Louis	0% (0% - 0.9%)	0% (0% - 0.8%)	0% (0% - 0.8%)	0% (0% - 0.7%)	0% (0% - 0.7%)	0% (0% - 0.6%)	0% (0% - 0.6%)	0% (0% - 0.5%)
Washington, DC	0% (0% - 0.9%)	0% (0% - 0.8%)	0% (0% - 0.8%)	0% (0% - 0.7%)	0% (0% - 0.7%)	0% (0% - 0.6%)	0% (0% - 0.6%)	0% (0% - 0.5%)

*Numbers are median (0.5 fractile) percents of occurrences. Numbers in parentheses below the median are 95% confidence 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.

***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.

Table 3-15. 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 2004 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 FEV1 Greater Than or Equal to 10%							
Atlanta	62 (17 - 111)	61 (16 - 109)	54 (13 - 99)	47 (10 - 88)	44 (9 - 83)	43 (9 - 82)	37 (7 - 73)	29 (4 - 61)
Boston	52 (11 - 100)	46 (9 - 91)	45 (9 - 90)	43 (8 - 86)	36 (6 - 75)	33 (5 - 70)	31 (4 - 66)	24 (2 - 54)
Chicago	67 (11 - 136)	61 (9 - 127)	57 (8 - 120)	51 (6 - 109)	46 (5 - 100)	43 (4 - 94)	38 (4 - 86)	28 (2 - 67)
Cleveland	25 (5 - 49)	23 (4 - 46)	22 (4 - 44)	18 (3 - 38)	17 (2 - 37)	16 (2 - 34)	15 (2 - 32)	11 (1 - 26)
Detroit	50 (10 - 96)	45 (8 - 88)	43 (8 - 86)	41 (7 - 83)	34 (5 - 72)	31 (4 - 66)	29 (4 - 63)	22 (2 - 51)
Houston	69 (20 - 120)	63 (17 - 111)	60 (15 - 108)	50 (11 - 93)	49 (11 - 90)	45 (9 - 84)	41 (8 - 78)	31 (5 - 61)
Los Angeles	130 (30 - 235)	123 (27 - 223)	109 (23 - 201)	81 (15 - 156)	78 (14 - 150)	73 (12 - 141)	60 (10 - 118)	32 (4 - 65)
New York	168 (31 - 335)	158 (27 - 318)	146 (24 - 300)	113 (14 - 244)	117 (15 - 251)	110 (14 - 240)	100 (11 - 222)	76 (7 - 177)
Philadelphia	64 (15 - 119)	58 (13 - 111)	56 (12 - 107)	46 (8 - 92)	45 (8 - 90)	41 (7 - 84)	38 (6 - 79)	30 (3 - 65)
Sacramento	15 (4 - 27)	14 (3 - 26)	13 (3 - 24)	10 (2 - 19)	10 (2 - 18)	9 (2 - 17)	8 (1 - 15)	5 (1 - 11)
St. Louis	29 (6 - 54)	26 (5 - 51)	25 (5 - 48)	21 (3 - 42)	20 (3 - 40)	18 (3 - 38)	17 (2 - 35)	13 (1 - 29)
Washington, DC	86 (22 - 158)	77 (17 - 144)	76 (17 - 143)	65 (13 - 126)	61 (11 - 120)	54 (9 - 110)	52 (8 - 106)	40 (5 - 85)
	Response = Decrease in FEV1 Greater Than or Equal to 15%							
Atlanta	16 (2 - 69)	16 (1 - 67)	13 (1 - 61)	10 (0 - 53)	8 (0 - 50)	8 (0 - 49)	6 (0 - 44)	4 (0 - 36)
Boston	11 (1 - 61)	8 (0 - 54)	8 (0 - 54)	7 (0 - 51)	5 (0 - 45)	4 (0 - 41)	4 (0 - 39)	2 (0 - 31)
Chicago	10 (0 - 80)	8 (0 - 75)	7 (0 - 71)	5 (0 - 64)	4 (0 - 59)	4 (0 - 55)	3 (0 - 50)	1 (0 - 39)
Cleveland	4 (0 - 29)	4 (0 - 27)	3 (0 - 26)	2 (0 - 22)	2 (0 - 22)	2 (0 - 20)	1 (0 - 19)	1 (0 - 15)
Detroit	9 (0 - 58)	8 (0 - 53)	7 (0 - 51)	6 (0 - 49)	4 (0 - 42)	4 (0 - 39)	3 (0 - 37)	2 (0 - 30)
Houston	19 (2 - 76)	16 (1 - 69)	15 (1 - 67)	11 (1 - 56)	10 (0 - 55)	8 (0 - 51)	7 (0 - 47)	4 (0 - 36)
Los Angeles	28 (1 - 142)	26 (1 - 135)	21 (1 - 121)	13 (0 - 92)	12 (0 - 89)	11 (0 - 84)	8 (0 - 70)	4 (0 - 38)

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	29 (1 - 200)	25 (1 - 189)	22 (0 - 178)	12 (0 - 143)	13 (0 - 147)	12 (0 - 141)	9 (0 - 130)	5 (0 - 103)
Philadelphia	14 (1 - 72)	12 (1 - 67)	11 (0 - 64)	8 (0 - 55)	7 (0 - 53)	6 (0 - 50)	5 (0 - 46)	3 (0 - 38)
Sacramento	4 (0 - 17)	3 (0 - 16)	3 (0 - 14)	2 (0 - 12)	2 (0 - 11)	2 (0 - 10)	1 (0 - 9)	1 (0 - 6)
St. Louis	6 (0 - 33)	5 (0 - 30)	4 (0 - 29)	3 (0 - 25)	3 (0 - 24)	2 (0 - 22)	2 (0 - 21)	1 (0 - 17)
Washington, DC	21 (2 - 97)	17 (1 - 87)	16 (1 - 87)	12 (0 - 76)	10 (0 - 71)	8 (0 - 65)	8 (0 - 63)	4 (0 - 50)
	Response = Decrease in FEV1 Greater Than or Equal to 20%							
Atlanta	3 (0 - 44)	3 (0 - 43)	2 (0 - 39)	1 (0 - 34)	1 (0 - 32)	1 (0 - 31)	0 (0 - 28)	0 (0 - 22)
Boston	1 (0 - 38)	1 (0 - 34)	1 (0 - 33)	1 (0 - 32)	0 (0 - 27)	0 (0 - 25)	0 (0 - 24)	0 (0 - 18)
Chicago	1 (0 - 50)	0 (0 - 47)	0 (0 - 44)	0 (0 - 40)	0 (0 - 36)	0 (0 - 33)	0 (0 - 30)	0 (0 - 23)
Cleveland	0 (0 - 18)	0 (0 - 17)	0 (0 - 16)	0 (0 - 14)	0 (0 - 13)	0 (0 - 12)	0 (0 - 11)	0 (0 - 9)
Detroit	1 (0 - 36)	1 (0 - 33)	1 (0 - 32)	0 (0 - 31)	0 (0 - 26)	0 (0 - 24)	0 (0 - 22)	0 (0 - 18)
Houston	4 (0 - 49)	3 (0 - 45)	3 (0 - 43)	1 (0 - 36)	1 (0 - 35)	1 (0 - 33)	1 (0 - 30)	0 (0 - 23)
Los Angeles	3 (0 - 93)	3 (0 - 88)	2 (0 - 79)	1 (0 - 60)	1 (0 - 58)	1 (0 - 54)	0 (0 - 45)	0 (0 - 25)
New York	3 (0 - 124)	2 (0 - 117)	2 (0 - 110)	0 (0 - 87)	1 (0 - 89)	0 (0 - 85)	0 (0 - 78)	0 (0 - 60)
Philadelphia	2 (0 - 46)	1 (0 - 42)	1 (0 - 41)	1 (0 - 34)	0 (0 - 33)	0 (0 - 31)	0 (0 - 29)	0 (0 - 23)
Sacramento	0 (0 - 11)	0 (0 - 10)	0 (0 - 9)	0 (0 - 8)	0 (0 - 7)	0 (0 - 7)	0 (0 - 6)	0 (0 - 4)
St. Louis	1 (0 - 21)	0 (0 - 19)	0 (0 - 18)	0 (0 - 16)	0 (0 - 15)	0 (0 - 14)	0 (0 - 13)	0 (0 - 10)
Washington, DC	4 (0 - 61)	2 (0 - 55)	2 (0 - 55)	1 (0 - 48)	1 (0 - 45)	1 (0 - 41)	0 (0 - 39)	0 (0 - 31)

*Numbers are median (0.5 fractile) numbers of children. Numbers in parentheses below the median are 95% confidence 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.

***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.

Table 3-16. 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 FEV1 Greater Than or Equal to 10%							
Atlanta	87 (29 - 144)	85 (28 - 142)	76 (23 - 129)	67 (19 - 118)	62 (17 - 111)	62 (16 - 110)	53 (13 - 98)	42 (8 - 82)
Boston	115 (44 - 186)	102 (36 - 169)	100 (35 - 167)	95 (32 - 160)	80 (24 - 140)	72 (20 - 129)	68 (18 - 124)	53 (11 - 101)
Chicago	184 (63 - 304)	170 (55 - 286)	159 (49 - 271)	143 (41 - 249)	129 (35 - 230)	121 (31 - 218)	110 (26 - 203)	85 (16 - 165)
Cleveland	68 (26 - 110)	61 (21 - 101)	59 (21 - 99)	50 (16 - 86)	48 (15 - 84)	43 (12 - 77)	41 (11 - 74)	32 (7 - 61)
Detroit	118 (42 - 192)	105 (35 - 176)	103 (34 - 173)	99 (32 - 168)	82 (23 - 145)	74 (19 - 134)	70 (18 - 129)	55 (11 - 105)
Houston	70 (20 - 121)	63 (17 - 111)	61 (16 - 108)	50 (11 - 92)	48 (11 - 90)	45 (9 - 84)	41 (8 - 78)	30 (5 - 60)
Los Angeles	132 (32 - 235)	127 (30 - 227)	111 (25 - 202)	80 (15 - 150)	79 (15 - 148)	75 (14 - 143)	61 (11 - 117)	34 (5 - 66)
New York	373 (122 - 628)	349 (109 - 597)	327 (98 - 568)	257 (65 - 470)	266 (69 - 483)	250 (62 - 460)	229 (53 - 430)	179 (33 - 353)
Philadelphia	141 (54 - 223)	128 (47 - 207)	124 (44 - 201)	104 (33 - 176)	100 (31 - 170)	92 (27 - 159)	87 (24 - 152)	68 (16 - 126)
Sacramento	28 (9 - 45)	25 (8 - 42)	24 (7 - 40)	20 (5 - 34)	19 (5 - 33)	17 (4 - 31)	16 (4 - 28)	12 (2 - 22)
St. Louis	72 (29 - 112)	66 (25 - 105)	63 (23 - 101)	54 (18 - 89)	50 (16 - 85)	46 (14 - 79)	43 (12 - 74)	33 (8 - 61)
Washington, DC	163 (60 - 262)	143 (49 - 237)	142 (48 - 236)	125 (39 - 213)	116 (34 - 201)	104 (28 - 184)	99 (26 - 178)	79 (17 - 148)
	Response = Decrease in FEV1 Greater Than or Equal to 15%							
Atlanta	30 (5 - 93)	29 (4 - 92)	23 (3 - 82)	19 (2 - 73)	16 (1 - 68)	16 (1 - 68)	12 (1 - 60)	8 (0 - 49)
Boston	46 (11 - 125)	37 (8 - 111)	36 (7 - 109)	33 (6 - 104)	24 (3 - 88)	20 (2 - 81)	18 (2 - 77)	11 (1 - 61)
Chicago	64 (11 - 198)	56 (8 - 184)	50 (6 - 172)	41 (4 - 156)	34 (3 - 142)	30 (2 - 134)	25 (1 - 124)	15 (0 - 99)
Cleveland	27 (5 - 73)	22 (4 - 66)	21 (3 - 64)	16 (2 - 55)	15 (2 - 53)	12 (1 - 48)	11 (1 - 45)	7 (0 - 37)
Detroit	44 (8 - 126)	36 (5 - 114)	34 (5 - 111)	33 (4 - 108)	23 (2 - 90)	19 (1 - 82)	17 (1 - 79)	11 (0 - 63)
Houston	20 (2 - 76)	17 (2 - 69)	16 (1 - 67)	11 (1 - 56)	10 (1 - 54)	9 (0 - 51)	8 (0 - 47)	4 (0 - 36)
Los Angeles	31 (2 - 143)	29 (1 - 138)	24 (1 - 122)	14 (0 - 90)	14 (0 - 89)	13 (0 - 85)	10 (0 - 69)	5 (0 - 39)

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	125 (19 - 405)	111 (15 - 381)	98 (12 - 358)	63 (5 - 288)	68 (5 - 297)	60 (4 - 281)	51 (3 - 261)	31 (1 - 210)
Philadelphia	57 (13 - 151)	49 (10 - 138)	46 (9 - 133)	34 (5 - 113)	31 (4 - 108)	27 (3 - 100)	24 (2 - 95)	16 (1 - 77)
Sacramento	9 (1 - 29)	8 (1 - 27)	7 (1 - 25)	5 (0 - 21)	5 (0 - 20)	4 (0 - 19)	4 (0 - 17)	2 (0 - 13)
St. Louis	30 (7 - 77)	26 (5 - 70)	24 (5 - 67)	18 (3 - 58)	16 (2 - 54)	14 (2 - 50)	12 (1 - 47)	8 (0 - 37)
Washington, DC	63 (13 - 175)	50 (8 - 154)	50 (8 - 153)	39 (5 - 136)	34 (4 - 126)	28 (2 - 114)	26 (2 - 110)	17 (1 - 89)
	Response = Decrease in FEV1 Greater Than or Equal to 20%							
Atlanta	8 (1 - 60)	7 (0 - 59)	5 (0 - 53)	4 (0 - 47)	3 (0 - 44)	3 (0 - 44)	2 (0 - 38)	1 (0 - 31)
Boston	15 (2 - 80)	11 (1 - 70)	11 (1 - 69)	9 (1 - 66)	6 (0 - 56)	4 (0 - 51)	4 (0 - 48)	1 (0 - 38)
Chicago	17 (1 - 126)	14 (1 - 117)	11 (0 - 110)	8 (0 - 99)	6 (0 - 90)	5 (0 - 85)	3 (0 - 79)	1 (0 - 62)
Cleveland	8 (1 - 46)	6 (0 - 42)	6 (0 - 41)	4 (0 - 35)	3 (0 - 33)	2 (0 - 30)	2 (0 - 29)	1 (0 - 23)
Detroit	12 (1 - 80)	9 (0 - 72)	9 (0 - 70)	8 (0 - 68)	4 (0 - 57)	3 (0 - 52)	3 (0 - 50)	1 (0 - 40)
Houston	4 (0 - 49)	3 (0 - 45)	3 (0 - 43)	1 (0 - 36)	1 (0 - 35)	1 (0 - 33)	1 (0 - 30)	0 (0 - 23)
Los Angeles	4 (0 - 94)	4 (0 - 90)	3 (0 - 80)	1 (0 - 59)	1 (0 - 58)	1 (0 - 56)	1 (0 - 45)	0 (0 - 25)
New York	32 (2 - 256)	26 (1 - 241)	21 (1 - 226)	10 (0 - 182)	11 (0 - 187)	9 (0 - 177)	7 (0 - 164)	3 (0 - 131)
Philadelphia	18 (2 - 96)	14 (1 - 87)	13 (1 - 84)	8 (0 - 72)	7 (0 - 69)	6 (0 - 63)	5 (0 - 60)	2 (0 - 49)
Sacramento	2 (0 - 19)	2 (0 - 17)	1 (0 - 16)	1 (0 - 14)	1 (0 - 13)	1 (0 - 12)	0 (0 - 11)	0 (0 - 8)
St. Louis	10 (1 - 49)	8 (1 - 45)	7 (1 - 43)	5 (0 - 37)	4 (0 - 35)	3 (0 - 32)	2 (0 - 30)	1 (0 - 24)
Washington, DC	19 (2 - 111)	13 (1 - 98)	13 (1 - 97)	9 (0 - 86)	7 (0 - 80)	5 (0 - 72)	4 (0 - 70)	2 (0 - 57)

*Numbers are median (0.5 fractile) numbers of children. Numbers in parentheses below the median are 95% confidence 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.

***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.

Table 3-17. 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 2004 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 FEV1 Greater Than or Equal to 10%							
Atlanta	6.6% (1.8% - 11.7%)	6.5% (1.7% - 11.5%)	5.7% (1.4% - 10.5%)	5% (1.1% - 9.4%)	4.6% (0.9% - 8.8%)	4.6% (0.9% - 8.7%)	3.9% (0.7% - 7.8%)	3.1% (0.4% - 6.4%)
Boston	4.8% (1% - 9.1%)	4.2% (0.8% - 8.3%)	4.1% (0.8% - 8.2%)	3.9% (0.7% - 7.9%)	3.3% (0.5% - 6.9%)	3% (0.4% - 6.4%)	2.8% (0.4% - 6.1%)	2.2% (0.2% - 4.9%)
Chicago	3.4% (0.5% - 7%)	3.1% (0.5% - 6.5%)	2.9% (0.4% - 6.2%)	2.6% (0.3% - 5.6%)	2.3% (0.3% - 5.1%)	2.2% (0.2% - 4.8%)	2% (0.2% - 4.4%)	1.4% (0.1% - 3.4%)
Cleveland	4.2% (0.8% - 8.3%)	3.8% (0.7% - 7.7%)	3.7% (0.6% - 7.4%)	3% (0.4% - 6.4%)	2.9% (0.4% - 6.2%)	2.7% (0.3% - 5.8%)	2.5% (0.3% - 5.4%)	1.9% (0.2% - 4.4%)
Detroit	4.5% (0.9% - 8.7%)	4% (0.7% - 8%)	3.9% (0.7% - 7.8%)	3.7% (0.6% - 7.5%)	3.1% (0.4% - 6.5%)	2.8% (0.4% - 6%)	2.6% (0.3% - 5.7%)	2% (0.2% - 4.6%)
Houston	6.4% (1.8% - 11.1%)	5.8% (1.5% - 10.2%)	5.6% (1.4% - 9.9%)	4.6% (1% - 8.5%)	4.5% (1% - 8.3%)	4.1% (0.8% - 7.7%)	3.8% (0.7% - 7.2%)	2.8% (0.4% - 5.6%)
Los Angeles	3.6% (0.8% - 6.4%)	3.4% (0.7% - 6.1%)	3% (0.6% - 5.5%)	2.2% (0.4% - 4.2%)	2.1% (0.4% - 4.1%)	2% (0.3% - 3.8%)	1.6% (0.3% - 3.2%)	0.9% (0.1% - 1.8%)
New York	4.1% (0.8% - 8.1%)	3.8% (0.7% - 7.7%)	3.5% (0.6% - 7.2%)	2.7% (0.3% - 5.9%)	2.8% (0.4% - 6%)	2.7% (0.3% - 5.8%)	2.4% (0.3% - 5.4%)	1.8% (0.2% - 4.3%)
Philadelphia	5.4% (1.2% - 10%)	4.9% (1.1% - 9.4%)	4.7% (1% - 9%)	3.9% (0.7% - 7.8%)	3.8% (0.6% - 7.6%)	3.5% (0.6% - 7.1%)	3.2% (0.5% - 6.6%)	2.5% (0.3% - 5.5%)
Sacramento	3.8% (0.9% - 6.7%)	3.5% (0.8% - 6.3%)	3.2% (0.7% - 5.8%)	2.5% (0.5% - 4.7%)	2.4% (0.5% - 4.5%)	2.2% (0.4% - 4.2%)	1.9% (0.3% - 3.6%)	1.3% (0.2% - 2.6%)
St. Louis	5% (1.1% - 9.4%)	4.5% (0.9% - 8.7%)	4.3% (0.8% - 8.3%)	3.6% (0.6% - 7.2%)	3.4% (0.5% - 6.9%)	3.1% (0.5% - 6.5%)	2.9% (0.4% - 6%)	2.2% (0.2% - 4.9%)
Washington, DC	5.8% (1.5% - 10.7%)	5.2% (1.2% - 9.7%)	5.1% (1.1% - 9.6%)	4.4% (0.9% - 8.5%)	4.1% (0.8% - 8.1%)	3.7% (0.6% - 7.4%)	3.5% (0.6% - 7.1%)	2.7% (0.3% - 5.7%)
	Response = Decrease in FEV1 Greater Than or Equal to 15%							
Atlanta	1.7% (0.2% - 7.3%)	1.7% (0.1% - 7.1%)	1.3% (0.1% - 6.4%)	1% (0% - 5.6%)	0.9% (0% - 5.3%)	0.9% (0% - 5.2%)	0.6% (0% - 4.6%)	0.4% (0% - 3.8%)
Boston	1% (0.1% - 5.5%)	0.8% (0% - 5%)	0.7% (0% - 4.9%)	0.7% (0% - 4.7%)	0.5% (0% - 4.1%)	0.4% (0% - 3.7%)	0.3% (0% - 3.6%)	0.2% (0% - 2.9%)
Chicago	0.5% (0% - 4.1%)	0.4% (0% - 3.8%)	0.4% (0% - 3.6%)	0.3% (0% - 3.3%)	0.2% (0% - 3%)	0.2% (0% - 2.8%)	0.1% (0% - 2.6%)	0.1% (0% - 2%)
Cleveland	0.8% (0% - 5%)	0.6% (0% - 4.6%)	0.6% (0% - 4.4%)	0.4% (0% - 3.8%)	0.3% (0% - 3.6%)	0.3% (0% - 3.4%)	0.2% (0% - 3.2%)	0.1% (0% - 2.6%)
Detroit	0.8% (0% - 5.2%)	0.7% (0% - 4.7%)	0.6% (0% - 4.6%)	0.6% (0% - 4.5%)	0.4% (0% - 3.8%)	0.3% (0% - 3.5%)	0.3% (0% - 3.3%)	0.2% (0% - 2.7%)
Houston	1.8% (0.2% - 6.9%)	1.5% (0.1% - 6.3%)	1.4% (0.1% - 6.1%)	1% (0.1% - 5.2%)	0.9% (0% - 5%)	0.8% (0% - 4.6%)	0.7% (0% - 4.3%)	0.4% (0% - 3.3%)
Los Angeles	0.8% (0% - 3.9%)	0.7% (0% - 3.7%)	0.6% (0% - 3.3%)	0.4% (0% - 2.5%)	0.3% (0% - 2.4%)	0.3% (0% - 2.3%)	0.2% (0% - 1.9%)	0.1% (0% - 1%)

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	0.7% (0% - 4.8%)	0.6% (0% - 4.6%)	0.5% (0% - 4.3%)	0.3% (0% - 3.5%)	0.3% (0% - 3.5%)	0.3% (0% - 3.4%)	0.2% (0% - 3.1%)	0.1% (0% - 2.5%)
Philadelphia	1.2% (0.1% - 6.1%)	1% (0% - 5.7%)	0.9% (0% - 5.4%)	0.6% (0% - 4.6%)	0.6% (0% - 4.5%)	0.5% (0% - 4.2%)	0.4% (0% - 3.9%)	0.2% (0% - 3.2%)
Sacramento	0.9% (0% - 4%)	0.8% (0% - 3.8%)	0.7% (0% - 3.5%)	0.5% (0% - 2.8%)	0.4% (0% - 2.7%)	0.4% (0% - 2.5%)	0.3% (0% - 2.2%)	0.2% (0% - 1.5%)
St. Louis	1% (0% - 5.6%)	0.8% (0% - 5.2%)	0.8% (0% - 5%)	0.5% (0% - 4.3%)	0.5% (0% - 4.1%)	0.4% (0% - 3.8%)	0.3% (0% - 3.6%)	0.2% (0% - 2.9%)
Washington, DC	1.4% (0.1% - 6.6%)	1.1% (0.1% - 5.9%)	1.1% (0.1% - 5.8%)	0.8% (0% - 5.1%)	0.7% (0% - 4.8%)	0.6% (0% - 4.4%)	0.5% (0% - 4.2%)	0.3% (0% - 3.4%)
	Response = Decrease in FEV1 Greater Than or Equal to 20%							
Atlanta	0.3% (0% - 4.7%)	0.3% (0% - 4.6%)	0.2% (0% - 4.1%)	0.1% (0% - 3.6%)	0.1% (0% - 3.4%)	0.1% (0% - 3.3%)	0% (0% - 2.9%)	0% (0% - 2.4%)
Boston	0.1% (0% - 3.4%)	0.1% (0% - 3.1%)	0.1% (0% - 3%)	0.1% (0% - 2.9%)	0% (0% - 2.5%)	0% (0% - 2.3%)	0% (0% - 2.1%)	0% (0% - 1.7%)
Chicago	0% (0% - 2.6%)	0% (0% - 2.4%)	0% (0% - 2.3%)	0% (0% - 2%)	0% (0% - 1.8%)	0% (0% - 1.7%)	0% (0% - 1.5%)	0% (0% - 1.2%)
Cleveland	0.1% (0% - 3.1%)	0% (0% - 2.8%)	0% (0% - 2.7%)	0% (0% - 2.3%)	0% (0% - 2.2%)	0% (0% - 2.1%)	0% (0% - 1.9%)	0% (0% - 1.5%)
Detroit	0.1% (0% - 3.3%)	0.1% (0% - 3%)	0.1% (0% - 2.9%)	0% (0% - 2.8%)	0% (0% - 2.3%)	0% (0% - 2.1%)	0% (0% - 2%)	0% (0% - 1.6%)
Houston	0.4% (0% - 4.5%)	0.3% (0% - 4.1%)	0.2% (0% - 3.9%)	0.1% (0% - 3.3%)	0.1% (0% - 3.2%)	0.1% (0% - 3%)	0.1% (0% - 2.8%)	0% (0% - 2.1%)
Los Angeles	0.1% (0% - 2.5%)	0.1% (0% - 2.4%)	0% (0% - 2.2%)	0% (0% - 1.6%)	0% (0% - 1.6%)	0% (0% - 1.5%)	0% (0% - 1.2%)	0% (0% - 0.7%)
New York	0.1% (0% - 3%)	0% (0% - 2.8%)	0% (0% - 2.6%)	0% (0% - 2.1%)	0% (0% - 2.2%)	0% (0% - 2.1%)	0% (0% - 1.9%)	0% (0% - 1.5%)
Philadelphia	0.2% (0% - 3.8%)	0.1% (0% - 3.6%)	0.1% (0% - 3.4%)	0% (0% - 2.9%)	0% (0% - 2.8%)	0% (0% - 2.6%)	0% (0% - 2.4%)	0% (0% - 1.9%)
Sacramento	0.1% (0% - 2.7%)	0.1% (0% - 2.5%)	0.1% (0% - 2.3%)	0% (0% - 1.8%)	0% (0% - 1.8%)	0% (0% - 1.6%)	0% (0% - 1.4%)	0% (0% - 1%)
St. Louis	0.1% (0% - 3.6%)	0.1% (0% - 3.3%)	0.1% (0% - 3.2%)	0% (0% - 2.7%)	0% (0% - 2.6%)	0% (0% - 2.4%)	0% (0% - 2.2%)	0% (0% - 1.8%)
Washington, DC	0.2% (0% - 4.1%)	0.2% (0% - 3.7%)	0.2% (0% - 3.7%)	0.1% (0% - 3.2%)	0.1% (0% - 3%)	0% (0% - 2.7%)	0% (0% - 2.6%)	0% (0% - 2.1%)

*Numbers are median (0.5 fractile) percents of children. Numbers in parentheses below the median are 95% confidence 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.

***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.

Table 3-18. 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 FEV1 Greater Than or Equal to 10%							
Atlanta	9.2% (3.1% - 15.3%)	9.1% (3% - 15.1%)	8.1% (2.5% - 13.7%)	7.1% (2% - 12.5%)	6.6% (1.8% - 11.7%)	6.6% (1.7% - 11.7%)	5.7% (1.3% - 10.4%)	4.5% (0.9% - 8.7%)
Boston	10.5% (4% - 17%)	9.3% (3.3% - 15.4%)	9.2% (3.2% - 15.2%)	8.7% (2.9% - 14.6%)	7.3% (2.2% - 12.8%)	6.6% (1.8% - 11.8%)	6.2% (1.7% - 11.3%)	4.8% (1% - 9.2%)
Chicago	9.4% (3.2% - 15.6%)	8.7% (2.8% - 14.7%)	8.1% (2.5% - 13.9%)	7.3% (2.1% - 12.8%)	6.6% (1.8% - 11.8%)	6.2% (1.6% - 11.2%)	5.6% (1.3% - 10.4%)	4.3% (0.8% - 8.5%)
Cleveland	11.5% (4.3% - 18.5%)	10.3% (3.6% - 17%)	10% (3.5% - 16.6%)	8.5% (2.6% - 14.6%)	8.1% (2.4% - 14.1%)	7.2% (2% - 12.9%)	6.9% (1.8% - 12.4%)	5.5% (1.2% - 10.3%)
Detroit	10.6% (3.8% - 17.3%)	9.5% (3.2% - 15.9%)	9.2% (3% - 15.5%)	9% (2.9% - 15.2%)	7.4% (2.1% - 13%)	6.7% (1.7% - 12%)	6.3% (1.6% - 11.6%)	4.9% (1% - 9.5%)
Houston	6.4% (1.9% - 11.1%)	5.8% (1.6% - 10.2%)	5.6% (1.5% - 9.9%)	4.6% (1.1% - 8.5%)	4.5% (1% - 8.2%)	4.1% (0.9% - 7.7%)	3.8% (0.7% - 7.2%)	2.8% (0.4% - 5.5%)
Los Angeles	3.6% (0.9% - 6.4%)	3.5% (0.8% - 6.2%)	3% (0.7% - 5.5%)	2.2% (0.4% - 4.1%)	2.1% (0.4% - 4%)	2.1% (0.4% - 3.9%)	1.7% (0.3% - 3.2%)	0.9% (0.1% - 1.8%)
New York	9% (2.9% - 15.2%)	8.4% (2.6% - 14.4%)	7.9% (2.4% - 13.7%)	6.2% (1.6% - 11.3%)	6.4% (1.7% - 11.6%)	6% (1.5% - 11.1%)	5.5% (1.3% - 10.4%)	4.3% (0.8% - 8.5%)
Philadelphia	11.9% (4.6% - 18.8%)	10.8% (4% - 17.5%)	10.4% (3.7% - 17%)	8.8% (2.8% - 14.8%)	8.4% (2.6% - 14.3%)	7.7% (2.3% - 13.4%)	7.3% (2.1% - 12.8%)	5.8% (1.4% - 10.7%)
Sacramento	6.7% (2.2% - 11%)	6.2% (1.9% - 10.3%)	5.7% (1.7% - 9.7%)	4.7% (1.3% - 8.2%)	4.5% (1.2% - 7.9%)	4.2% (1.1% - 7.5%)	3.8% (0.9% - 6.8%)	2.8% (0.6% - 5.2%)
St. Louis	12.4% (4.9% - 19.3%)	11.4% (4.3% - 18%)	10.8% (3.9% - 17.3%)	9.2% (3.1% - 15.3%)	8.7% (2.8% - 14.5%)	8% (2.4% - 13.6%)	7.4% (2.1% - 12.8%)	5.7% (1.4% - 10.4%)
Washington, DC	11% (4% - 17.6%)	9.6% (3.3% - 16%)	9.6% (3.2% - 15.9%)	8.4% (2.6% - 14.3%)	7.8% (2.3% - 13.5%)	7% (1.9% - 12.4%)	6.7% (1.8% - 12%)	5.3% (1.2% - 10%)
	Response = Decrease in FEV1 Greater Than or Equal to 15%							
Atlanta	3.2% (0.5% - 9.9%)	3.1% (0.5% - 9.7%)	2.5% (0.3% - 8.7%)	2% (0.2% - 7.8%)	1.7% (0.1% - 7.3%)	1.7% (0.1% - 7.2%)	1.3% (0.1% - 6.3%)	0.8% (0% - 5.2%)
Boston	4.2% (1% - 11.4%)	3.4% (0.7% - 10.1%)	3.3% (0.7% - 10%)	3% (0.6% - 9.5%)	2.2% (0.3% - 8.1%)	1.8% (0.2% - 7.4%)	1.7% (0.2% - 7%)	1% (0.1% - 5.6%)
Chicago	3.3% (0.5% - 10.2%)	2.9% (0.4% - 9.4%)	2.5% (0.3% - 8.8%)	2.1% (0.2% - 8%)	1.7% (0.1% - 7.3%)	1.5% (0.1% - 6.9%)	1.3% (0.1% - 6.3%)	0.8% (0% - 5.1%)
Cleveland	4.5% (0.9% - 12.4%)	3.7% (0.6% - 11.1%)	3.5% (0.6% - 10.8%)	2.7% (0.3% - 9.2%)	2.5% (0.3% - 8.9%)	2% (0.2% - 8%)	1.8% (0.1% - 7.6%)	1.2% (0.1% - 6.3%)
Detroit	3.9% (0.7% - 11.4%)	3.2% (0.5% - 10.3%)	3.1% (0.4% - 10%)	2.9% (0.4% - 9.7%)	2.1% (0.2% - 8.1%)	1.7% (0.1% - 7.4%)	1.6% (0.1% - 7.1%)	1% (0% - 5.7%)
Houston	1.9% (0.2% - 7%)	1.5% (0.1% - 6.3%)	1.4% (0.1% - 6.1%)	1% (0.1% - 5.2%)	0.9% (0% - 5%)	0.8% (0% - 4.7%)	0.7% (0% - 4.3%)	0.4% (0% - 3.3%)
Los Angeles	0.8% (0% - 3.9%)	0.8% (0% - 3.8%)	0.6% (0% - 3.3%)	0.4% (0% - 2.4%)	0.4% (0% - 2.4%)	0.4% (0% - 2.3%)	0.3% (0% - 1.9%)	0.1% (0% - 1.1%)

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% (0.5% - 9.8%)	2.7% (0.4% - 9.2%)	2.4% (0.3% - 8.6%)	1.5% (0.1% - 6.9%)	1.6% (0.1% - 7.2%)	1.4% (0.1% - 6.8%)	1.2% (0.1% - 6.3%)	0.7% (0% - 5.1%)
Philadelphia	4.8% (1.1% - 12.7%)	4.1% (0.8% - 11.6%)	3.9% (0.7% - 11.2%)	2.9% (0.4% - 9.5%)	2.6% (0.3% - 9.1%)	2.3% (0.2% - 8.4%)	2% (0.2% - 8%)	1.3% (0.1% - 6.5%)
Sacramento	2.2% (0.3% - 7%)	1.9% (0.2% - 6.5%)	1.7% (0.1% - 6.1%)	1.2% (0.1% - 5.1%)	1.2% (0.1% - 4.9%)	1% (0% - 4.5%)	0.9% (0% - 4.1%)	0.5% (0% - 3.1%)
St. Louis	5.2% (1.2% - 13.2%)	4.5% (0.9% - 12.1%)	4.1% (0.8% - 11.5%)	3.1% (0.5% - 9.9%)	2.8% (0.4% - 9.3%)	2.4% (0.3% - 8.6%)	2.1% (0.2% - 8%)	1.3% (0.1% - 6.4%)
Washington, DC	4.2% (0.9% - 11.8%)	3.4% (0.6% - 10.4%)	3.3% (0.5% - 10.3%)	2.7% (0.3% - 9.1%)	2.3% (0.3% - 8.5%)	1.9% (0.2% - 7.7%)	1.7% (0.1% - 7.4%)	1.1% (0% - 6%)
	Response = Decrease in FEV1 Greater Than or Equal to 20%							
Atlanta	0.8% (0.1% - 6.3%)	0.8% (0.1% - 6.2%)	0.6% (0% - 5.6%)	0.4% (0% - 5%)	0.3% (0% - 4.6%)	0.3% (0% - 4.6%)	0.2% (0% - 4%)	0.1% (0% - 3.3%)
Boston	1.4% (0.2% - 7.3%)	1% (0.1% - 6.4%)	1% (0.1% - 6.3%)	0.8% (0.1% - 6%)	0.5% (0% - 5.1%)	0.4% (0% - 4.6%)	0.3% (0% - 4.4%)	0.1% (0% - 3.5%)
Chicago	0.9% (0.1% - 6.5%)	0.7% (0% - 6%)	0.6% (0% - 5.6%)	0.4% (0% - 5.1%)	0.3% (0% - 4.6%)	0.2% (0% - 4.4%)	0.2% (0% - 4%)	0.1% (0% - 3.2%)
Cleveland	1.4% (0.1% - 7.8%)	1% (0.1% - 7%)	0.9% (0% - 6.8%)	0.6% (0% - 5.8%)	0.5% (0% - 5.6%)	0.4% (0% - 5%)	0.3% (0% - 4.8%)	0.1% (0% - 3.9%)
Detroit	1.1% (0.1% - 7.2%)	0.8% (0% - 6.5%)	0.8% (0% - 6.3%)	0.7% (0% - 6.1%)	0.4% (0% - 5.1%)	0.3% (0% - 4.7%)	0.2% (0% - 4.5%)	0.1% (0% - 3.6%)
Houston	0.4% (0% - 4.5%)	0.3% (0% - 4.1%)	0.2% (0% - 3.9%)	0.1% (0% - 3.3%)	0.1% (0% - 3.2%)	0.1% (0% - 3%)	0.1% (0% - 2.8%)	0% (0% - 2.1%)
Los Angeles	0.1% (0% - 2.6%)	0.1% (0% - 2.5%)	0.1% (0% - 2.2%)	0% (0% - 1.6%)	0% (0% - 1.6%)	0% (0% - 1.5%)	0% (0% - 1.2%)	0% (0% - 0.7%)
New York	0.8% (0% - 6.2%)	0.6% (0% - 5.8%)	0.5% (0% - 5.5%)	0.2% (0% - 4.4%)	0.3% (0% - 4.5%)	0.2% (0% - 4.3%)	0.2% (0% - 3.9%)	0.1% (0% - 3.2%)
Philadelphia	1.5% (0.2% - 8.1%)	1.2% (0.1% - 7.4%)	1.1% (0.1% - 7.1%)	0.7% (0% - 6%)	0.6% (0% - 5.8%)	0.5% (0% - 5.3%)	0.4% (0% - 5.1%)	0.2% (0% - 4.1%)
Sacramento	0.5% (0% - 4.6%)	0.4% (0% - 4.2%)	0.3% (0% - 3.9%)	0.2% (0% - 3.3%)	0.2% (0% - 3.2%)	0.1% (0% - 3%)	0.1% (0% - 2.7%)	0% (0% - 2%)
St. Louis	1.7% (0.2% - 8.4%)	1.4% (0.1% - 7.7%)	1.2% (0.1% - 7.3%)	0.8% (0% - 6.3%)	0.7% (0% - 5.9%)	0.5% (0% - 5.5%)	0.4% (0% - 5.1%)	0.2% (0% - 4.1%)
Washington, DC	1.3% (0.1% - 7.5%)	0.9% (0.1% - 6.6%)	0.9% (0.1% - 6.6%)	0.6% (0% - 5.8%)	0.5% (0% - 5.4%)	0.3% (0% - 4.9%)	0.3% (0% - 4.7%)	0.1% (0% - 3.8%)

*Numbers are median (0.5 fractile) percents of children. Numbers in parentheses below the median are 95% confidence 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.

***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.

Table 3-19. 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 Active Children (Ages 5-18) Engaged in Moderate Exertion, for Location-Specific O_3 Seasons: Based on Adjusting 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**							
	0.084/4***	0.084/3	0.080/4****	0.074/5	0.074/4	0.074/3	0.070/4****	0.064/4
	Response = Decrease in FEV1 Greater Than or Equal to 10%							
Atlanta	333 (31 - 1143)	327 (29 - 1129)	298 (24 - 1058)	264 (18 - 974)	248 (16 - 932)	245 (16 - 925)	219 (12 - 852)	179 (8 - 737)
Boston	205 (15 - 767)	186 (12 - 716)	184 (11 - 711)	176 (10 - 691)	154 (8 - 629)	142 (6 - 594)	135 (6 - 576)	110 (3 - 497)
Chicago	319 (16 - 1181)	297 (14 - 1120)	281 (12 - 1072)	252 (10 - 988)	229 (8 - 916)	214 (7 - 869)	195 (6 - 808)	151 (3 - 654)
Cleveland	115 (7 - 420)	106 (6 - 396)	103 (6 - 386)	88 (4 - 346)	85 (4 - 336)	79 (3 - 319)	74 (3 - 304)	60 (2 - 256)
Detroit	219 (14 - 805)	201 (12 - 756)	195 (11 - 742)	189 (10 - 724)	162 (7 - 650)	150 (6 - 613)	142 (5 - 589)	113 (3 - 497)
Houston	266 (31 - 602)	242 (26 - 542)	233 (24 - 519)	194 (18 - 413)	187 (17 - 395)	170 (14 - 346)	155 (12 - 297)	99 (7 - 85)
Los Angeles	1106 (73 - 3598)	1058 (67 - 3472)	966 (56 - 3213)	729 (35 - 2455)	700 (33 - 2357)	646 (29 - 2168)	521 (21 - 1712)	279 (9 - 731)
New York	795 (48 - 2939)	754 (42 - 2833)	710 (36 - 2717)	582 (22 - 2363)	596 (24 - 2405)	570 (21 - 2326)	526 (18 - 2195)	412 (10 - 1813)
Philadelphia	331 (27 - 1085)	307 (23 - 1028)	296 (21 - 1002)	254 (15 - 899)	248 (14 - 881)	232 (12 - 841)	218 (10 - 802)	178 (6 - 687)
Sacramento	94 (7 - 315)	88 (6 - 300)	82 (5 - 283)	69 (4 - 248)	66 (3 - 238)	62 (3 - 228)	56 (2 - 208)	41 (1 - 160)
St. Louis	150 (12 - 507)	139 (10 - 478)	132 (9 - 461)	113 (6 - 409)	108 (6 - 395)	100 (5 - 373)	92 (4 - 351)	72 (3 - 288)
Washington, DC	394 (34 - 1374)	356 (27 - 1281)	353 (27 - 1274)	313 (20 - 1173)	295 (18 - 1124)	269 (15 - 1054)	260 (13 - 1028)	210 (8 - 881)
	Response = Decrease in FEV1 Greater Than or Equal to 15%							
Atlanta	27 (1 - 592)	26 (1 - 584)	20 (1 - 544)	15 (0 - 497)	13 (0 - 473)	13 (0 - 469)	9 (0 - 430)	6 (0 - 368)
Boston	12 (0 - 391)	10 (0 - 363)	9 (0 - 360)	8 (0 - 349)	6 (0 - 315)	5 (0 - 297)	4 (0 - 286)	2 (0 - 244)
Chicago	13 (0 - 615)	11 (0 - 581)	9 (0 - 555)	7 (0 - 510)	5 (0 - 471)	5 (0 - 446)	4 (0 - 413)	2 (0 - 333)
Cleveland	6 (0 - 218)	5 (0 - 205)	4 (0 - 200)	3 (0 - 178)	3 (0 - 172)	2 (0 - 163)	2 (0 - 155)	1 (0 - 130)
Detroit	12 (0 - 416)	10 (0 - 389)	9 (0 - 381)	8 (0 - 371)	5 (0 - 330)	4 (0 - 310)	4 (0 - 297)	2 (0 - 249)
Houston	27 (1 - 374)	22 (1 - 341)	21 (1 - 328)	15 (0 - 271)	14 (0 - 260)	11 (0 - 235)	10 (0 - 210)	5 (0 - 106)
Los Angeles	58 (1 - 1948)	53 (1 - 1878)	43 (0 - 1738)	26 (0 - 1340)	24 (0 - 1290)	21 (0 - 1192)	15 (0 - 962)	5 (0 - 479)

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	38 (1 - 1521)	33 (0 - 1461)	28 (0 - 1397)	16 (0 - 1202)	17 (0 - 1225)	15 (0 - 1183)	12 (0 - 1112)	6 (0 - 910)
Philadelphia	23 (1 - 581)	19 (0 - 548)	17 (0 - 533)	12 (0 - 475)	11 (0 - 465)	9 (0 - 443)	8 (0 - 422)	4 (0 - 359)
Sacramento	5 (0 - 166)	5 (0 - 158)	4 (0 - 149)	3 (0 - 130)	3 (0 - 124)	2 (0 - 119)	2 (0 - 108)	1 (0 - 83)
St. Louis	10 (0 - 267)	8 (0 - 251)	7 (0 - 241)	5 (0 - 212)	4 (0 - 205)	4 (0 - 193)	3 (0 - 181)	2 (0 - 148)
Washington, DC	29 (1 - 711)	23 (1 - 659)	23 (1 - 654)	17 (0 - 598)	14 (0 - 571)	11 (0 - 533)	10 (0 - 519)	6 (0 - 440)
	Response = Decrease in FEV1 Greater Than or Equal to 20%							
Atlanta	2 (0 - 244)	2 (0 - 240)	2 (0 - 218)	1 (0 - 194)	1 (0 - 182)	1 (0 - 180)	0 (0 - 160)	0 (0 - 131)
Boston	1 (0 - 149)	1 (0 - 135)	1 (0 - 134)	0 (0 - 128)	0 (0 - 111)	0 (0 - 103)	0 (0 - 98)	0 (0 - 79)
Chicago	0 (0 - 235)	0 (0 - 219)	0 (0 - 206)	0 (0 - 185)	0 (0 - 167)	0 (0 - 156)	0 (0 - 142)	0 (0 - 109)
Cleveland	0 (0 - 84)	0 (0 - 78)	0 (0 - 75)	0 (0 - 65)	0 (0 - 62)	0 (0 - 58)	0 (0 - 54)	0 (0 - 43)
Detroit	1 (0 - 160)	0 (0 - 147)	0 (0 - 143)	0 (0 - 138)	0 (0 - 118)	0 (0 - 109)	0 (0 - 103)	0 (0 - 81)
Houston	3 (0 - 202)	2 (0 - 185)	2 (0 - 178)	1 (0 - 150)	1 (0 - 145)	1 (0 - 133)	0 (0 - 122)	0 (0 - 80)
Los Angeles	2 (0 - 826)	2 (0 - 791)	1 (0 - 723)	0 (0 - 545)	0 (0 - 524)	0 (0 - 483)	0 (0 - 390)	0 (0 - 213)
New York	2 (0 - 583)	1 (0 - 553)	1 (0 - 520)	0 (0 - 424)	0 (0 - 435)	0 (0 - 415)	0 (0 - 382)	0 (0 - 296)
Philadelphia	2 (0 - 244)	1 (0 - 227)	1 (0 - 219)	0 (0 - 188)	0 (0 - 183)	0 (0 - 172)	0 (0 - 161)	0 (0 - 130)
Sacramento	0 (0 - 70)	0 (0 - 66)	0 (0 - 61)	0 (0 - 51)	0 (0 - 49)	0 (0 - 46)	0 (0 - 41)	0 (0 - 30)
St. Louis	1 (0 - 111)	0 (0 - 103)	0 (0 - 98)	0 (0 - 83)	0 (0 - 80)	0 (0 - 74)	0 (0 - 68)	0 (0 - 53)
Washington, DC	3 (0 - 288)	2 (0 - 261)	2 (0 - 258)	1 (0 - 229)	1 (0 - 215)	0 (0 - 196)	0 (0 - 190)	0 (0 - 152)

*Numbers are median (0.5 fractile) numbers of occurrences. Numbers in parentheses below the median are 95% confidence 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.

***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.

Table 3-20. 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 Active 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 FEV1 Greater Than or Equal to 10%							
Atlanta	404 (55 - 1203)	399 (53 - 1192)	362 (44 - 1116)	327 (35 - 1037)	306 (31 - 992)	305 (31 - 989)	271 (24 - 909)	224 (16 - 792)
Boston	378 (57 - 1146)	344 (47 - 1079)	340 (46 - 1072)	326 (42 - 1044)	289 (32 - 966)	268 (27 - 921)	258 (24 - 899)	215 (16 - 798)
Chicago	662 (97 - 1881)	623 (85 - 1802)	592 (77 - 1742)	542 (64 - 1638)	498 (53 - 1545)	474 (48 - 1493)	441 (41 - 1418)	361 (26 - 1234)
Cleveland	254 (42 - 712)	233 (35 - 673)	228 (33 - 664)	200 (25 - 609)	193 (24 - 595)	178 (20 - 565)	171 (18 - 550)	142 (12 - 486)
Detroit	433 (69 - 1227)	396 (57 - 1155)	387 (55 - 1140)	378 (52 - 1121)	325 (38 - 1014)	298 (31 - 959)	287 (29 - 934)	235 (18 - 819)
Houston	227 (28 - 475)	207 (23 - 423)	199 (22 - 402)	165 (16 - 310)	158 (15 - 291)	145 (13 - 252)	130 (11 - 201)	79 (6 - 3)
Los Angeles	997 (70 - 3105)	966 (67 - 3020)	856 (54 - 2685)	609 (32 - 1862)	601 (31 - 1830)	571 (29 - 1721)	436 (20 - 1207)	218 (9 - 281)
New York	1587 (212 - 4682)	1506 (189 - 4524)	1435 (170 - 4384)	1197 (114 - 3888)	1228 (120 - 3957)	1173 (108 - 3839)	1099 (93 - 3677)	894 (59 - 3183)
Philadelphia	641 (108 - 1710)	596 (93 - 1627)	580 (87 - 1598)	511 (67 - 1469)	494 (62 - 1437)	463 (54 - 1376)	443 (49 - 1334)	371 (32 - 1184)
Sacramento	140 (15 - 436)	132 (13 - 418)	125 (12 - 401)	108 (9 - 361)	104 (8 - 351)	99 (8 - 338)	91 (6 - 318)	73 (4 - 268)
St. Louis	282 (50 - 744)	263 (44 - 709)	252 (40 - 688)	222 (31 - 630)	210 (28 - 607)	198 (25 - 581)	185 (22 - 555)	151 (14 - 480)
Washington, DC	712 (110 - 2044)	646 (90 - 1917)	641 (89 - 1909)	578 (72 - 1781)	546 (63 - 1715)	501 (53 - 1621)	487 (49 - 1592)	406 (33 - 1409)
	Response = Decrease in FEV1 Greater Than or Equal to 15%							
Atlanta	51 (4 - 647)	49 (4 - 641)	40 (2 - 596)	32 (1 - 550)	27 (1 - 524)	27 (1 - 522)	20 (0 - 477)	13 (0 - 411)
Boston	55 (7 - 614)	44 (5 - 572)	43 (5 - 569)	39 (4 - 551)	29 (2 - 505)	24 (1 - 478)	21 (1 - 465)	13 (0 - 407)
Chicago	92 (8 - 1033)	80 (6 - 985)	71 (5 - 949)	58 (3 - 887)	48 (2 - 832)	42 (2 - 801)	35 (1 - 758)	21 (0 - 652)
Cleveland	40 (5 - 391)	33 (3 - 366)	32 (3 - 360)	23 (2 - 327)	22 (1 - 318)	18 (1 - 300)	16 (1 - 291)	10 (0 - 254)
Detroit	66 (6 - 670)	54 (4 - 626)	52 (4 - 616)	49 (3 - 605)	34 (2 - 540)	28 (1 - 508)	25 (1 - 493)	15 (0 - 427)
Houston	25 (1 - 307)	21 (1 - 278)	19 (1 - 267)	14 (0 - 217)	13 (0 - 207)	11 (0 - 187)	9 (0 - 161)	5 (0 - 65)
Los Angeles	57 (1 - 1718)	54 (1 - 1671)	43 (1 - 1494)	24 (0 - 1068)	24 (0 - 1052)	22 (0 - 997)	15 (0 - 741)	6 (0 - 292)

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	197 (15 - 2539)	174 (11 - 2442)	155 (9 - 2357)	99 (3 - 2063)	106 (4 - 2103)	94 (3 - 2034)	79 (2 - 1940)	47 (1 - 1661)
Philadelphia	104 (12 - 957)	88 (8 - 905)	83 (7 - 887)	61 (4 - 807)	57 (3 - 787)	49 (2 - 750)	44 (2 - 725)	28 (1 - 636)
Sacramento	14 (1 - 232)	12 (0 - 221)	10 (0 - 212)	8 (0 - 189)	7 (0 - 184)	6 (0 - 176)	5 (0 - 166)	3 (0 - 138)
St. Louis	49 (6 - 416)	42 (5 - 394)	39 (4 - 380)	29 (2 - 345)	26 (2 - 331)	23 (1 - 316)	20 (1 - 300)	12 (0 - 256)
Washington, DC	105 (11 - 1109)	84 (7 - 1030)	83 (7 - 1025)	66 (4 - 949)	57 (3 - 909)	47 (2 - 854)	43 (2 - 836)	28 (1 - 731)
	Response = Decrease in FEV1 Greater Than or Equal to 20%							
Atlanta	8 (0 - 293)	7 (0 - 290)	5 (0 - 264)	3 (0 - 239)	3 (0 - 225)	3 (0 - 224)	1 (0 - 199)	1 (0 - 165)
Boston	11 (1 - 272)	8 (1 - 248)	8 (1 - 246)	7 (0 - 236)	4 (0 - 210)	3 (0 - 195)	2 (0 - 188)	1 (0 - 157)
Chicago	15 (1 - 480)	12 (0 - 452)	10 (0 - 431)	7 (0 - 396)	5 (0 - 365)	4 (0 - 348)	3 (0 - 324)	1 (0 - 266)
Cleveland	8 (0 - 183)	6 (0 - 168)	5 (0 - 165)	3 (0 - 145)	3 (0 - 140)	2 (0 - 130)	2 (0 - 125)	1 (0 - 104)
Detroit	12 (0 - 312)	9 (0 - 286)	8 (0 - 280)	7 (0 - 273)	4 (0 - 236)	3 (0 - 218)	2 (0 - 210)	1 (0 - 173)
Houston	3 (0 - 172)	2 (0 - 158)	2 (0 - 152)	1 (0 - 128)	1 (0 - 123)	1 (0 - 114)	0 (0 - 102)	0 (0 - 65)
Los Angeles	3 (0 - 745)	3 (0 - 722)	2 (0 - 641)	1 (0 - 458)	1 (0 - 452)	1 (0 - 430)	0 (0 - 331)	0 (0 - 172)
New York	29 (1 - 1154)	24 (1 - 1097)	19 (0 - 1047)	9 (0 - 878)	10 (0 - 900)	8 (0 - 861)	6 (0 - 808)	2 (0 - 659)
Philadelphia	20 (1 - 463)	15 (1 - 432)	14 (1 - 421)	8 (0 - 373)	7 (0 - 361)	6 (0 - 340)	5 (0 - 325)	2 (0 - 274)
Sacramento	1 (0 - 103)	1 (0 - 97)	1 (0 - 92)	1 (0 - 80)	0 (0 - 77)	0 (0 - 73)	0 (0 - 68)	0 (0 - 54)
St. Louis	10 (1 - 203)	8 (0 - 190)	7 (0 - 182)	4 (0 - 161)	4 (0 - 153)	3 (0 - 145)	2 (0 - 136)	1 (0 - 111)
Washington, DC	19 (1 - 515)	13 (1 - 468)	13 (1 - 465)	9 (0 - 421)	7 (0 - 398)	5 (0 - 367)	4 (0 - 357)	2 (0 - 299)

*Numbers are median (0.5 fractile) numbers of occurrences. Numbers in parentheses below the median are 95% confidence 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.

***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.

Table 3-21. Estimated Percent 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 Active Children (Ages 5-18) Engaged in Moderate Exertion, for Location-Specific O_3 Seasons: Based on Adjusting 2004 O_3 Concentrations*

Location	Percent of Occurrences 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 FEV1 Greater Than or Equal to 10%							
Atlanta	0.8% (0.1% - 2.9%)	0.8% (0.1% - 2.8%)	0.7% (0.1% - 2.7%)	0.7% (0% - 2.5%)	0.6% (0% - 2.3%)	0.6% (0% - 2.3%)	0.6% (0% - 2.1%)	0.5% (0% - 1.9%)
Boston	0.7% (0% - 2.6%)	0.6% (0% - 2.4%)	0.6% (0% - 2.4%)	0.6% (0% - 2.3%)	0.5% (0% - 2.1%)	0.5% (0% - 2%)	0.5% (0% - 1.9%)	0.4% (0% - 1.7%)
Chicago	0.6% (0% - 2.1%)	0.5% (0% - 2%)	0.5% (0% - 1.9%)	0.5% (0% - 1.8%)	0.4% (0% - 1.7%)	0.4% (0% - 1.6%)	0.4% (0% - 1.5%)	0.3% (0% - 1.2%)
Cleveland	0.6% (0% - 2.3%)	0.6% (0% - 2.2%)	0.6% (0% - 2.1%)	0.5% (0% - 1.9%)	0.5% (0% - 1.8%)	0.4% (0% - 1.7%)	0.4% (0% - 1.7%)	0.3% (0% - 1.4%)
Detroit	0.7% (0% - 2.5%)	0.6% (0% - 2.4%)	0.6% (0% - 2.3%)	0.6% (0% - 2.3%)	0.5% (0% - 2%)	0.5% (0% - 1.9%)	0.4% (0% - 1.8%)	0.4% (0% - 1.6%)
Houston	0.4% (0% - 1%)	0.4% (0% - 0.9%)	0.4% (0% - 0.8%)	0.3% (0% - 0.7%)	0.3% (0% - 0.6%)	0.3% (0% - 0.6%)	0.3% (0% - 0.5%)	0.2% (0% - 0.1%)
Los Angeles	0.5% (0% - 1.7%)	0.5% (0% - 1.6%)	0.5% (0% - 1.5%)	0.3% (0% - 1.2%)	0.3% (0% - 1.1%)	0.3% (0% - 1%)	0.2% (0% - 0.8%)	0.1% (0% - 0.3%)
New York	0.7% (0% - 2.5%)	0.6% (0% - 2.4%)	0.6% (0% - 2.3%)	0.5% (0% - 2%)	0.5% (0% - 2%)	0.5% (0% - 2%)	0.4% (0% - 1.9%)	0.3% (0% - 1.5%)
Philadelphia	0.8% (0.1% - 2.8%)	0.8% (0.1% - 2.6%)	0.8% (0.1% - 2.6%)	0.6% (0% - 2.3%)	0.6% (0% - 2.2%)	0.6% (0% - 2.1%)	0.6% (0% - 2%)	0.5% (0% - 1.8%)
Sacramento	0.5% (0% - 1.8%)	0.5% (0% - 1.7%)	0.5% (0% - 1.6%)	0.4% (0% - 1.4%)	0.4% (0% - 1.4%)	0.4% (0% - 1.3%)	0.3% (0% - 1.2%)	0.2% (0% - 0.9%)
St. Louis	0.7% (0.1% - 2.4%)	0.7% (0% - 2.3%)	0.6% (0% - 2.2%)	0.5% (0% - 2%)	0.5% (0% - 1.9%)	0.5% (0% - 1.8%)	0.4% (0% - 1.7%)	0.3% (0% - 1.4%)
Washington, DC	0.8% (0.1% - 2.7%)	0.7% (0.1% - 2.5%)	0.7% (0.1% - 2.5%)	0.6% (0% - 2.3%)	0.6% (0% - 2.2%)	0.5% (0% - 2.1%)	0.5% (0% - 2%)	0.4% (0% - 1.7%)
	Response = Decrease in FEV1 Greater Than or Equal to 15%							
Atlanta	0.1% (0% - 1.5%)	0.1% (0% - 1.5%)	0.1% (0% - 1.4%)	0% (0% - 1.3%)	0% (0% - 1.2%)	0% (0% - 1.2%)	0% (0% - 1.1%)	0% (0% - 0.9%)
Boston	0% (0% - 1.3%)	0% (0% - 1.2%)	0% (0% - 1.2%)	0% (0% - 1.2%)	0% (0% - 1.1%)	0% (0% - 1%)	0% (0% - 1%)	0% (0% - 0.8%)
Chicago	0% (0% - 1.1%)	0% (0% - 1.1%)	0% (0% - 1%)	0% (0% - 0.9%)	0% (0% - 0.9%)	0% (0% - 0.8%)	0% (0% - 0.7%)	0% (0% - 0.6%)
Cleveland	0% (0% - 1.2%)	0% (0% - 1.1%)	0% (0% - 1.1%)	0% (0% - 1%)	0% (0% - 0.9%)	0% (0% - 0.9%)	0% (0% - 0.8%)	0% (0% - 0.7%)
Detroit	0% (0% - 1.3%)	0% (0% - 1.2%)	0% (0% - 1.2%)	0% (0% - 1.2%)	0% (0% - 1%)	0% (0% - 1%)	0% (0% - 0.9%)	0% (0% - 0.8%)
Houston	0% (0% - 0.6%)	0% (0% - 0.6%)	0% (0% - 0.5%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.3%)	0% (0% - 0.2%)
Los Angeles	0% (0% - 0.9%)	0% (0% - 0.9%)	0% (0% - 0.8%)	0% (0% - 0.6%)	0% (0% - 0.6%)	0% (0% - 0.6%)	0% (0% - 0.5%)	0% (0% - 0.2%)

Location	Percent of Occurrences 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	0% (0% - 1.3%)	0% (0% - 1.2%)	0% (0% - 1.2%)	0% (0% - 1%)	0% (0% - 1%)	0% (0% - 1%)	0% (0% - 0.9%)	0% (0% - 0.8%)
Philadelphia	0.1% (0% - 1.5%)	0% (0% - 1.4%)	0% (0% - 1.4%)	0% (0% - 1.2%)	0% (0% - 1.2%)	0% (0% - 1.1%)	0% (0% - 1.1%)	0% (0% - 0.9%)
Sacramento	0% (0% - 0.9%)	0% (0% - 0.9%)	0% (0% - 0.8%)	0% (0% - 0.7%)	0% (0% - 0.7%)	0% (0% - 0.7%)	0% (0% - 0.6%)	0% (0% - 0.5%)
St. Louis	0% (0% - 1.3%)	0% (0% - 1.2%)	0% (0% - 1.2%)	0% (0% - 1%)	0% (0% - 1%)	0% (0% - 0.9%)	0% (0% - 0.9%)	0% (0% - 0.7%)
Washington, DC	0.1% (0% - 1.4%)	0% (0% - 1.3%)	0% (0% - 1.3%)	0% (0% - 1.2%)	0% (0% - 1.1%)	0% (0% - 1%)	0% (0% - 1%)	0% (0% - 0.9%)
	Response = Decrease in FEV1 Greater Than or Equal to 20%							
Atlanta	0% (0% - 0.6%)	0% (0% - 0.6%)	0% (0% - 0.5%)	0% (0% - 0.5%)	0% (0% - 0.5%)	0% (0% - 0.5%)	0% (0% - 0.4%)	0% (0% - 0.3%)
Boston	0% (0% - 0.5%)	0% (0% - 0.5%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.3%)
Chicago	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.2%)
Cleveland	0% (0% - 0.5%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.2%)
Detroit	0% (0% - 0.5%)	0% (0% - 0.5%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.3%)
Houston	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.2%)	0% (0% - 0.2%)	0% (0% - 0.2%)	0% (0% - 0.2%)	0% (0% - 0.1%)
Los Angeles	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.2%)	0% (0% - 0.2%)	0% (0% - 0.2%)	0% (0% - 0.1%)
New York	0% (0% - 0.5%)	0% (0% - 0.5%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.3%)	0% (0% - 0.2%)
Philadelphia	0% (0% - 0.6%)	0% (0% - 0.6%)	0% (0% - 0.6%)	0% (0% - 0.5%)	0% (0% - 0.5%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.3%)
Sacramento	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.2%)	0% (0% - 0.2%)
St. Louis	0% (0% - 0.5%)	0% (0% - 0.5%)	0% (0% - 0.5%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.3%)	0% (0% - 0.3%)
Washington, DC	0% (0% - 0.6%)	0% (0% - 0.5%)	0% (0% - 0.5%)	0% (0% - 0.5%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.3%)

*Numbers are median (0.5 fractile) percents of occurrences. Numbers in parentheses below the median are 95% confidence 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.

***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.

Table 3-22. Estimated Percent 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 Active Children (Ages 5-18) Engaged in Moderate Exertion, for Location-Specific O_3 Seasons: Based on Adjusting 2002 O_3 Concentrations*

Location	Percent of Occurrences 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 FEV1 Greater Than or Equal to 10%							
Atlanta	1% (0.1% - 3%)	1% (0.1% - 3%)	0.9% (0.1% - 2.8%)	0.8% (0.1% - 2.6%)	0.8% (0.1% - 2.5%)	0.8% (0.1% - 2.5%)	0.7% (0.1% - 2.3%)	0.6% (0% - 2%)
Boston	1.3% (0.2% - 3.9%)	1.2% (0.2% - 3.6%)	1.1% (0.2% - 3.6%)	1.1% (0.1% - 3.5%)	1% (0.1% - 3.3%)	0.9% (0.1% - 3.1%)	0.9% (0.1% - 3%)	0.7% (0.1% - 2.7%)
Chicago	1.2% (0.2% - 3.5%)	1.2% (0.2% - 3.4%)	1.1% (0.1% - 3.3%)	1% (0.1% - 3.1%)	0.9% (0.1% - 2.9%)	0.9% (0.1% - 2.8%)	0.8% (0.1% - 2.7%)	0.7% (0% - 2.3%)
Cleveland	1.5% (0.2% - 4.1%)	1.3% (0.2% - 3.9%)	1.3% (0.2% - 3.8%)	1.2% (0.1% - 3.5%)	1.1% (0.1% - 3.4%)	1% (0.1% - 3.3%)	1% (0.1% - 3.2%)	0.8% (0.1% - 2.8%)
Detroit	1.4% (0.2% - 4.1%)	1.3% (0.2% - 3.8%)	1.3% (0.2% - 3.8%)	1.3% (0.2% - 3.7%)	1.1% (0.1% - 3.4%)	1% (0.1% - 3.2%)	0.9% (0.1% - 3.1%)	0.8% (0.1% - 2.7%)
Houston	0.4% (0% - 0.8%)	0.3% (0% - 0.7%)	0.3% (0% - 0.7%)	0.3% (0% - 0.5%)	0.3% (0% - 0.5%)	0.2% (0% - 0.4%)	0.2% (0% - 0.3%)	0.1% (0% - 0%)
Los Angeles	0.5% (0% - 1.4%)	0.4% (0% - 1.4%)	0.4% (0% - 1.2%)	0.3% (0% - 0.9%)	0.3% (0% - 0.8%)	0.3% (0% - 0.8%)	0.2% (0% - 0.6%)	0.1% (0% - 0.1%)
New York	1.4% (0.2% - 4%)	1.3% (0.2% - 3.9%)	1.2% (0.1% - 3.7%)	1% (0.1% - 3.3%)	1% (0.1% - 3.4%)	1% (0.1% - 3.3%)	0.9% (0.1% - 3.1%)	0.8% (0.1% - 2.7%)
Philadelphia	1.6% (0.3% - 4.3%)	1.5% (0.2% - 4.1%)	1.5% (0.2% - 4%)	1.3% (0.2% - 3.7%)	1.2% (0.2% - 3.6%)	1.2% (0.1% - 3.5%)	1.1% (0.1% - 3.4%)	0.9% (0.1% - 3%)
Sacramento	0.8% (0.1% - 2.5%)	0.8% (0.1% - 2.4%)	0.7% (0.1% - 2.3%)	0.6% (0.1% - 2.1%)	0.6% (0% - 2%)	0.6% (0% - 1.9%)	0.5% (0% - 1.8%)	0.4% (0% - 1.5%)
St. Louis	1.4% (0.3% - 3.8%)	1.3% (0.2% - 3.6%)	1.3% (0.2% - 3.5%)	1.1% (0.2% - 3.2%)	1.1% (0.1% - 3.1%)	1% (0.1% - 3%)	0.9% (0.1% - 2.8%)	0.8% (0.1% - 2.5%)
Washington, DC	1.4% (0.2% - 4%)	1.3% (0.2% - 3.8%)	1.3% (0.2% - 3.8%)	1.1% (0.1% - 3.5%)	1.1% (0.1% - 3.4%)	1% (0.1% - 3.2%)	1% (0.1% - 3.1%)	0.8% (0.1% - 2.8%)
	Response = Decrease in FEV1 Greater Than or Equal to 15%							
Atlanta	0.1% (0% - 1.6%)	0.1% (0% - 1.6%)	0.1% (0% - 1.5%)	0.1% (0% - 1.4%)	0.1% (0% - 1.3%)	0.1% (0% - 1.3%)	0.1% (0% - 1.2%)	0% (0% - 1%)
Boston	0.2% (0% - 2.1%)	0.1% (0% - 1.9%)	0.1% (0% - 1.9%)	0.1% (0% - 1.9%)	0.1% (0% - 1.7%)	0.1% (0% - 1.6%)	0.1% (0% - 1.6%)	0% (0% - 1.4%)
Chicago	0.2% (0% - 2%)	0.2% (0% - 1.9%)	0.1% (0% - 1.8%)	0.1% (0% - 1.7%)	0.1% (0% - 1.6%)	0.1% (0% - 1.5%)	0.1% (0% - 1.4%)	0% (0% - 1.2%)
Cleveland	0.2% (0% - 2.3%)	0.2% (0% - 2.1%)	0.2% (0% - 2.1%)	0.1% (0% - 1.9%)	0.1% (0% - 1.8%)	0.1% (0% - 1.7%)	0.1% (0% - 1.7%)	0.1% (0% - 1.5%)
Detroit	0.2% (0% - 2.2%)	0.2% (0% - 2.1%)	0.2% (0% - 2%)	0.2% (0% - 2%)	0.1% (0% - 1.8%)	0.1% (0% - 1.7%)	0.1% (0% - 1.6%)	0.1% (0% - 1.4%)
Houston	0% (0% - 0.5%)	0% (0% - 0.5%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.1%)
Los Angeles	0% (0% - 0.8%)	0% (0% - 0.8%)	0% (0% - 0.7%)	0% (0% - 0.5%)	0% (0% - 0.5%)	0% (0% - 0.5%)	0% (0% - 0.3%)	0% (0% - 0.1%)

Location	Percent of Occurrences 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	0.2% (0% - 2.2%)	0.1% (0% - 2.1%)	0.1% (0% - 2%)	0.1% (0% - 1.8%)	0.1% (0% - 1.8%)	0.1% (0% - 1.7%)	0.1% (0% - 1.7%)	0% (0% - 1.4%)
Philadelphia	0.3% (0% - 2.4%)	0.2% (0% - 2.3%)	0.2% (0% - 2.2%)	0.2% (0% - 2%)	0.1% (0% - 2%)	0.1% (0% - 1.9%)	0.1% (0% - 1.8%)	0.1% (0% - 1.6%)
Sacramento	0.1% (0% - 1.3%)	0.1% (0% - 1.3%)	0.1% (0% - 1.2%)	0% (0% - 1.1%)	0% (0% - 1.1%)	0% (0% - 1%)	0% (0% - 1%)	0% (0% - 0.8%)
St. Louis	0.3% (0% - 2.1%)	0.2% (0% - 2%)	0.2% (0% - 1.9%)	0.1% (0% - 1.8%)	0.1% (0% - 1.7%)	0.1% (0% - 1.6%)	0.1% (0% - 1.5%)	0.1% (0% - 1.3%)
Washington, DC	0.2% (0% - 2.2%)	0.2% (0% - 2%)	0.2% (0% - 2%)	0.1% (0% - 1.9%)	0.1% (0% - 1.8%)	0.1% (0% - 1.7%)	0.1% (0% - 1.6%)	0.1% (0% - 1.4%)
	Response = Decrease in FEV1 Greater Than or Equal to 20%							
Atlanta	0% (0% - 0.7%)	0% (0% - 0.7%)	0% (0% - 0.7%)	0% (0% - 0.6%)	0% (0% - 0.6%)	0% (0% - 0.6%)	0% (0% - 0.5%)	0% (0% - 0.4%)
Boston	0% (0% - 0.9%)	0% (0% - 0.8%)	0% (0% - 0.8%)	0% (0% - 0.8%)	0% (0% - 0.7%)	0% (0% - 0.7%)	0% (0% - 0.6%)	0% (0% - 0.5%)
Chicago	0% (0% - 0.9%)	0% (0% - 0.9%)	0% (0% - 0.8%)	0% (0% - 0.7%)	0% (0% - 0.7%)	0% (0% - 0.7%)	0% (0% - 0.6%)	0% (0% - 0.5%)
Cleveland	0% (0% - 1.1%)	0% (0% - 1%)	0% (0% - 1%)	0% (0% - 0.8%)	0% (0% - 0.8%)	0% (0% - 0.8%)	0% (0% - 0.7%)	0% (0% - 0.6%)
Detroit	0% (0% - 1%)	0% (0% - 0.9%)	0% (0% - 0.9%)	0% (0% - 0.9%)	0% (0% - 0.8%)	0% (0% - 0.7%)	0% (0% - 0.7%)	0% (0% - 0.6%)
Houston	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.2%)	0% (0% - 0.2%)	0% (0% - 0.2%)	0% (0% - 0.2%)	0% (0% - 0.1%)
Los Angeles	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.3%)	0% (0% - 0.2%)	0% (0% - 0.2%)	0% (0% - 0.2%)	0% (0% - 0.2%)	0% (0% - 0.1%)
New York	0% (0% - 1%)	0% (0% - 0.9%)	0% (0% - 0.9%)	0% (0% - 0.7%)	0% (0% - 0.8%)	0% (0% - 0.7%)	0% (0% - 0.7%)	0% (0% - 0.6%)
Philadelphia	0.1% (0% - 1.2%)	0% (0% - 1.1%)	0% (0% - 1.1%)	0% (0% - 0.9%)	0% (0% - 0.9%)	0% (0% - 0.9%)	0% (0% - 0.8%)	0% (0% - 0.7%)
Sacramento	0% (0% - 0.6%)	0% (0% - 0.6%)	0% (0% - 0.5%)	0% (0% - 0.5%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.4%)	0% (0% - 0.3%)
St. Louis	0.1% (0% - 1%)	0% (0% - 1%)	0% (0% - 0.9%)	0% (0% - 0.8%)	0% (0% - 0.8%)	0% (0% - 0.7%)	0% (0% - 0.7%)	0% (0% - 0.6%)
Washington, DC	0% (0% - 1%)	0% (0% - 0.9%)	0% (0% - 0.9%)	0% (0% - 0.8%)	0% (0% - 0.8%)	0% (0% - 0.7%)	0% (0% - 0.7%)	0% (0% - 0.6%)

*Numbers are median (0.5 fractile) percents of occurrences. Numbers in parentheses below the median are 95% confidence 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.

***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.

Table 3-23. Number of Active 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 2004 O_3 Concentrations*

Location	Number of Active 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 FEV1 Greater Than or Equal to 10%							
Atlanta	32 (9 - 57)	32 (9 - 56)	28 (7 - 51)	24 (5 - 45)	23 (5 - 43)	22 (5 - 42)	19 (4 - 37)	15 (2 - 31)
Boston	24 (5 - 46)	21 (4 - 42)	21 (4 - 41)	20 (4 - 39)	17 (3 - 34)	15 (2 - 32)	14 (2 - 30)	11 (1 - 24)
Chicago	33 (5 - 65)	30 (5 - 61)	28 (4 - 58)	25 (3 - 53)	23 (3 - 48)	21 (2 - 46)	19 (2 - 42)	14 (1 - 32)
Cleveland	11 (2 - 22)	10 (2 - 20)	10 (2 - 20)	8 (1 - 17)	8 (1 - 16)	7 (1 - 15)	7 (1 - 15)	5 (1 - 12)
Detroit	24 (5 - 46)	22 (4 - 43)	21 (4 - 41)	20 (4 - 40)	17 (3 - 34)	15 (2 - 32)	14 (2 - 30)	11 (1 - 24)
Houston	34 (10 - 58)	31 (8 - 54)	29 (8 - 52)	25 (6 - 45)	24 (5 - 43)	22 (5 - 40)	20 (4 - 38)	15 (2 - 30)
Los Angeles	62 (15 - 110)	58 (14 - 104)	51 (11 - 93)	38 (7 - 71)	37 (7 - 69)	34 (6 - 65)	29 (5 - 55)	14 (2 - 28)
New York	82 (16 - 160)	76 (14 - 151)	71 (12 - 142)	55 (7 - 116)	56 (8 - 119)	53 (7 - 113)	49 (6 - 105)	37 (3 - 84)
Philadelphia	32 (8 - 58)	29 (6 - 54)	28 (6 - 52)	23 (4 - 45)	22 (4 - 44)	20 (3 - 41)	19 (3 - 38)	15 (2 - 32)
Sacramento	6 (2 - 10)	6 (1 - 10)	5 (1 - 9)	4 (1 - 7)	4 (1 - 7)	4 (1 - 7)	3 (1 - 6)	2 (0 - 4)
St. Louis	15 (3 - 28)	14 (3 - 26)	13 (3 - 25)	11 (2 - 22)	10 (2 - 21)	10 (1 - 19)	9 (1 - 18)	7 (1 - 15)
Washington, DC	44 (12 - 79)	39 (9 - 72)	39 (9 - 71)	33 (7 - 62)	31 (6 - 59)	28 (5 - 55)	26 (5 - 53)	20 (3 - 42)
	Response = Decrease in FEV1 Greater Than or Equal to 15%							
Atlanta	9 (1 - 35)	9 (1 - 35)	7 (0 - 31)	5 (0 - 27)	5 (0 - 26)	4 (0 - 25)	3 (0 - 22)	2 (0 - 18)
Boston	5 (0 - 28)	4 (0 - 25)	4 (0 - 25)	4 (0 - 24)	2 (0 - 20)	2 (0 - 19)	2 (0 - 18)	1 (0 - 14)
Chicago	5 (0 - 39)	4 (0 - 36)	4 (0 - 34)	3 (0 - 31)	2 (0 - 28)	2 (0 - 27)	2 (0 - 24)	1 (0 - 19)
Cleveland	2 (0 - 13)	2 (0 - 12)	2 (0 - 12)	1 (0 - 10)	1 (0 - 10)	1 (0 - 9)	1 (0 - 9)	0 (0 - 7)
Detroit	5 (0 - 28)	4 (0 - 25)	4 (0 - 25)	3 (0 - 24)	2 (0 - 20)	2 (0 - 19)	2 (0 - 18)	1 (0 - 14)
Houston	10 (1 - 37)	8 (1 - 33)	8 (1 - 32)	5 (0 - 27)	5 (0 - 26)	4 (0 - 24)	4 (0 - 23)	2 (0 - 18)
Los Angeles	14 (0 - 67)	13 (0 - 63)	10 (0 - 56)	6 (0 - 42)	6 (0 - 41)	6 (0 - 39)	4 (0 - 32)	2 (0 - 17)

Location	Number of Active 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	15 (0 - 96)	13 (0 - 90)	11 (0 - 85)	6 (0 - 68)	7 (0 - 70)	6 (0 - 67)	5 (0 - 62)	3 (0 - 49)
Philadelphia	7 (0 - 35)	6 (0 - 33)	6 (0 - 32)	4 (0 - 27)	4 (0 - 26)	3 (0 - 24)	3 (0 - 23)	2 (0 - 19)
Sacramento	1 (0 - 6)	1 (0 - 6)	1 (0 - 5)	1 (0 - 4)	1 (0 - 4)	1 (0 - 4)	0 (0 - 3)	0 (0 - 2)
St. Louis	3 (0 - 17)	3 (0 - 16)	2 (0 - 15)	2 (0 - 13)	2 (0 - 12)	1 (0 - 11)	1 (0 - 11)	1 (0 - 9)
Washington, DC	11 (1 - 49)	9 (1 - 44)	9 (1 - 43)	6 (0 - 38)	6 (0 - 35)	5 (0 - 33)	4 (0 - 31)	2 (0 - 25)
	Response = Decrease in FEV1 Greater Than or Equal to 20%							
Atlanta	2 (0 - 23)	2 (0 - 22)	1 (0 - 20)	1 (0 - 18)	0 (0 - 16)	0 (0 - 16)	0 (0 - 14)	0 (0 - 12)
Boston	1 (0 - 17)	0 (0 - 16)	0 (0 - 15)	0 (0 - 15)	0 (0 - 13)	0 (0 - 12)	0 (0 - 11)	0 (0 - 9)
Chicago	0 (0 - 24)	0 (0 - 23)	0 (0 - 22)	0 (0 - 19)	0 (0 - 18)	0 (0 - 17)	0 (0 - 15)	0 (0 - 11)
Cleveland	0 (0 - 8)	0 (0 - 8)	0 (0 - 7)	0 (0 - 6)	0 (0 - 6)	0 (0 - 6)	0 (0 - 5)	0 (0 - 4)
Detroit	1 (0 - 18)	0 (0 - 16)	0 (0 - 16)	0 (0 - 15)	0 (0 - 13)	0 (0 - 12)	0 (0 - 11)	0 (0 - 9)
Houston	2 (0 - 24)	1 (0 - 22)	1 (0 - 21)	1 (0 - 18)	1 (0 - 17)	0 (0 - 16)	0 (0 - 15)	0 (0 - 11)
Los Angeles	1 (0 - 44)	1 (0 - 42)	1 (0 - 37)	0 (0 - 28)	0 (0 - 27)	0 (0 - 26)	0 (0 - 21)	0 (0 - 11)
New York	1 (0 - 60)	1 (0 - 57)	1 (0 - 53)	0 (0 - 42)	0 (0 - 43)	0 (0 - 41)	0 (0 - 38)	0 (0 - 29)
Philadelphia	1 (0 - 23)	1 (0 - 21)	1 (0 - 20)	0 (0 - 17)	0 (0 - 16)	0 (0 - 15)	0 (0 - 14)	0 (0 - 11)
Sacramento	0 (0 - 4)	0 (0 - 4)	0 (0 - 4)	0 (0 - 3)	0 (0 - 3)	0 (0 - 3)	0 (0 - 2)	0 (0 - 2)
St. Louis	0 (0 - 11)	0 (0 - 10)	0 (0 - 10)	0 (0 - 8)	0 (0 - 8)	0 (0 - 7)	0 (0 - 7)	0 (0 - 5)
Washington, DC	2 (0 - 31)	1 (0 - 28)	1 (0 - 28)	1 (0 - 24)	1 (0 - 22)	0 (0 - 21)	0 (0 - 20)	0 (0 - 15)

*Numbers are median (0.5 fractile) numbers of children. Numbers in parentheses below the median are 95% confidence 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.

***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.

Table 3-24. Number of Active 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 Active 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 FEV1 Greater Than or Equal to 10%							
Atlanta	45 (16 - 74)	45 (15 - 73)	40 (13 - 67)	35 (10 - 60)	33 (9 - 57)	32 (9 - 57)	28 (7 - 50)	22 (5 - 42)
Boston	53 (20 - 84)	47 (17 - 76)	46 (16 - 76)	43 (15 - 72)	36 (11 - 63)	33 (9 - 58)	31 (9 - 56)	24 (5 - 46)
Chicago	89 (32 - 145)	83 (28 - 137)	77 (25 - 129)	69 (21 - 118)	63 (18 - 109)	58 (16 - 104)	53 (13 - 97)	41 (8 - 78)
Cleveland	30 (12 - 48)	27 (10 - 44)	26 (9 - 43)	22 (7 - 38)	21 (7 - 36)	19 (5 - 33)	18 (5 - 32)	14 (3 - 27)
Detroit	55 (21 - 89)	50 (17 - 81)	48 (17 - 80)	47 (16 - 78)	39 (11 - 67)	35 (10 - 62)	33 (9 - 59)	26 (6 - 48)
Houston	34 (10 - 57)	30 (8 - 53)	29 (8 - 51)	24 (6 - 44)	23 (5 - 42)	22 (5 - 40)	20 (4 - 37)	14 (2 - 28)
Los Angeles	63 (16 - 110)	61 (15 - 107)	53 (12 - 95)	38 (7 - 70)	37 (7 - 69)	36 (7 - 67)	29 (5 - 55)	15 (2 - 29)
New York	178 (60 - 296)	167 (54 - 280)	156 (48 - 267)	123 (32 - 221)	127 (34 - 227)	120 (31 - 216)	110 (26 - 202)	85 (17 - 165)
Philadelphia	70 (28 - 108)	63 (24 - 101)	61 (23 - 98)	51 (17 - 85)	49 (16 - 82)	45 (14 - 77)	43 (12 - 74)	33 (8 - 61)
Sacramento	11 (4 - 17)	10 (3 - 16)	9 (3 - 15)	8 (2 - 13)	7 (2 - 12)	7 (2 - 12)	6 (2 - 11)	4 (1 - 8)
St. Louis	36 (15 - 55)	33 (13 - 52)	31 (12 - 50)	27 (9 - 44)	25 (8 - 42)	23 (7 - 39)	21 (6 - 37)	17 (4 - 30)
Washington, DC	82 (31 - 130)	72 (25 - 118)	72 (25 - 117)	63 (20 - 106)	58 (18 - 100)	52 (15 - 91)	50 (14 - 88)	40 (9 - 73)
	Response = Decrease in FEV1 Greater Than or Equal to 15%							
Atlanta	16 (3 - 49)	16 (3 - 48)	13 (2 - 43)	10 (1 - 38)	9 (1 - 35)	9 (1 - 35)	7 (0 - 31)	4 (0 - 25)
Boston	21 (5 - 57)	17 (4 - 51)	17 (3 - 50)	15 (3 - 47)	11 (2 - 40)	9 (1 - 37)	9 (1 - 35)	5 (0 - 28)
Chicago	33 (6 - 95)	29 (5 - 89)	25 (3 - 83)	21 (2 - 75)	17 (2 - 68)	15 (1 - 64)	13 (1 - 59)	8 (0 - 47)
Cleveland	12 (3 - 32)	10 (2 - 29)	10 (2 - 28)	7 (1 - 24)	7 (1 - 23)	5 (0 - 21)	5 (0 - 20)	3 (0 - 16)
Detroit	21 (4 - 59)	18 (3 - 53)	17 (3 - 52)	16 (2 - 50)	11 (1 - 42)	9 (1 - 38)	9 (1 - 36)	5 (0 - 29)
Houston	10 (1 - 36)	8 (1 - 33)	8 (1 - 32)	6 (0 - 27)	5 (0 - 26)	5 (0 - 24)	4 (0 - 22)	2 (0 - 17)
Los Angeles	15 (1 - 67)	15 (1 - 65)	12 (0 - 57)	7 (0 - 42)	7 (0 - 41)	6 (0 - 40)	5 (0 - 32)	2 (0 - 17)

Location	Number of Active 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	62 (10 - 192)	55 (8 - 180)	49 (6 - 169)	32 (2 - 136)	34 (3 - 141)	30 (2 - 133)	25 (1 - 123)	15 (0 - 99)
Philadelphia	29 (7 - 74)	25 (5 - 68)	23 (4 - 65)	17 (2 - 55)	16 (2 - 53)	14 (2 - 49)	12 (1 - 46)	8 (0 - 37)
Sacramento	4 (0 - 11)	3 (0 - 10)	3 (0 - 10)	2 (0 - 8)	2 (0 - 8)	2 (0 - 7)	1 (0 - 6)	1 (0 - 5)
St. Louis	15 (4 - 38)	13 (3 - 35)	12 (2 - 33)	9 (1 - 29)	8 (1 - 27)	7 (1 - 25)	6 (1 - 23)	4 (0 - 18)
Washington, DC	33 (7 - 88)	26 (5 - 77)	26 (4 - 77)	21 (3 - 68)	18 (2 - 63)	15 (1 - 57)	14 (1 - 55)	9 (0 - 44)
	Response = Decrease in FEV1 Greater Than or Equal to 20%							
Atlanta	4 (0 - 31)	4 (0 - 31)	3 (0 - 27)	2 (0 - 24)	2 (0 - 23)	2 (0 - 23)	1 (0 - 20)	0 (0 - 16)
Boston	7 (1 - 36)	5 (1 - 32)	5 (1 - 32)	4 (0 - 30)	3 (0 - 25)	2 (0 - 23)	2 (0 - 22)	1 (0 - 17)
Chicago	9 (1 - 61)	8 (0 - 57)	6 (0 - 53)	4 (0 - 48)	3 (0 - 44)	3 (0 - 41)	2 (0 - 38)	1 (0 - 30)
Cleveland	4 (0 - 21)	3 (0 - 18)	3 (0 - 18)	2 (0 - 15)	2 (0 - 15)	1 (0 - 13)	1 (0 - 12)	0 (0 - 10)
Detroit	6 (0 - 38)	5 (0 - 34)	4 (0 - 33)	4 (0 - 32)	2 (0 - 27)	2 (0 - 24)	1 (0 - 23)	1 (0 - 18)
Houston	2 (0 - 23)	2 (0 - 21)	1 (0 - 20)	1 (0 - 17)	1 (0 - 17)	1 (0 - 16)	0 (0 - 14)	0 (0 - 11)
Los Angeles	2 (0 - 45)	2 (0 - 43)	1 (0 - 38)	0 (0 - 28)	0 (0 - 27)	0 (0 - 26)	0 (0 - 21)	0 (0 - 11)
New York	16 (1 - 122)	13 (1 - 115)	11 (0 - 108)	5 (0 - 87)	6 (0 - 89)	5 (0 - 85)	4 (0 - 78)	1 (0 - 62)
Philadelphia	10 (1 - 47)	8 (1 - 43)	7 (1 - 42)	4 (0 - 35)	4 (0 - 34)	3 (0 - 31)	2 (0 - 30)	1 (0 - 24)
Sacramento	1 (0 - 7)	1 (0 - 7)	1 (0 - 6)	0 (0 - 5)	0 (0 - 5)	0 (0 - 5)	0 (0 - 4)	0 (0 - 3)
St. Louis	5 (1 - 24)	4 (0 - 22)	4 (0 - 21)	2 (0 - 18)	2 (0 - 17)	2 (0 - 16)	1 (0 - 15)	1 (0 - 12)
Washington, DC	10 (1 - 56)	7 (0 - 49)	7 (0 - 49)	5 (0 - 43)	4 (0 - 40)	3 (0 - 36)	2 (0 - 35)	1 (0 - 28)

*Numbers are median (0.5 fractile) numbers of children. Numbers in parentheses below the median are 95% confidence 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.

***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.

Table 3-25. Percent of Active 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 2004 O_3 Concentrations*

Location	Percent of Active 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 FEV1 Greater Than or Equal to 10%							
Atlanta	7.2% (2% - 12.7%)	7.1% (1.9% - 12.5%)	6.3% (1.6% - 11.3%)	5.4% (1.2% - 10.1%)	5% (1.1% - 9.5%)	5% (1% - 9.4%)	4.3% (0.8% - 8.3%)	3.4% (0.5% - 6.9%)
Boston	5% (1.1% - 9.5%)	4.5% (0.9% - 8.7%)	4.4% (0.9% - 8.6%)	4.2% (0.8% - 8.2%)	3.5% (0.6% - 7.1%)	3.2% (0.5% - 6.6%)	3% (0.4% - 6.3%)	2.3% (0.2% - 5.1%)
Chicago	3.7% (0.6% - 7.4%)	3.4% (0.5% - 7%)	3.2% (0.5% - 6.6%)	2.8% (0.4% - 6%)	2.6% (0.3% - 5.5%)	2.4% (0.3% - 5.2%)	2.1% (0.2% - 4.7%)	1.6% (0.1% - 3.7%)
Cleveland	4.5% (0.9% - 8.7%)	4.1% (0.7% - 8%)	3.9% (0.7% - 7.8%)	3.2% (0.5% - 6.7%)	3.1% (0.4% - 6.4%)	2.8% (0.4% - 6%)	2.7% (0.3% - 5.7%)	2.1% (0.2% - 4.6%)
Detroit	4.9% (1% - 9.3%)	4.4% (0.8% - 8.5%)	4.2% (0.8% - 8.3%)	4% (0.7% - 8%)	3.3% (0.5% - 6.8%)	3% (0.4% - 6.3%)	2.9% (0.4% - 6.1%)	2.2% (0.2% - 4.8%)
Houston	6.9% (2% - 11.9%)	6.3% (1.7% - 11%)	6% (1.6% - 10.6%)	5% (1.2% - 9.2%)	4.8% (1.1% - 8.9%)	4.4% (0.9% - 8.3%)	4.1% (0.8% - 7.7%)	3.1% (0.5% - 6.1%)
Los Angeles	3.8% (0.9% - 6.8%)	3.6% (0.8% - 6.4%)	3.2% (0.7% - 5.7%)	2.4% (0.4% - 4.4%)	2.3% (0.4% - 4.3%)	2.1% (0.4% - 4%)	1.8% (0.3% - 3.4%)	0.9% (0.1% - 1.7%)
New York	4.5% (0.9% - 8.7%)	4.2% (0.8% - 8.2%)	3.9% (0.7% - 7.8%)	3% (0.4% - 6.3%)	3.1% (0.4% - 6.5%)	2.9% (0.4% - 6.2%)	2.6% (0.3% - 5.7%)	2% (0.2% - 4.6%)
Philadelphia	5.9% (1.4% - 10.9%)	5.4% (1.2% - 10.1%)	5.2% (1.1% - 9.8%)	4.3% (0.8% - 8.4%)	4.2% (0.7% - 8.2%)	3.8% (0.6% - 7.7%)	3.5% (0.5% - 7.1%)	2.8% (0.3% - 5.9%)
Sacramento	4% (1% - 6.9%)	3.7% (0.9% - 6.5%)	3.4% (0.8% - 6%)	2.7% (0.6% - 4.9%)	2.5% (0.5% - 4.6%)	2.3% (0.5% - 4.3%)	2% (0.4% - 3.7%)	1.4% (0.2% - 2.7%)
St. Louis	5.4% (1.2% - 10%)	4.9% (1% - 9.4%)	4.7% (0.9% - 9%)	3.9% (0.7% - 7.7%)	3.7% (0.6% - 7.4%)	3.4% (0.5% - 6.9%)	3.1% (0.4% - 6.5%)	2.5% (0.3% - 5.3%)
Washington, DC	6.4% (1.7% - 11.5%)	5.7% (1.4% - 10.5%)	5.6% (1.3% - 10.4%)	4.8% (1% - 9.1%)	4.5% (0.9% - 8.7%)	4% (0.7% - 8%)	3.9% (0.7% - 7.7%)	2.9% (0.4% - 6.2%)
	Response = Decrease in FEV1 Greater Than or Equal to 15%							
Atlanta	2% (0.2% - 7.9%)	1.9% (0.2% - 7.7%)	1.5% (0.1% - 7%)	1.2% (0.1% - 6.1%)	1% (0% - 5.7%)	1% (0% - 5.7%)	0.7% (0% - 5%)	0.4% (0% - 4.1%)
Boston	1.1% (0.1% - 5.8%)	0.8% (0% - 5.2%)	0.8% (0% - 5.1%)	0.7% (0% - 4.9%)	0.5% (0% - 4.2%)	0.4% (0% - 3.9%)	0.4% (0% - 3.7%)	0.2% (0% - 3%)
Chicago	0.6% (0% - 4.4%)	0.5% (0% - 4.1%)	0.4% (0% - 3.9%)	0.3% (0% - 3.5%)	0.3% (0% - 3.2%)	0.2% (0% - 3.1%)	0.2% (0% - 2.8%)	0.1% (0% - 2.1%)
Cleveland	0.8% (0% - 5.2%)	0.7% (0% - 4.8%)	0.6% (0% - 4.6%)	0.4% (0% - 3.9%)	0.4% (0% - 3.8%)	0.3% (0% - 3.6%)	0.3% (0% - 3.4%)	0.2% (0% - 2.7%)
Detroit	1% (0% - 5.6%)	0.8% (0% - 5.1%)	0.7% (0% - 4.9%)	0.7% (0% - 4.8%)	0.4% (0% - 4%)	0.4% (0% - 3.7%)	0.3% (0% - 3.6%)	0.2% (0% - 2.8%)
Houston	2% (0.2% - 7.5%)	1.7% (0.2% - 6.8%)	1.6% (0.1% - 6.6%)	1.1% (0.1% - 5.6%)	1% (0.1% - 5.4%)	0.9% (0% - 5%)	0.7% (0% - 4.6%)	0.4% (0% - 3.6%)

Location	Percent of Active 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**
Los Angeles	0.9% (0% - 4.1%)	0.8% (0% - 3.9%)	0.6% (0% - 3.5%)	0.4% (0% - 2.6%)	0.4% (0% - 2.5%)	0.3% (0% - 2.4%)	0.3% (0% - 2%)	0.1% (0% - 1%)
New York	0.8% (0% - 5.2%)	0.7% (0% - 4.9%)	0.6% (0% - 4.6%)	0.3% (0% - 3.7%)	0.4% (0% - 3.8%)	0.3% (0% - 3.6%)	0.3% (0% - 3.4%)	0.1% (0% - 2.7%)
Philadelphia	1.4% (0.1% - 6.6%)	1.2% (0% - 6.1%)	1.1% (0% - 5.9%)	0.7% (0% - 5%)	0.7% (0% - 4.9%)	0.6% (0% - 4.5%)	0.5% (0% - 4.2%)	0.3% (0% - 3.5%)
Sacramento	1% (0% - 4.2%)	0.9% (0% - 3.9%)	0.8% (0% - 3.6%)	0.5% (0% - 2.9%)	0.5% (0% - 2.8%)	0.4% (0% - 2.6%)	0.3% (0% - 2.2%)	0.2% (0% - 1.6%)
St. Louis	1.1% (0% - 6.1%)	1% (0% - 5.6%)	0.9% (0% - 5.4%)	0.6% (0% - 4.6%)	0.5% (0% - 4.4%)	0.5% (0% - 4.1%)	0.4% (0% - 3.8%)	0.2% (0% - 3.1%)
Washington, DC	1.7% (0.1% - 7.1%)	1.3% (0.1% - 6.4%)	1.3% (0.1% - 6.3%)	0.9% (0% - 5.5%)	0.8% (0% - 5.2%)	0.7% (0% - 4.8%)	0.6% (0% - 4.6%)	0.3% (0% - 3.6%)
	Response = Decrease in FEV1 Greater Than or Equal to 20%							
Atlanta	0.4% (0% - 5.1%)	0.3% (0% - 5%)	0.2% (0% - 4.5%)	0.1% (0% - 3.9%)	0.1% (0% - 3.7%)	0.1% (0% - 3.6%)	0.1% (0% - 3.2%)	0% (0% - 2.6%)
Boston	0.1% (0% - 3.6%)	0.1% (0% - 3.3%)	0.1% (0% - 3.2%)	0.1% (0% - 3.1%)	0% (0% - 2.6%)	0% (0% - 2.4%)	0% (0% - 2.3%)	0% (0% - 1.8%)
Chicago	0% (0% - 2.8%)	0% (0% - 2.6%)	0% (0% - 2.4%)	0% (0% - 2.2%)	0% (0% - 2%)	0% (0% - 1.9%)	0% (0% - 1.7%)	0% (0% - 1.3%)
Cleveland	0.1% (0% - 3.3%)	0.1% (0% - 3%)	0% (0% - 2.9%)	0% (0% - 2.4%)	0% (0% - 2.4%)	0% (0% - 2.2%)	0% (0% - 2.1%)	0% (0% - 1.6%)
Detroit	0.1% (0% - 3.5%)	0.1% (0% - 3.2%)	0.1% (0% - 3.1%)	0.1% (0% - 3%)	0% (0% - 2.5%)	0% (0% - 2.3%)	0% (0% - 2.2%)	0% (0% - 1.7%)
Houston	0.4% (0% - 4.8%)	0.3% (0% - 4.4%)	0.3% (0% - 4.3%)	0.1% (0% - 3.6%)	0.1% (0% - 3.5%)	0.1% (0% - 3.2%)	0.1% (0% - 3%)	0% (0% - 2.3%)
Los Angeles	0.1% (0% - 2.7%)	0.1% (0% - 2.6%)	0.1% (0% - 2.3%)	0% (0% - 1.7%)	0% (0% - 1.7%)	0% (0% - 1.6%)	0% (0% - 1.3%)	0% (0% - 0.7%)
New York	0.1% (0% - 3.3%)	0.1% (0% - 3.1%)	0% (0% - 2.9%)	0% (0% - 2.3%)	0% (0% - 2.4%)	0% (0% - 2.2%)	0% (0% - 2.1%)	0% (0% - 1.6%)
Philadelphia	0.2% (0% - 4.2%)	0.1% (0% - 3.9%)	0.1% (0% - 3.7%)	0.1% (0% - 3.2%)	0% (0% - 3.1%)	0% (0% - 2.9%)	0% (0% - 2.6%)	0% (0% - 2.1%)
Sacramento	0.1% (0% - 2.8%)	0.1% (0% - 2.6%)	0.1% (0% - 2.4%)	0% (0% - 1.9%)	0% (0% - 1.8%)	0% (0% - 1.7%)	0% (0% - 1.5%)	0% (0% - 1%)
St. Louis	0.1% (0% - 3.9%)	0.1% (0% - 3.6%)	0.1% (0% - 3.4%)	0% (0% - 2.9%)	0% (0% - 2.8%)	0% (0% - 2.6%)	0% (0% - 2.4%)	0% (0% - 1.9%)
Washington, DC	0.3% (0% - 4.5%)	0.2% (0% - 4.1%)	0.2% (0% - 4%)	0.1% (0% - 3.5%)	0.1% (0% - 3.3%)	0.1% (0% - 3%)	0% (0% - 2.9%)	0% (0% - 2.3%)

*Numbers are median (0.5 fractile) percents of children. Numbers in parentheses below the median are 95% confidence 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.

***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.

Table 3-26. Percent of Active 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 Active 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 FEV1 Greater Than or Equal to 10%							
Atlanta	10.2% (3.5% - 16.6%)	10% (3.4% - 16.4%)	8.9% (2.8% - 14.9%)	7.8% (2.3% - 13.5%)	7.3% (2% - 12.8%)	7.3% (2% - 12.7%)	6.2% (1.5% - 11.3%)	5% (1% - 9.4%)
Boston	11.1% (4.3% - 17.7%)	9.8% (3.5% - 16.1%)	9.7% (3.4% - 16%)	9.1% (3.1% - 15.2%)	7.7% (2.3% - 13.3%)	7% (2% - 12.3%)	6.6% (1.8% - 11.8%)	5.1% (1.1% - 9.6%)
Chicago	10.5% (3.7% - 17%)	9.7% (3.3% - 16.1%)	9.1% (2.9% - 15.2%)	8.1% (2.4% - 13.9%)	7.4% (2.1% - 12.9%)	6.9% (1.8% - 12.2%)	6.3% (1.6% - 11.4%)	4.8% (1% - 9.2%)
Cleveland	12.4% (4.8% - 19.6%)	11.1% (4% - 17.9%)	10.7% (3.8% - 17.5%)	9.2% (3% - 15.5%)	8.8% (2.8% - 14.9%)	7.8% (2.2% - 13.6%)	7.4% (2% - 13%)	5.9% (1.4% - 10.9%)
Detroit	11.6% (4.3% - 18.5%)	10.4% (3.6% - 17%)	10.1% (3.5% - 16.6%)	9.8% (3.3% - 16.2%)	8% (2.4% - 13.9%)	7.3% (2% - 12.8%)	6.9% (1.8% - 12.4%)	5.3% (1.2% - 10.1%)
Houston	7.1% (2.1% - 12%)	6.4% (1.8% - 11%)	6.1% (1.6% - 10.7%)	5.1% (1.2% - 9.2%)	4.9% (1.1% - 8.9%)	4.5% (1% - 8.4%)	4.1% (0.9% - 7.8%)	3% (0.5% - 6%)
Los Angeles	3.9% (1% - 6.8%)	3.8% (0.9% - 6.6%)	3.3% (0.8% - 5.8%)	2.3% (0.5% - 4.3%)	2.3% (0.5% - 4.2%)	2.2% (0.4% - 4.1%)	1.8% (0.3% - 3.3%)	0.9% (0.2% - 1.8%)
New York	9.9% (3.3% - 16.3%)	9.2% (3% - 15.5%)	8.6% (2.7% - 14.7%)	6.8% (1.8% - 12.2%)	7% (1.9% - 12.5%)	6.6% (1.7% - 12%)	6.1% (1.5% - 11.2%)	4.7% (0.9% - 9.1%)
Philadelphia	13.1% (5.2% - 20.4%)	11.9% (4.5% - 18.9%)	11.5% (4.2% - 18.4%)	9.6% (3.2% - 16%)	9.2% (3% - 15.5%)	8.5% (2.6% - 14.5%)	8% (2.3% - 13.9%)	6.3% (1.5% - 11.4%)
Sacramento	7.2% (2.4% - 11.5%)	6.6% (2.1% - 10.7%)	6.1% (1.9% - 10.1%)	5% (1.4% - 8.5%)	4.8% (1.3% - 8.2%)	4.5% (1.2% - 7.7%)	4% (1% - 7%)	2.9% (0.6% - 5.3%)
St. Louis	13.4% (5.4% - 20.7%)	12.3% (4.8% - 19.4%)	11.6% (4.4% - 18.5%)	10% (3.4% - 16.4%)	9.4% (3.1% - 15.6%)	8.6% (2.7% - 14.6%)	8% (2.4% - 13.7%)	6.2% (1.5% - 11.2%)
Washington, DC	12.1% (4.6% - 19.1%)	10.6% (3.7% - 17.3%)	10.5% (3.7% - 17.2%)	9.2% (3% - 15.5%)	8.6% (2.6% - 14.6%)	7.7% (2.2% - 13.4%)	7.4% (2% - 13%)	5.8% (1.3% - 10.7%)
	Response = Decrease in FEV1 Greater Than or Equal to 15%							
Atlanta	3.6% (0.6% - 10.9%)	3.5% (0.6% - 10.7%)	2.8% (0.4% - 9.5%)	2.3% (0.2% - 8.5%)	2% (0.2% - 7.9%)	2% (0.2% - 7.9%)	1.5% (0.1% - 6.9%)	1% (0% - 5.6%)
Boston	4.5% (1.1% - 12%)	3.6% (0.8% - 10.6%)	3.6% (0.7% - 10.5%)	3.2% (0.6% - 9.9%)	2.4% (0.3% - 8.4%)	2% (0.2% - 7.7%)	1.8% (0.2% - 7.4%)	1.1% (0.1% - 5.8%)
Chicago	3.9% (0.7% - 11.2%)	3.4% (0.5% - 10.4%)	3% (0.4% - 9.8%)	2.4% (0.3% - 8.8%)	2.1% (0.2% - 8%)	1.8% (0.1% - 7.5%)	1.5% (0.1% - 7%)	0.9% (0% - 5.5%)
Cleveland	5.1% (1.1% - 13.3%)	4.2% (0.7% - 11.8%)	3.9% (0.7% - 11.5%)	3% (0.4% - 9.9%)	2.8% (0.3% - 9.5%)	2.2% (0.2% - 8.5%)	2% (0.2% - 8.1%)	1.3% (0.1% - 6.6%)
Detroit	4.5% (0.8% - 12.3%)	3.7% (0.6% - 11.1%)	3.5% (0.5% - 10.8%)	3.4% (0.5% - 10.5%)	2.4% (0.2% - 8.7%)	2% (0.1% - 8%)	1.8% (0.1% - 7.6%)	1.1% (0% - 6.1%)
Houston	2.1% (0.3% - 7.6%)	1.8% (0.2% - 6.9%)	1.6% (0.1% - 6.6%)	1.2% (0.1% - 5.6%)	1.1% (0.1% - 5.4%)	0.9% (0% - 5.1%)	0.8% (0% - 4.7%)	0.4% (0% - 3.5%)

Location	Percent of Active 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
Los Angeles	0.9% (0% - 4.1%)	0.9% (0% - 4%)	0.7% (0% - 3.5%)	0.4% (0% - 2.6%)	0.4% (0% - 2.5%)	0.4% (0% - 2.4%)	0.3% (0% - 2%)	0.1% (0% - 1.1%)
New York	3.4% (0.6% - 10.6%)	3% (0.4% - 10%)	2.7% (0.3% - 9.4%)	1.8% (0.1% - 7.5%)	1.9% (0.2% - 7.8%)	1.7% (0.1% - 7.4%)	1.4% (0.1% - 6.8%)	0.9% (0% - 5.5%)
Philadelphia	5.5% (1.3% - 13.9%)	4.7% (0.9% - 12.7%)	4.4% (0.8% - 12.2%)	3.3% (0.5% - 10.3%)	3% (0.4% - 9.9%)	2.6% (0.3% - 9.2%)	2.3% (0.2% - 8.7%)	1.5% (0.1% - 7%)
Sacramento	2.5% (0.3% - 7.4%)	2.1% (0.2% - 6.8%)	1.9% (0.2% - 6.4%)	1.4% (0.1% - 5.3%)	1.3% (0.1% - 5%)	1.2% (0.1% - 4.7%)	1% (0% - 4.3%)	0.6% (0% - 3.2%)
St. Louis	5.8% (1.4% - 14.2%)	5% (1.1% - 13.1%)	4.6% (0.9% - 12.4%)	3.5% (0.5% - 10.7%)	3.1% (0.4% - 10%)	2.7% (0.3% - 9.3%)	2.4% (0.2% - 8.6%)	1.5% (0.1% - 6.8%)
Washington, DC	4.8% (1% - 12.8%)	3.8% (0.7% - 11.3%)	3.8% (0.6% - 11.3%)	3% (0.4% - 10%)	2.6% (0.3% - 9.3%)	2.2% (0.2% - 8.4%)	2% (0.2% - 8.1%)	1.3% (0.1% - 6.5%)
	Response = Decrease in FEV1 Greater Than or Equal to 20%							
Atlanta	1% (0.1% - 7%)	0.9% (0.1% - 6.8%)	0.7% (0% - 6.1%)	0.5% (0% - 5.4%)	0.4% (0% - 5.1%)	0.4% (0% - 5.1%)	0.2% (0% - 4.4%)	0.1% (0% - 3.6%)
Boston	1.5% (0.2% - 7.6%)	1.1% (0.1% - 6.8%)	1.1% (0.1% - 6.7%)	0.9% (0.1% - 6.3%)	0.6% (0% - 5.3%)	0.4% (0% - 4.9%)	0.4% (0% - 4.6%)	0.1% (0% - 3.6%)
Chicago	1.1% (0.1% - 7.2%)	0.9% (0% - 6.7%)	0.7% (0% - 6.2%)	0.5% (0% - 5.6%)	0.4% (0% - 5.1%)	0.3% (0% - 4.8%)	0.2% (0% - 4.4%)	0.1% (0% - 3.5%)
Cleveland	1.6% (0.1% - 8.4%)	1.2% (0.1% - 7.5%)	1.1% (0.1% - 7.3%)	0.7% (0% - 6.3%)	0.6% (0% - 6%)	0.4% (0% - 5.4%)	0.4% (0% - 5.1%)	0.2% (0% - 4.2%)
Detroit	1.3% (0.1% - 7.8%)	1% (0% - 7.1%)	0.9% (0% - 6.9%)	0.8% (0% - 6.7%)	0.5% (0% - 5.6%)	0.3% (0% - 5.1%)	0.3% (0% - 4.8%)	0.1% (0% - 3.8%)
Houston	0.5% (0% - 4.9%)	0.3% (0% - 4.5%)	0.3% (0% - 4.3%)	0.2% (0% - 3.6%)	0.1% (0% - 3.5%)	0.1% (0% - 3.3%)	0.1% (0% - 3%)	0% (0% - 2.3%)
Los Angeles	0.1% (0% - 2.7%)	0.1% (0% - 2.7%)	0.1% (0% - 2.3%)	0% (0% - 1.7%)	0% (0% - 1.7%)	0% (0% - 1.6%)	0% (0% - 1.3%)	0% (0% - 0.7%)
New York	0.9% (0.1% - 6.8%)	0.7% (0% - 6.3%)	0.6% (0% - 6%)	0.3% (0% - 4.8%)	0.3% (0% - 4.9%)	0.3% (0% - 4.7%)	0.2% (0% - 4.3%)	0.1% (0% - 3.5%)
Philadelphia	1.8% (0.2% - 8.9%)	1.4% (0.1% - 8.1%)	1.3% (0.1% - 7.8%)	0.8% (0% - 6.6%)	0.7% (0% - 6.3%)	0.6% (0% - 5.8%)	0.5% (0% - 5.6%)	0.2% (0% - 4.5%)
Sacramento	0.5% (0% - 4.8%)	0.4% (0% - 4.4%)	0.4% (0% - 4.2%)	0.2% (0% - 3.5%)	0.2% (0% - 3.3%)	0.1% (0% - 3.1%)	0.1% (0% - 2.8%)	0% (0% - 2.1%)
St. Louis	1.9% (0.2% - 9.1%)	1.6% (0.1% - 8.4%)	1.4% (0.1% - 7.9%)	0.9% (0% - 6.8%)	0.8% (0% - 6.4%)	0.6% (0% - 5.9%)	0.5% (0% - 5.5%)	0.2% (0% - 4.4%)
Washington, DC	1.5% (0.1% - 8.2%)	1.1% (0.1% - 7.2%)	1% (0.1% - 7.2%)	0.7% (0% - 6.3%)	0.6% (0% - 5.9%)	0.4% (0% - 5.3%)	0.4% (0% - 5.1%)	0.2% (0% - 4.1%)

*Numbers are median (0.5 fractile) percents of children. Numbers in parentheses below the median are 95% confidence 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.

***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.

Figure 3-7. Percent Changes in Aggregate Numbers (Across All Locations) of Occurrences of Lung Function Response Among Active School Age Children when O_3 Concentrations are Reduced from Those Just Meeting the Current Standard to Those that Would Just Meet Each Alternative Standard, for Each of the Three Definitions of Response

Figure 3-7a. Based on 2004 Data

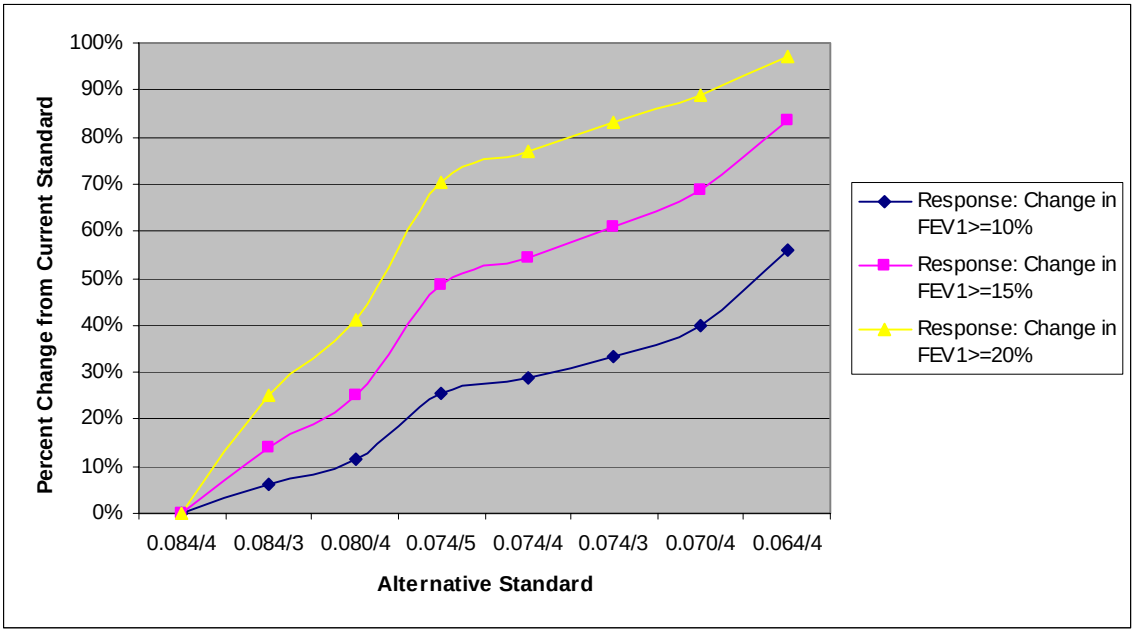


Figure 3-7b. Based on 2002 Data

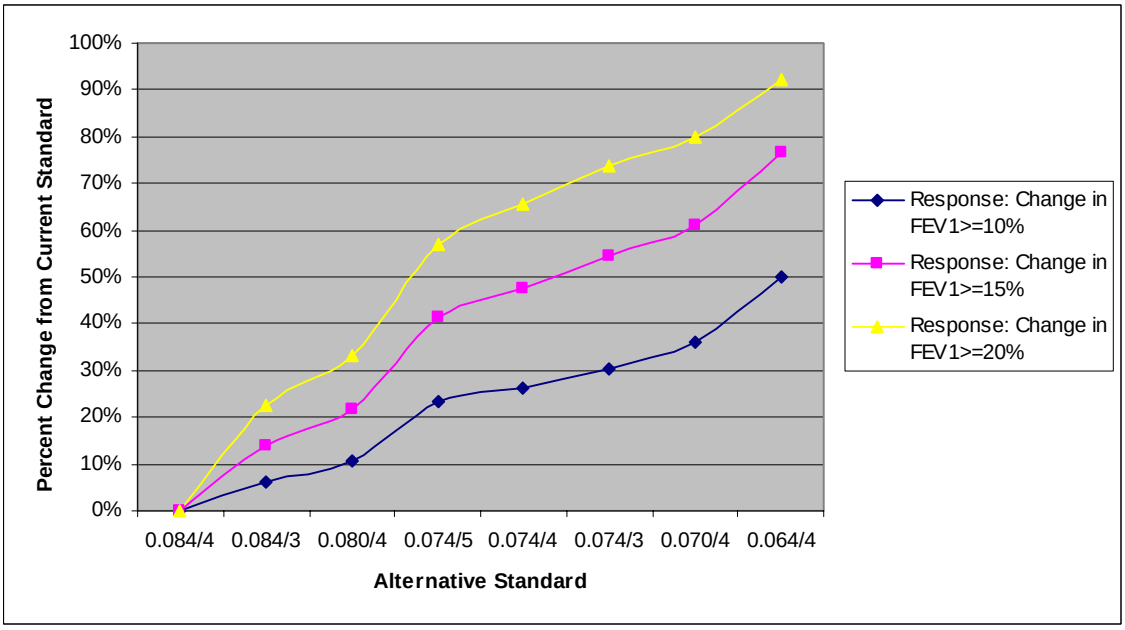


Figure 3-8. Percent Changes of Occurrences of Decrement in FEV_1 ≥15% Among Active School Age Children when O_3 Concentrations are Reduced from Those Just Meeting the Current Standard to Those that Would Just Meet Each Alternative Standard, Separately for Each Location

Figure 3-8a. Based on 2004 Data

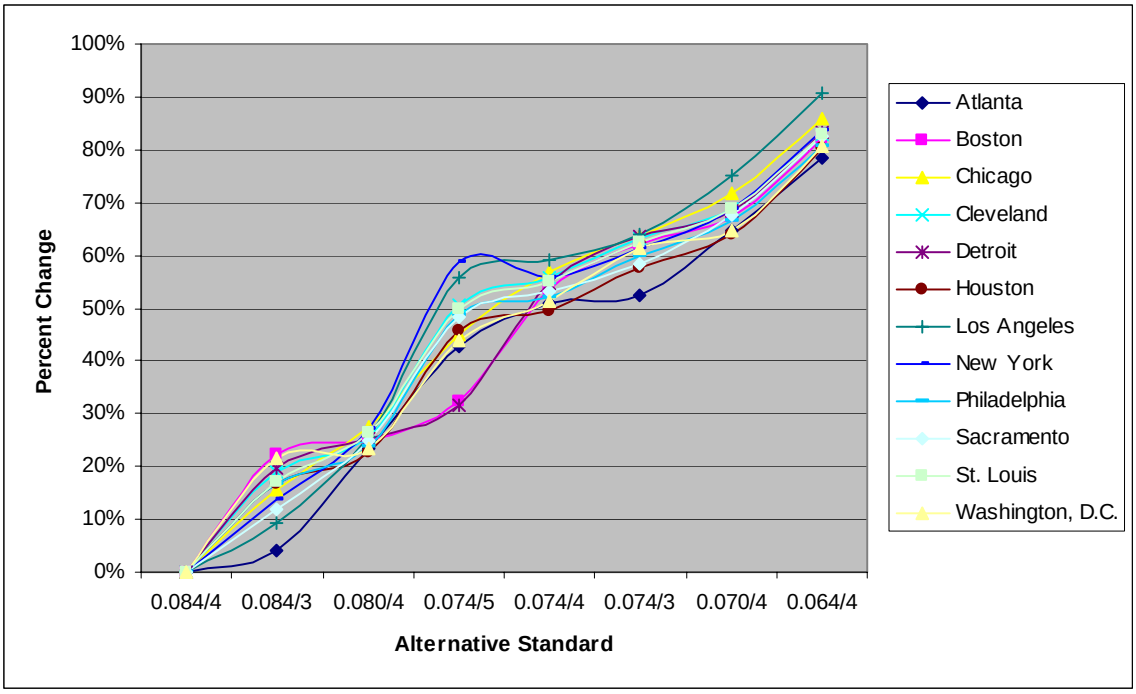


Figure 3-8b. Based on 2002 Data

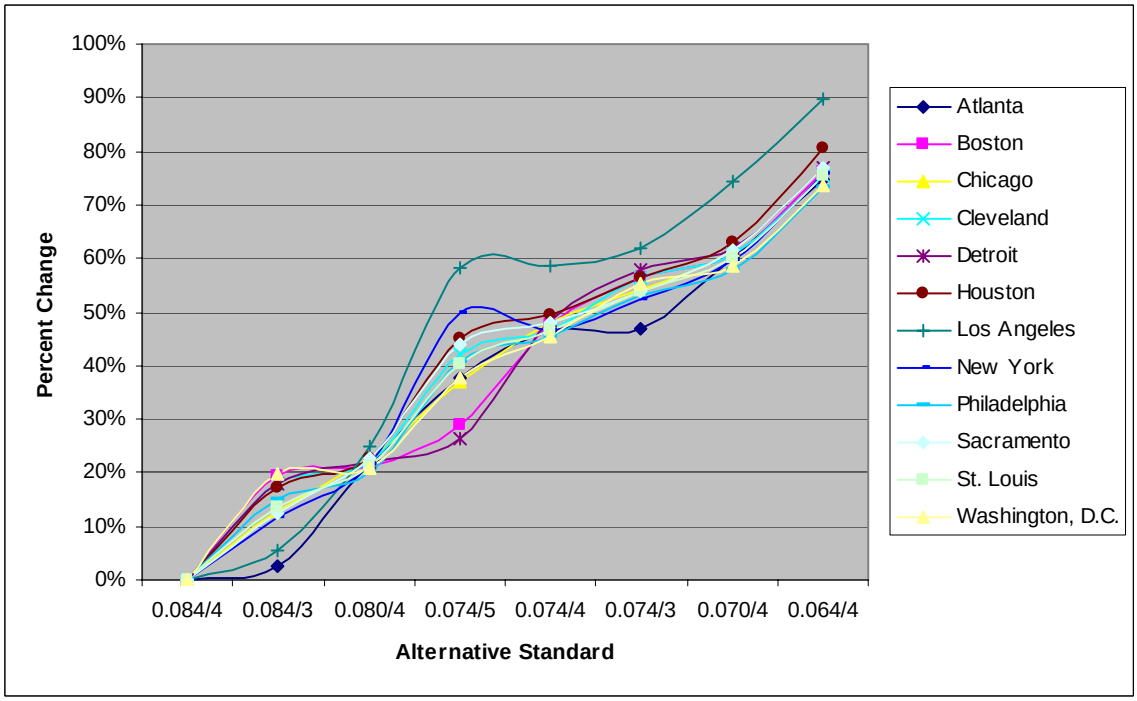


Figure 3-9. Percent Changes in Aggregate Numbers (Across All Locations) of Active School Age Children Experiencing at Least One Occurrence of Lung Function Response when O_3 Concentrations are Reduced from Those Just Meeting the Current Standard to Those that Would Just Meet Each Alternative Standard, for Each of the Three Definitions of Response

Figure 3-9a. Based on 2004 Data

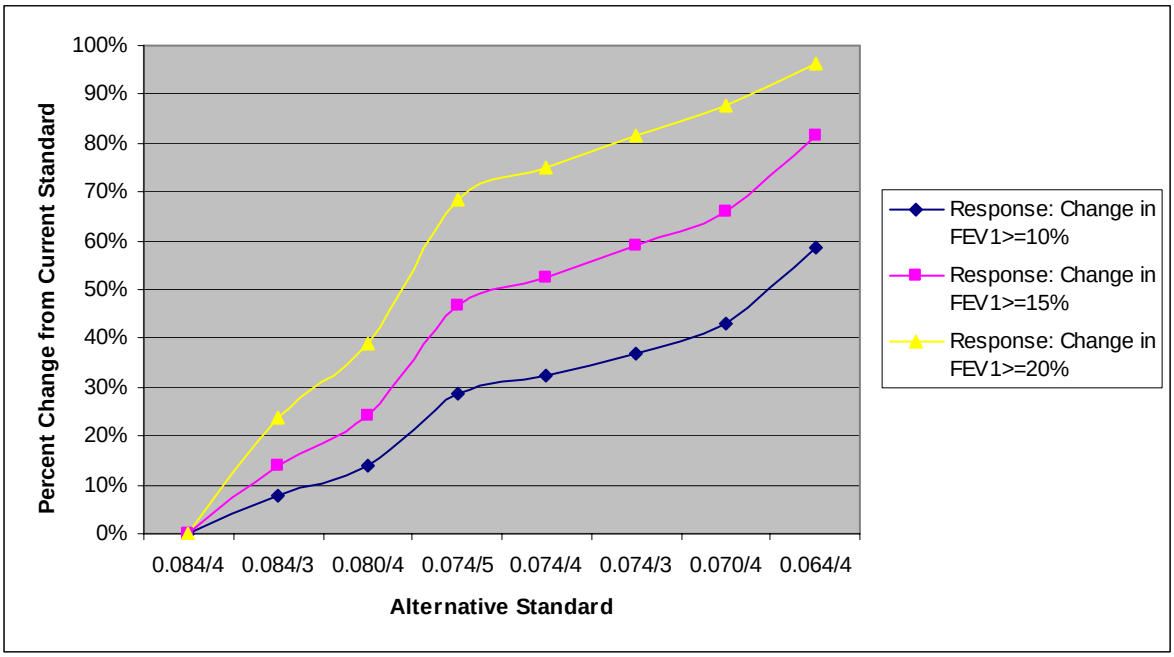


Figure 3-9b. Based on 2002 Data

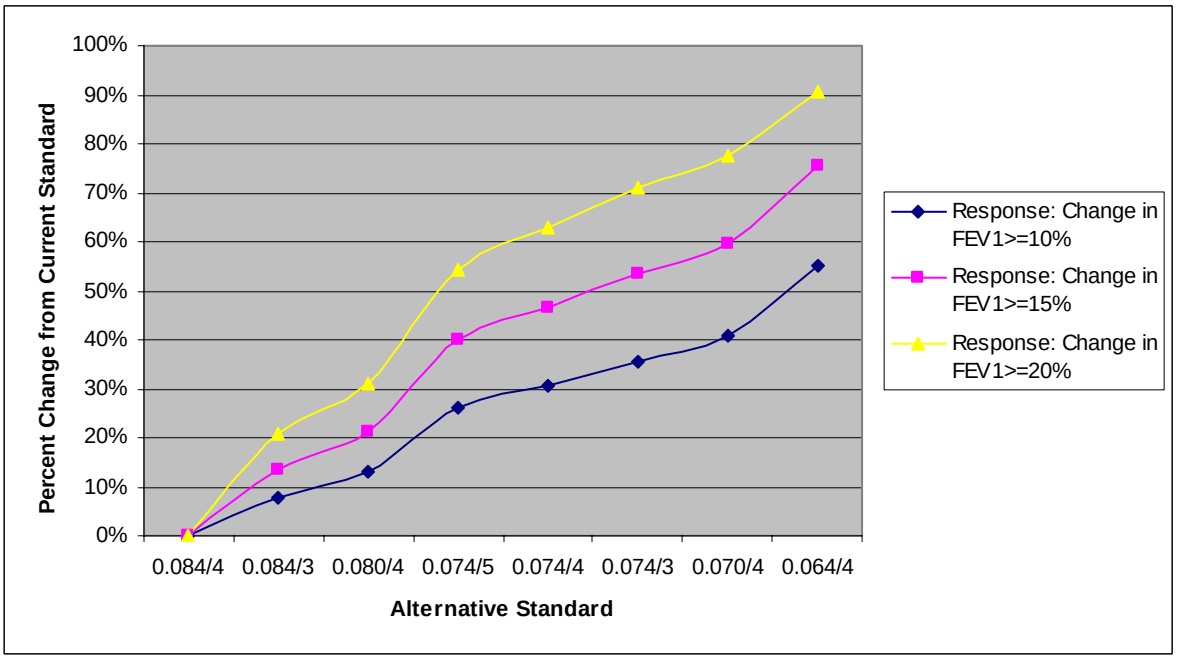


Figure 3-10. Percent Changes in Numbers of Active School Age Children Experiencing at Least One Decrement in FEV_1 ≥15% when O_3 Concentrations are Reduced from Those Just Meeting the Current Standard to Those that Would Just Meet Each Alternative Standard, Separately for Each Location

Figure 3-10a. Based on 2004 Data

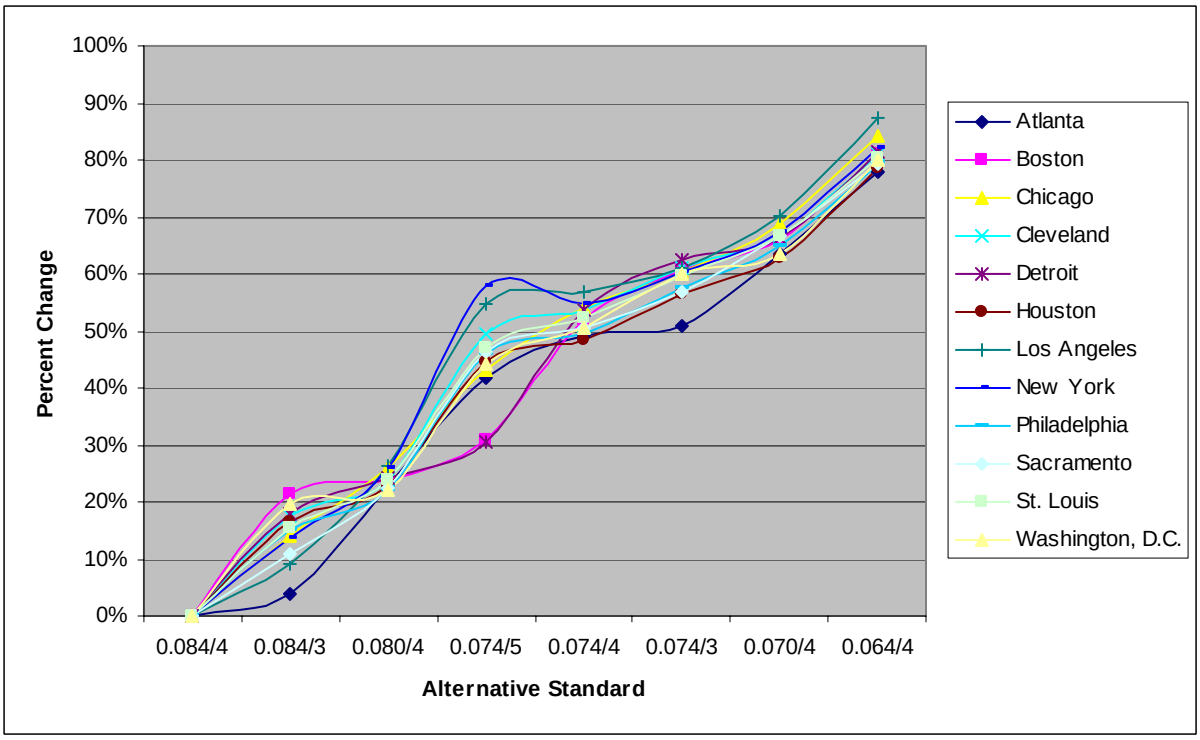
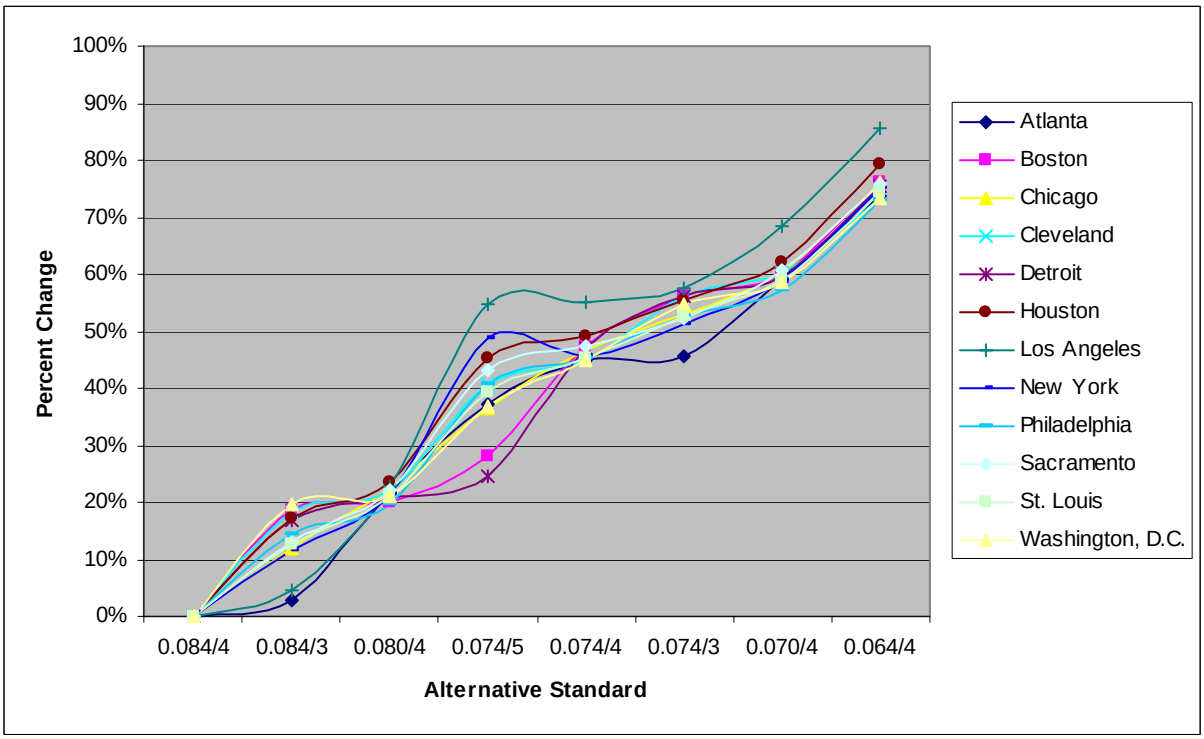


Figure 3-10b. Based on 2002 Data



The estimated decreases in occurrence of lung function response when O_3 concentrations just meet alternative daily maximum 8-hour standards, relative to when O_3 concentrations just meet the current standard are greater the more stringent the alternative standard. For example, at the 0.084 ppm 3rd daily maximum standard (the standard that is closest to the current standard of 0.084 ppm 4th daily maximum), the aggregate number of occurrences of decrements in $FEV_1 \geq 10\%$ (across all locations) among active school age children is 6.1 percent less than when O_3 concentrations just meet the current standard, based on 2004 air quality. At the most stringent standard considered (0.064 ppm 4th daily maximum), the aggregate number of such occurrences is estimated to be 56 percent less than when O_3 concentrations just meet the current standard. The pattern is the same when exposure estimates are based on 2002 air quality – the corresponding percents based on 2002 air quality are 6 percent and 50 percent.

Similarly, the estimated percent decreases in occurrence of lung function response from when O_3 concentrations just meet the current standard to when they just meet an alternative standard are greater the larger the decrement being measured. Using 2004 air quality data, at the most stringent standard considered, the aggregate number of decrements in $FEV_1 \geq 20\%$ among active school age children is estimated to be 97 percent less than when O_3 concentrations just meet the current standard (compared with 84 percent less for decrements in $FEV_1 \geq 15\%$ and 56 percent less for decrements in $FEV_1 \geq 10\%$, as noted above). The pattern is similar when 2002 air quality data are used.

The same patterns can be seen when the measure of interest is the number of children experiencing at least one occurrence of lung function response. The estimated decreases in aggregate number of children with at least one occurrence of lung function response when O_3 concentrations just meet alternative daily maximum 8-hour standards, relative to when O_3 concentrations just meet the current standard, are greater the more stringent the alternative standard. For example, at the 0.084 ppm 3rd daily maximum standard, the aggregate number of active school age children with at least one decrement in $FEV_1 \geq 10\%$ is 8 percent less than when O_3 concentrations just meet the current standard, based on 2004 air quality. At the most stringent standard considered, this aggregate number is estimated to be 59 percent less than when O_3 concentrations just meet the current standard. The pattern is the same when exposure estimates are based on 2002 air quality – the corresponding percents based on 2002 air quality are 8 percent and 55 percent.

Similarly, the estimated percent decreases in aggregate number of children with at least one lung function response from when O_3 concentrations just meet the current standard to when they just meet an alternative standard are greater the larger the decrement being measured. Using 2004 air quality data, at the most stringent standard considered, the aggregate number of active school age children experiencing at least one decrement in $FEV_1 \geq 20\%$ is estimated to be 97 percent less than when O_3 concentrations just meet the current standard (compared with about 82 percent less for decrements in $FEV_1 \geq 15\%$ and 59 percent less for decrements in $FEV_1 \geq 10\%$). The pattern is similar when 2002 air quality data are used.

The same patterns can be seen for all school age children. For example, at the 0.084 ppm 3rd daily maximum standard (the standard that is closest to the current standard of 0.084 ppm 4th daily maximum), the aggregate number of occurrences of decrements in $FEV_1 \geq 10\%$ among all school age children is 6 percent less than when O_3 concentrations just meet the current standard, based on 2004 air quality. At the most stringent standard considered, the aggregate number of such occurrences is estimated to be 56 percent less than when O_3 concentrations just meet the current standard. The pattern is the same when exposure estimates are based on 2002 air quality – the corresponding percents based on 2002 air quality are 6 percent and 50 percent.

4 ASSESSMENT OF RISK BASED ON EPIDEMIOLOGICAL STUDIES

As discussed in the O_3 CD, a significant number of epidemiological studies examining a variety of health effects associated with ambient O_3 concentrations in various locations throughout the U.S., Canada, Europe, and other regions of the world have been published since the last O_3 NAAQS review. As a result of the availability of these epidemiological studies and air quality information, EPA staff decided to expand the O_3 risk assessment to include an assessment of selected health risks attributable to ambient O_3 concentrations over PRB concentrations and the reduced health risks associated with just meeting the current O_3 standard and alternative O_3 standards in selected urban locations in the U.S. The methods and results of this portion of the risk assessment are discussed below.

4.1 Methods

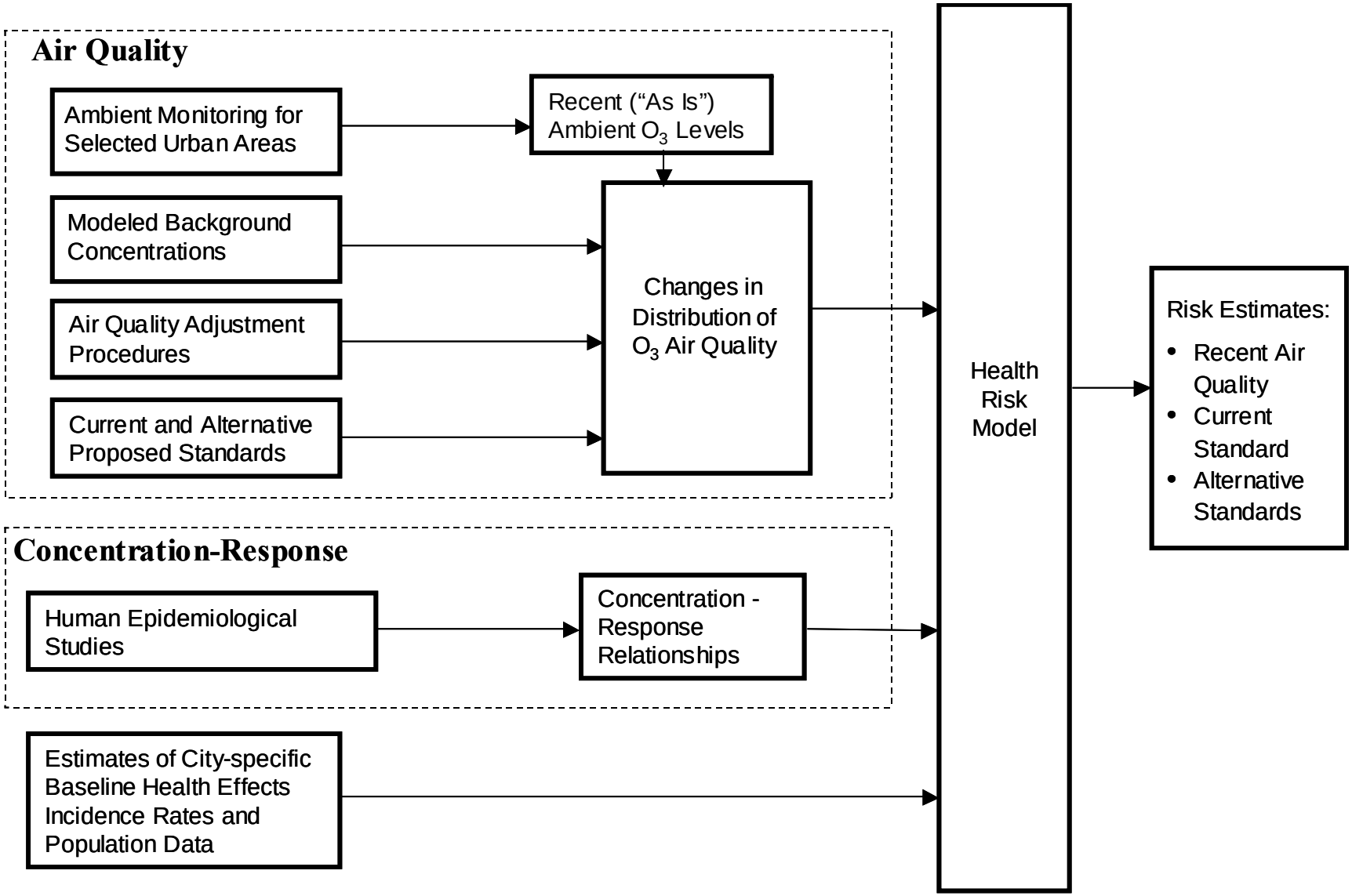
4.1.1 General approach

As in the recently completed particulate matter (PM) risk assessment (see EPA, 2005c, Chapter 4, and Abt Associates 2005), the general approach used in this part of the O_3 risk assessment relies upon C-R functions which have been estimated in epidemiological studies. Since these studies estimate C-R functions using ambient air quality data from fixed-site, population-oriented monitors, the appropriate application of these functions in a risk assessment similarly requires the use of ambient air quality data at fixed-site, ambient monitors. The general O_3 health risk model combines information about O_3 air quality for specific urban areas with C-R functions derived from epidemiological studies and baseline health incidence data for specific health endpoints and population estimates to derive estimates of the incidence of specified health effects attributable to ambient O_3 concentrations during the period examined. Although the O_3 season varies somewhat from one location to another, in most locations it coincides roughly with spring and summer. To allow comparisons across locations, and because O_3 effects have been more clearly and consistently shown for warm season analyses, all analyses were carried out for the same time period, April through September. The analyses are conducted for "as is" air quality and for air quality simulated to reflect just meeting the current O_3 ambient standard, as well as air quality simulated to reflect just meeting alternative O_3 ambient standards. Because O_3 concentrations varied substantially over the 3-year period from 2002 through 2004, separate analyses were carried out using air quality data from 2002, in which O_3 concentrations were relatively higher in most locations for this 3-year period, and air quality data from 2004, in which O_3 concentrations were relatively lower in most locations for this 3-year period, to provide generally upper- and lower-end cases within this 3-year period. Two of the 12 urban areas, Houston and Los Angeles, had similar or higher O_3 concentrations in 2004 than in 2002. The major components of the portion of the health risk assessment based on data from epidemiological studies are illustrated in Figure 4-1.

In the first part of the epidemiology-based portion of the risk assessment, we estimated health effects incidence associated with "as is" O_3 levels. In the second part, we estimated the reduced health effects incidence associated with those O_3 concentrations that would result if the current and alternative O_3 standards were just met in the assessment locations. In both parts, we considered only the incidence of health effects associated with O_3 concentrations in excess of estimated PRB O_3 levels.

Both parts of the epidemiology-based portion of the risk assessment may be viewed as assessing the change in incidence of the health effect associated with a change in O_3 concentrations from some upper levels to specified (lower) levels. The important operational difference between the two parts is in the upper O_3 levels. In the first part, the upper O_3 levels are "as is" concentrations. In contrast, the upper O_3 levels in the second part are the estimated O_3 levels that would occur when the current 8-hour daily maximum O_3 standard is just met in the assessment locations or when one of several alternative 8-hour daily maximum O_3 standards is just met in these locations. The second part therefore requires that a method be developed to simulate just meeting the current or alternative standards. This method is described in Chapter 4 of the draft Staff Paper and in Rizzo (2005, 2006).

Figure 4-1. Major Components of Ozone Health Risk Assessment Based on Epidemiology Studies



To estimate the change in incidence of a given health effect resulting from a change in ambient O_3 concentrations from "as is" levels to PRB levels, or from O_3 concentrations that just meet the current or an alternative standard to PRB levels, in an assessment location, the following analysis inputs are necessary:

- **Air quality information** including: (1) "as is" air quality data for O_3 from ambient monitors in the assessment location, (2) "as is" concentrations adjusted to reflect patterns of air quality estimated to occur when the area just meets the specified standard, and (3) estimates of PRB O_3 concentrations appropriate to this location. (These air quality inputs are discussed in more detail in Chapters 2 and 4 of the draft Staff Paper.

- **Concentration-response function(s)** which provide an estimate of the relationship between the health endpoint of interest and O_3 concentrations (preferably derived in the assessment location, although functions estimated in other locations can be used at the cost of increased uncertainty -- see Section 4.1.9.1.3).

- **Baseline health effects incidence rate and population**. The baseline incidence rate provides an estimate of the incidence rate (number of cases of the health effect per O_3 season, usually per 10,000 or 100,000 population) in the assessment location corresponding to "as is" O_3 levels in that location. To derive the total baseline incidence per O_3 season, the baseline incidence rate must be multiplied by the corresponding population number (e.g., if the baseline incidence rate is number of cases per O_3 season per 100,000 population, it must be multiplied by the number of 100,000s in the population). (Section 4.1.8 summarizes considerations related to the baseline incidence rate and population data inputs to the risk assessment).

These inputs are combined to estimate health effect incidence changes associated with specified changes in O_3 levels. Although some epidemiological studies have estimated linear or logistic C-R functions, by far the most common form is the exponential (or log-linear) form:

$$y = Be^{\beta x}, \qquad (4\text{-}1)$$

where x is the ambient O_3 level, y is the incidence of the health endpoint of interest at O_3 level x, β is the coefficient of ambient O_3 concentration, and B is the incidence at x=0, i.e., when there is no ambient O_3. The relationship between a specified ambient O_3 level, x_0, for example, and the incidence of a given health endpoint associated with that level (denoted as y_0) is then

$$y_0 = Be^{\beta x_0}. \qquad (4\text{-}2)$$

Because the log-linear form of C-R function (equation (4-1)) is by far the most common form, we use this form to illustrate the "health impact function" used in this portion of the risk assessment.[4]

If we let x_0 denote the baseline (upper) O_3 level, and x_1 denote the lower O_3 level, and y_0 and y_1 denote the corresponding incidences of the health effect, we can derive the following relationship between the change in x, $\Delta x = (x_0 - x_1)$, and the corresponding change in y, Δy, from equation (4-1)[5]:

$$\Delta y = (y_0 - y_1) = y_0[1 - e^{-\beta \Delta x}]. \quad (4\text{-}3)$$

Alternatively, the difference in health effects incidence can be calculated indirectly using relative risk. Relative risk (RR) is a measure commonly used by epidemiologists to characterize the comparative health effects associated with a particular air quality comparison. The risk of mortality at ambient O_3 level x_0 relative to the risk of mortality at ambient O_3 level x_1, for example, may be characterized by the ratio of the two mortality rates: the mortality rate among individuals when the ambient O_3 level is x_0 and the mortality rate among (otherwise identical) individuals when the ambient O_3 level is x_1. This is the RR for mortality associated with the difference between the two ambient O_3 levels, x_0 and x_1. Given a C-R function of the form shown in equation (4-1) and a particular difference in ambient O_3 levels, Δx, the RR associated with that difference in ambient O_3, denoted as $RR_{\Delta x}$, is equal to $e^{\beta \Delta x}$. The difference in health effects incidence, Δy, corresponding to a given difference in ambient O_3 levels, Δx, can then be calculated based on this $RR_{\Delta x}$ as

$$\Delta y = (y_0 - y_1) = y_0[1 - (1/RR_{\Delta x})]. \quad (4\text{-}4)$$

Equations (4-3) and (4-4) are simply alternative ways of expressing the relationship between a given difference in ambient O_3 levels, $\Delta x > 0$, and the corresponding difference in health effects incidence, Δy. These health impact equations are the key equations that combine air quality information, C-R function information, and baseline health effects incidence information to estimate ambient O_3 health risk.

4.1.2 Air quality considerations

Air quality considerations are discussed in detail in Chapters 2 and 4 of the draft Staff Paper and in Rizzo (2005, 2006). Here we describe those air quality considerations that are directly relevant to the estimation of health risks in the epidemiology-based portion of the risk assessment.

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[4] The derivations of health impact functions from concentration-response functions for all three functional forms found in the epidemiological literature – the log-linear, the linear and the logistic – are given in section B.2 of Appendix B.

[5] If $\Delta x < 0$ – i.e., if $\Delta x = (x_1 - x_0)$ – then the relationship between Δx and Δy can be shown to be $\Delta y = (y_1 - y_0) = y_0[e^{\beta \Delta x} - 1]$. If $\Delta x < 0$, Δy will similarly be negative. However, the *magnitude* of Δy will be the same whether $\Delta x > 0$ or $\Delta x < 0$ – i.e., the absolute value of Δy does not depend on which equation is used.

In the first part of the epidemiology-based portion of the risk assessment, we estimated the change in health effect incidence, Δy, associated with a change in O_3 concentrations from current ("as is") levels of O_3 to PRB levels. In the second part, we estimated the change in health effect incidence associated with a change in O_3 concentrations from the levels simulated to just meet a standard (i.e., the current 8-hour daily maximum standard as well as each of several alternative 8-hour daily maximum standards) to PRB levels.

To estimate the change in incidence of a health effect associated with a change in O_3 concentrations from "as is" levels to PRB levels in an assessment location, we need two time series of O_3 concentrations for that location: (1) hourly "as is" O_3 concentrations, and (2) hourly PRB O_3 concentrations. In order to be consistent with the approach generally used in the epidemiological studies that estimated O_3 C-R functions, the (spatial) average ambient O_3 concentration on each hour for which measured data are available is deemed most appropriate for the risk assessment. Consistent with the approach used in the recently completed PM risk assessment (see EPA, 2005c, Chapter 4, and Abt Associates 2005), a composite monitor data set was created for each assessment location. The concentration at the composite monitor in a given hour on a given day is simply the average of the monitor-specific concentrations for that hour on that day.

Several different exposure metrics, the 24-hour average, the daily 8-hour maximum, and the daily 1-hour maximum, have been used in epidemiological O_3 studies. We therefore calculated daily changes at the composite monitor in the O_3 exposure metric appropriate to a given C-R function. For example, if a C-R function related daily mortality to daily 1-hour maximum O_3 concentrations, we calculated the daily changes in 1-hour maximum O_3 concentrations at the composite monitor. In the first part of the epidemiology-based risk assessment, in which we estimated risks associated with the recent levels of O_3 ("as is" levels) above PRB levels, this required the following steps:

- Using the monitor-specific input streams of hourly "as is" O_3 concentrations, calculate a stream of hourly "as is" O_3 concentrations at the composite monitor. The "as is" O_3 concentration at the composite monitor for a given hour on a given day is the average of the monitor-specific "as is" O_3 concentrations for that hour on that day.
- Using the stream of "as is" hourly O_3 concentrations at the composite monitor, just created, calculate the 1-hour maximum "as is" O_3 concentration for each day at the composite monitor.
- Using the monitor-specific input streams of hourly PRB O_3 concentrations, calculate a stream of hourly PRB O_3 concentrations at the composite monitor.
- Using the stream of PRB hourly O_3 concentrations at the composite monitor, just created, calculate the 1-hour maximum PRB O_3 concentration for each day at the composite monitor.

- For each day, calculate Δx = (the 1-hour maximum "as is" O_3 concentration for that day at the composite monitor) - (the 1-hour maximum PRB O_3 concentration for that day at the composite monitor).[6]

The calculations for the second part of the epidemiology-based risk assessment, in which we estimated risks associated with estimated O_3 levels that just meet the current standard above PRB levels were done analogously, using the monitor-specific series of adjusted hourly concentrations rather than the monitor-specific series of "as is" hourly concentrations. Similarly, calculations for C-R functions that used a different exposure metric (e.g., the 24-hour average) were done analogously, using the exposure metric appropriate to the C-R function.

4.1.3 Selection of health endpoints

EPA staff has carefully reviewed the epidemiological evidence evaluated in Chapter 7 and in Chapter 7 Annex as well as in Appendix 8A of the O_3 CD. Tables 8A-1 through 8A-5 which is in Appendix 8A of the CD summarize the available U.S. and Canadian studies of the effects of acute (short-term) exposures for various health effect categories. Given the substantial number of health endpoints and studies addressing O_3 effects, we included in this quantitative O_3 risk assessment only the better- understood (in terms of health consequences) health endpoint categories for which the weight of the evidence supports the inference of a likely causal relationship between O_3 and the effect category. In addition, we included only those categories for which there are studies that satisfy the study selection criteria discussed below.

Based on its review of the evidence evaluated in the O_3 CD, EPA staff included in the portion of the O_3 risk assessment based on epidemiology studies the following broad categories of health endpoints associated with short-term exposures:

- premature total, respiratory, and cardiorespiratory mortality;
- hospital admissions for respiratory illnesses; and
- asthmatic symptoms in moderate/severe asthmatic children.

4.1.4 Selection of urban areas

Several objectives were considered in selecting potential urban areas for which to conduct the epidemiology-based O_3 risk assessment. An urban area was considered for inclusion only if it satisfied the following criteria:

- It has sufficient air quality data for the 3-year period (2002-2004).
- It is the same as or close to the location where at least one C-R function for one of the recommended health endpoints (see above) has been estimated by a study that satisfies the study selection criteria (see below).

[6] Note that the maximum-concentration hour for a given day in the "as is" series is not necessarily the same hour as the maximum-concentration hour for that day in the PRB series.

- For the hospital admission categories, relatively recent location-specific baseline incidence data, specific to International Classification of Disease (ICD) codes, or an equivalent illness classification system, are available.[7]

Because baseline mortality incidence data are available at the county level, this is not a constraint in the selection of urban areas for the O_3 risk assessment. Data on hospital admissions for recent years, however, specific to ICD codes, are available in some cities but not others. The availability of this type of incidence data was therefore a consideration in the selection of urban areas to include in the analysis.

In addition, we took into account the following considerations in selecting from among those urban locations that satisfied the above selection criteria:

- Locations with more health endpoints were preferred to those with fewer.
- The overall set of urban locations should represent a range of geographic areas and population demographics among those areas not meeting the current O_3 8-hour daily maximum standard within the U.S.

Based on the selection criteria and additional considerations listed above, we included the following urban areas in our assessment of risk based on epidemiological studies:

- Atlanta
- Boston
- Chicago
- Cleveland
- Detroit
- Houston
- Los Angeles
- New York City
- Philadelphia
- Sacramento
- St. Louis
- Washington, D.C.

4.1.5 Selection of epidemiological studies

As discussed above, we included in the O_3 risk assessment only the better understood health effects for which the weight of the evidence supports a likely causal inference. Thus, in cases where the majority of the available studies did not report a statistically significant relationship, the effect endpoint was not included. Once it had been determined that a health endpoint would be included in the analysis, however, inclusion of a study on that health endpoint was not based on statistical significance. That is, consistent with the approach taken in the

[7] The absence of hospital admissions baseline incidence data does not necessarily mean that we cannot use an urban area in the risk assessment, only that we cannot use it for the hospital admissions endpoint.

particulate matter (PM) risk assessment (see EPA, 2005c, Chapter 4, and Abt Associates, 2005), no credible study on an included health endpoint was excluded from the analysis on the basis of lack of statistical significance.

We applied the following selection criteria for any study that estimated one or more O_3 C-R functions for a selected health endpoint in an urban location to be used for the O_3 risk assessment:

- It is a published, peer-reviewed study that has been evaluated in the O_3 CD and judged adequate by EPA staff for purposes of inclusion in this risk assessment based on that evaluation.

- It directly measured, rather than estimated, O_3 on a reasonable proportion of the days in the study.

- It either did not rely on Generalized Additive Models (GAMs) using the S-Plus software to estimate C-R functions or has appropriately re-estimated these functions using revised methods.[8]

- For studies of mortality associated with short-term exposure to O_3, the study reported results for the O_3 season in the location in which the study was conducted.[9]

4.1.6 A summary of selected health endpoints, urban areas and studies

Based on applying the criteria and considerations discussed above, the health endpoints, urban locations, and epidemiology studies that were included in the O_3 risk assessment are given in Table 4-1.

Table 4-1. Locations and Health Endpoints Included in the O_3 Risk Assessment Based on Epidemiological Studies*

Urban Area	Premature Mortality	Hospital Admissions for Respiratory Illnesses	Asthmatic Symptoms in Children
Atlanta	Bell et al. (2004) Bell et al. (2004) – 95 cities Huang et al. (2004)** Huang et al. (2004) – 19 cities**		
Boston	Bell et al. (2004) – 95 cities		Gent et al. (2003)

[8] The GAM S-Plus problem was discovered prior to the recent PM risk assessment that was carried out as part of the PM NAAQS review. It is discussed in the PM Criteria Document (EPA, 2004), PM Staff Paper (EPA, 2005e), and PM Health Risk Assessment Technical Support Document (Abt Associates, 2005).

[9] In most locations, the O_3 season is generally the warm season; in Houston, Los Angeles, and Sacramento, however, the O_3 season is all year.

Urban Area	Premature Mortality	Hospital Admissions for Respiratory Illnesses	Asthmatic Symptoms in Children
Chicago	Bell et al. (2004) – 95 cities Huang et al. (2004) Huang et al. (2004) – 19 cities Schwartz (2004) Schwartz (2004) – 14 cities		
Cleveland	Bell et al. (2004) Bell et al. (2004) – 95 cities Huang et al. (2004) Huang et al. (2004) – 19 cities	Schwartz et al. (1996)	
Detroit	Bell et al. (2004) Bell et al. (2004) – 95 cities Huang et al. (2004) Huang et al. (2004) – 19 cities Schwartz (2004) Schwartz (2004) – 14 cities Ito (2003)	Ito (2003)	
Houston	Bell et al. (2004) Bell et al. (2004) – 95 cities Huang et al. (2004) Huang et al. (2004) – 19 cities Schwartz (2004) Schwartz (2004) – 14 cities		
Los Angeles	Bell et al. (2004) Bell et al. (2004) – 95 cities Huang et al. (2004) Huang et al. (2004) – 19 cities	Linn et al. (2000)	
New York	Bell et al. (2004) – 95 cities Huang et al. (2004) Huang et al. (2004) – 19 cities	Thurston et al. (1992)	
Philadelphia	Bell et al. (2004) – 95 cities Huang et al. (2004) Huang et al. (2004) – 19 cities Moolgavkar et al. (1995)		
Sacramento	Bell et al. (2004) Bell et al. (2004) – 95 cities		
St. Louis	Bell et al. (2004) Bell et al. (2004) – 95 cities		
Washington, D.C.	Bell et al. (2004) – 95 cities		

*Studies listed for a given assessment location reported a C-R function specifically for that location unless otherwise specified. A study reporting a multi-city C-R function is listed for a given assessment location only if that location is included among the cities used to estimate the multi-city C-R function.
**This study estimated C-R functions for cardiorespiratory mortality.

4.1.7 Selection of concentration-response functions

Studies often report more than one estimated C-R function for the same location and health endpoint. Sometimes models including different sets of co-pollutants are estimated in a study; sometimes different lags are estimated. In some cases, two or more different studies estimated a C-R function for O_3 and the same health endpoint in the same location (this is the case, for example, with O_3 and mortality associated with short-term exposures). For some health endpoints, there are studies that estimated multi-city O_3 C-R functions, while other studies estimated single-city functions.

All else being equal, a C-R function estimated in the assessment location is preferable to a function estimated elsewhere, since it avoids uncertainties related to potential differences due to geographic location. That is why the urban areas selected for the epidemiological studies-based O_3 risk assessment are those locations in which C-R functions have been estimated. There are several advantages, however, to using estimates from multi-city studies versus studies carried out in single cities. Multi-city studies are applicable to a variety of settings, since they estimate a central tendency across multiple locations. When they are estimating a single C-R function based on several cities, multi-city studies also tend to have more statistical power and provide effect estimates with relatively greater precision than single city studies due to larger sample sizes, reducing the uncertainty around the estimated coefficient. Because single-city and multi-city studies have different advantages, if a single-city C-R function has been estimated in a risk assessment location and a multi-city study that includes that location is also available for the same health endpoint, we used both functions for that location in the risk assessment.

Some O_3 epidemiological studies estimated C-R functions in which O_3 was the only pollutant entered into the health effects model (i.e., single pollutant models) as well as other C-R functions in which O_3 and one or more co-pollutants (e.g., PM, nitrogen dioxide, sulfur dioxide, carbon monoxide) were entered into the health effects model (i.e., multi-pollutant models). To the extent that any of the co-pollutants present in the ambient air may have contributed to the health effects attributed to O_3 in single pollutant models, risks attributed to O_3 might be overestimated where C-R functions are based on single pollutant models. However, if co-pollutants are highly correlated with O_3, their inclusion in an O_3 health effects model can lead to misleading conclusions in identifying a specific causal pollutant. When collinearity exists, inclusion of multiple pollutants in models often produces unstable and statistically insignificant effect estimates for both O_3 and the co-pollutants. Given that single and multi-pollutant models each have both potential advantages and disadvantages, with neither type clearly preferable over the other in all cases, we report risk estimates based on both single- and multi-pollutant models where both are available.

Many daily time-series epidemiological studies estimated C-R functions in which the O_3-related incidence on a given day depends only on same-day O_3 concentration or previous-day O_3 concentration (or some variant of those, such as a two-day average

concentration). Such models necessarily assume that the longer pattern of O_3 levels preceding the O_3 concentration on a given day does not affect incidence of the health effect on that day. To the extent that an O_3-related health effect on a given day is affected by O_3 concentrations over a longer period of time, then these models would be mis-specified, and this mis-specification would affect the predictions of daily incidence based on the model.

A few recent studies (e.g., Bell et al., 2004; Huang et al., 2004) have estimated distributed lag models, in which health effect incidence is a function of O_3 concentrations on several days – that is, the incidence of the health endpoint on day t is a function of the O_3 concentration on day t, day (t-1), day (t-2), and so forth. Such models can be reconfigured so that the sum of the coefficients of the different O_3 lags in the model can be used to predict the changes in incidence on several days. For example, corresponding to a change in O_3 on day t in a distributed lag model with 0-day, 1-day, and 2-day lags considered, the sum of the coefficients of the 0-day, 1-day, and 2-day lagged O_3 concentrations can be used to predict the sum of incidence changes on days t, (t+1) and (t+2). This is explained more fully in Appendix G.

The extent to which time-series studies using single-day O_3 concentrations may underestimate the relationship between short-term O_3 exposure and mortality is unknown; however, there is some evidence, based on analyses of PM_{10} data, that mortality on a given day may be influenced by prior PM exposures up to more than a month before the date of death (Schwartz, 2000b). The extent to which short-term exposure studies (including those that consider distributed lags) may not capture the possible impact of long-term exposures to O_3 is similarly not known. Currently, there is insufficient information to adequately adjust for the potential impact of longer-term exposure on mortality associated with O_3 exposures, if any, and this uncertainty should be kept in mind as one considers the results from the short-term exposure O_3 risk assessment.

Epidemiological studies sometimes present several C-R functions, each incorporating a different lag structure. The question of lags and the problems of correctly specifying the lag structure in a model have been discussed extensively [see, for example, the PM CD (EPA, 2004, section 8.4.4); the PM Staff Paper (EPA, 2005c, sections 3.5.5.2 and 4.2.6.3); the O_3 CD (EPA, 2006a, section 7.1.3.3); and Schwartz, 2000)]. The O_3 CD notes that "analyzing a large number of lags and simply choosing the largest and most significant results may bias the air pollution risk estimates away from the null." (EPA, 2006a, section 7.1.3.3). On the other hand, there is recent evidence (Schwartz, 2000) that the relationship between PM and health effects may best be described by a distributed lag (i.e., the incidence of the health effect on day n is influenced by PM concentrations on day n, day n-1, day n-2 and so on). If this is true for O_3 as well, then a model with only a single lag may bias air pollution risk estimates towards the null. For mortality associated with short-term exposure to O_3, Bell et al. (2004) and Huang et al. (2004) present the results for distributed lag models that take into account exposure from the previous 6 days. When a study reported several single lag models for a health effect, we based our initial selection of the appropriate lag structure for each health effect on the

overall assessment provided in the O_3 CD (EPA, 2006a), based on all studies reporting C-R functions for that health effect.

In summary:

- if a single-city C-R function was estimated in a risk assessment location and a multi-city function which includes that location was also available for the same health endpoint, we used both functions for that location in the risk assessment;

- risk estimates based on both single- and multi-pollutant models were used when both were available;

- distributed lag models were used, when available; when a study reported several single lag models for a health effect, we based our initial selection of the appropriate lag structure for the health effect on the overall assessment in the O_3 CD (EPA, 2006a), based on all studies reporting C-R functions for that health effect.

The locations, health endpoints, studies, and C-R functions included in that portion of the risk assessment based on epidemiological studies are summarized in Table 4-2.

Table 4-2. Summary of Locations, Concentration-Response Functions, Months Included and Counties Included

Risk Assessment Location	Ozone Season in Risk Assessment Location	Study/C-R Function	Health Endpoint	Other Pollutants in Model	Exposure Metric	Months Included for C-R Functions[1]	Counties Included for C-R Functions
Atlanta	March - October	Bell et al. (2004) - 95 cities	non-accidental mortality	none[2]	24-hr avg.	April - October	---
		Bell et al. (2004) - Atlanta	non-accidental mortality	none	24-hr avg.	April - October	Fulton, De Kalb [3]
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	none	24-hr avg.	June - September	---
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	PM_{10}	24-hr avg.	June - September	---
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	NO_2	24-hr avg.	June - September	---
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	SO_2	24-hr avg.	June - September	---
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	CO	24-hr avg.	June - September	---
		Huang et al. (2004) - Atlanta	cardiorespiratory mortality	none	24-hr avg.	June - September	Fulton, De Kalb
Boston	April - September	Bell et al. (2004) - 95 cities	non-accidental mortality	none	24-hr avg.	April - October	---
		Gent et al. (2003)	Chest tightness in asthmatic children	none	1-hr max.	April - September	CT and Springfield area of MA[4]
		Gent et al. (2003)	Chest tightness in asthmatic children	none	8-hr max.	April - September	CT and Springfield area of MA[4]

Risk Assessment Location	Ozone Season in Risk Assessment Location	Study/C-R Function	Health Endpoint	Other Pollutants in Model	Exposure Metric	Months Included for C-R Functions[1]	Counties Included for C-R Functions
		Gent et al. (2003)	Chest tightness in asthmatic children	$PM_{2.5}$	1-hr max.	April - September	CT and Springfield area of MA[4]
		Gent et al. (2003)	Shortness of breath in asthmatic children	none	1-hr max.	April - September	CT and Springfield area of MA[4]
		Gent et al. (2003)	Shortness of breath in asthmatic children	none	8-hr max.	April - September	CT and Springfield area of MA[4]
		Gent et al. (2003)	Wheeze in asthmatic children	$PM_{2.5}$	1-hr max.	April - September	
Chicago	April - September	Bell et al. (2004) - 95 cities	non-accidental mortality	none	24-hr avg.	April - October	---
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	none	24-hr avg.	June - September	---
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	PM_{10}	24-hr avg.	June - September	---
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	NO_2	24-hr avg.	June - September	---
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	SO_2	24-hr avg.	June - September	---
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	CO	24-hr avg.	June - September	---
		Huang et al. (2004) - Chicago	cardiorespiratory mortality	none	24-hr avg.	June - September	Cook

Risk Assessment Location	Ozone Season in Risk Assessment Location	Study/C-R Function	Health Endpoint	Other Pollutants in Model	Exposure Metric	Months Included for C-R Functions[1]	Counties Included for C-R Functions
		Schwartz (2004) - 14-city	non-accidental mortality	none	1-hr max.	May - September	---
		Schwartz (2004) - Chicago	non-accidental mortality	none	1-hr max.	May - September	Cook [5]
Cleveland	April - October	Bell et al. (2004) - 95 cities	non-accidental mortality	none	24-hr avg.	April - October	---
		Bell et al. (2004) - Cleveland	non-accidental mortality	none	24-hr avg.	April - October	Cuyahoga
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	none	24-hr avg.	June - September	---
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	PM_{10}	24-hr avg.	June - September	---
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	NO_2	24-hr avg.	June - September	---
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	SO_2	24-hr avg.	June - September	---
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	CO	24-hr avg.	June - September	---
		Huang et al. (2004) - Cleveland	cardiorespiratory mortality	none	24-hr avg.	June - September	Cuyahoga
		Schwartz et al. (1996)	hosp. adms. for resp. illness	none	1-hr max.	"warm season"	Cuyahoga
Detroit	April - October	Bell et al. (2004) - 95 cities	non-accidental mortality	none	24-hr avg.	April - October	---
		Bell et al. (2004) - Detroit	non-accidental mortality	none	24-hr avg.	April - October	Wayne

Risk Assessment Location	Ozone Season in Risk Assessment Location	Study/C-R Function	Health Endpoint	Other Pollutants in Model	Exposure Metric	Months Included for C-R Functions[1]	Counties Included for C-R Functions
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	none	24-hr avg.	June - September	---
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	PM_{10}	24-hr avg.	June - September	---
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	NO_2	24-hr avg.	June - September	---
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	SO_2	24-hr avg.	June - September	---
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	CO	24-hr avg.	June - September	---
		Huang et al. (2004) - Detroit	cardiorespiratory mortality	none	24-hr avg.	June - September	Wayne
		Schwartz (2004) - 14-city	non-accidental mortality	none	1-hr max.	May - September	---
		Schwartz (2004) - Detroit	non-accidental mortality	none	1-hr max.	May - September	Wayne [5]
		Ito (2003) – GAM stringent[6]	non-accidental mortality	none	24-hr avg.	April - October	Wayne
		Ito (2003) – GAM stringent	respiratory mortality	none	24-hr avg.	April - October	Wayne
		Ito (2003) – GAM stringent	unscheduled hospital adms. for pnuemonia	none	24-hr avg.	April - October	Wayne
		Ito (2003) – GAM stringent	unscheduled hospital adms. for COPD	none	24-hr avg.	April - October	Wayne
		Ito (2003) – GLM[7]	unscheduled hospital adms. for pnuemonia	none	24-hr avg.	April - October	Wayne

Risk Assessment Location	Ozone Season in Risk Assessment Location	Study/C-R Function	Health Endpoint	Other Pollutants in Model	Exposure Metric	Months Included for C-R Functions[1]	Counties Included for C-R Functions
		Ito (2003) – GLM	unscheduled hospital adms. For COPD	none	24-hr avg.	April - October	Wayne
Houston	All year	Bell et al. (2004) - 95 cities	non-accidental mortality	none	24-hr avg.	April - October	---
		Bell et al. (2004) - Houston	non-accidental mortality	none	24-hr avg.	All year	Harris
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	none	24-hr avg.	June - September	---
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	PM_{10}	24-hr avg.	June - September	---
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	NO_2	24-hr avg.	June - September	---
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	SO_2	24-hr avg.	June - September	---
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	CO	24-hr avg.	June - September	---
		Huang et al. (2004) - Houston	cardiorespiratory mortality	none	24-hr avg.	June - September	Harris
		Schwartz (2004) - 14-city	non-accidental mortality	none	1-hr max.	May - September	---
		Schwartz (2004) - Houston	non-accidental mortality	none	1-hr max.	May - September	Harris [5]
Los Angeles	All year	Bell et al. (2004) - 95 cities	non-accidental mortality	none	24-hr avg.	April - October	---
		Bell et al. (2004) - Los Angeles	non-accidental mortality	none	24-hr avg.	All year	Los Angeles

Risk Assessment Location	Ozone Season in Risk Assessment Location	Study/C-R Function	Health Endpoint	Other Pollutants in Model	Exposure Metric	Months Included for C-R Functions[1]	Counties Included for C-R Functions
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	none	24-hr avg.	June - September	---
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	PM_{10}	24-hr avg.	June - September	---
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	NO_2	24-hr avg.	June - September	---
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	SO_2	24-hr avg.	June - September	---
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	CO	24-hr avg.	June - September	---
		Huang et al. (2004) - Los Angeles	cardiorespiratory mortality	none	24-hr avg.	June - September	Los Angeles
		Linn et al. (2000)	unscheduled hosp. adms. for pulmonary illness	none	24-hr avg.	All year; separately by season	Los Angeles, Riverside, San Bernardino, Orange[8]
New York	April - September	Bell et al. (2004) - 95 cities	non-accidental mortality	none	24-hr avg.	April - October	---
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	none	24-hr avg.	June - September	---
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	PM_{10}	24-hr avg.	June - September	---
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	NO_2	24-hr avg.	June - September	---
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	SO_2	24-hr avg.	June - September	---

Risk Assessment Location	Ozone Season in Risk Assessment Location	Study/C-R Function	Health Endpoint	Other Pollutants in Model	Exposure Metric	Months Included for C-R Functions[1]	Counties Included for C-R Functions
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	CO	24-hr avg.	June - September	---
		Huang et al. (2004) - New York	cardiorespiratory mortality	none	24-hr avg.	June - September	Bronx, Kings, New York, Richmond, Queens, Westchester
		Thurston et al. (1992)	unscheduled hosp. adms. for respiratory illness	none	1-hr max.	June - August	Bronx, Kings, New York, Richmond, Queens[9]
		Thurston et al. (1992)	unscheduled hosp. adms. for asthma	none	1-hr max.	June - August	Bronx, Kings, New York, Richmond, Queens
Philadelphia	April - October	Bell et al. (2004) - 95 cities	non-accidental mortality	none	24-hr avg.	April - October	---
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	none	24-hr avg.	June - September	---
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	PM_{10}	24-hr avg.	June - September	---
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	NO_2	24-hr avg.	June - September	---
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	SO_2	24-hr avg.	June - September	---
		Huang et al. (2004) - 19 cities	cardiorespiratory mortality	CO	24-hr avg.	June - September	---

Risk Assessment Location	Ozone Season in Risk Assessment Location	Study/C-R Function	Health Endpoint	Other Pollutants in Model	Exposure Metric	Months Included for C-R Functions[1]	Counties Included for C-R Functions
		Huang et al. (2004) - Phila.	cardiorespiratory mortality	none	24-hr avg.	June - September	Philadelphia
		Moolgavkar et al. (1995)	non-accidental mortality	none	24-hr avg.	June - August	Philadelphia
		Moolgavkar et al. (1995)	non-accidental mortality	TSP, SO_2	24-hr avg.	June - August	Philadelphia
Sacramento	All year	Bell et al. (2004) - 95 cities	non-accidental mortality	none	24-hr avg.	April - October	---
		Bell et al. (2004) - Sacramento	non-accidental mortality	none	24-hr avg.	All year	Sacramento
St. Louis	April - October	Bell et al. (2004) - 95 cities	non-accidental mortality	none	24-hr avg.	April - October	---
		Bell et al. (2004) - St. Louis	non-accidental mortality	none	24-hr avg.		St. Louis city (FIPS 29510)
Washington, D.C.	April - October	Bell et al. (2004) - 95 cities	non-accidental mortality	none	24-hr avg.	April - October	---

[1] The months listed here are the months for which the C-R function was estimated. However, all C-R functions were *applied* in the risk assessment to April – Sept.
[2] The authors report that the results were robust to adjustment for PM_{10}, but do not report the multi-pollutant functions.
[3] Counties used by Bell et al. and Huang et al. are provided at http://www.ihapss.jhsph.edu/data/NMMAPS/documentation/counties.htm and in the June 2000 NMMAPS report (Number 94, Part II) are given in Appendix A, Table A.1.
[4] Specific counties not given.
[5] Personal communication via email (6-12-05) from J. Schwartz.
[6] Generalized Additive Model, using a stringent convergence criterion.
[7] Generalized Linear Model.
[8] Excluding mountain and desert regions of the first three counties.
[9] The paper doesn't list the counties, but notes that, in the case of New York City, surrounding counties were not included; this implies that only the five counties of which New York City is comprised are included in the analysis. This was confirmed in a personal communication from the author (G. Thurston).

4.1.8 Baseline health effects incidence considerations

The most common epidemiologically-based health risk model expresses the reduction in health risk (Δy) associated with a given reduction in O_3 concentrations (Δx) as a percentage of the baseline incidence (y). To accurately assess the impact of changes in O_3 air quality on health risk in the selected urban areas, information on the baseline incidence of health effects (i.e., the incidence under "as is" air quality conditions) in each location is therefore needed.

Incidence rates express the occurrence of a disease or event (e.g., asthma episode, hospital admission, premature death) in a specific period of time, usually per year. Rates are expressed either as a value per population group (e.g., the number of cases in Philadelphia County) or a value per number of people (e.g., number of cases per 10,000 population), and may be age and sex specific. Incidence rates vary among geographic areas due to differences in population characteristics (e.g, age distribution) and factors promoting illness (e.g., smoking, air pollution levels). The sizes of the populations in the assessment locations that are relevant to the risk assessment (i.e., the populations for which the O_3 C-R functions are estimated and to which the baseline incidences refer) are given in Table 4-3.

We obtained estimates of location-specific baseline mortality rates for each of the O_3 risk assessment locations for 2002 from CDC Wonder, an interface for public health data dissemination from the Centers for Disease Control (CDC).[9] Rates were calculated for the specific sets of counties for which C-R functions were estimated. The mortality rates are derived from U.S. death records and U.S. Census Bureau post-censal population estimates, and are reported in Table 4-4. National rates are provided from CDC Wonder for 2002 for comparison. The epidemiological studies used in the risk assessment reported causes of mortality using the ninth revision of the International Classification of Diseases (ICD-9) codes. However, the tenth revision has since come out, and baseline mortality incidence rates for 2002 shown in Table 4-4 use ICD-10 codes. The groupings of ICD-9 codes used in the epidemiological studies and the corresponding ICD-10 codes used to calculate year 2002 baseline incidence rates are given in Table 4-5.

[9] United States Department of Health and Human Services (US DHHS), Centers for Disease Control and Prevention (CDC), National Center for Health Statistics (NCHS), Compressed Mortality File (CMF) compiled from CMF 1968-1988, Series 20, No. 2A 2000, CMF 1989-1998, Series 20, No. 2E 2003 and CMF 1999-2002, Series 20, No. 2H 2004 on CDC WONDER On-line Database. See http://wonder.cdc.gov/.

Table 4-3. Relevant Population Sizes for O_3 Risk Assessment Locations

City	Counties	Population*			
		Total	Ages ≥30	Ages ≥ 65	Children, Ages ≤ 12, with moderate/severe asthma**
Boston	Suffolk	690,000	---	---	
Boston	Essex, Middlesex, Norfolk, Suffolk, Worcester	---	---	---	25,000
Philadelphia	Philadelphia	1,517,000	---	---	---
New York	Bronx, Kings, Queens, New York, Richmond, Westchester	8,930,000	---	---	---
New York	Bronx, Kings, Queens, New York, Richmond	8,006,000	---	---	---
Washington, D.C.	Washington, D.C.	572,000	---	---	---
Atlanta	Fulton, DeKalb	1,482,000	---	---	---
St. Louis	St. Louis City	348,000	---	---	---
Chicago	Cook	5,376,000	---	---	---
Houston	Harris	3,400,000	---	---	---
Los Angeles	Los Angeles	9,518,000	---	---	---
Los Angeles	Los Angeles, Riverside, San Bernardino, Orange	---	8,378,000	---	---
Sacramento	Sacramento	1,223,000	---	---	---
Detroit	Wayne	2,061,000	---	---	---
Cleveland	Cuyahoga	1,394,000	---	217,000	

* Total population and age-specific population estimates taken from the 2000 U.S. Census. Populations are rounded to the nearest thousand. The urban areas given in this table are those considered in the studies used in the O_3 risk assessment, with the exception of the larger Boston area, which is the CSA for Boston (since the study that estimated a C-R function for respiratory symptoms observed in moderate and severe asthmatic children (ages 0 -12) was conducted in Springfield, MA and CT).

** Population derived as follows: The populations of children <5 and 5 - 12 in the counties listed were multiplied by corresponding percents of children [in each age group] in New England with "current asthma" -- 5.1% and 10.7% for the two age groups, respectively (see "The Burden of Asthma in New England." Asthma Regional Council. March 2006. Table S-2. www.asthmaregionalcouncil.org). These estimated numbers of asthmatic children were then multiplied by the estimated percent of asthmatic children using maintenance medications (40%) (obtained via email 4-05-06 from Jeanne Moorman, CDC) and the results were summed.

Table 4-4. Baseline Mortality Rates (per 100,000 Population) for 2002 for O_3 Risk Assessment Locations*

City	Counties	Type of Mortality (ICD-9 Codes)		
		Non-accidental (<800)	Cardiorespiratory (390-448; 490-496; 487; 480-486; 507)	Respiratory (460-519)
Boston	Suffolk	736	---	---
Philadelphia	Philadelphia	1,057	242	---
New York	Bronx, Kings, Queens, New York, Richmond, Westchester	704	199	---
Washington, D.C.	Washington, D.C.	942	---	---
Atlanta	Fulton, DeKalb	623	131	---
St. Louis	St. Louis City	1147	---	---
Chicago	Cook	781	189	---
Houston	Harris	533	123	---
Los Angeles	Los Angeles	569	155	---
Sacramento	Sacramento	686	---	---
Detroit	Wayne	913	234	76
Cleveland	Cuyahoga	1,058	268	---
National	---	790	196	80

* Data from United States Department of Health and Human Services (US DHHS), Centers for Disease Control and Prevention (CDC), National Center for Health Statistics (NCHS), Compressed Mortality File (CMF) compiled from CMF 1968-1988, Series 20, No. 2A 2000, CMF 1989-1998, Series 20, No. 2E 2003 and CMF 1999-2002, Series 20, No. 2H 2004 on CDC WONDER On-line Database. See http://wonder.cdc.gov/.

Table 4-5. ICD-9 Codes used in Epidemiological Studies and Corresponding ICD-10 Codes

Causes of Death	ICD-9 Codes	ICD-10 Codes
Non-accidental	<800	A00-R99
Cardiorespiratory	390-448; 490-496; 487; 480-486; 507	G45.0-G45.2, G45.4-G45.9, G54.0, G93.6, G93.8, G93.8, G95.1, I00-I13.9, I20.0-I22.9, I24.1-I64, I67.0-I78.9, M21.9, M30.0-M31.9, R00.1, R00.8, R01.2, J40-J47, J67, J10-J18, J69
Respiratory	460-519	J00-J01.9, J02.8-J02.9, J03.8-J64, J66.0-J94.9, J98.0-J98.9, P28.8, R06.5, R09.1

Hospital admissions studies included in the O_3 risk assessment were conducted in Los Angeles, Cleveland, and New York City. Because Thurston et al. (1992) estimated a linear C-R function for New York City, a baseline incidence rate is not required to estimate risks. However, a baseline incidence rate is needed to calculate hospital admissions as a percent of the total (baseline) hospital admissions. Baseline rates of unscheduled hospital admissions for respiratory illnesses and for asthma in New York City (the five boroughs) were calculated from the year 2001 data provided to us by the New York Statewide Planning and Research Cooperative. Baseline rates of unscheduled hospital admissions for Los Angeles (Los Angeles, Riverside, San Bernardino, and Orange Counties) were calculated from patient discharge data for 1999, obtained from California's Office of Statewide Health Planning and Development, which also provided records of hospital admissions for the study by Linn et al. (2000). The records provided for the Linn study included both ICD codes and All-Patient-Refined Diagnosis-Related Group (APR-DRG). Because Linn et al. (2000) used diagnosis categories based on the APR-DRG, we made sure that the records we obtained from California's Office of Statewide Health Planning and Development also contained the APR-DRG so that baseline incidence rates could be calculated for hospital admissions categories that matched those used in the Linn study. In addition, we used a flag in the dataset indicating whether an admission was scheduled or unscheduled to ensure that the rates we calculated were for unscheduled admissions only.

Schwartz et al. (1996) report several percentiles as well as the mean of the distribution of daily hospital admissions for respiratory illness (ICD-9 codes 460-519) among people ages 65 and older in Cuyahoga County, which contains Cleveland, Ohio, during the years 1988-90. The mean daily hospital admissions in this age group in Cuyahoga County was 22 in 1988-90. To estimate a daily rate, we obtained the population age 65 and older in Cuyahoga County in 1990[10] and divided the mean daily hospital admissions for respiratory illness by that population. Baseline incidence rates for hospital admissions used in the risk assessment are shown in Table 4-6.

[10] 1990 U.S. Census, at: http://factfinder.census.gov/servlet/BasicFactsServlet

Table 4-6. Baseline Rates for Hospital Admissions Used in the O_3 Risk Assessment

	Rate per 100,000 Relevant Population			
	Los Angeles[1]	**New York[2]**	**Detroit[3]**	**Cleveland[4]**
Relevant Population:	**Ages 30+**	**All Ages**	**Ages 65+**	**Ages 65+**
Admissions for:				
Pulmonary illness (DRG Codes 75 – 101) – spring	208	---	---	---
Pulmonary illness (DRG Codes 75 – 101) – summer	174	---	---	---
Respiratory illness (ICD codes 466, 480-486, 490, 491, 492, 493)	---	800	---	---
Asthma (ICD code 493)	---	327	---	---
Pneumonia (ICD codes 480-486)	---	---	2,068	---
Respiratory illness ((ICD codes 460-519)	---	---	---	3,632

[1] Rates of unscheduled hospital admissions were calculated from patient discharge data for 1999, obtained from California's Office of Statewide Health Planning and Development, which also provided records of hospital admissions for the study by Linn et al. (2000).
[2] Rates of unscheduled hospital admissions were calculated from patient discharge data for 2001, obtained from the New York Statewide Planning and Research Cooperative.
[3] Rates were calculated from hospitalization data for Wayne County for the year 2000, obtained from the Michigan Health and Hospital Association in April 2002.
[4] Based on mean daily hospital admissions for ages 65+ for ICD-9 codes 460-519 -- Table 1 in Schwartz et al. (1996).

Baseline rates of symptoms among moderate/severe asthmatic children in the Boston area were estimated by using the median rates of the respiratory symptoms reported in Table 3 of Gent et al. (2003). Each symptom rate, the percentage of days on which the symptom occurred, was calculated for each subject by dividing the number of days of the symptom by the number of days of participation in the study and then multiplying by 100. Median symptom rates among maintenance medication users for wheeze, chest tightness, and shortness of breath were 2.8%, 1.2%, and 1.5% of days, respectively.

4.1.9 Addressing uncertainty and variability

Any estimation of "as is" risk and reduced risks associated with just meeting the current O_3 standards should address both the variability and uncertainty that generally underlie such an analysis. In Section 3.1.5 we discussed the difference between uncertainty and variability, and gave examples of each. The discussion in that section is applicable to the uncertainty and variability to be addressed in the portion of the risk assessment based on epidemiological studies as well.

As with the controlled human exposure studies portion of the risk assessment, the epidemiology-based portion incorporates some of the variability in key inputs to the

analysis by using location-specific inputs (e.g., location-specific population data and baseline incidence rates). Although spatial variability in these key inputs across all U.S. locations has not been fully characterized, variability across the selected locations is imbedded in the analysis by using, to the extent possible, inputs specific to each urban area. As in the controlled human exposure studies portion of the risk assessment, temporal variability is more difficult to address, because the risk assessment focuses on some unspecified time in the future. To minimize the degree to which values of inputs to the analysis may be different from the values of those inputs at that unspecified time, we have used recent input data – for example, year 2004 and year 2002 air quality data for all of the urban locations, and recent population data (from the 2000 Census). However, future changes in inputs have not been predicted (e.g., future population levels). To address the impact of variability in O_3 concentrations from one year to another, we carried out the risk assessment for two years separately – 2002 and 2004 – which represent generally upper- and lower-ends of overall O_3 concentrations during the three-year period under consideration.

A number of important sources of uncertainty in the epidemiology-based portion of the risk assessment were addressed where possible. The following are among the major sources of uncertainty:

- Uncertainties related to estimating the C-R functions, including
    - uncertainty about the extent to which the association between O_3 and the health endpoint actually reflects a causal relationship.
    - uncertainty surrounding estimates of O_3 coefficients in C-R functions used in the analyses.
    - uncertainty about the specification of the model (including the shape of the C-R relationship), particularly whether or not there are thresholds below which no response occurs.
    - uncertainty related to the transferability of O_3 C-R functions from study locations and time periods to the locations and time periods selected for the risk assessment. A C-R function in a study location may not provide an accurate representation of the C-R relationship in the analysis location(s) and time periods because of
        - the possible role of associated co-pollutants, which vary from location to location and over time, in influencing O_3 risk,
        - variations in the relationship of total ambient exposure (both outdoor and ambient contributions to indoor exposure) to ambient monitoring in different locations (e.g, due to differences in air conditioning use in different regions of the U.S. or changes in usage over time),

        - differences in population characteristics (e.g., the proportions of members of sensitive subpopulations) and population behavior patterns across locations or over time in the same location.

- Uncertainties related to the air quality data, including
    - the adjustment procedure that was used to simulate just meeting the current and alternative O_3 standards.
    - uncertainties about estimated background concentrations for each location.
- Uncertainties associated with use of baseline health effects incidence information that is not specific to the analysis locations.

The specific sources of uncertainty in the O_3 risk assessment are described in detail below and are summarized in Table 4-7.

Table 4-7. Key Uncertainties in the Risk Assessment

Uncertainty	Comments
Causality	Statistical association does not prove causation. However, the risk assessment considers only health endpoints for which the overall weight of the evidence supports the assumption that O_3 is likely causally related.
Empirically estimated C-R relations	Because C-R functions are empirically estimated, there is uncertainty surrounding these estimates. Omitted confounding variables could cause bias in the estimated O_3 coefficients. However, including potential confounding variables that are highly correlated with one another can lead to unstable estimators. Both single- and multi-pollutant models were used where available. In addition, for those studies which provided both single-location and multiple-location estimates, single-location estimates were adjusted, using a Bayesian adjustment procedure, to make more efficient use of the data in the study. This is explained more fully below.
Functional form of C-R relation	Statistical significance of coefficients in an estimated C-R function does not necessarily mean that the mathematical form of the function is the best model of the true C-R relation.
Lag structure of C-R relation	There is some evidence that a distributed lag might be the most appropriate model for O_3 effects associated with short-term exposures. Most studies, however, included only one lag in their models. (Two important exceptions are Bell et al. (2004) and Huang et al. (2004).) Omitted lags could cause downward bias in the predicted incidence associated with a given reduction in O_3 concentrations.
Transferability of C-R relations	C-R functions may not provide an adequate representation of the C-R relationship in times and places other than those in which they were estimated. For example, populations in the analysis locations may have more or fewer members of sensitive subgroups than locations in which functions were derived, which would introduce additional uncertainty related to the use of a given C-R function in the analysis location. However, in the majority of cases, the risk assessment relies on C-R functions estimated from studies conducted in the same location.
Extrapolation of C-R relations beyond the range of observed O_3 data	A C-R relationship estimated by an epidemiological study may not be valid at concentrations outside the range of concentrations observed during the study.

Uncertainty	Comments
Adequacy of ambient O_3 monitors as surrogate for population exposure	Possible differences in how the spatial variation in ambient O_3 levels across each urban area are characterized in the original epidemiological studies compared to the more recent ambient O_3 data used to characterize current air quality would contribute to uncertainty in the health risk estimates.
Adjustment of air quality distributions to simulate just meeting current O_3 standards.	The pattern and extent of daily reductions in O_3 concentrations that would result if the current O_3 standard or alternative O_3 standards were just met is not known. There remains uncertainty about the shape of the air quality distribution of hourly levels upon just meeting an O_3 standard that will depend on future air quality control strategies.
Background O_3 concentrations	The calculation of O_3 risk associated with "as is" air quality and of reduced risks that would result if the current or an alternative standard were just met requires as inputs the background O_3 concentrations in each of the assessment locations. Background concentrations were estimated based on the GEOS-CHEM model simulations for each location for all hours of an "average day" in a given month, for each of the months from April through September. There is uncertainty about these estimated background levels.
Baseline health effects data	Data on baseline incidence is uncertain for a variety of reasons. For example, location- and age-group-specific baseline rates may not be available in all cases. Baseline incidence may change over time for reasons unrelated to O_3.

We handled uncertainties in the risk assessment as follows:

- Limitations and assumptions in estimating risks and reduced risks are clearly stated and explained.

- The uncertainty resulting from the statistical uncertainty associated with the estimate of the O_3 coefficient in a C-R function was characterized either by confidence intervals or by Bayesian credible intervals around the corresponding point estimate of risk. Confidence intervals and credible intervals express the range within which the true risk is likely to fall if the uncertainty surrounding the O_3 coefficient estimate were the only uncertainty in the analysis. They do not, for example, reflect the uncertainty concerning whether the O_3 coefficients in the study location and the assessment location are the same.

- Where possible, we made use of multi-city information to adjust location-specific estimates to make more efficient use of the data (see Section 4.1.9.1.2 below).

Although the O_3 risk assessment considered mortality as well as morbidity health effects, not all health effects which may result from O_3 exposure were included. Only those for which there was sufficient epidemiological evidence from studies which met the study selection criteria (see Section 4.1.5) were included in the risk assessment. Other possible health effects reported to be associated with exposure to O_3 are considered qualitatively in the draft Staff Paper. Thus, the draft O_3 risk assessment does not represent all of the health risks associated with O_3 exposures.

In addition, we limited application of a C-R function to only that portion of the population on which estimation of the function was based. For example, unscheduled hospital admissions for pneumonia were examined in Ito (2003) for people ages 65 and older. It is likely that the effect of O_3 on hospital admissions for these illnesses and conditions does not begin at age 65; however, data are not available to estimate the number of cases avoided for younger age groups for the urban area examined by Ito (2003). Therefore, some number of potentially avoided health effects was likely not captured in this analysis.

4.1.9.1 Concentration-response functions

The C-R function is a key element of the O_3 risk assessment. The quality of the risk assessment depends, in part, on (1) whether the C-R functions used in the risk assessment are good estimates of the relationship between the population health response and ambient O_3 concentration in the study locations, (2) how applicable these functions are to the analysis periods and locations, and (3) the extent to which these relationships apply beyond the range of the O_3 concentrations from which they were estimated. These issues are discussed in the subsections below.

4.1.9.1.1 Uncertainty associated with the appropriate model form

The relationship between a health endpoint and O_3 can be characterized in terms of the form of the function describing the relationship – e.g., linear, log-linear, or logistic – and the value of the O_3 coefficient in that function. Although most epidemiological studies estimated O_3 coefficients in log-linear models, there is still substantial uncertainty about the correct functional form of the relationship between O_3 and various health endpoints – especially at the low end of the range of O_3 values, where data are generally too sparse to discern possible thresholds. While there are likely biological thresholds in individuals for specific health responses, the available epidemiological studies generally have not supported or refuted the existence of thresholds at the population level for O_3 exposures within the range of air quality observed in the studies. A recent study, Bell et al. (2006), specifically addressed the question of thresholds, however, and found no evidence to support the threshold hypothesis. Applying several different statistical approaches specifically designed to address the threshold issue to data on air pollution, weather and mortality for 98 U.S. cities from 1987 to 2000, they found that "even low levels of tropospheric ozone are associated with increased risk of premature mortality" (Bell et al., 2006).

4.1.9.1.2 Uncertainty associated with the estimated concentration-response functions in the study locations

The uncertainty associated with an estimate of the O_3 coefficient in a C-R function reported by a study depends on the sample size and the study design. The O_3 CD has evaluated the substantial body of O_3 epidemiological studies. In general, critical considerations in evaluating the design of an epidemiological study include the adequacy of the measurement of ambient O_3, the adequacy of the health effects incidence data, and the consideration of potentially important health determinants and potential confounders and effect modifiers such as:

- other pollutants;
- exposure to other health risks, such as smoking and occupational exposure; and
- demographic characteristics, including age, sex, socioeconomic status, and access to medical care.

The possible confounding effects of copollutants, including other criteria air pollutants, has often been noted as a problem in air pollutant risk assessments, particularly when these other pollutants are highly correlated with the pollutant of interest. O_3 is generally not highly correlated with other criteria air pollutants, although it may be more highly correlated with fine particles, especially during the summer months. A recent meta-analysis of time-series studies of O_3 and mortality, however, found that the effect of O_3 on mortality was insensitive to whether particulate matter was included in the model (Bell et al., 2005). The issue of possible confounding by copollutants is discussed in more detail in Section 3.4.2.2 of the draft Staff Paper (EPA, 2006b).

The selection of studies included in the O_3 risk assessment was guided by the evaluations in the O_3 CD. One of the criteria for selecting studies addresses the adequacy of the measurement of ambient O_3. This criterion was that O_3 was directly measured, rather than estimated, on a reasonable proportion of the days in the study. This criterion was designed to minimize error in the estimated O_3 coefficients in the C-R functions used in the risk assessment.

Ambient concentrations at central monitors, however, may not provide a good representation of personal exposures. The O_3 CD (EPA, 2006a) identifies the following three components to exposure measurement error: (1) the use of average population rather than individual exposure data; (2) the difference between average personal ambient exposure and ambient concentrations at central monitoring sites; and (3) the difference between true and measured ambient concentrations (O_3 CD, p. 7-7). The O_3 CD notes that "these components are expected to have different effects, with the first and third likely not causing bias in a particular direction ("nondifferential error") but increasing the standard error, while the second component may result in downward bias, or attenuation of the risk estimate" (O_3 CD, pp. 7-7 to 7-8). While a concentration-response function may understate the effect of personal exposures to O_3 on the incidence of a health effect, however, it will give an unbiased estimate of the effect of ambient concentrations on the incidence of the health effect, if the ambient concentrations at monitoring stations provide an unbiased estimate of the ambient concentrations to which the population is exposed. In this case, if O_3 is actually the causal agent, the understatement of the impact of personal exposures isn't an issue (since EPA regulates ambient concentrations rather than personal exposures). If O_3 is not the causal agent, however, then there is a problem of confounding copollutants or other factors, so that reducing ambient O_3 concentrations might not result in the expected reductions in the health effect. A more comprehensive discussion of exposure measurement is given in Section 3.4.2.1 of EPA's draft Staff Paper (EPA, 2006b).

To the extent that a study did not address all relevant factors (i.e., all factors that affect the health endpoint), there is uncertainty associated with the C-R function estimated in that study, beyond that reflected in the confidence or credible interval. It may result in either over- or underestimates of risk associated with ambient O_3 concentrations in the location in which the study was carried out. Techniques for addressing the problem of confounding factors and other study design issues have improved over the years, however, and the epidemiological studies currently available for use in the O_3 risk assessment provide a higher level of confidence in study quality than ever before.

When a study is conducted in a single location, the problem of possible confounding co-pollutants may be particularly difficult, if co-pollutants are highly correlated in the study location. Single-pollutant models, which omit co-pollutants, may produce overestimates of the O_3 effect, if some of the effects of other pollutants (omitted from the model) are falsely attributed to O_3. Statistical estimates of an O_3 effect based on a multi-pollutant model can be more uncertain, and even statistically insignificant, if the co-pollutants included in the model are highly correlated with O_3. As a result of these

considerations, we report risk estimates based on both single-pollutant and multi-pollutant models, when both are reported by a study.

As noted above, the uncertainty resulting from the statistical uncertainty associated with the estimate of the O_3 coefficient in a C-R function was characterized either by confidence intervals (if the coefficient was estimated using a classical statistical approach) or by Bayesian credible intervals (if the coefficient was estimated using a Bayesian approach) around the corresponding point estimate of risk.

Two studies, Bell et al. (2004) and Huang et al. (2004), reported both multi-location and single-location C-R functions in a variety of locations, using a Bayesian two-stage hierarchical model. In these cases, the single-location estimates can be adjusted to make more efficient use of the data from all locations. The resulting "shrinkage" estimates are so called because they "shrink" the location-specific estimates towards the overall mean estimate (the mean of the posterior distribution of the multi-location C-R function coefficient). The greater the uncertainty about the estimate of the location-specific coefficient relative to the estimate of between-study heterogeneity, the more the location-specific estimate is "pulled in" towards the overall mean estimate. Bell et al. (2004) calculated these shrinkage estimates, which were presented in Figure 2 of that paper. These location-specific shrinkage estimates, and their adjusted standard errors were provided to us by the study authors and were used in the risk assessment.

The location-specific estimates reported in Table 1 of Huang et al. (2004) are not "shrinkage" estimates. However, the study authors provided us with the posterior distribution for the heterogeneity parameter, τ, for their distributed lag model, shown in Figure 4(b) of their paper. Given this posterior distribution, and the original location-specific estimates presented in Table 1 of their paper, we calculated location-specific "shrinkage" estimates using a Bayesian method described in DuMouchel (1994) (see Section B-3 in Appendix B for a complete explanation of the calculation of these "shrinkage" estimates). As with the shrinkage estimates presented in Bell et al. (2004), the resulting Bayesian shrinkage estimates use the data from all of the locations considered in the study more efficiently than do the original location-specific estimates. The calculation of these shrinkage estimates is thus one way to address the relatively large uncertainty surrounding estimates of coefficients in location-specific C-R functions.

Several recent meta-analyses (Bell et al. 2005; Levy et al., 2005; and Ito et al., 2005) have addressed the impact of various factors on estimates of mortality associated with short-term exposures to O_3. We reviewed these meta-analyses for additional information that might be used to assist in characterizing the uncertainties associated with risk estimates for this health outcome. Overall, the meta-analyses helped delineate the sources of heterogeneity in the estimated relationships between mortality and short-term exposure to O_3, the robustness of these estimated relationships to inclusion of PM in the model, the relative importance of 0-day lag among the different lag structures considered, and the indication of publication bias in single-city studies and meta-analyses of such studies. Because of this last issue in particular, while the meta-analyses provided insight

into relevant issues, we considered multi-city studies preferable for use in the risk assessment.

4.1.9.1.3 Applicability of concentration-response functions in different locations

As described in Section 4.1.4, risk assessment locations were selected on the basis of where C-R functions have been estimated, to avoid the uncertainties associated with applying a C-R function estimated in one location to another location. However, multi-city C-R functions were also applied to any risk assessment location contained in the set of locations used to estimate the C-R function. The accuracy of the results based on a multi-location C-R function rests in part on how well this multi-location C-R function represents the relationship between ambient O_3 and the given population health response in the individual cities involved in the study.

The relationship between ambient O_3 concentration and the incidence of a given health endpoint in the population (the population health response) depends on (1) the relationship between ambient O_3 concentration and personal exposure to ambient-generated O_3 and (2) the relationship between personal exposure to ambient-generated O_3 and the population health response. Both of these are likely to vary to some degree from one location to another.

The relationship between ambient O_3 concentration and personal exposure to ambient-generated O_3 will depend on patterns of behavior, such as the amount of time spent outdoors, as well as on factors affecting the extent to which ambient-generated O_3 infiltrates into indoor environments. The relationship between personal exposure to ambient-generated O_3 and the population health response will depend on the population exposed.

Exposed populations differ from one location to another in characteristics that are likely to affect their susceptibility to O_3 air pollution. For instance, people with pre-existing conditions such as chronic bronchitis are probably more susceptible to the adverse effects of exposure to O_3, and populations vary from one location to another in the prevalence of specific diseases. Also, some age groups may be more susceptible than others, and population age distributions also vary from one location to another. Closely matching populations observed in studies to the populations of the assessment locations is not possible for many characteristics (for example, smoking status, workplace exposure, socioeconomic status, and the prevalence of highly susceptible subgroups).

Other pollutants may also play a role in either causing or modifying health effects, either independently or in combination with O_3 (see Section 8.1.3.2 in the 2004 PM CD and Section 7.1.3.5 in the O_3 CD). Inter-locational differences in these pollutants could also induce differences in the O_3 C-R relationship between one location and another.

In summary, the C-R relationship is most likely not the same everywhere. Even if the relationship between personal exposure to ambient-generated O_3 and population

health response were the same everywhere, the relationship between ambient concentrations and personal exposure to ambient-generated O_3 differs among locations. Similarly, even if the relationship between ambient concentrations and personal exposure to ambient-generated O_3 were the same everywhere, the relationship between personal exposure to ambient-generated O_3 and population health response may differ among locations. In either case, the C-R relationship would differ.

4.1.9.1.4 Extrapolation beyond observed air quality levels

Although a C-R function describes the relationship between ambient O_3 and a given health endpoint for all possible O_3 levels (potentially down to zero), the estimation of a C-R function is based on real ambient O_3 values that are limited to the range of O_3 concentrations in the location in which the study was conducted. Thus, uncertainty in the shape of the estimated C-R function increases considerably outside the range of O_3 concentrations observed in the study.

Because we are interested in the effects of anthropogenic O_3, in this initial analysis, the O_3 risk assessment assumes that the estimated C-R functions adequately represent the true C-R relationship down to PRB O_3 levels in the assessment locations. Because those studies that reported the minimum O_3 levels observed all reported levels below PRB O_3 levels, the problem of extrapolation to levels below those air quality levels observed in a study does not arise.

The C-R relationship may also be less certain towards the upper end of the concentration range being considered in a risk assessment, particularly if the O_3 concentrations in the assessment location exceed the O_3 concentrations observed in the study location. Even though it may be reasonable to model the C-R relationship as log-linear over the ranges of O_3 concentrations typically observed in epidemiological studies, it may not be log-linear over the entire range of O_3 levels at the locations considered in the O_3 risk assessment.

4.1.9.2 The air quality data

4.1.9.2.1 Adequacy of O_3 air quality data

The method of averaging data from monitors across a metropolitan area in the risk assessment is similar to the methods used to characterize ambient air quality in most of the epidemiology studies. Ideally, the measurement of average hourly ambient O_3 concentrations in the study location is unbiased. In this case, unbiased risk predictions in the assessment location depend, in part, on an unbiased measurement of average hourly ambient O_3 concentrations in the assessment location as well. If, however, the measurement of average hourly ambient O_3 concentrations in the study location is biased, unbiased risk predictions in the assessment location are still possible if the measurement of average hourly ambient O_3 concentrations in the assessment location incorporates the same bias as exists in the study location measurements. Because this is not known,

however, the errors in the O_3 measurements in the assessment locations are a source of uncertainty in the risk assessment.

O_3 air quality data were not available for all hours of the ozone season in the year chosen for the risk assessment in all of the assessment locations. Missing O_3 concentrations were filled in, as described in section 3.2 of the draft Exposure Assessment TSD.

The results of the risk assessment are generalizable to other years only to the extent that ambient O_3 levels in the available data are similar to ambient O_3 levels in those locations in the other years. A substantial difference between O_3 levels in the year used in the risk assessment and O_3 levels in the other years could imply a substantial difference in predicted incidences of health effects. We selected two years, 2002 and 2004, in the 2002 – 2004 three-year period. O_3 levels in 2004 in most of the 12 urban areas were somewhat lower than in other recent years, due to both meteorological conditions that were not conducive to O_3 formation and lower emissions of NO_x due to newly implemented regional controls on major power plants in the eastern U.S. O_3 levels in 2002 were generally higher than in either 2003 or 2004 except in Detroit, Houston and Los Angeles.

4.1.9.2.2 Estimation of PRB O_3 concentrations

The PRB O_3 concentrations that were used in the risk assessment are monthly averaged GEOS-CHEM model predictions, and the measured ambient O_3 concentrations are frequently lower than these PRB values. After assessing the uncertainty of the GEOS-Chem model predictions, the O_3 CD estimates that "the PRB ozone values reported by Fiore et al. (2003a) for afternoon surface air over the United States are likely 10 ppbv too high in the southeast in summer, and accurate within 5 ppbv in other regions and seasons" (O_3 CD, page 3-53). This raises the question of how best to deal with this in our estimation of risk above PRB. We considered two different approaches, described in Appendix E, calculating the bias expected in each case. As described in Appendix E, the relative magnitudes of the expected biases from the two approaches depends on whether we have overestimated or underestimated the monthly average PRB. The frequency with which the measured ambient O_3 concentrations are lower than our estimated PRB values suggests that these monthly PRB averages were overestimated. Fiore et al. (2002a) noted that the GEOS-CHEM model tends to overpredict O_3 concentrations in highly populated coastal areas, lending additional support for this hypothesis in Houston, where the frequency of estimated PRB concentrations above monitored "as is" concentrations was the greatest. On the assumption that monthly PRB averages were overestimated, the lowest-bias method to estimating risk above PRB is to set negative ΔO_3 (= "as is" O_3 concentration – PRB O_3 concentration) to zero. We believe this approach minimizes bias.

4.1.9.2.3 Simulation of reductions in O_3 concentrations to just meet the current or an alternative standard

The pattern of hourly O_3 concentrations that would result if the current O_3 standard or an alternative standard were just met in any of the assessment locations is, of course, not known. This therefore adds uncertainty to estimates of reduced risk when O_3 concentrations just meet a standard.

Although the health risk assessment uses air quality data from two years, 2002 and 2004, it simulates just attaining a standard in each year separately, since we are estimating annual reduced health risks. Design values based on the most recent three-year period available are used to determine the amount of adjustment to apply to each of these years. Because O_3 levels in 2004 were, in most locations, the lowest of the three most recent years, applying a design value based on the most recent three-year period available only to O_3 levels in 2004 would result in lower estimates of remaining risk than would be the case if either of the other two years of the three-year period were evaluated in the assessment. Conversely, because O_3 levels in 2002 were, in most locations, the highest of the three most recent years, applying the same design value only to O_3 levels in 2002 would result in higher estimates of remaining risk than would be the case if either of the other two years of the three-year period were evaluated in the assessment. Using both a year of generally higher O_3 levels (2002) and a year of generally lower O_3 levels (2004) provides plausible ranges of estimates of annual remaining risk and reductions in health risks in each location.

4.1.9.3 Baseline health effects incidence rates

Most of the C-R functions used in the O_3 risk assessment are log-linear (see equation 4-1 in Section 4.1.1). Given this functional form, the percent change in incidence of a health effect corresponding to a change in O_3 depends only on the change in O_3 levels (and not the actual value of either the initial or final O_3 concentration). This percent change is multiplied by a baseline incidence, y_0, in order to determine the change in health effects incidence, as shown in equation (4-3) in Section 4.1.1:

$$\Delta y = y_0[1 - e^{-\beta \Delta x}]$$

Predicted changes in incidence therefore depend on the baseline incidence of the health effect.

4.1.9.3.1 Quality of incidence data

County-specific incidence data were available for mortality for all counties. We have also obtained hospital admissions baseline incidence data for all the urban areas for which we have hospital admissions C-R functions for O_3 (Detroit, Los Angeles, and Cleveland). This is clearly preferable to using non-local data, such as national or regional incidence rates. As with any health statistics, however, misclassification of disease, errors in coding, and difficulties in correctly assigning residence location are potential

problems. These same potential sources of error are present in most epidemiological studies. In most cases, the reporting institutions and agencies utilize standard forms and codes for reporting, and quality control is monitored.

Data on hospital admissions are actually hospital discharge data rather than admissions data. Because of this, the date associated with a given hospital stay is the date of discharge rather than the date of admissions. Therefore, there may be some hospital admissions in an assessment location that are within the O_3 season that are not included in the baseline incidence rate, if the date of discharge was after the ozone season ended, even though the date of admissions was within the ozone season. Similarly, there may be some hospital admissions that preceded the O_3 season that are included in the baseline incidence rate because the date of discharge was within the ozone season. This is a very minor problem, however, partly because the percentage of such cases is likely to be very small, and partly because the error at the beginning of the O_3 season (i.e., admissions that should not have been included but were) will largely cancel the error at the end of the O_3 season (i.e., admissions that should have been included but were not).

Another minor uncertainty surrounding the hospital admissions baseline incidence rates arises from the fact that these rates are based on the reporting of hospitals within each of the assessment counties. Hospitals report the numbers of ICD code-specific discharges in a given year. If people from outside the county use these hospitals, and/or if residents of the county use hospitals outside the county, these rates will not accurately reflect the numbers of county residents who were admitted to the hospital for specific illnesses during the year, the rates that are desired for the risk assessment. Once again, however, this is likely to be a very minor problem because the health conditions studied tend to be acute events that require immediate hospitalization, rather than planned hospital stays.

Regardless of the data source, if actual incidence rates are higher than the incidence rates used, risks will be underestimated. If actual incidence rates are lower than the incidence rates used, then risks will be overestimated.

Both morbidity and mortality rates change over time for various reasons. One of the most important of these is that population age distributions change over time. The old and the extremely young are more susceptible to many health problems than is the population as a whole. The most recent available data were used in the risk assessment. However, the average age of the population in many locations will increase as post-World War II children age. Consequently, the baseline incidence rates for some endpoints may rise, resulting in an increase in the number of cases attributable to any given level of O_3 pollution. Alternatively, areas which experience rapid in-migration, as is currently occurring in the South and West, may tend to have a decreasing mean population age and corresponding changes in incidence rates and risk. Temporal changes in incidence are relevant to both morbidity and mortality endpoints. However, recent data were used in all cases, so temporal changes are not expected to be a large source of uncertainty.

4.1.9.3.2 Lack of daily health effects incidence rates

Both ambient O_3 levels and the daily health effects incidence rates corresponding to ambient O_3 levels vary somewhat from day to day. Those analyses based on C-R functions estimated by short-term exposure studies calculate daily changes in incidence and sum them over the days of the O_3 season to predict a total change in health effect incidence during the O_3 season (standardized in this analysis to April through September). However, only annual baseline incidence rates are available. Average daily baseline incidence rates, necessary for short-term daily C-R functions, were calculated by dividing the annual rate by the number of days in the year for which the baseline incidence rates were obtained. To the extent that O_3 affects health, however, actual incidence rates would be expected to be somewhat higher than average on days with high O_3 concentrations; using an average daily incidence rate would therefore result in underestimating the changes in incidence on such days. Similarly, actual incidence rates would be expected to be somewhat lower than average on days with low O_3 concentrations; using an average daily incidence rate would therefore result in overestimating the changes in incidence on low O_3 days. Both effects would be expected to be small, however, and should largely cancel one another out.

4.2 Results

The results of the assessment of health risks associated with "as is" O_3 concentrations (representing levels measured in 2004 and 2002 for all of the assessment locations) over PRB levels are presented in Section 4.2.1. The results of the assessment of the reduced health risks associated with O_3 concentrations that just meet the current 8-hour daily maximum standard, based on 2004 and 2002 O_3 concentrations, are presented in Section 4.2.2. In both portions of the risk assessment, with the exception of respiratory symptoms-days, all estimated incidences were rounded to the nearest whole number, and all estimated incidences per 100,000 relevant population and all percentages were rounded to one decimal place. Estimated incidences of respiratory symptom-days and corresponding incidences per 100,000 relevant population were rounded to the nearest 100. These rounding conventions are not intended to imply confidence in that level of precision, but rather to avoid the confusion that can result when a greater amount of rounding is used (for example, when the central tendency estimate and both the lower and upper bounds of the 95 confidence or credible interval of incidence per 100,000 relevant population are all less than 0.5.)

There is uncertainty surrounding almost all estimates of incidence associated with "as is" O_3 concentrations in any location. Because we had to simulate the profiles of O_3 concentrations that just meet the current and alternative 8-hour daily maximum O_3 standards in each location, there is additional uncertainty surrounding estimates of the reduced incidence associated with O_3 concentrations that just meet these O_3 standards. We tried to minimize the extent of this uncertainty by avoiding the application of a C-R function estimated in one location to another location as much as possible. As discussed in Section 4.1.9, however, there are other sources of uncertainty. The uncertainty surrounding risk estimates resulting from the statistical uncertainty of the O_3 coefficients

in the C-R functions used is characterized by ninety-five percent confidence or credible intervals around estimates of incidence, incidence per 100,000 relevant population, and the percent of total incidence that is O_3-related. In some cases, the lower bound of a confidence interval falls below zero. This does not imply that additional exposure to O_3 has a beneficial effect, but only that the estimated O_3 coefficient in the C-R function was not statistically significantly different from zero. Lack of statistical significance could mean that there is no relationship between O_3 and the health endpoint or it could mean that there wasn't sufficient statistical power to detect a relationship that exists. Conversely, statistical significance does not prove causation. The case for a causal relationship between O_3 and a health endpoint rests on a variety of types of supporting evidence, and overall confidence in such a causal relationship varies substantially across health endpoints that have been associated with ambient O_3, as illustrated in Figure 3-5 of the draft Staff Paper (EPA, 2006b).

4.2.1 Assessment of the health risks associated with "as is" O_3 concentrations in excess of policy relevant background levels

The results of the assessment of mortality risks associated with "as is" O_3 concentrations (representing levels measured in 2004 and in 2002 for all of the assessment locations are summarized across urban areas in Figures 4-2a and b through 4-8a and b, and in Tables 4-8 and 4-11. Figures 4-2a and b through 4-8a and b show results expressed as percent of total incidence. The corresponding figures showing results expressed as number of cases per 100,000 relevant population are given in Appendix C. Figures 4-2a through 4-8a show results based on year 2004 air quality data; Figures 4-2b through 4-8b show results based on 2002 air quality data. Only one study, Ito (2003) for hospital admissions in Detroit, provided different lag models. The results from these different lag models are shown in Figures 4-6a and b. All results are for health risks associated with short-term exposures to O_3 concentrations in excess of PRB levels from April through September.

Although we carried out the analysis in each of the assessment locations, to reduce the number of tables in this section of the report, we selected one location (New York City) to include here for illustrative purposes. Tables 4-12 and 4-13 show results in New York for health endpoints associated with short-term exposure to "as is" O_3 concentrations in excess of estimated PRB concentrations for 2004 and 2002 air quality data, respectively. Results for the other locations corresponding to those shown for New York in Tables 4-12 and 4-13 are shown in Appendix C, in Tables C-1 through C-22.

The central tendency estimates in all of the figures and in Tables 4-8 through 4-13 and C-1 through C-22 are based on the O_3 coefficients estimated in the studies, or, in the case of the location-specific estimates from Huang et al. (2004), on "shrinkage" estimates based on the O_3 coefficients estimated in the study (see Section 4.1.9.1.2). The ranges are based either on the 95 percent confidence intervals (CIs) around those estimates (if the coefficients were estimated using classical statistical techniques) or on the 95 percent credible intervals (if the coefficients were estimated using Bayesian statistical techniques).

Figure 4-2. Estimated Annual Percent of (Non-Accidental) Mortality Associated with Short-Term Exposure to O_3 Above Background: Single-Pollutant, Single-City Models (April – September)

Figure 4-2a. Based on 2004 Air Quality

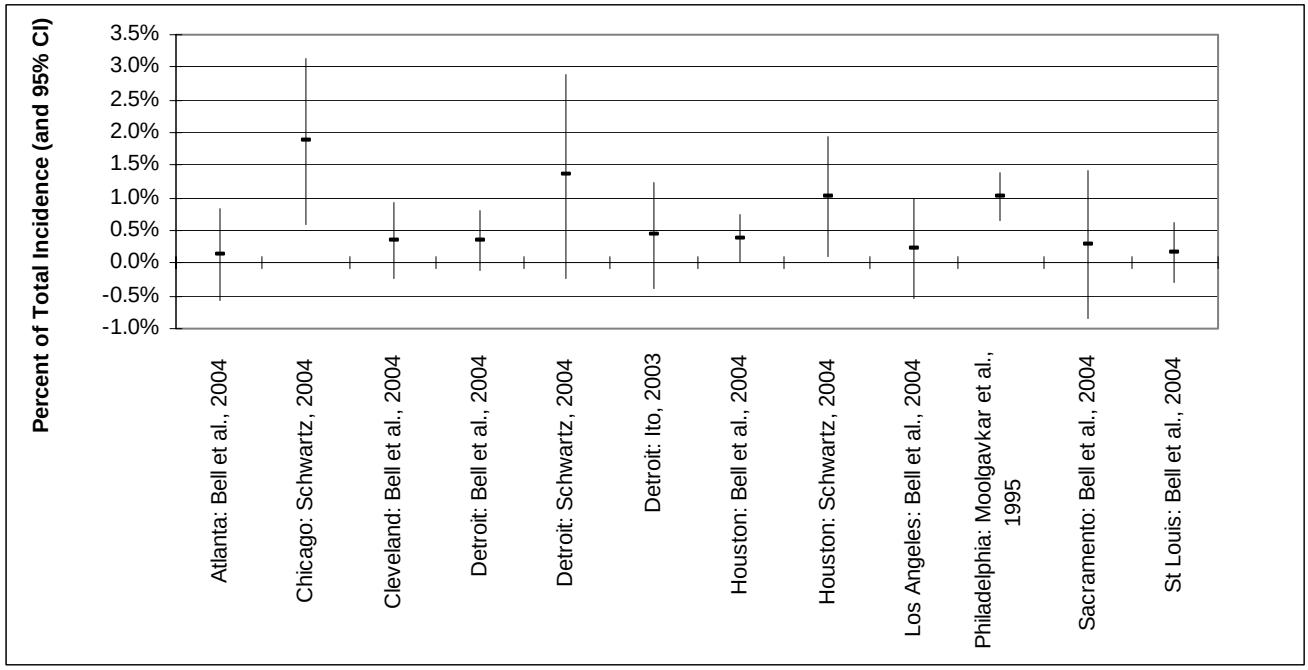

Figure 4-2b. Based on 2002 Air Quality

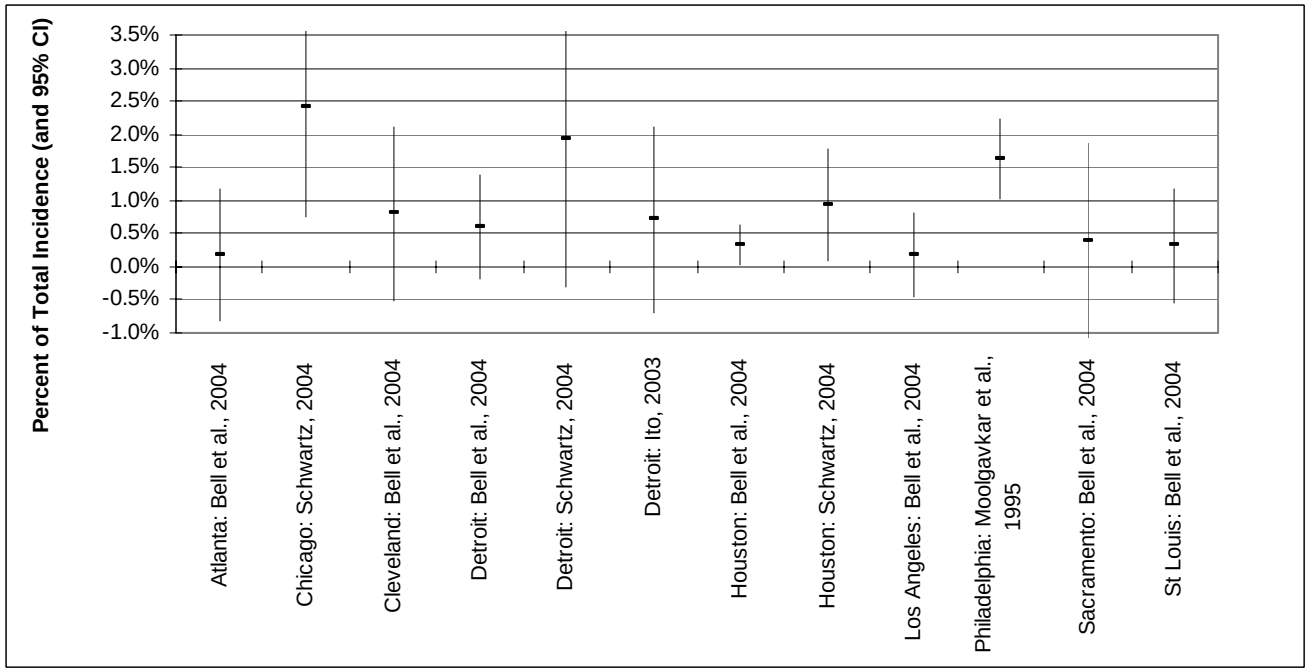

Figure 4-3. Estimated Annual Percent of Cardiorespiratory Mortality Associated with Short-Term Exposure to O_3 Above Background (April – September): Single-Pollutant vs. Multi-Pollutant Models [Huang et al. (2004), additional pollutants, from left to right: none, CO, NO_2, PM_{10}, SO_2]

Figure 4-3a. Based on 2004 Air Quality

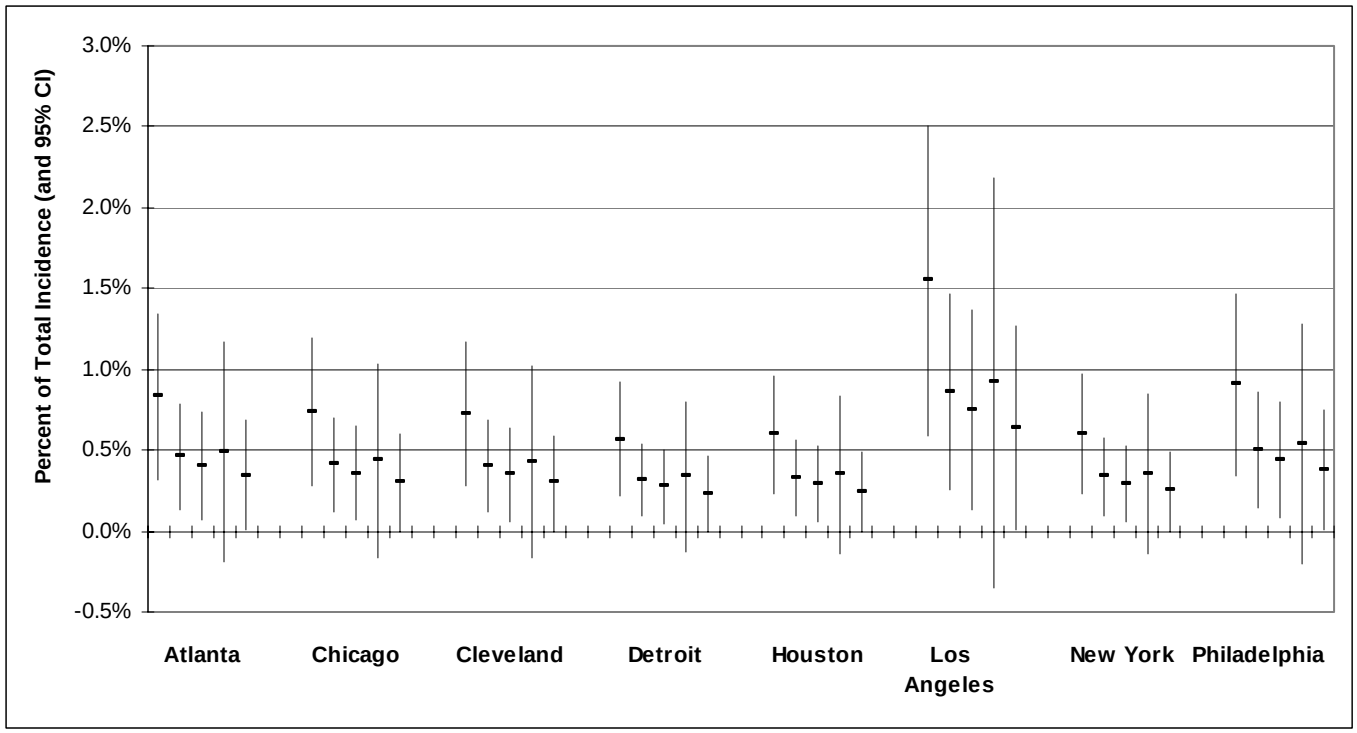

Figure 4-3b. Based on 2002 Air Quality

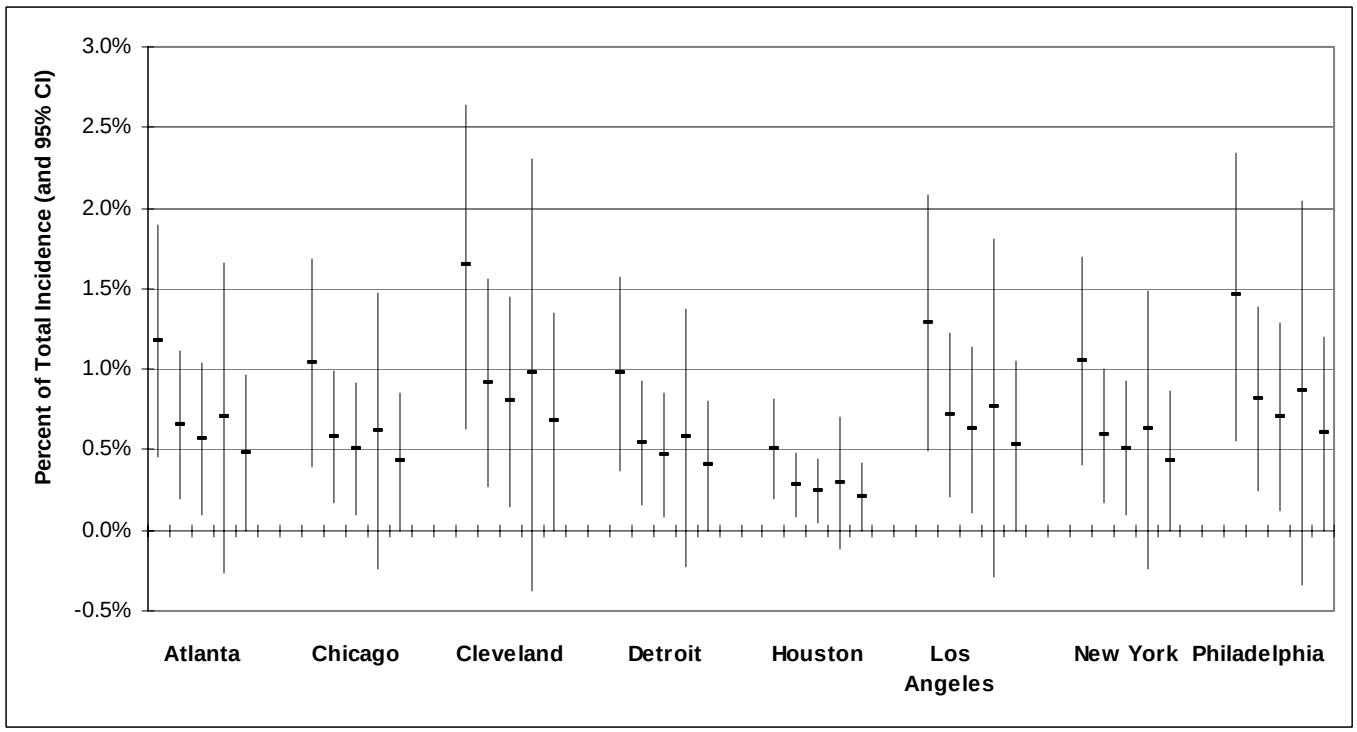

Figure 4-4. Estimated Annual Percent of (Non-Accidental) Mortality Associated with Short-Term Exposure to O_3 Above Background (April – September): Single-City Model (left bar) vs. Multi-City Model (right bar)

Figure 4-4a. Based on 2004 Air Quality

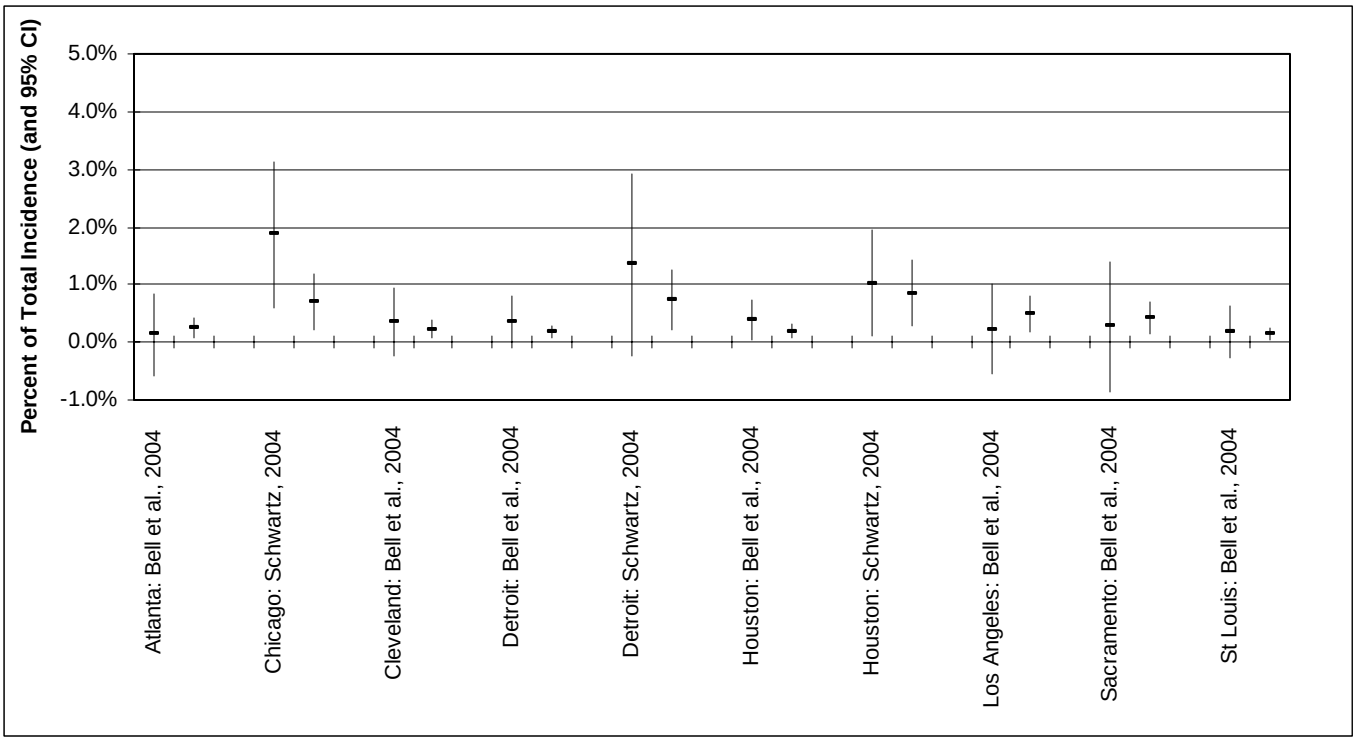

Figure 4-4b. Based on 2002 Air Quality

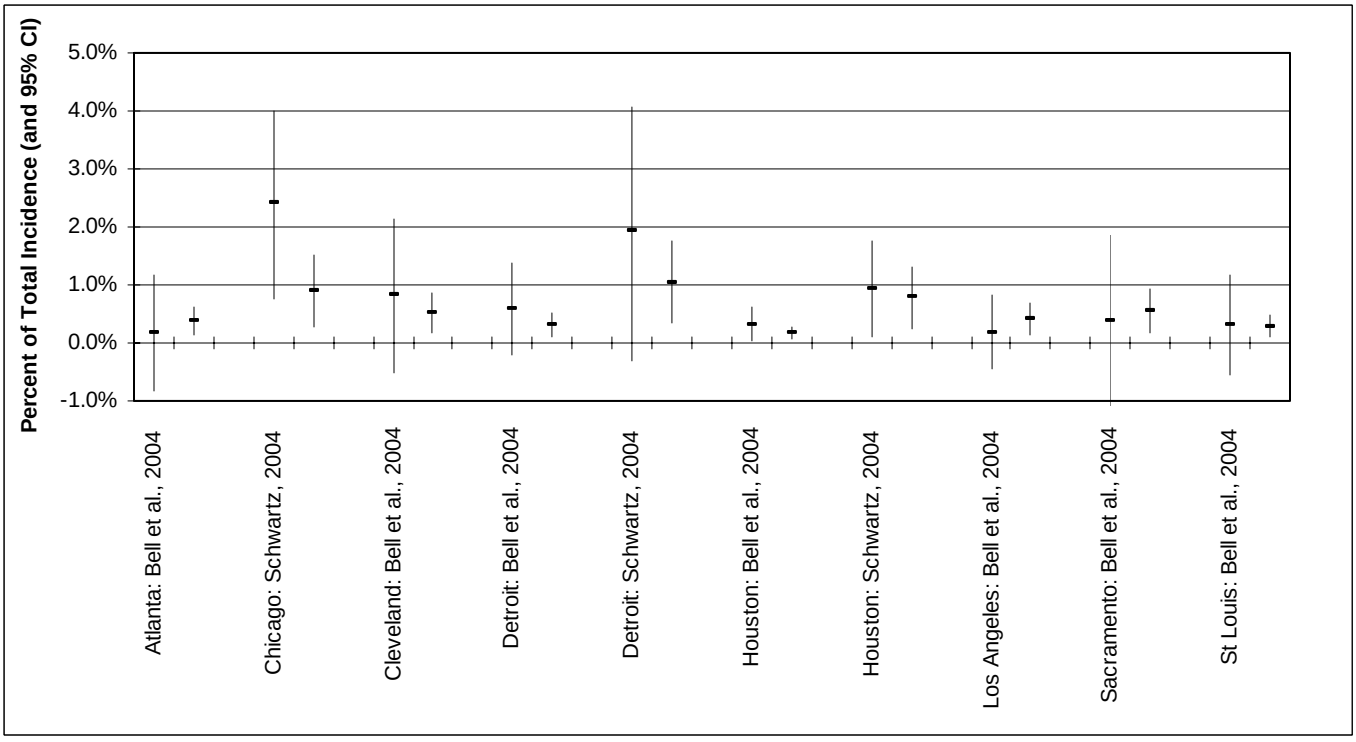

Figure 4-5. Estimated Annual Percent of Cardiorespiratory Mortality Associated with Short-Term Exposure to O_3 Above Background (April – September): Single-City Model (left bar) vs. Multi-City Model (right bar) – Based on Huang et al. (2004)

Figure 4-5a. Based on 2004 Air Quality

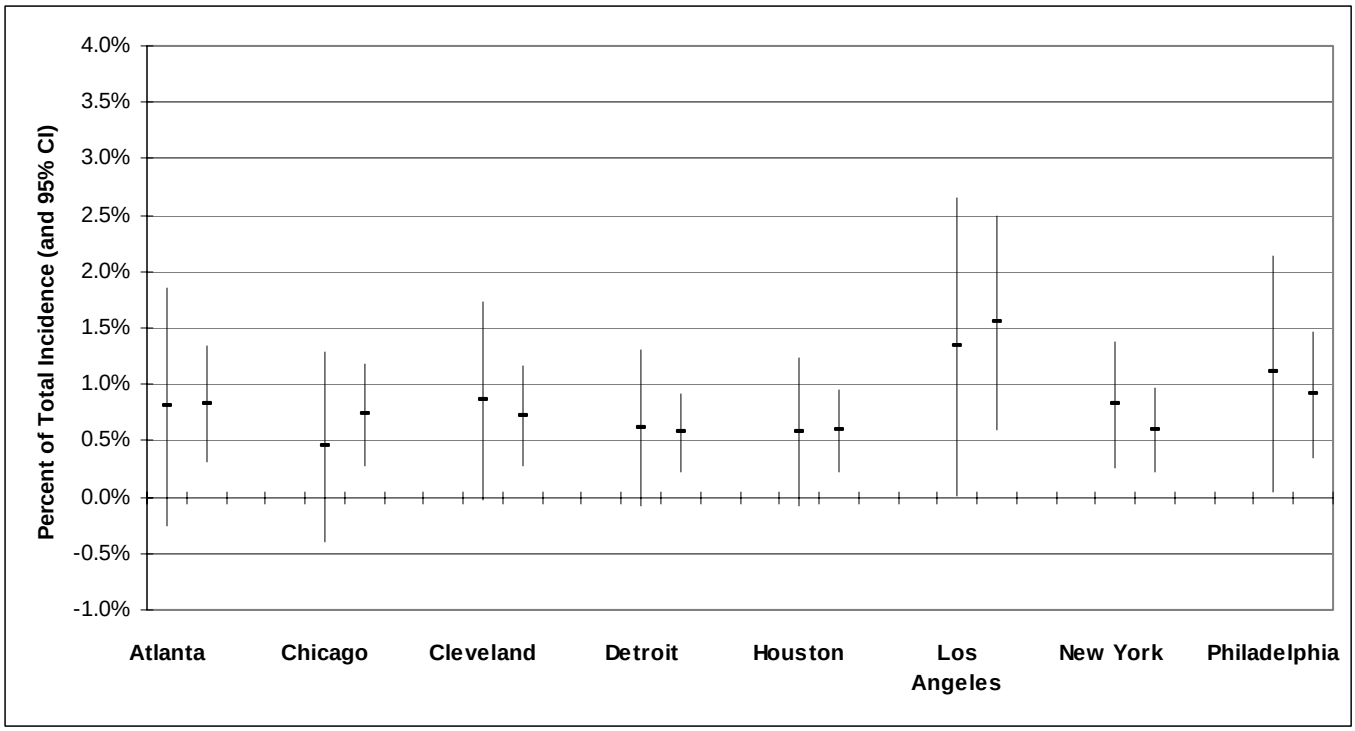

Figure 4-5b. Based on 2002 Air Quality

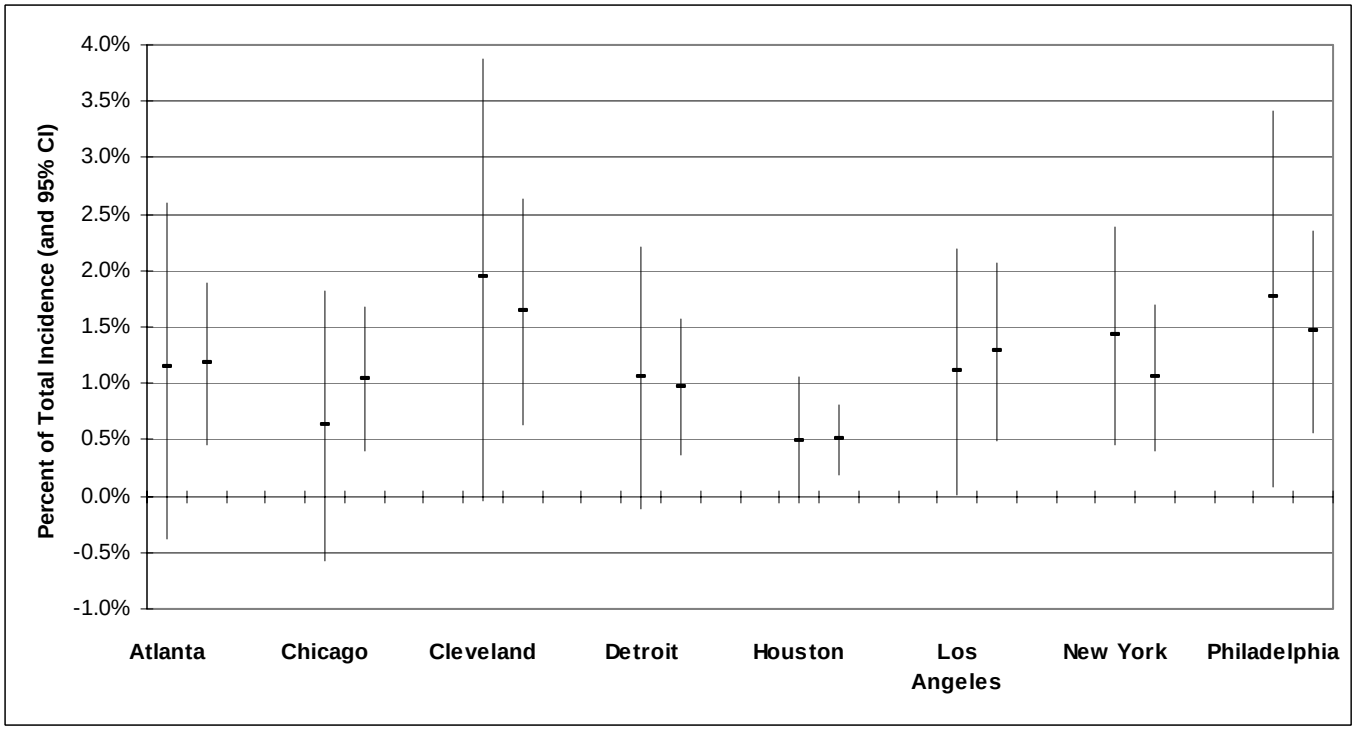

Figure 4-6. Estimated Annual Percent of (Unscheduled) Hospital Admissions for Pneumonia in Detroit Associated with Short-Term Exposure to O_3 Above Background (April – September): Different Lag Models – Based on Ito (2003) [bars from left to right are 0-day, 1-day, 2-day, and 3-day lag models]

Figure 4-6a. Based on 2004 Air Quality

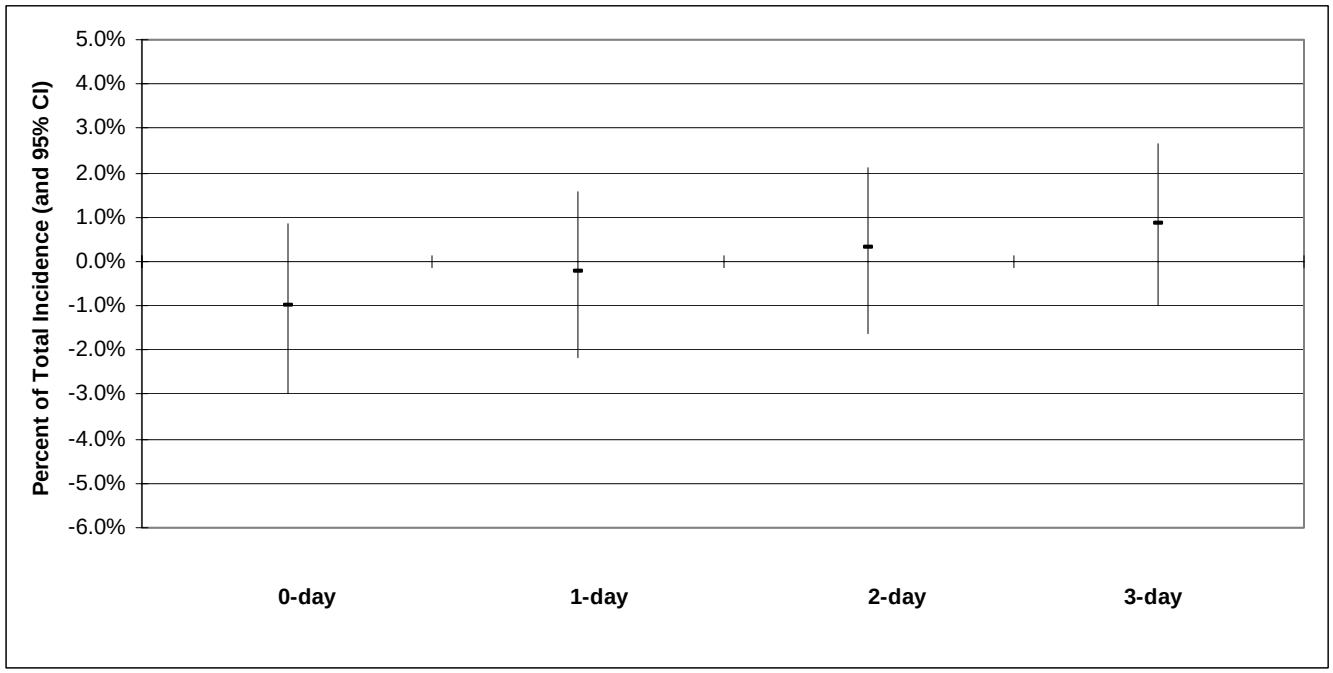

Figure 4-6b. Based on 2002 Air Quality

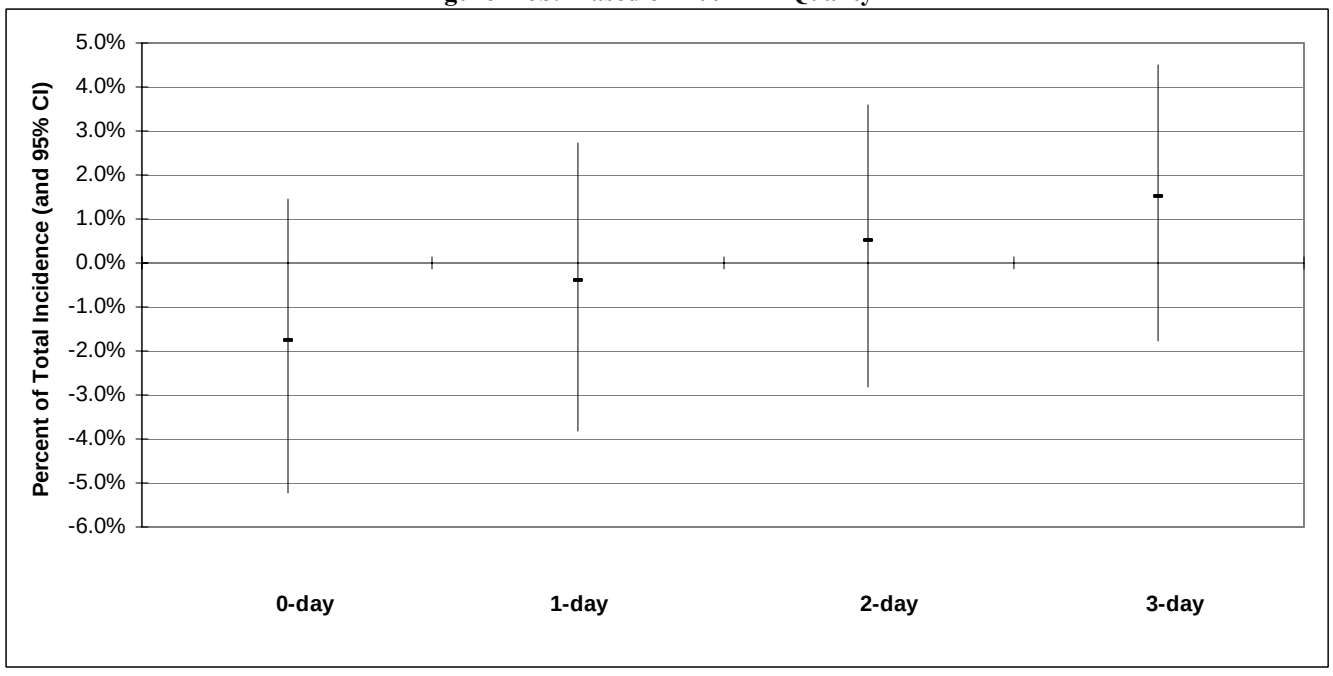

Figure 4-7. Estimated Annual Percent of Non-Accidental Mortality Associated with Short-Term Exposure to "As Is" O_3 Above Background for the Period April – September (Based on Bell et al., 2004 – 95 U.S. Cities) – Total and Contribution of 24-Hour O_3 Ranges

Figure 4-7a. Based on 2004 Air Quality

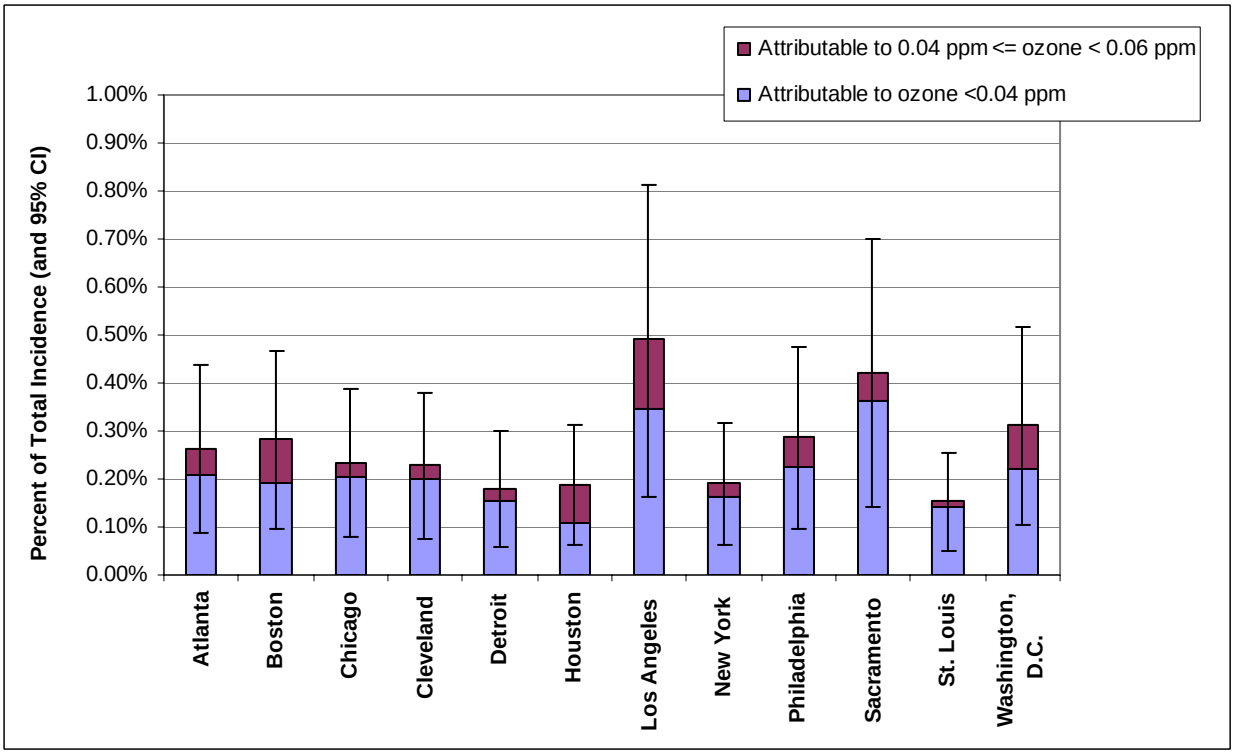

Figure 4-7b. Based on 2002 Air Quality

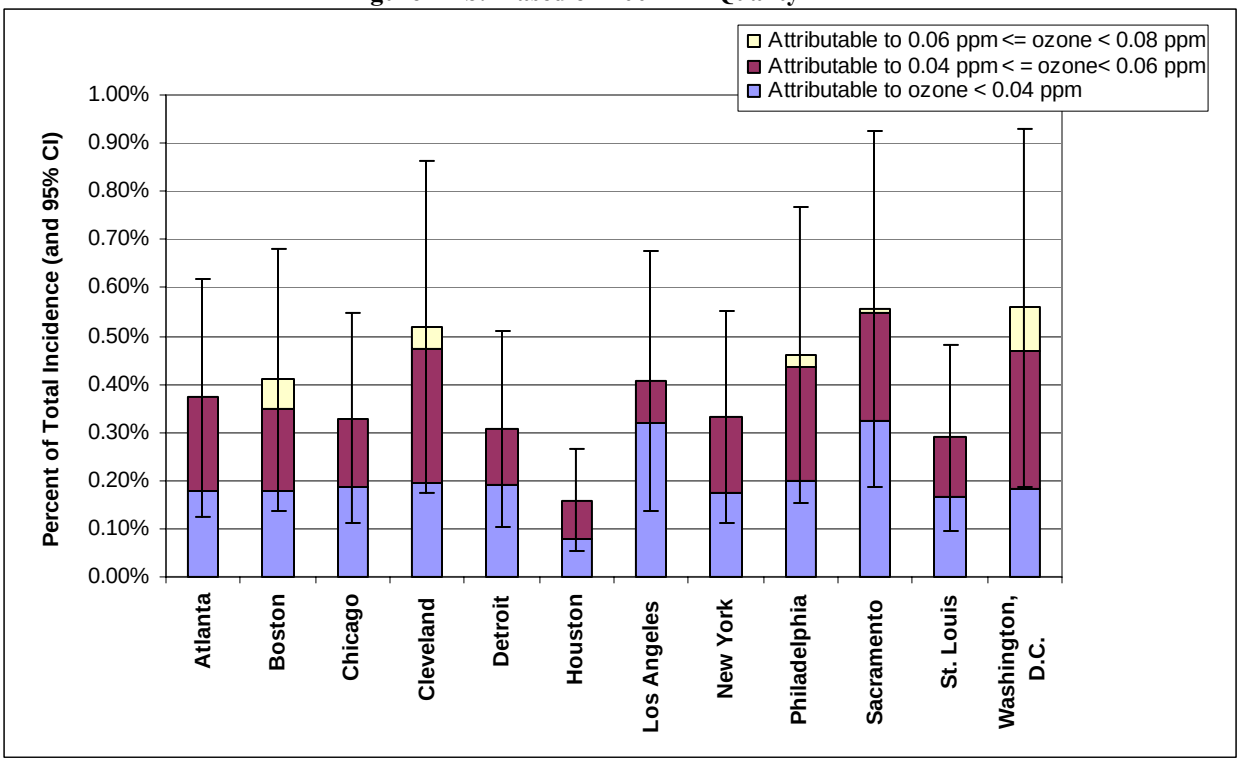

Figure 4-8. Estimated Annual Percent of Cardiorespiratory Mortality Associated with Short-Term Exposure to "As Is" O_3 Above Background for the Period April – September (Based on Huang et al., 2004 – 19 U.S. Cities) – Total and Contribution of 24-Hour O_3 Ranges

Figure 4-8a. Based on 2004 Air Quality

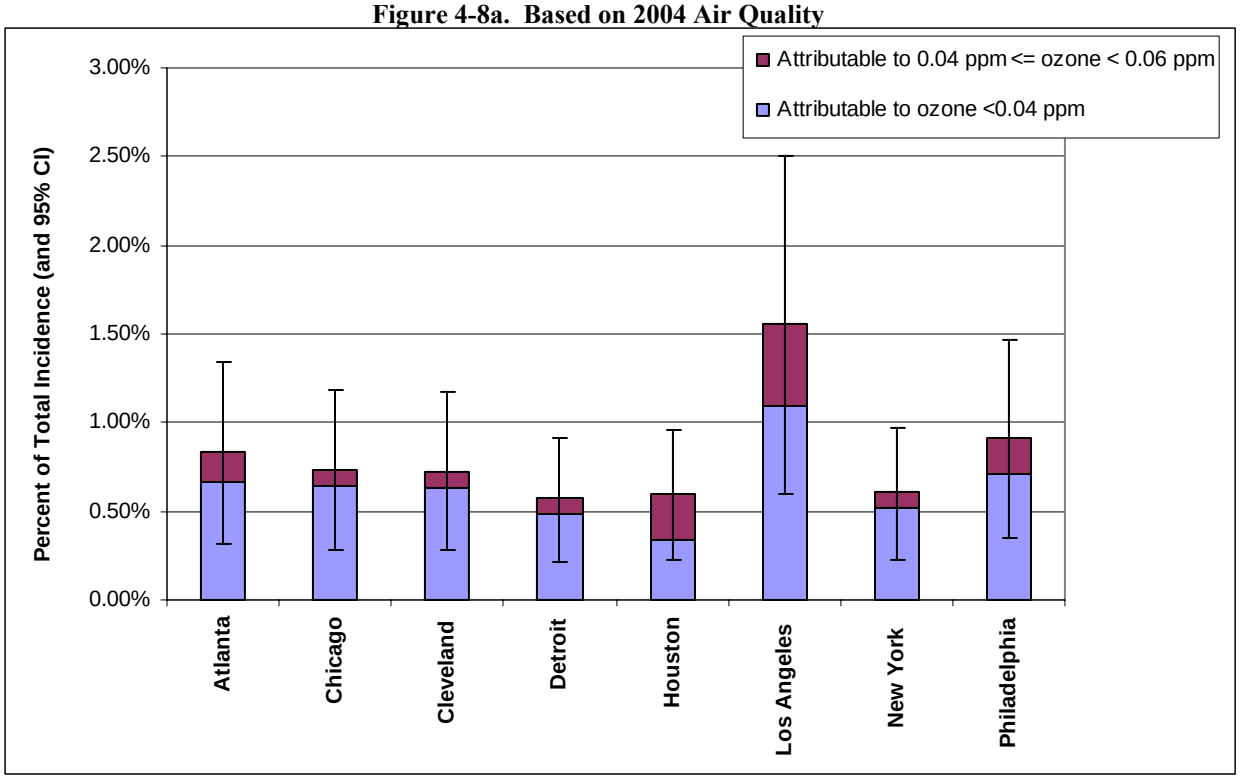

Figure 4-8b. Based on 2002 Air Quality

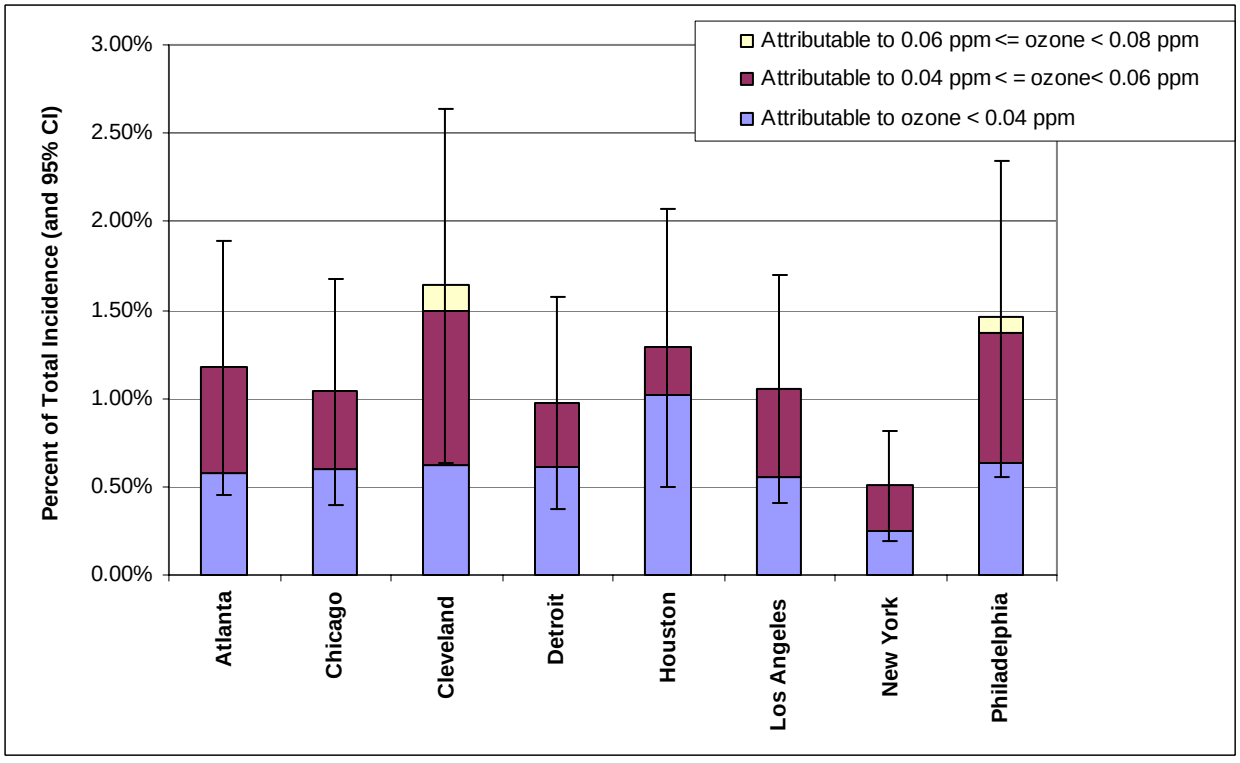

Table 4-8. Estimated Non-Accidental Mortality Associated with "As Is" O_3 Concentrations: April - September, 2004*

Location	Study	Lag	Exposure Metric	Non-Accidental Mortality Associated with O_3 Above Policy Relevant Background Levels**		
				Incidence	Incidence per 100,000 Relevant Population	Percent of Total Incidence
Atlanta	Bell et al. (2004)	distributed lag	24 hr avg.	6 (-26 - 38)	0.4 (-1.8 - 2.6)	0.1% (-0.6% - 0.8%)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	12 (4 - 20)	0.8 (0.3 - 1.4)	0.3% (0.1% - 0.4%)
Boston	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	7 (2 - 12)	1.0 (0.3 - 1.7)	0.3% (0.1% - 0.5%)
Chicago	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	49 (16 - 81)	0.9 (0.3 - 1.5)	0.2% (0.1% - 0.4%)
	Schwartz (2004)	0-day lag	1 hr max.	394 (125 - 658)	7.3 (2.3 - 12.2)	1.9% (0.6% - 3.1%)
	Schwartz -- 14 US Cities (2004)	0-day lag	1 hr max.	148 (46 - 250)	2.8 (0.9 - 4.6)	0.7% (0.2% - 1.2%)
Cleveland	Bell et al. (2004)	distributed lag	24 hr avg.	27 (-17 - 69)	1.9 (-1.2 - 5)	0.4% (-0.2% - 0.9%)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	17 (6 - 28)	1.2 (0.4 - 2)	0.2% (0.1% - 0.4%)
Detroit	Bell et al. (2004)	distributed lag	24 hr avg.	33 (-11 - 76)	1.6 (-0.5 - 3.7)	0.4% (-0.1% - 0.8%)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	17 (6 - 28)	0.8 (0.3 - 1.4)	0.2% (0.1% - 0.3%)
	Schwartz (2004)	0-day lag	1 hr max.	128 (-21 - 274)	6.2 (-1 - 13.3)	1.4% (-0.2% - 2.9%)
	Schwartz -- 14 US Cities (2004)	0-day lag	1 hr max.	70 (22 - 117)	3.4 (1.1 - 5.7)	0.7% (0.2% - 1.2%)
	Ito (2003)	0-day lag	24 hr avg.	40 (-37 - 116)	2.0 (-1.8 - 5.6)	0.4% (-0.4% - 1.2%)
Houston	Bell et al. (2004)	distributed lag	24 hr avg.	35 (2 - 67)	1.0 (0.1 - 2)	0.4% (0% - 0.7%)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	17 (6 - 28)	0.5 (0.2 - 0.8)	0.2% (0.1% - 0.3%)
	Schwartz (2004)	0-day lag	1 hr max.	93 (9 - 176)	2.7 (0.3 - 5.2)	1% (0.1% - 1.9%)
	Schwartz -- 14 US Cities (2004)	0-day lag	1 hr max.	78 (24 - 130)	2.3 (0.7 - 3.8)	0.9% (0.3% - 1.4%)
Los Angeles	Bell et al. (2004)	distributed lag	24 hr avg.	62 (-149 - 271)	0.6 (-1.6 - 2.8)	0.2% (-0.5% - 1%)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	133 (45 - 221)	1.4 (0.5 - 2.3)	0.5% (0.2% - 0.8%)
New York	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	60 (20 - 100)	0.7 (0.2 - 1.1)	0.2% (0.1% - 0.3%)
Philadelphia	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	23 (8 - 38)	1.5 (0.5 - 2.5)	0.3% (0.1% - 0.5%)
	Moolgavkar et al. (1995)	1-day lag	24 hr avg.	82 (52 - 112)	5.4 (3.4 - 7.4)	1% (0.6% - 1.4%)

Location	Study	Lag	Exposure Metric	Non-Accidental Mortality Associated with O_3 Above Policy Relevant Background Levels**		
				Incidence	Incidence per 100,000 Relevant Population	Percent of Total Incidence
Sacramento	Bell et al. (2004)	distributed lag	24 hr avg.	12 (-36 - 59)	1.0 (-3 - 4.8)	0.3% (-0.9% - 1.4%)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	18 (6 - 29)	1.4 (0.5 - 2.4)	0.4% (0.1% - 0.7%)
St Louis	Bell et al. (2004)	distributed lag	24 hr avg.	3 (-6 - 13)	1.0 (-1.7 - 3.6)	0.2% (-0.3% - 0.6%)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	3 (1 - 5)	0.9 (0.3 - 1.5)	0.2% (0.1% - 0.3%)
Washington, D.C.	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	8 (3 - 14)	1.5 (0.5 - 2.4)	0.3% (0.1% - 0.5%)

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

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

Table 4-9. Estimated Non-Accidental Mortality Associated with "As Is" O_3 Concentrations: April - September, 2002*

Location	Study	Lag	Exposure Metric	Non-Accidental Mortality Associated with O_3 Above Policy Relevant Background Levels**		
				Incidence	Incidence per 100,000 Relevant Population	Percent of Total Incidence
Atlanta	Bell et al. (2004)	distributed lag	24 hr avg.	9 (-37 - 54)	0.6 (-2.5 - 3.6)	0.2% (-0.8% - 1.2%)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	17 (6 - 29)	1.2 (0.4 - 1.9)	0.4% (0.1% - 0.6%)
Boston	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	10 (3 - 17)	1.5 (0.5 - 2.5)	0.4% (0.1% - 0.7%)
Chicago	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	69 (23 - 115)	1.3 (0.4 - 2.1)	0.3% (0.1% - 0.5%)
	Schwartz (2004)	0-day lag	1 hr max.	505 (161 - 840)	9.4 (3 - 15.6)	2.4% (0.8% - 4%)
	Schwartz -- 14 US Cities (2004)	0-day lag	1 hr max.	191 (60 - 321)	3.6 (1.1 - 6)	0.9% (0.3% - 1.5%)
Cleveland	Bell et al. (2004)	distributed lag	24 hr avg.	61 (-38 - 157)	4.3 (-2.7 - 11.3)	0.8% (-0.5% - 2.1%)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	38 (13 - 64)	2.8 (0.9 - 4.6)	0.5% (0.2% - 0.9%)
Detroit	Bell et al. (2004)	distributed lag	24 hr avg.	57 (-18 - 131)	2.8 (-0.9 - 6.3)	0.6% (-0.2% - 1.4%)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	29 (10 - 48)	1.4 (0.5 - 2.3)	0.3% (0.1% - 0.5%)
	Schwartz (2004)	0-day lag	1 hr max.	181 (-30 - 385)	8.8 (-1.4 - 18.7)	1.9% (-0.3% - 4.1%)
	Schwartz -- 14 US Cities (2004)	0-day lag	1 hr max.	99 (31 - 165)	4.8 (1.5 - 8)	1% (0.3% - 1.8%)
	Ito (2003)	0-day lag	24 hr avg.	69 (-64 - 198)	3.4 (-3.1 - 9.6)	0.7% (-0.7% - 2.1%)
Houston	Bell et al. (2004)	distributed lag	24 hr avg.	29 (2 - 57)	0.9 (0.1 - 1.7)	0.3% (0% - 0.6%)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	14 (5 - 24)	0.4 (0.1 - 0.7)	0.2% (0.1% - 0.3%)
	Schwartz (2004)	0-day lag	1 hr max.	85 (8 - 161)	2.5 (0.2 - 4.7)	0.9% (0.1% - 1.8%)
	Schwartz -- 14 US Cities (2004)	0-day lag	1 hr max.	71 (22 - 119)	2.1 (0.7 - 3.5)	0.8% (0.2% - 1.3%)
Los Angeles	Bell et al. (2004)	distributed lag	24 hr avg.	51 (-124 - 224)	0.5 (-1.3 - 2.4)	0.2% (-0.5% - 0.8%)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	110 (37 - 184)	1.2 (0.4 - 1.9)	0.4% (0.1% - 0.7%)
New York	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	105 (35 - 174)	1.2 (0.4 - 2)	0.3% (0.1% - 0.6%)
Philadelphia	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	37 (12 - 62)	2.4 (0.8 - 4.1)	0.5% (0.2% - 0.8%)
	Moolgavkar et al. (1995)	1-day lag	24 hr avg.	132 (83 - 180)	8.7 (5.5 - 11.9)	1.6% (1% - 2.2%)

Location	Study	Lag	Exposure Metric	Non-Accidental Mortality Associated with O_3 Above Policy Relevant Background Levels**		
				Incidence	Incidence per 100,000 Relevant Population	Percent of Total Incidence
Sacramento	Bell et al. (2004)	distributed lag	24 hr avg.	16 (-48 - 78)	1.3 (-3.9 - 6.4)	0.4% (-1.1% - 1.9%)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	23 (8 - 39)	1.9 (0.6 - 3.2)	0.6% (0.2% - 0.9%)
St Louis	Bell et al. (2004)	distributed lag	24 hr avg.	6 (-11 - 23)	1.9 (-3.1 - 6.7)	0.3% (-0.5% - 1.2%)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	6 (2 - 10)	1.7 (0.6 - 2.8)	0.3% (0.1% - 0.5%)
Washington	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	15 (5 - 25)	2.6 (0.9 - 4.4)	0.6% (0.2% - 0.9%)

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

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

Table 4-10. Estimated Cardiorespiratory Mortality Associated with "As Is" O_3 Concentrations: April - September, 2004*

Risk Assessment Location	Study Location	Cardiorespiratory Mortality Associated with O_3 Above Policy Relevant Background Levels**		
		Incidence	Incidence per 100,000 Relevant Population	Percent of Total Incidence
Atlanta	Atlanta	8 (-3 - 18)	0.5 (-0.2 - 1.2)	0.8% (-0.3% - 1.8%)
	19 U.S. Cities	8 (3 - 13)	0.5 (0.2 - 0.9)	0.8% (0.3% - 1.3%)
Chicago	Chicago	23 (-21 - 66)	0.4 (-0.4 - 1.2)	0.4% (-0.4% - 1.3%)
	19 U.S. Cities	38 (14 - 61)	0.7 (0.3 - 1.1)	0.7% (0.3% - 1.2%)
Cleveland	Cleveland	16 (0 - 32)	1.2 (0 - 2.3)	0.9% (0% - 1.7%)
	19 U.S. Cities	14 (5 - 22)	1.0 (0.4 - 1.6)	0.7% (0.3% - 1.2%)
Detroit	Detroit	15 (-2 - 31)	0.7 (-0.1 - 1.5)	0.6% (-0.1% - 1.3%)
	19 U.S. Cities	14 (5 - 22)	0.7 (0.3 - 1.1)	0.6% (0.2% - 0.9%)
Houston	Houston	12 (-2 - 26)	0.4 (0 - 0.8)	0.6% (-0.1% - 1.2%)
	19 U.S. Cities	13 (5 - 20)	0.4 (0.1 - 0.6)	0.6% (0.2% - 1%)
Los Angeles	Los Angeles	99 (1 - 195)	1.0 (0 - 2.1)	1.3% (0% - 2.6%)
	19 U.S. Cities	115 (44 - 185)	1.2 (0.5 - 1.9)	1.6% (0.6% - 2.5%)
New York	New York	73 (23 - 123)	0.8 (0.3 - 1.4)	0.8% (0.3% - 1.4%)
	19 U.S. Cities	54 (21 - 87)	0.6 (0.2 - 1)	0.6% (0.2% - 1%)
Philadelphia	Philadelphia	20 (1 - 39)	1.3 (0.1 - 2.6)	1.1% (0.1% - 2.1%)
	19 U.S. Cities	17 (6 - 27)	1.1 (0.4 - 1.8)	0.9% (0.3% - 1.5%)

*All results are for cardiorespiratory mortality (among all ages) associated with short-term exposures to O_3. Results are based on single-pollutant single-city models or a single pollutant multi-city model estimated in Huang et al. (2004).

**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 percents are rounded to the nearest tenth.

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

Table 4-11. Estimated Cardiorespiratory Mortality Associated with "As Is" O_3 Concentrations: April - September, 2002*

Risk Assessment Location	Study Location	Cardiorespiratory Mortality Associated with O_3 Above Policy Relevant Background Levels**		
		Incidence	Incidence per 100,000 Relevant Population	Percent of Total Incidence
Atlanta	Atlanta	11 (-4 - 25)	0.7 (-0.2 - 1.7)	1.1% (-0.4% - 2.6%)
	19 U.S. Cities	11 (4 - 18)	0.8 (0.3 - 1.2)	1.2% (0.5% - 1.9%)
Chicago	Chicago	32 (-29 - 93)	0.6 (-0.5 - 1.7)	0.6% (-0.6% - 1.8%)
	19 U.S. Cities	53 (20 - 86)	1.0 (0.4 - 1.6)	1% (0.4% - 1.7%)
Cleveland	Cleveland	36 (-1 - 72)	2.6 (-0.1 - 5.2)	2% (0% - 3.9%)
	19 U.S. Cities	31 (12 - 49)	2.2 (0.8 - 3.5)	1.6% (0.6% - 2.6%)
Detroit	Detroit	26 (-3 - 54)	1.2 (-0.1 - 2.6)	1.1% (-0.1% - 2.2%)
	19 U.S. Cities	24 (9 - 38)	1.1 (0.4 - 1.8)	1% (0.4% - 1.6%)
Houston	Houston	10 (-1 - 22)	0.3 (0 - 0.6)	0.5% (-0.1% - 1%)
	19 U.S. Cities	11 (4 - 17)	0.3 (0.1 - 0.5)	0.5% (0.2% - 0.8%)
Los Angeles	Los Angeles	82 (1 - 162)	0.9 (0 - 1.7)	1.1% (0% - 2.2%)
	19 U.S. Cities	95 (36 - 153)	1.0 (0.4 - 1.6)	1.3% (0.5% - 2.1%)
New York	New York	128 (41 - 213)	1.4 (0.5 - 2.4)	1.4% (0.5% - 2.4%)
	19 U.S. Cities	94 (36 - 151)	1.1 (0.4 - 1.7)	1.1% (0.4% - 1.7%)
Philadelphia	Philadelphia	33 (2 - 63)	2.2 (0.1 - 4.1)	1.8% (0.1% - 3.4%)
	19 U.S. Cities	27 (10 - 43)	1.8 (0.7 - 2.8)	1.5% (0.6% - 2.3%)

*All results are for cardiorespiratory mortality (among all ages) associated with short-term exposures to O_3. Results are based on single-pollutant single-city models or a single pollutant multi-city model estimated in Huang et al. (2004).

**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 percents are rounded to the nearest tenth.

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

Table 4-12. Estimated Health Risks Associated with "As Is" O_3 Concentrations: New York, NY, April - September, 2004

Health Effects*	Study	Ages	Lag	Exposure Metric	Other Pollutants in Model	Health Effects Associated with O_3 Above Policy Relevant Background Levels**		
						Incidence	Incidence per 100,000 Relevant Population	Percent of Total Incidence
Mortality, non-accidental	Bell et al. -- 95 US Cities (2004)***	all	distributed lag	24 hr avg.	none	60 (20 - 100)	0.7 (0.2 - 1.1)	0.2% (0.1% - 0.3%)
Mortality, cardiorespiratory	Huang et al. (2004)***	all	distributed lag	24 hr avg.	none	73 (23 - 123)	0.8 (0.3 - 1.4)	0.8% (0.3% - 1.4%)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)***	all	distributed lag	24 hr avg.	none	54 (21 - 87)	0.6 (0.2 - 1)	0.6% (0.2% - 1%)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)***	all	0-day lag	24 hr avg.	CO	30 (9 - 51)	0.3 (0.1 - 0.6)	0.3% (0.1% - 0.6%)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)***	all	0-day lag	24 hr avg.	NO2	26 (5 - 47)	0.3 (0.1 - 0.5)	0.3% (0.1% - 0.5%)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)***	all	0-day lag	24 hr avg.	PM10	32 (-12 - 76)	0.4 (-0.1 - 0.8)	0.4% (-0.1% - 0.9%)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)***	all	0-day lag	24 hr avg.	SO2	22 (0 - 44)	0.2 (0 - 0.5)	0.2% (0% - 0.5%)
Hospital admissions (unscheduled), respiratory	Thurston et al. (1992)****	all	3-day lag	1 hr max.	none	447 (108 - 786)	5.6 (1.4 - 9.8)	1.3% (0.3% - 2.2%)
Hospital admissions (unscheduled), asthma	Thurston et al. (1992)****	all	1-day lag	1 hr max.	none	382 (81 - 683)	4.8 (1 - 8.5)	2.9% (0.6% - 5.2%)

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

**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 percents are rounded to the nearest tenth.

***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.

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

Table 4-13. Estimated Health Risks Associated with "As Is" O_3 Concentrations: New York, NY, April - September, 2002

Health Effects*	Study	Ages	Lag	Exposure Metric	Other Pollutants in Model	Health Effects Associated with O_3 Above Policy Relevant Background Levels**		
						Incidence	Incidence per 100,000 Relevant Population	Percent of Total Incidence
Mortality, non-accidental	Bell et al. -- 95 US Cities (2004)***	all	distributed lag	24 hr avg.	none	105 (35 - 174)	1.2 (0.4 - 2)	0.3% (0.1% - 0.6%)
Mortality, cardiorespiratory	Huang et al. (2004)***	all	distributed lag	24 hr avg.	none	128 (41 - 213)	1.4 (0.5 - 2.4)	1.4% (0.5% - 2.4%)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)***	all	distributed lag	24 hr avg.	none	94 (36 - 151)	1.1 (0.4 - 1.7)	1.1% (0.4% - 1.7%)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)***	all	0-day lag	24 hr avg.	CO	52 (15 - 89)	0.6 (0.2 - 1)	0.6% (0.2% - 1%)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)***	all	0-day lag	24 hr avg.	NO2	45 (8 - 82)	0.5 (0.1 - 0.9)	0.5% (0.1% - 0.9%)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)***	all	0-day lag	24 hr avg.	PM10	56 (-22 - 132)	0.6 (-0.2 - 1.5)	0.6% (-0.2% - 1.5%)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)***	all	0-day lag	24 hr avg.	SO2	39 (0 - 77)	0.4 (0 - 0.9)	0.4% (0% - 0.9%)
Hospital admissions (unscheduled), respiratory	Thurston et al. (1992)****	all	3-day lag	1 hr max.	none	608 (147 - 1068)	7.6 (1.8 - 13.3)	1.7% (0.4% - 3%)
Hospital admissions (unscheduled), asthma	Thurston et al. (1992)****	all	1-day lag	1 hr max.	none	519 (110 - 928)	6.5 (1.4 - 11.6)	4% (0.8% - 7.1%)

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

**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 percents are rounded to the nearest tenth.

***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.

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

As discussed in Section 4.1.4, assessment locations were chosen in part on the basis of whether an acceptable C-R function had been reported for that location. As a result, risks were estimated in a given assessment location only for those health endpoints for which there is at least one acceptable C-R function reported for that location. The set of health effects shown in Tables 4-12 and 4-13 and Tables C-1 through C-22 therefore varies from one location to another. For example, hospital admissions for pneumonia associated with short-term exposure to O_3 is included in Tables C-9 and C-10 for Detroit, but no hospital admissions endpoints are included in Tables C-1 through C-6 for Atlanta, Boston, and Chicago, because there was no study that met the selection criteria that reports a C-R function for hospital admissions reported in the O_3 epidemiological literature for any of those cities evaluated in the O_3 CD. For non-accidental mortality associated with short-term exposure to O_3, Figures 4-4a and b display estimates for only nine of the twelve risk assessment locations because single-city C-R functions for this health outcome were not available for the other three locations.

All results discussed below are for April through September. The top graph on each page shows results based on 2004 air quality, and the bottom graph shows results based on 2002 air quality. Figures 4-2a and b show estimated percent of non-accidental mortality related to "as is" O_3 concentrations over PRB levels, based on single-pollutant, single-city models across all locations for which such models were available. Tables 4-8 and 4-9 show estimates of incidence, incidence per 100,000 relevant population, and percent of total incidence of non-accidental mortality related to "as is" O_3 concentrations over PRB levels in all locations, based on both single-city and multi-city models, using air quality data for 2004 and 2002, respectively.

Estimates of O_3-related (non-accidental) mortality based on 2004 air quality (Table 4-8) ranged from 0.4 per 100,000 relevant population in Atlanta (Bell et al., 2004) to 7.3 per 100,000 relevant population in Chicago (Schwartz, 2004). The corresponding range based on 2002 air quality (Table 4-9) is from 0.4 per 100,000 relevant population in Houston (Bell et al., 2004) to 9.4 per 100,000 relevant population in Chicago (Schwartz, 2004). Estimated O_3-related (non-accidental) mortality reported by Schwartz (2004) for Chicago, Detroit, and Houston, based on both the single-city and the multi-city C-R functions, tend to be higher than other estimates in those locations in large part because Schwartz used the 1-hr maximum O_3 concentration, rather than the 24-hour average, as the exposure metric. The changes from "as is" 1-hr maximum to PRB 1-hr maximum O_3 concentrations were generally larger in the assessment locations than the corresponding changes from "as is" 24-hr average to PRB 24-hr average O_3 concentrations. As a percent of total incidence, estimated O_3-related (non-accidental) mortality ranged from 0.1 percent in Atlanta (Bell et al., 2004) to 1.9 percent in Chicago (Schwartz, 2004), using 2004 air quality data. Using 2002 air quality data, the range was from 0.2 percent in Atlanta (Bell et al., 2004), Houston (Bell et al., 2004), and Los Angeles (Bell et al., 2004) to 2.4 percent in Chicago (Schwartz, 2004). Although 7 of the 12 estimates from single-city single-pollutant models shown in Figure 4-4 were not statistically significant, all 12 were positive.

Figures 4-3a and b show estimated percent of cardiorespiratory mortality related to "as is" O_3 concentrations over PRB levels, based on multi-city single-pollutant versus multi-pollutant models from Huang et al. (2004) across all locations for which such models were available. Tables 4-10 and 4-11 show estimates of incidence, incidence per 100,000 relevant population, and percent of total incidence of cardiorespiratory mortality related to "as is" O_3 concentrations over PRB levels in all risk assessment locations covered in Huang et al. (2004), based on both single-city and multi-city single-pollutant models from that study. Estimates of O_3-related cardiorespiratory mortality ranged from 0.4 per 100,000 relevant population in Chicago (using the single-city C-R function) and Houston (using both the single-city and the multi-city C-R functions) to 1.3 per 100,000 relevant population in Philadelphia (using the single-city C-R function), when 2004 air quality data was used. The corresponding range using 2002 air quality data was from 0.3 per 100,000 relevant population in Houston (using both the single-city and the multi-city C-R functions) to 2.6 per 100,000 relevant population in Cleveland (using the single-city C-R function). As a percent of total incidence, estimated O_3-related cardiorespiratory mortality ranged from 0.4 percent in Chicago (using the single-city C-R function) to 1.6 percent in Los Angeles (using the multi-city C-R function), when 2004 air quality data was used. The corresponding range using 2002 air quality data was from 0.5 percent in Houston (using both the single-city and the multi-city C-R functions) to 2 percent in Cleveland (using the single-city C-R function). All of the estimates of O_3-related cardiorespiratory mortality based on Huang et al. (2004), from both single-city and multi-city models, and from both single-pollutant and multi-pollutant models, were positive. Five of the single-city single-pollutant "shrinkage" estimates (for Atlanta, Chicago, Cleveland, Detroit, and Houston) and the estimate from the multi-city multi-pollutant model with PM_{10} were not statistically significant. All the rest of the estimates of O_3-related cardiorespiratory mortality based on Huang et al. (2004) were statistically significant.

Figures 4-4a and b show estimated percent of non-accidental mortality that is O_3-related, based on single-city versus multi-city models across all locations for which both types of model were available. Estimates of O_3-related non-accidental mortality based on single-city models tended to have wider confidence or credible intervals than those based on multi-city models, with both multi-city models (from Bell et al., 2004 and Schwartz, 2004) producing statistically significant results. However, the choice of single-city versus multi-city model did not have a uniform affect on the magnitude of the point estimate. In some cases (Atlanta, Los Angeles, and Sacramento), the multi-city models produced larger estimates than the single-city models, while in other cases (Chicago, Cleveland, Detroit, Houston, and St. Louis) the reverse was true.

Bayesian credible intervals around the "shrinkage" estimates of O_3-related cardiorespiratory mortality (see Section 4.1.9.1.2) based on single-city models in Huang et al. (2004) were uniformly larger than the corresponding credible intervals around estimates based on the multi-city model from that study. As noted above, all of the estimates were positive and, with the exception of the single-city estimate for Chicago, all were statistically significant.

Estimated O_3-related pneumonia hospital admissions in Detroit (Ito 2003), shown in Figures 4-6a and b, increased monotonically with increasing lag, with the greatest estimate predicted by a 3-day lag model. None of the estimates of O_3-related unscheduled hospital admissions in Detroit were statistically significant.

Figures 4-7a and b and 4-8a and b show the estimated annual percent of non-accidental mortality and cardiorespiratory mortality, respectively, associated with short-term exposure to "as is" O_3 concentrations within specified ranges. In 2004, all O_3-related non-accidental mortality was associated with O_3 concentrations less than 0.06 ppm, and most of that was associated with O_3 concentrations less than 0.04 ppm. In 2002, all O_3-related non-accidental mortality was associated with O_3 concentrations less than 0.08 ppm, and the great majority was associated with O_3 concentrations less than 0.06 ppm. The results for cardiorespiratory mortality follow a similar pattern.

4.2.2 Assessment of the reduced health risks associated with O_3 concentrations that just meet the current and alternative 8-hour standards

The results of the assessment of the reduced mortality risks associated with O_3 concentrations that just meet the current and alternative 8-hour daily maximum standards (based on 2004 and in 2002 air quality data for all of the assessment locations) are summarized across urban areas in Figures 4-9a and b through 4-17a and b, and in Tables 4-14 and 4-25. Figures 4-9a and b through 4-17a and b show results expressed as percent of total incidence. The corresponding figures showing results expressed as number of cases per 100,000 relevant population are given in Appendix D. Figures 4-9a through 4-17a show results based on year 2004 air quality data; Figures 4-9b through 4-17b show results based on 2002 air quality data. Tables 4-14, 4-15, and 4-16 show estimated incidence, incidence per 100,000 relevant population, and percent of total incidence, respectively, of non-accidental mortality associated with O_3 concentrations that just meet the current and alternative 8-hour daily maximum standards, based on 2004 O_3 concentrations. Tables 4-17, 4-18, and 4-19 show results for the same measures of non-accidental mortality risk based on 2002 O_3 concentrations. Tables 4-20 through 4-26 show the corresponding results for cardiorespiratory mortality. All results are for health risks associated with short-term exposures to O_3 concentrations in excess of PRB levels from April through September.

Tables 4-26 through 4-28 show results in New York City for health endpoints associated with short-term exposure to O_3 concentrations that just meet the current and alternative 8-hour daily maximum standards, based on based on 2004 O_3 concentrations. Tables 4-29 through 4-31 show the corresponding results based on 2002 O_3 concentrations. Results for the other locations corresponding to those shown for New York in Tables 4-26 through 4-31 are shown in Appendix D, in Tables D-1 through D-66.

As described in the previous section, the central tendency estimates in all of the figures and tables are based on the O_3 coefficients estimated in the studies, or, in the case of the location-specific estimates from Huang et al. (2004), on "shrinkage" estimates

based on the O_3 coefficients estimated in the study (see Section 4.1.9.1.2). The ranges are based either on the 95 percent confidence intervals around those estimates (if the coefficients were estimated using classical statistical techniques) or on the 95 percent credible intervals (if the coefficients were estimated using Bayesian statistical techniques).

Figure 4-9. Estimated Annual Percent of (Non-Accidental) Mortality Associated with Short-Term Exposure to O_3 Above Background When the Current 8-Hour Standard is Just Met: Single-Pollutant, Single-City Models (April – September)

Figure 4-9a. Based on 2004 Air Quality

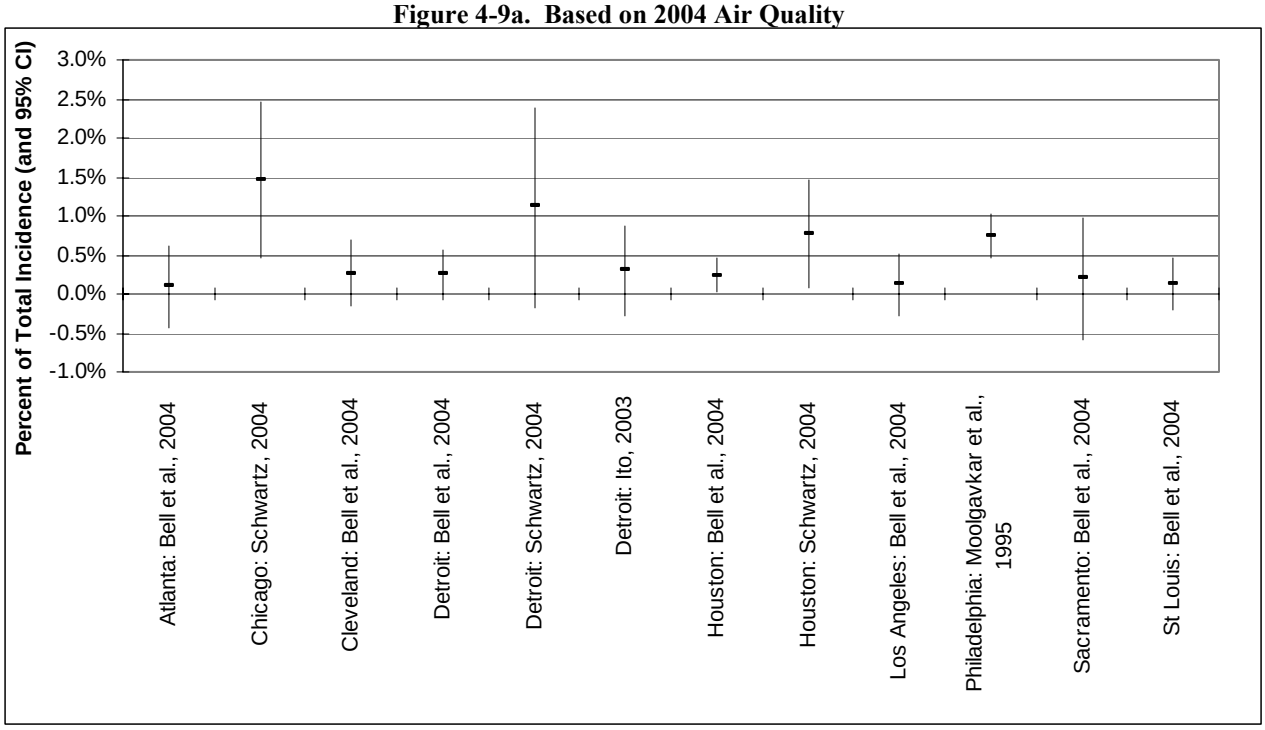

Figure 4-9b. Based on 2002 Air Quality

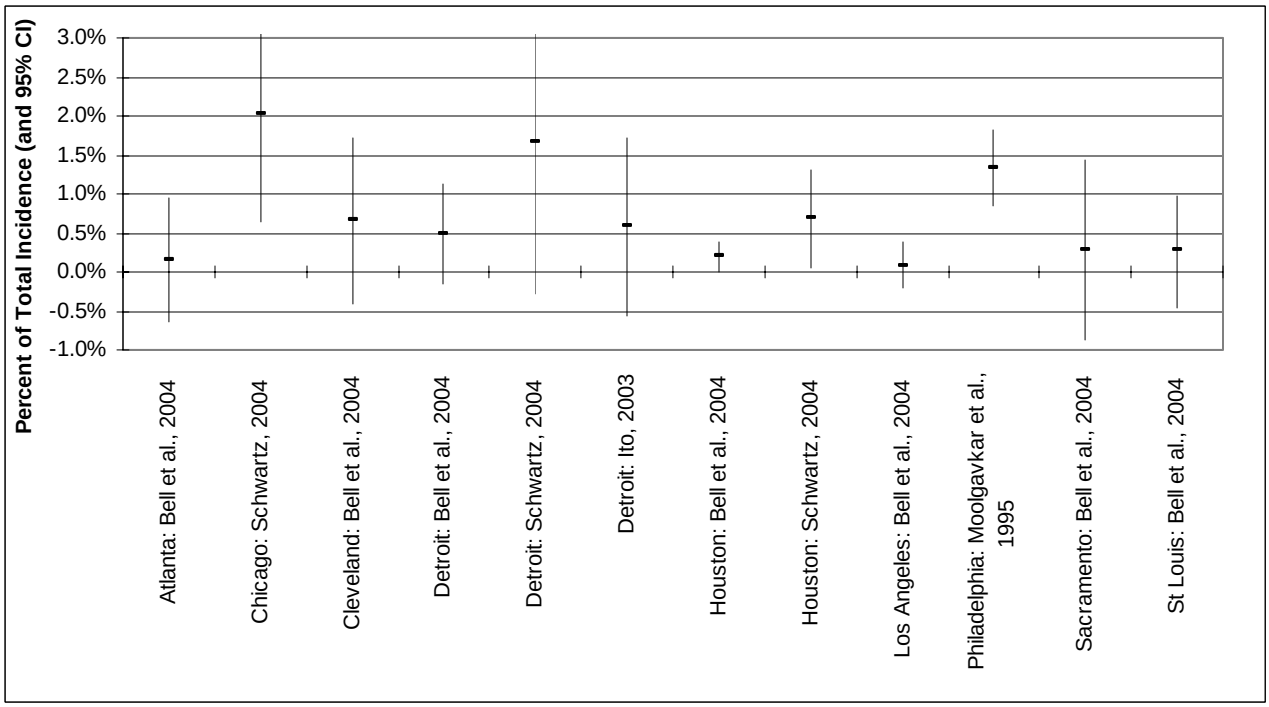

Figure 4-10. Estimated Annual Percent of Cardiorespiratory Mortality Associated with Short-Term Exposure to O_3 Above Background When the Current 8-Hour Standard is Just Met (April – September): Single-Pollutant vs. Multi-Pollutant Models [Huang et al. (2004), additional pollutants, from left to right: none, CO, NO_2, PM_{10}, SO_2]

Figure 4-10a. Based on 2004 Air Quality

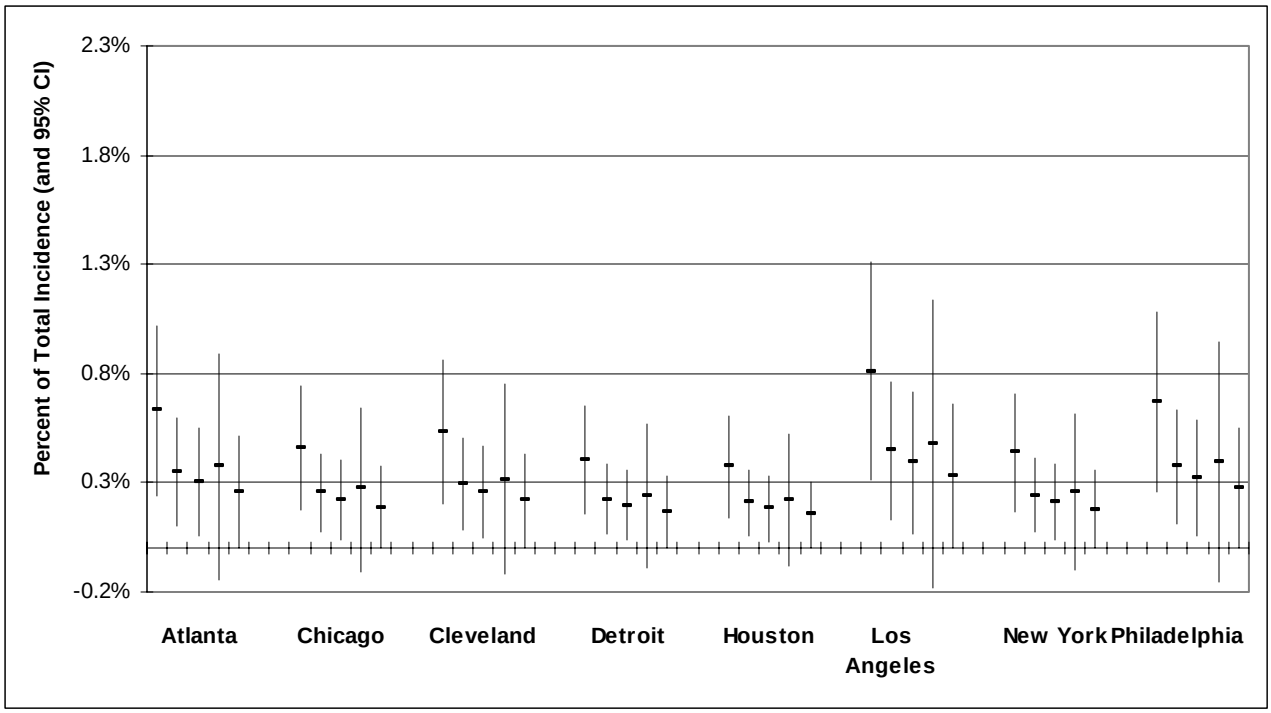

Figure 4-10b. Based on 2002 Air Quality

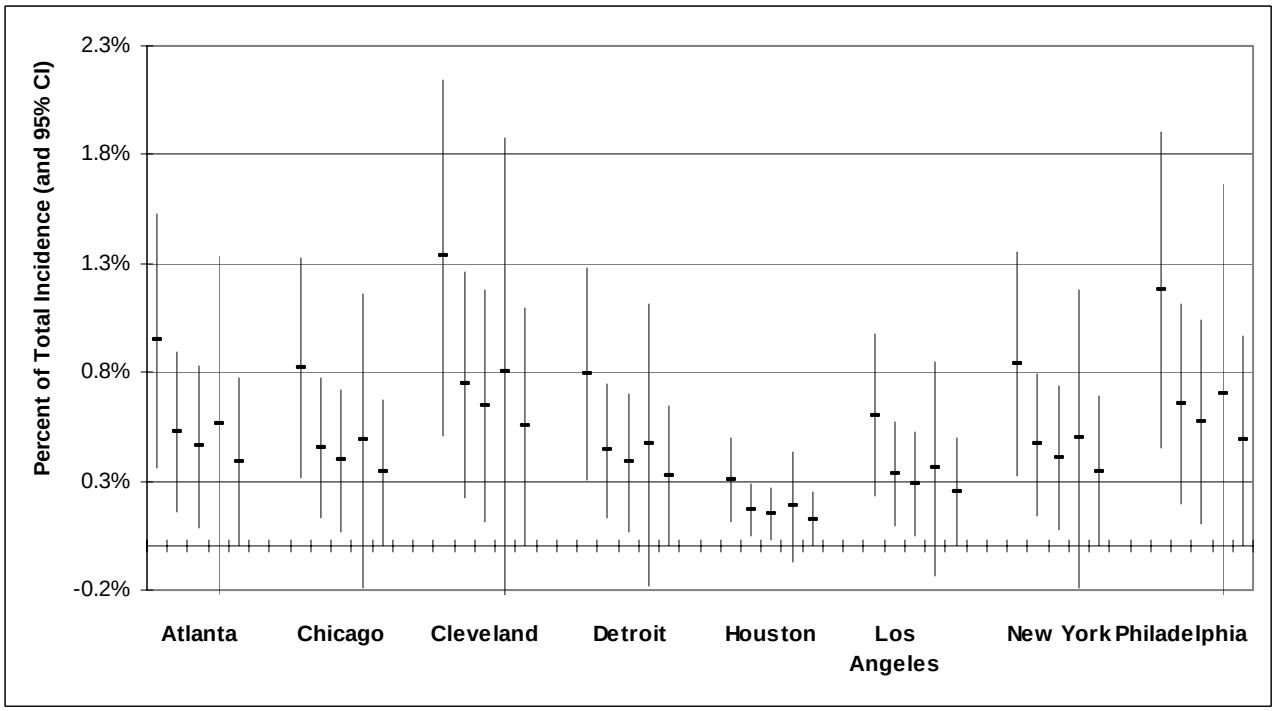

Figure 4-11. Estimated Annual Percent of (Non-Accidental) Mortality Associated with Short-Term Exposure to O_3 Above Background When the Current 8-Hour Standard is Just Met (April – September): Single-City Model (left bar) vs. Multi-City Model (right bar)

Figure 4-11a. Based on 2004 Air Quality

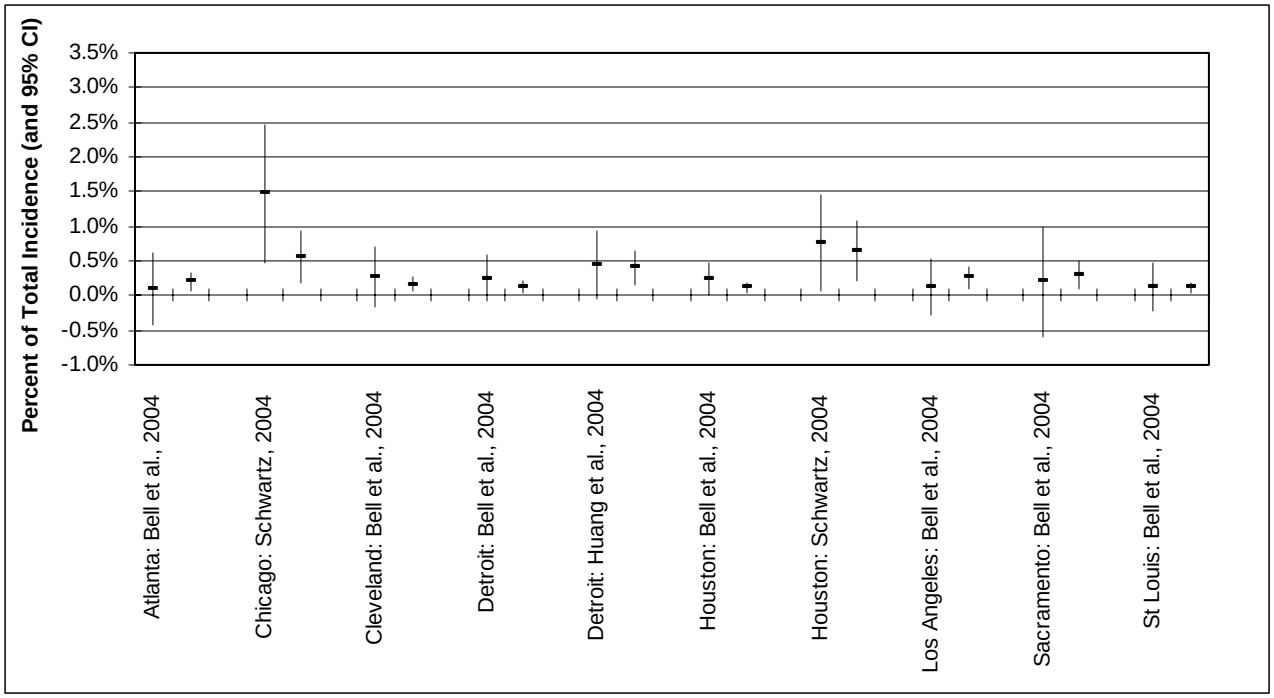

Figure 4-11b. Based on 2002 Air Quality

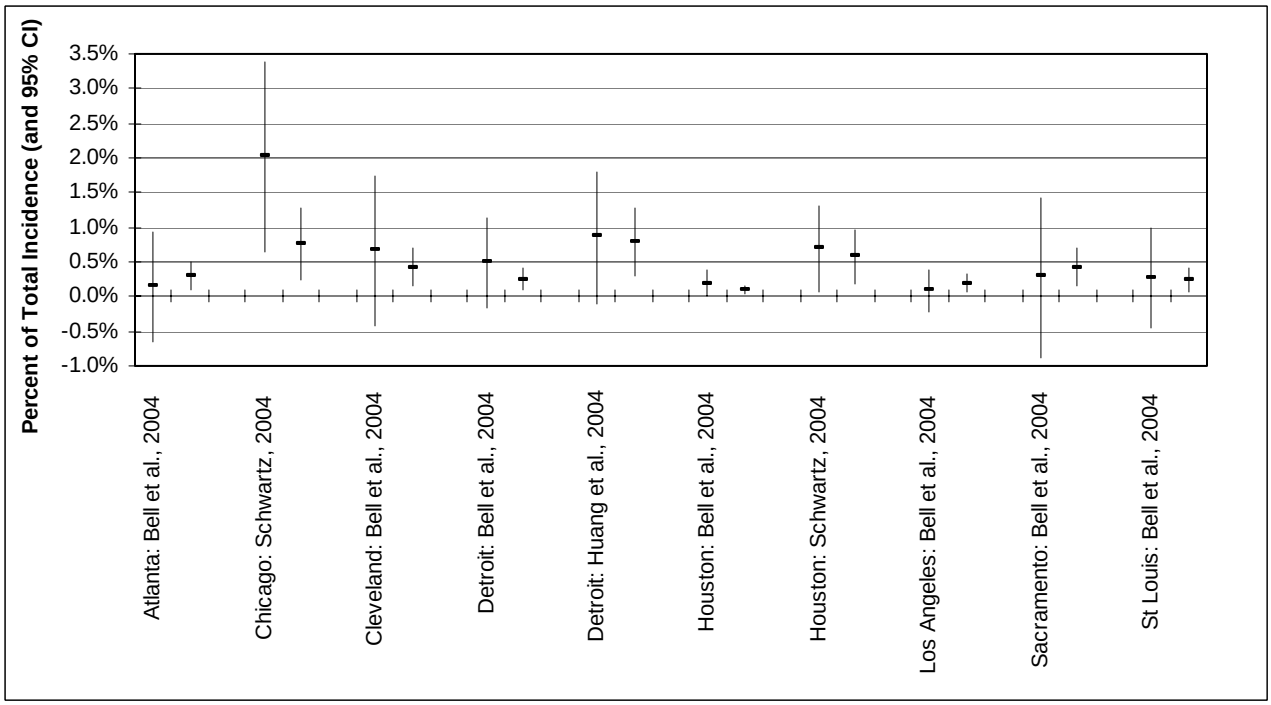

Figure 4-12. Estimated Annual Percent of Cardiorespiratory Mortality Associated with Short-Term Exposure to O_3 Above Background When the Current 8-Hour Standard is Just Met (April – September): Single-City Model (left bar) vs. Multi-City Model (right bar) – Based on Huang et al. (2004)

Figure 4-12a. Based on 2004 Air Quality

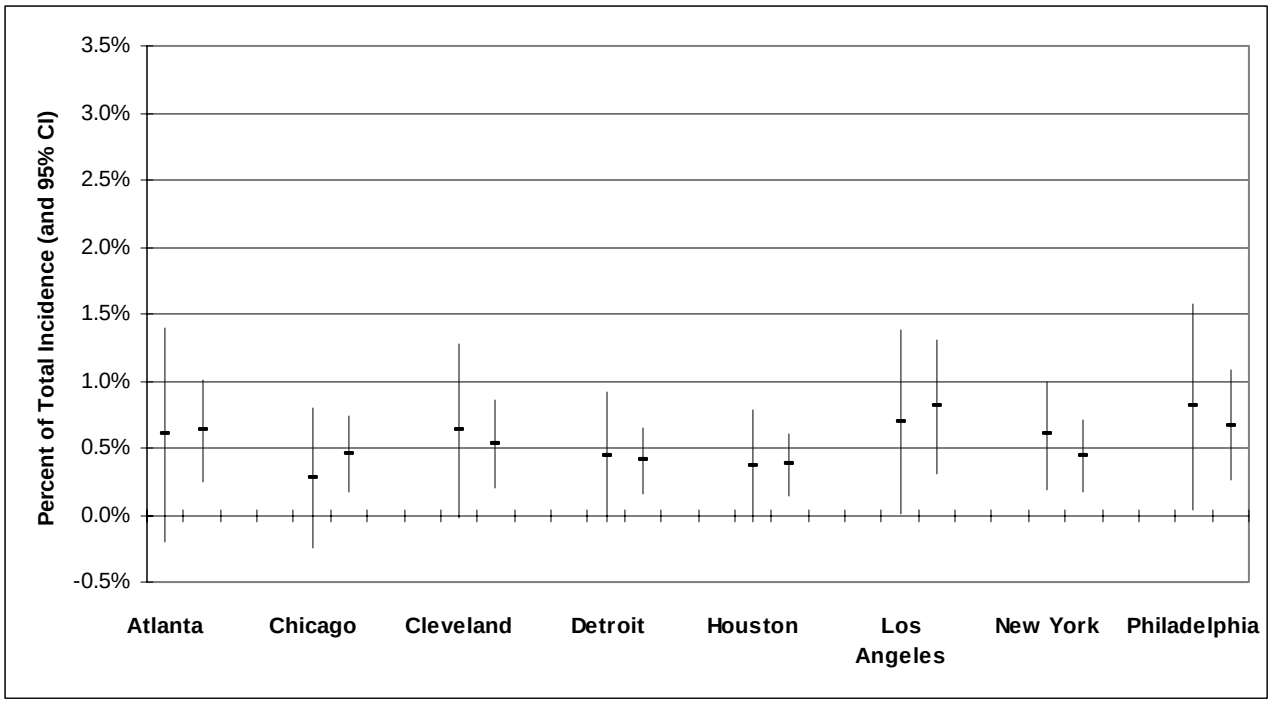

Figure 4-12b. Based on 2002 Air Quality

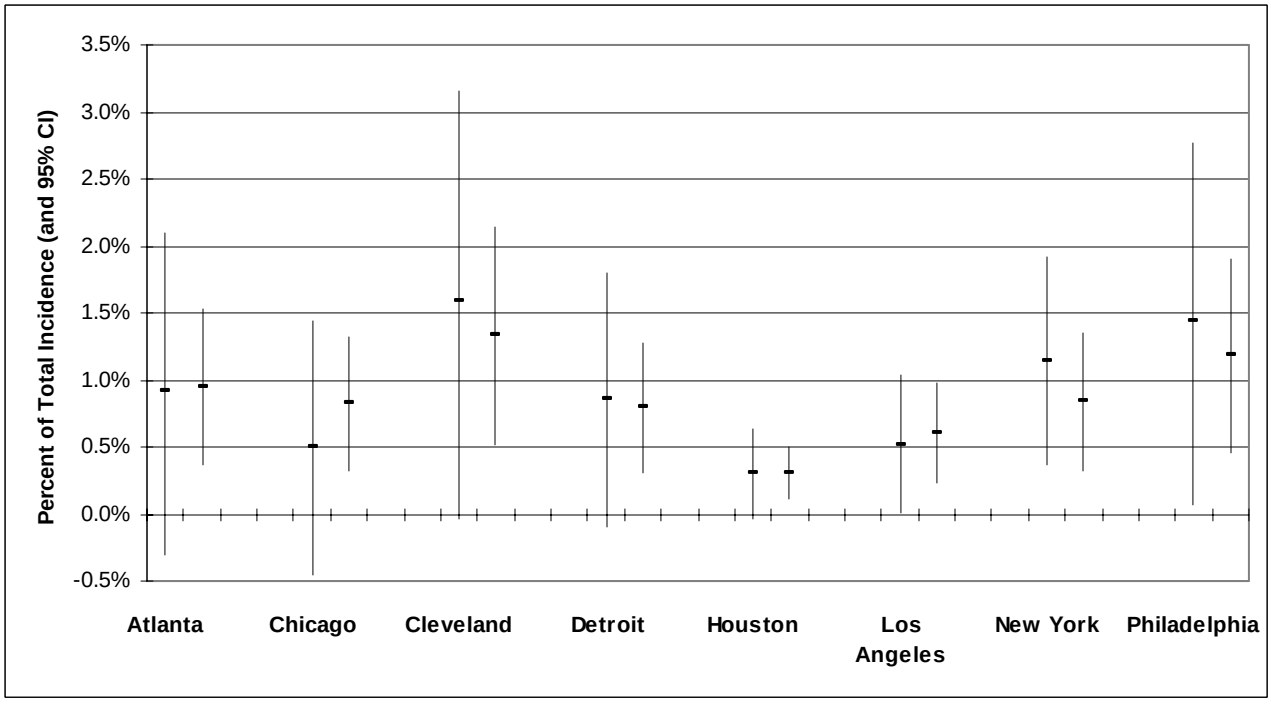

Figure 4-13. Estimated Annual Percent of (Unscheduled) Hospital Admissions for Pneumonia in Detroit Associated with Short-Term Exposure to O_3 Above Background When the Current 8-Hour Standard is Just Met (April – September): Different Lag Models – Based on Ito (2003) [bars from left to right are 0-day, 1-day, 2-day, and 3-day lag models]

Figure 4-13a. Based on 2004 Air Quality

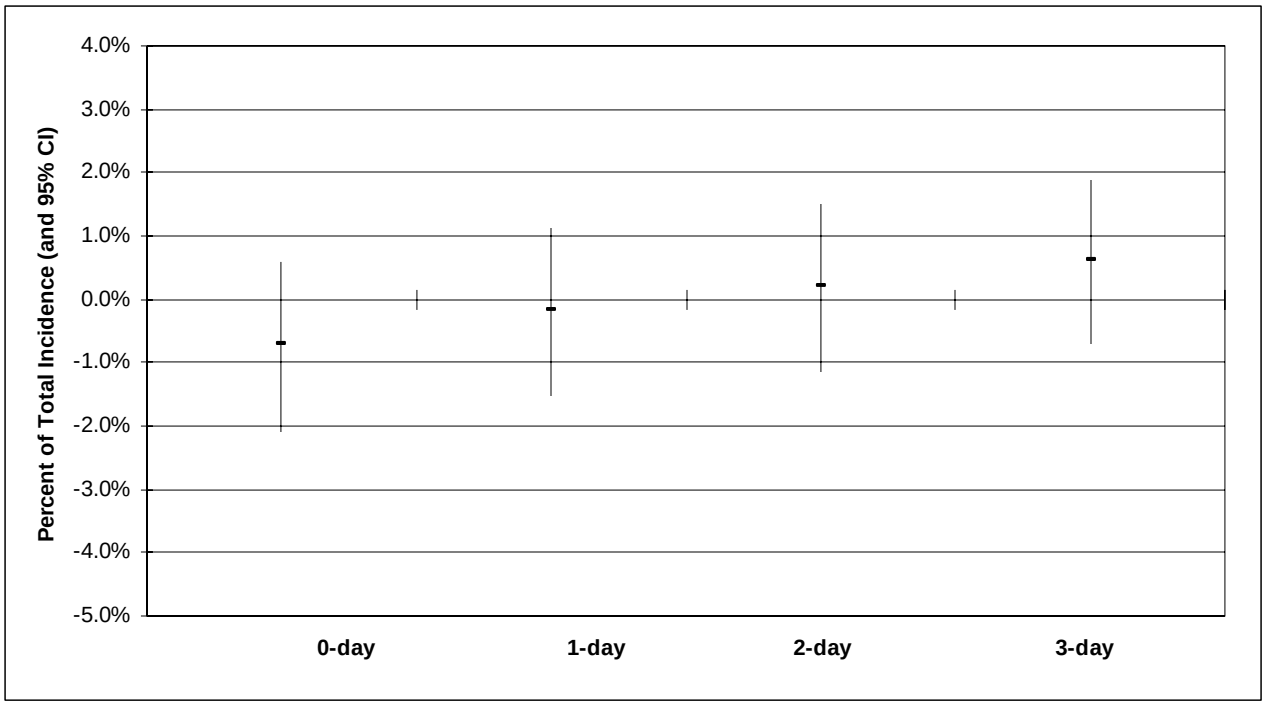

Figure 4-13b. Based on 2002 Air Quality

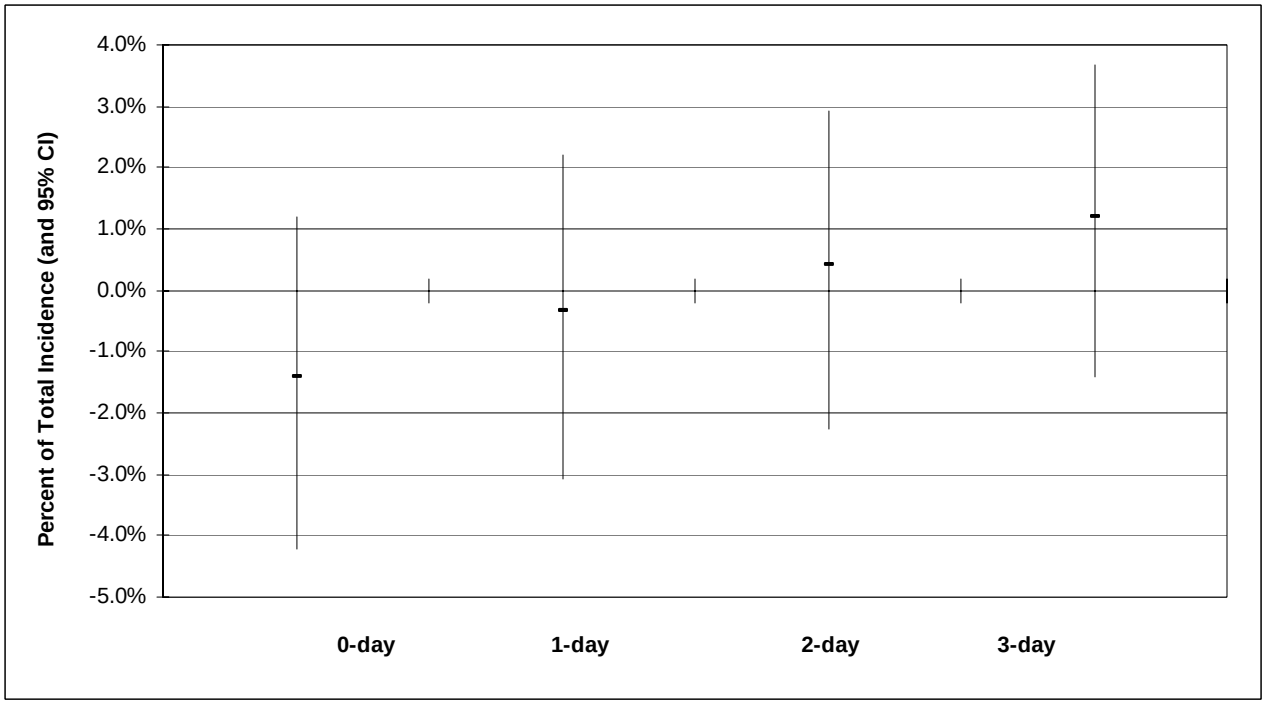

Figure 4-14. Estimated Annual Percent of Non-Accidental Mortality Associated with Short-Term Exposure to O_3 Above Policy Relevant Background for the Period April – September When the Current 8-Hour Standard is Just Met (Based on Bell et al., 2004 – 95 U.S. Cities) – Total and Contribution of 24-Hour O_3 Ranges

Figure 4-14a. Based on 2004 Air Quality

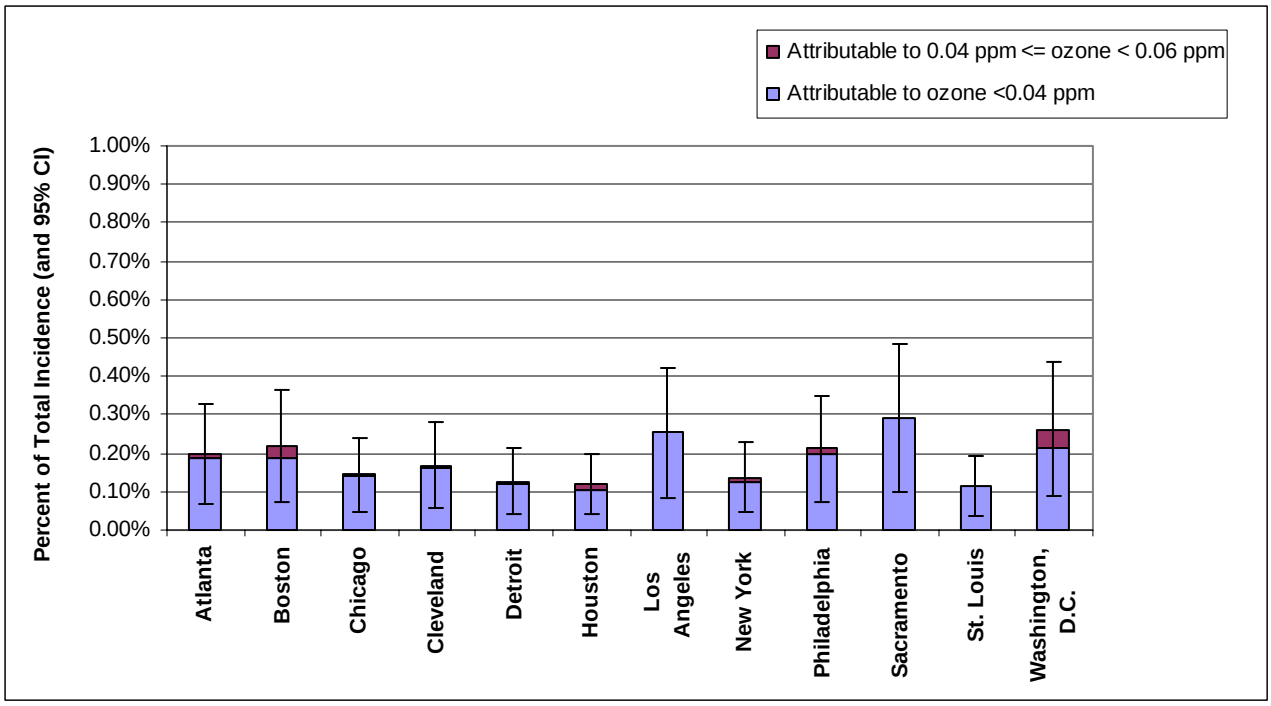

Figure 4-14b. Based on 2002 Air Quality

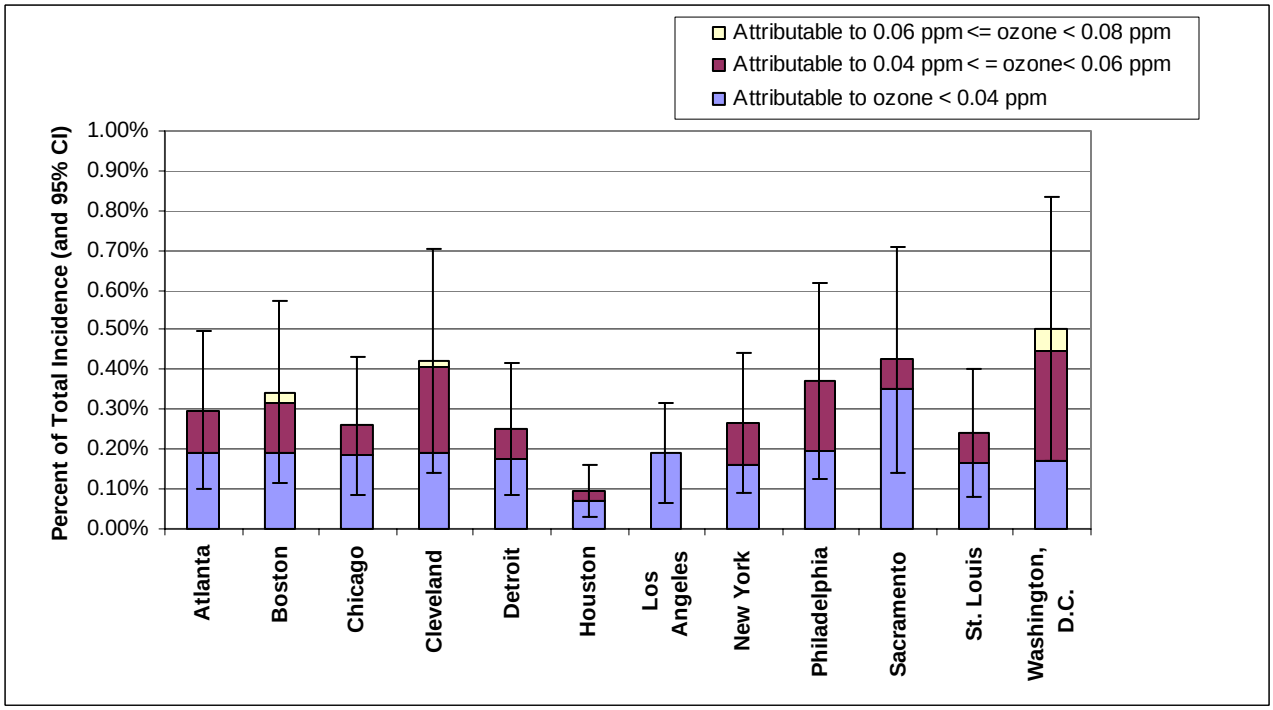

Figure 4-15. Estimated Annual Percent of Cardiorespiratory Mortality Associated with Short-Term Exposure to O_3 Above Policy Relevant Background for the Period April – September When the Current 8-Hour Standard is Just Met (Based on Huang et al., 2004 – 19 U.S. Cities) – Total and Contribution of 24-Hour O_3 Ranges

Figure 4-15a. Based on 2004 Air Quality

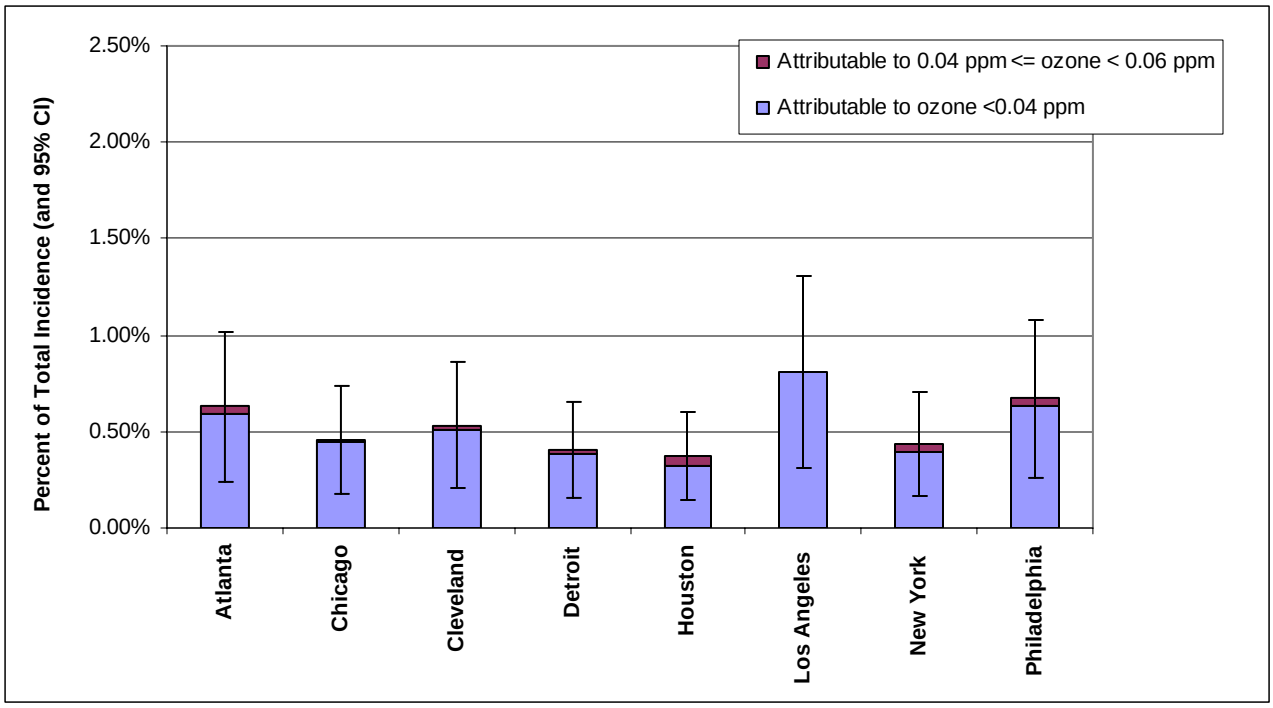

Figure 4-15b. Based on 2002 Air Quality

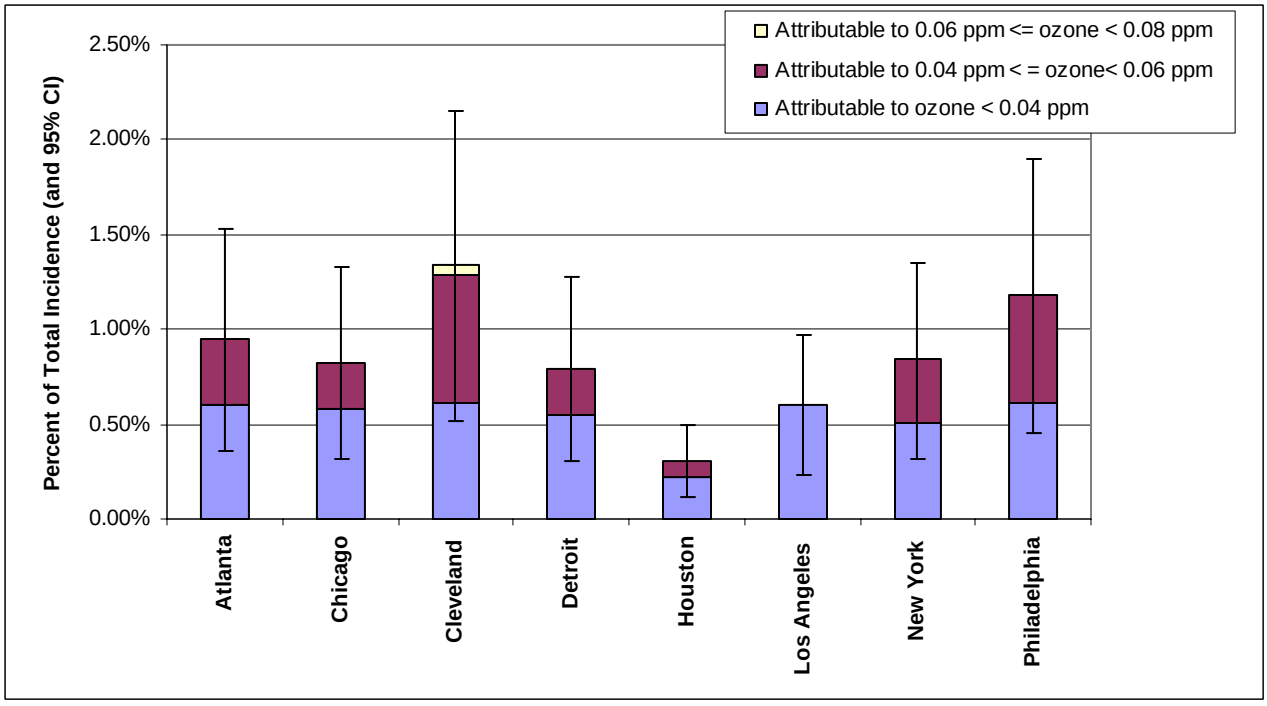

Figure 4-16. Estimated Percent Change From the Current Standard to Alternative Standards in Aggregate O_3-Related Non-Accidental Mortality (Over All Locations) (Based on Bell et al., 2004 -- 95 U.S. Cities)

Figure 4-16a. Based on 2004 Air Quality

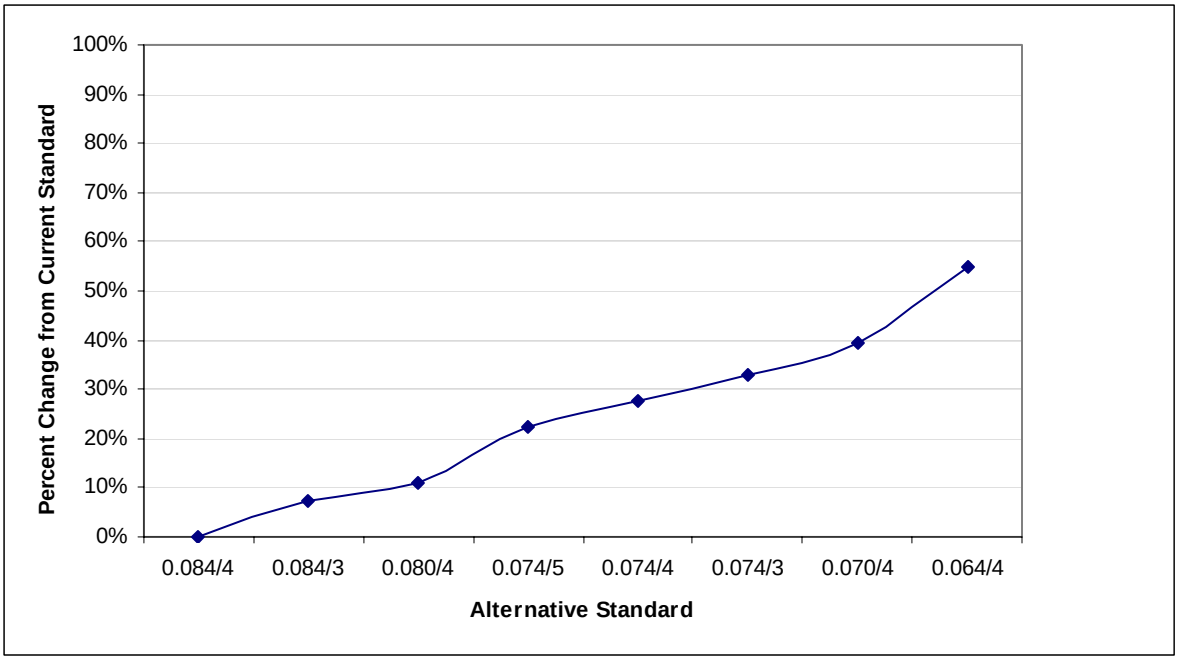

Figure 4-16b. Based on 2002 Air Quality

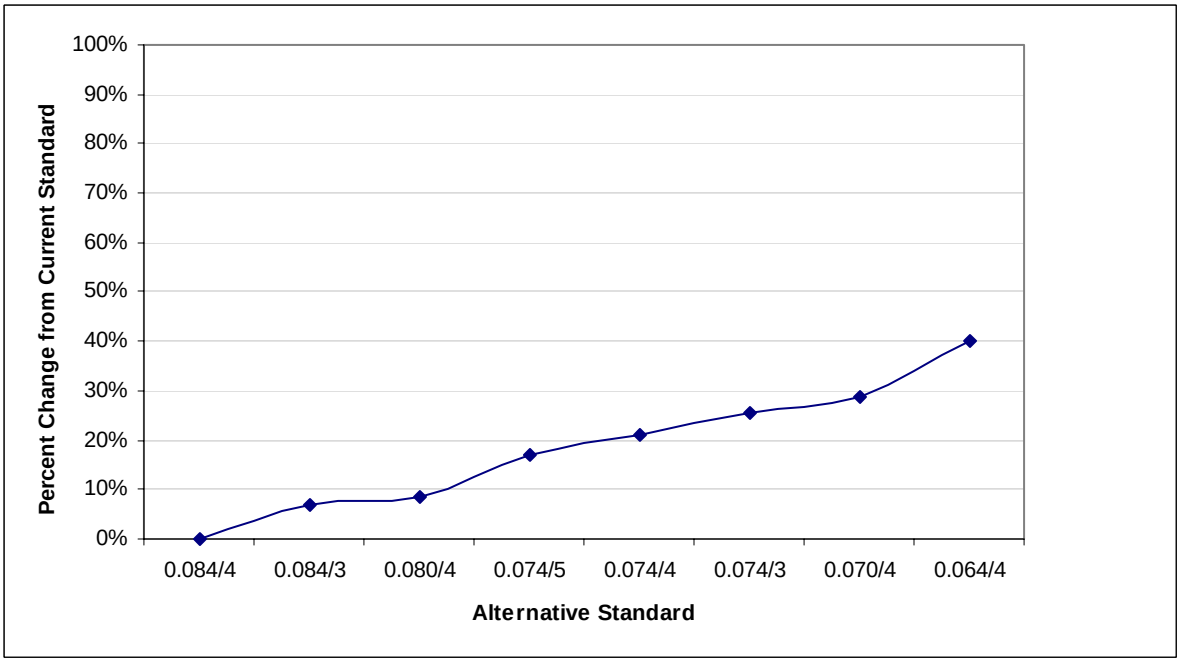

Figure 4-17. Estimated Percent Change From the Current Standard to Alternative Standards in Aggregate O_3-Related Cardiorespiratory Mortality (Over All Locations) (Based on Huang et al., 2004 -- 19 U.S. Cities)

Figure 4-17a. Based on 2004 Air Quality

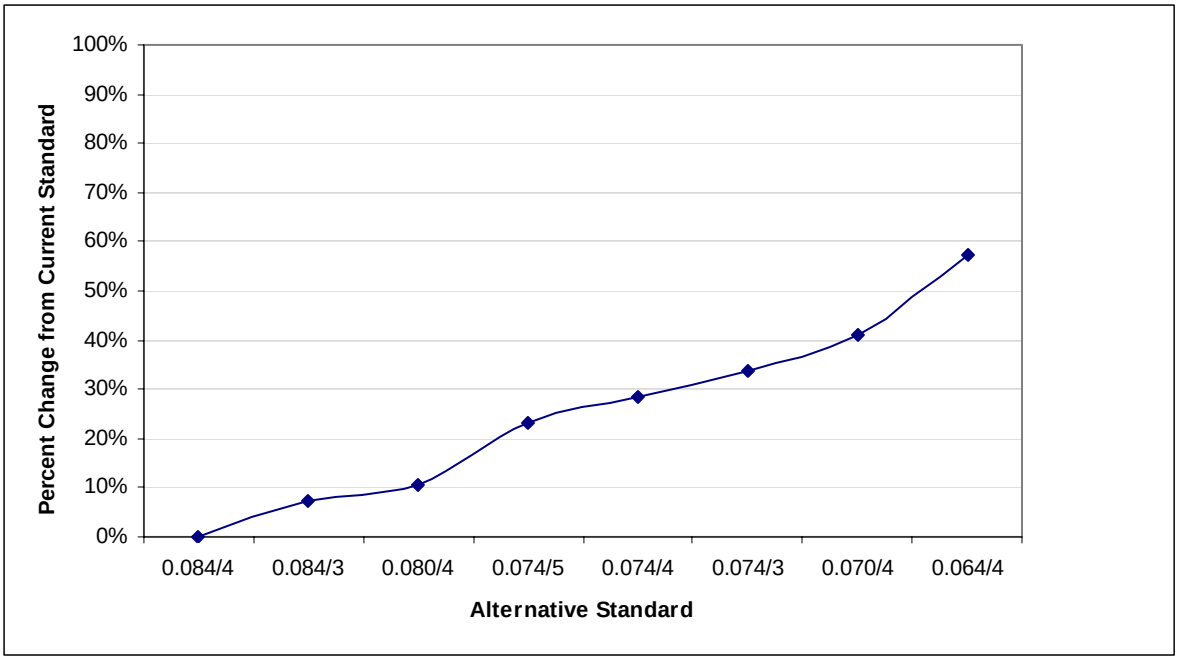

Figure 4-17b. Based on 2002 Air Quality

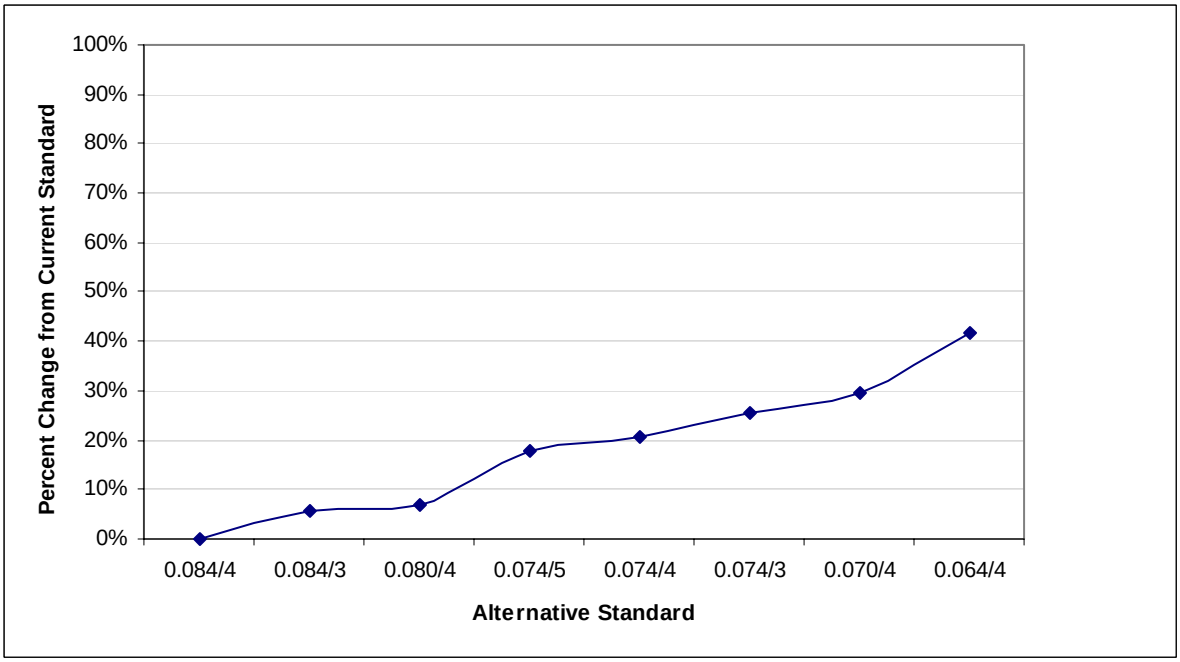

Table 4-14. Estimated Incidence of Non-Accidental Mortality Associated with O_3 Concentrations that Just Meet the Current and Alternative 8-Hour Daily Maximum Standards: April - September, Based on Adjusting 2004 O_3 Concentrations*

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)
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)

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
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 O3. 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 4-15. Estimated Incidence of Non-Accidental Mortality per 100,000 Relevant Population Associated with O_3 Concentrations that Just Meet the Current and Alternative 8-Hour Daily Maximum Standards: April - September, Based Adjusting on 2004 O_3 Concentrations*

Location	Study	Lag	Exposure Metric	Incidence of Non-Accidental Mortality 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
Atlanta	Bell et al. (2004)	distributed lag	24 hr avg.	0.3 (-1.3 - 1.9)	0.3 (-1.3 - 1.9)	0.3 (-1.2 - 1.8)	0.3 (-1.1 - 1.6)	0.2 (-1 - 1.5)	0.2 (-1 - 1.5)	0.2 (-0.9 - 1.3)	0.2 (-0.7 - 1.1)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	0.6 (0.2 - 1)	0.6 (0.2 - 1)	0.6 (0.2 - 0.9)	0.5 (0.2 - 0.8)	0.5 (0.2 - 0.8)	0.5 (0.2 - 0.8)	0.4 (0.1 - 0.7)	0.3 (0.1 - 0.6)
Boston	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	0.8 (0.3 - 1.4)	0.7 (0.2 - 1.2)	0.7 (0.2 - 1.2)	0.7 (0.2 - 1.2)	0.6 (0.2 - 1.1)	0.6 (0.2 - 1)	0.6 (0.2 - 1)	0.5 (0.2 - 0.8)
Chicago	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	0.6 (0.2 - 1)	0.6 (0.2 - 1)	0.5 (0.2 - 0.9)	0.5 (0.2 - 0.8)	0.4 (0.1 - 0.7)	0.4 (0.1 - 0.7)	0.4 (0.1 - 0.6)	0.3 (0.1 - 0.4)
	Schwartz (2004)	0-day lag	1 hr max.	5.8 (1.9 - 9.8)	5.6 (1.8 - 9.3)	5.4 (1.7 - 9)	5 (1.6 - 8.3)	4.6 (1.5 - 7.7)	4.4 (1.4 - 7.4)	4.1 (1.3 - 6.9)	3.4 (1.1 - 5.7)
	Schwartz -- 14 US Cities (2004)	0-day lag	1 hr max.	2.2 (0.7 - 3.7)	2.1 (0.7 - 3.5)	2 (0.6 - 3.4)	1.9 (0.6 - 3.2)	1.7 (0.5 - 2.9)	1.7 (0.5 - 2.8)	1.6 (0.5 - 2.6)	1.3 (0.4 - 2.2)
Cleveland	Bell et al. (2004)	distributed lag	24 hr avg.	1.3 (-0.8 - 3.5)	1.3 (-0.8 - 3.3)	1.2 (-0.8 - 3.2)	1.1 (-0.7 - 2.8)	1 (-0.6 - 2.7)	1 (-0.6 - 2.6)	0.9 (-0.6 - 2.4)	0.7 (-0.5 - 1.9)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	0.9 (0.3 - 1.4)	0.8 (0.3 - 1.3)	0.8 (0.3 - 1.3)	0.7 (0.2 - 1.1)	0.6 (0.2 - 1.1)	0.6 (0.2 - 1)	0.6 (0.2 - 1)	0.5 (0.2 - 0.8)
Detroit	Bell et al. (2004)	distributed lag	24 hr avg.	1.2 (-0.4 - 2.7)	1.1 (-0.3 - 2.5)	1 (-0.3 - 2.4)	1 (-0.3 - 2.3)	0.8 (-0.3 - 2)	0.8 (-0.3 - 1.8)	0.7 (-0.2 - 1.7)	0.6 (-0.2 - 1.3)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	0.6 (0.2 - 1)	0.6 (0.2 - 0.9)	0.5 (0.2 - 0.9)	0.5 (0.2 - 0.9)	0.4 (0.1 - 0.7)	0.4 (0.1 - 0.7)	0.4 (0.1 - 0.6)	0.3 (0.1 - 0.5)
	Schwartz (2004)	0-day lag	1 hr max.	5.2 (-0.8 - 11.1)	4.9 (-0.8 - 10.6)	4.8 (-0.8 - 10.3)	4.7 (-0.8 - 10.1)	4.2 (-0.7 - 9)	4 (-0.7 - 8.6)	3.8 (-0.6 - 8.2)	3.2 (-0.5 - 6.9)
	Schwartz -- 14 US Cities (2004)	0-day lag	1 hr max.	2.8 (0.9 - 4.7)	2.7 (0.8 - 4.5)	2.6 (0.8 - 4.4)	2.6 (0.8 - 4.3)	2.3 (0.7 - 3.8)	2.2 (0.7 - 3.7)	2.1 (0.6 - 3.5)	1.7 (0.5 - 2.9)
	Ito (2003)	0-day lag	24 hr avg.	1.4 (-1.3 - 4.1)	1.3 (-1.2 - 3.8)	1.3 (-1.2 - 3.6)	1.2 (-1.1 - 3.6)	1 (-1 - 3)	1 (-0.9 - 2.8)	0.9 (-0.8 - 2.6)	0.7 (-0.6 - 2)
Houston	Bell et al. (2004)	distributed lag	24 hr avg.	0.6 (0 - 1.2)	0.6 (0 - 1.1)	0.6 (0 - 1.1)	0.5 (0 - 0.9)	0.5 (0 - 0.9)	0.4 (0 - 0.8)	0.4 (0 - 0.7)	0.2 (0 - 0.4)
	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 - 0.3)	0.2 (0.1 - 0.3)	0.1 (0 - 0.2)
	Schwartz (2004)	0-day lag	1 hr max.	2 (0.2 - 3.9)	1.9 (0.2 - 3.7)	1.9 (0.2 - 3.6)	1.7 (0.2 - 3.3)	1.7 (0.2 - 3.2)	1.6 (0.1 - 3.1)	1.5 (0.1 - 2.9)	1.2 (0.1 - 2.3)
	Schwartz -- 14 US Cities (2004)	0-day lag	1 hr max.	1.7 (0.5 - 2.9)	1.6 (0.5 - 2.7)	1.6 (0.5 - 2.7)	1.4 (0.5 - 2.4)	1.4 (0.4 - 2.4)	1.3 (0.4 - 2.3)	1.3 (0.4 - 2.1)	1 (0.3 - 1.7)
Los Angeles	Bell et al. (2004)	distributed lag	24 hr avg.	0.3 (-0.8 - 1.4)	0.3 (-0.8 - 1.4)	0.3 (-0.7 - 1.3)	0.2 (-0.5 - 1)	0.2 (-0.5 - 0.9)	0.2 (-0.5 - 0.9)	0.2 (-0.4 - 0.7)	0.1 (-0.2 - 0.4)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	0.7 (0.2 - 1.2)	0.7 (0.2 - 1.1)	0.6 (0.2 - 1)	0.5 (0.2 - 0.8)	0.5 (0.2 - 0.8)	0.4 (0.1 - 0.7)	0.4 (0.1 - 0.6)	0.2 (0.1 - 0.4)
New York	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	0.5 (0.2 - 0.8)	0.4 (0.1 - 0.7)	0.4 (0.1 - 0.7)	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 - 0.4)

Location	Study	Lag	Exposure Metric	Incidence of Non-Accidental Mortality 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
Philadelphia	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	1.1 (0.4 - 1.8)	1 (0.3 - 1.7)	1 (0.3 - 1.7)	0.9 (0.3 - 1.5)	0.8 (0.3 - 1.4)	0.8 (0.3 - 1.3)	0.8 (0.3 - 1.3)	0.6 (0.2 - 1)
	Moolgavkar et al. (1995)	1-day lag	24 hr avg.	3.9 (2.5 - 5.3)	3.6 (2.3 - 4.9)	3.5 (2.2 - 4.9)	3.1 (2 - 4.3)	3 (1.9 - 4.2)	2.8 (1.8 - 3.8)	2.7 (1.7 - 3.7)	2.2 (1.4 - 3)
Sacramento	Bell et al. (2004)	distributed lag	24 hr avg.	0.7 (-2.1 - 3.4)	0.7 (-2 - 3.3)	0.6 (-1.9 - 3.1)	0.6 (-1.8 - 2.9)	0.6 (-1.7 - 2.8)	0.5 (-1.7 - 2.7)	0.5 (-1.5 - 2.5)	0.4 (-1.3 - 2.2)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	1 (0.3 - 1.7)	1 (0.3 - 1.6)	0.9 (0.3 - 1.6)	0.9 (0.3 - 1.4)	0.8 (0.3 - 1.4)	0.8 (0.3 - 1.4)	0.8 (0.3 - 1.3)	0.6 (0.2 - 1.1)
St Louis	Bell et al. (2004)	distributed lag	24 hr avg.	0.7 (-1.2 - 2.7)	0.7 (-1.1 - 2.4)	0.6 (-1 - 2.3)	0.5 (-0.8 - 1.8)	0.5 (-0.8 - 1.7)	0.4 (-0.7 - 1.5)	0.4 (-0.6 - 1.3)	0.2 (-0.4 - 0.9)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	0.7 (0.2 - 1.1)	0.6 (0.2 - 1)	0.6 (0.2 - 0.9)	0.4 (0.2 - 0.7)	0.4 (0.1 - 0.7)	0.4 (0.1 - 0.6)	0.3 (0.1 - 0.5)	0.2 (0.1 - 0.4)
Washington	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	1.2 (0.4 - 2.1)	1 (0.3 - 1.7)	1.1 (0.4 - 1.9)	1 (0.3 - 1.6)	1 (0.3 - 1.6)	0.8 (0.3 - 1.4)	0.9 (0.3 - 1.5)	0.7 (0.2 - 1.2)

*All results are for mortality (among all ages) associated with short-term exposures to O3. All results are based on single-pollutant models.

**Incidence was quantified down to estimated policy relevant background levels. Incidences per 100,000 relevant population 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 4-16. 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 Adjusting 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%)
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%)

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
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 O3. 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 4-17. 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 Adjusting 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)
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)

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
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 O3. 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 4-18. Estimated Incidence of Non-Accidental Mortality per 100,000 Relevant Population Associated with O_3 Concentrations that Just Meet the Current and Alternative 8-Hour Daily Maximum Standards: April - September, Based on Adjusting 2002 O_3 Concentrations*

Location	Study	Lag	Exposure Metric	Incidence of Non-Accidental Mortality 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
Atlanta	Bell et al. (2004)	distributed lag	24 hr avg.	0.5 (-2 - 2.9)	0.5 (-2 - 2.9)	0.4 (-1.9 - 2.7)	0.4 (-1.8 - 2.5)	0.4 (-1.6 - 2.4)	0.4 (-1.7 - 2.4)	0.3 (-1.5 - 2.2)	0.3 (-1.3 - 1.8)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	0.9 (0.3 - 1.6)	0.9 (0.3 - 1.5)	0.9 (0.3 - 1.4)	0.8 (0.3 - 1.3)	0.8 (0.3 - 1.3)	0.8 (0.3 - 1.3)	0.7 (0.2 - 1.1)	0.6 (0.2 - 1)
Boston	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	1.3 (0.4 - 2.1)	1.2 (0.4 - 2)	1.2 (0.4 - 2)	1.2 (0.4 - 1.9)	1.1 (0.4 - 1.8)	1 (0.3 - 1.7)	1 (0.3 - 1.7)	0.9 (0.3 - 1.5)
Chicago	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	1 (0.3 - 1.7)	1 (0.3 - 1.6)	0.9 (0.3 - 1.6)	0.9 (0.3 - 1.5)	0.8 (0.3 - 1.4)	0.8 (0.3 - 1.3)	0.7 (0.3 - 1.2)	0.6 (0.2 - 1.1)
	Schwartz (2004)	0-day lag	1 hr max.	7.9 (2.5 - 13.2)	7.7 (2.4 - 12.8)	7.5 (2.4 - 12.4)	7.1 (2.3 - 11.8)	6.7 (2.1 - 11.2)	6.5 (2.1 - 10.9)	6.2 (2 - 10.4)	5.5 (1.7 - 9.2)
	Schwartz -- 14 US Cities (2004)	0-day lag	1 hr max.	3 (0.9 - 5)	2.9 (0.9 - 4.9)	2.8 (0.9 - 4.7)	2.7 (0.8 - 4.5)	2.5 (0.8 - 4.3)	2.5 (0.8 - 4.1)	2.3 (0.7 - 3.9)	2.1 (0.6 - 3.5)
Cleveland	Bell et al. (2004)	distributed lag	24 hr avg.	3.5 (-2.2 - 9.2)	3.4 (-2.1 - 8.8)	3.3 (-2.1 - 8.6)	3.1 (-1.9 - 8)	3 (-1.9 - 7.8)	2.9 (-1.8 - 7.5)	2.8 (-1.8 - 7.3)	2.5 (-1.6 - 6.5)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	2.2 (0.8 - 3.7)	2.2 (0.7 - 3.6)	2.1 (0.7 - 3.5)	2 (0.7 - 3.3)	1.9 (0.6 - 3.2)	1.8 (0.6 - 3.1)	1.8 (0.6 - 3)	1.6 (0.5 - 2.7)
Detroit	Bell et al. (2004)	distributed lag	24 hr avg.	2.2 (-0.7 - 5.2)	2.1 (-0.7 - 4.8)	2.1 (-0.7 - 4.8)	2 (-0.7 - 4.7)	1.8 (-0.6 - 4.2)	1.7 (-0.6 - 3.9)	1.7 (-0.5 - 3.8)	1.4 (-0.5 - 3.3)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	1.1 (0.4 - 1.9)	1.1 (0.4 - 1.8)	1.1 (0.4 - 1.8)	1 (0.3 - 1.7)	0.9 (0.3 - 1.5)	0.9 (0.3 - 1.5)	0.9 (0.3 - 1.4)	0.7 (0.2 - 1.2)
	Schwartz (2004)	0-day lag	1 hr max.	7.7 (-1.3 - 16.3)	7.3 (-1.2 - 15.5)	7.2 (-1.2 - 15.4)	7.1 (-1.2 - 15.2)	6.5 (-1.1 - 13.9)	6.2 (-1 - 13.3)	6.1 (-1 - 13)	5.4 (-0.9 - 11.6)
	Schwartz -- 14 US Cities (2004)	0-day lag	1 hr max.	4.2 (1.3 - 7)	4 (1.2 - 6.6)	3.9 (1.2 - 6.6)	3.9 (1.2 - 6.5)	3.5 (1.1 - 6)	3.4 (1.1 - 5.7)	3.3 (1 - 5.6)	2.9 (0.9 - 4.9)
	Ito (2003)	0-day lag	24 hr avg.	2.7 (-2.5 - 7.8)	2.6 (-2.4 - 7.4)	2.5 (-2.3 - 7.3)	2.5 (-2.3 - 7.2)	2.2 (-2.1 - 6.4)	2.1 (-1.9 - 6)	2 (-1.9 - 5.8)	1.7 (-1.6 - 5)
Houston	Bell et al. (2004)	distributed lag	24 hr avg.	0.5 (0 - 1)	0.5 (0 - 0.9)	0.5 (0 - 0.9)	0.4 (0 - 0.8)	0.4 (0 - 0.7)	0.3 (0 - 0.7)	0.3 (0 - 0.6)	0.2 (0 - 0.4)
	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)	0.1 (0 - 0.2)
	Schwartz (2004)	0-day lag	1 hr max.	1.8 (0.2 - 3.5)	1.7 (0.2 - 3.3)	1.7 (0.2 - 3.2)	1.5 (0.1 - 2.9)	1.5 (0.1 - 2.9)	1.4 (0.1 - 2.7)	1.3 (0.1 - 2.6)	1.1 (0.1 - 2)
	Schwartz -- 14 US Cities (2004)	0-day lag	1 hr max.	1.5 (0.5 - 2.6)	1.5 (0.5 - 2.5)	1.4 (0.4 - 2.4)	1.3 (0.4 - 2.2)	1.3 (0.4 - 2.1)	1.2 (0.4 - 2)	1.1 (0.4 - 1.9)	0.9 (0.3 - 1.5)
Los Angeles	Bell et al. (2004)	distributed lag	24 hr avg.	0.3 (-0.6 - 1.1)	0.2 (-0.6 - 1.1)	0.2 (-0.5 - 1)	0.2 (-0.4 - 0.7)	0.2 (-0.4 - 0.7)	0.1 (-0.3 - 0.6)	0.1 (-0.3 - 0.5)	0.1 (-0.2 - 0.3)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	0.5 (0.2 - 0.9)	0.5 (0.2 - 0.9)	0.5 (0.2 - 0.8)	0.3 (0.1 - 0.6)	0.3 (0.1 - 0.6)	0.3 (0.1 - 0.5)	0.2 (0.1 - 0.4)	0.1 (0 - 0.2)
New York	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	0.9 (0.3 - 1.6)	0.9 (0.3 - 1.4)	0.9 (0.3 - 1.5)	0.8 (0.3 - 1.4)	0.8 (0.3 - 1.3)	0.7 (0.2 - 1.2)	0.7 (0.2 - 1.2)	0.6 (0.2 - 1.1)

Location	Study	Lag	Exposure Metric	Incidence of Non-Accidental Mortality 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
Philadelphia	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	2 (0.7 - 3.3)	1.9 (0.6 - 3.1)	1.9 (0.6 - 3.1)	1.7 (0.6 - 2.9)	1.7 (0.6 - 2.8)	1.6 (0.5 - 2.6)	1.6 (0.5 - 2.6)	1.4 (0.5 - 2.3)
	Moolgavkar et al. (1995)	1-day lag	24 hr avg.	7 (4.4 - 9.6)	6.6 (4.2 - 9.1)	6.6 (4.2 - 9.1)	6.1 (3.9 - 8.4)	6 (3.8 - 8.2)	5.7 (3.6 - 7.7)	5.6 (3.5 - 7.6)	5 (3.1 - 6.8)
Sacramento	Bell et al. (2004)	distributed lag	24 hr avg.	1 (-3 - 4.9)	1 (-2.9 - 4.8)	0.9 (-2.8 - 4.6)	0.9 (-2.6 - 4.3)	0.9 (-2.6 - 4.2)	0.8 (-2.5 - 4.1)	0.8 (-2.4 - 4)	0.7 (-2.2 - 3.6)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	1.5 (0.5 - 2.4)	1.4 (0.5 - 2.4)	1.4 (0.5 - 2.3)	1.3 (0.4 - 2.1)	1.3 (0.4 - 2.1)	1.2 (0.4 - 2)	1.2 (0.4 - 2)	1.1 (0.4 - 1.8)
St Louis	Bell et al. (2004)	distributed lag	24 hr avg.	1.6 (-2.6 - 5.6)	1.5 (-2.5 - 5.4)	1.4 (-2.4 - 5.2)	1.3 (-2.2 - 4.7)	1.2 (-2.1 - 4.5)	1.2 (-2 - 4.3)	1.1 (-1.8 - 4)	0.9 (-1.5 - 3.3)
	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	1.4 (0.5 - 2.3)	1.3 (0.4 - 2.2)	1.3 (0.4 - 2.1)	1.2 (0.4 - 1.9)	1.1 (0.4 - 1.8)	1.1 (0.4 - 1.8)	1 (0.3 - 1.6)	0.8 (0.3 - 1.4)
Washington	Bell et al. -- 95 US Cities (2004)	distributed lag	24 hr avg.	2.4 (0.8 - 3.9)	2.1 (0.7 - 3.5)	2.2 (0.8 - 3.7)	2 (0.7 - 3.4)	2 (0.7 - 3.4)	1.8 (0.6 - 3)	1.9 (0.6 - 3.2)	1.7 (0.6 - 2.9)

*All results are for mortality (among all ages) associated with short-term exposures to O3. All results are based on single-pollutant models.

**Incidence was quantified down to estimated policy relevant background levels. Incidences per 100,000 relevant population 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 4-19. 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 Adjusting 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%)
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%)

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
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 O3. 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 4-20. Estimated Cardiorespiratory Mortality Associated with O_3 Concentrations that Just Meet the Current and Alternative 8-Hour Daily Maximum Standards: April - September, Based on Adjusting 2004 O_3 Concentrations*

Risk Assessment Location	Study Location	Cardiorespiratory 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	Atlanta	6 (-2 - 14)	6 (-2 - 13)	5 (-2 - 12)	5 (-2 - 11)	5 (-1 - 10)	4 (-1 - 10)	4 (-1 - 9)	3 (-1 - 7)
	19 U.S. Cities	6 (2 - 10)	6 (2 - 10)	6 (2 - 9)	5 (2 - 8)	5 (2 - 8)	5 (2 - 8)	4 (2 - 7)	3 (1 - 5)
Chicago	Chicago	16 (-14 - 45)	15 (-13 - 42)	14 (-12 - 39)	12 (-11 - 35)	11 (-10 - 31)	10 (-9 - 29)	9 (-8 - 26)	7 (-6 - 19)
	19 U.S. Cities	26 (10 - 41)	24 (9 - 39)	22 (9 - 36)	20 (8 - 32)	18 (7 - 29)	17 (6 - 27)	15 (6 - 24)	11 (4 - 18)
Cleveland	Cleveland	11 (0 - 23)	11 (0 - 21)	10 (0 - 21)	9 (0 - 18)	9 (0 - 17)	8 (0 - 17)	8 (0 - 15)	6 (0 - 12)
	19 U.S. Cities	10 (4 - 15)	9 (3 - 15)	9 (3 - 14)	8 (3 - 12)	7 (3 - 12)	7 (3 - 11)	6 (2 - 10)	5 (2 - 8)
Detroit	Detroit	11 (-1 - 23)	10 (-1 - 21)	10 (-1 - 20)	9 (-1 - 20)	8 (-1 - 17)	7 (-1 - 15)	7 (-1 - 14)	5 (-1 - 11)
	19 U.S. Cities	10 (4 - 16)	9 (4 - 15)	9 (3 - 14)	9 (3 - 14)	7 (3 - 12)	7 (3 - 11)	6 (2 - 10)	5 (2 - 8)
Houston	Houston	8 (-1 - 16)	7 (-1 - 15)	7 (-1 - 15)	6 (-1 - 12)	6 (-1 - 12)	5 (-1 - 11)	5 (-1 - 10)	3 (0 - 6)
	19 U.S. Cities	8 (3 - 13)	7 (3 - 12)	7 (3 - 11)	6 (2 - 10)	6 (2 - 9)	5 (2 - 8)	5 (2 - 8)	3 (1 - 5)
Los Angeles	Los Angeles	50 (0 - 98)	48 (0 - 95)	44 (0 - 88)	35 (0 - 69)	33 (0 - 65)	30 (0 - 61)	25 (0 - 50)	15 (0 - 30)
	19 U.S. Cities	57 (22 - 93)	56 (21 - 90)	51 (19 - 83)	40 (15 - 65)	38 (15 - 62)	35 (13 - 57)	29 (11 - 47)	17 (7 - 28)
New York	New York	53 (17 - 89)	47 (15 - 78)	48 (15 - 80)	43 (14 - 71)	41 (13 - 68)	36 (11 - 60)	36 (11 - 60)	29 (9 - 49)
	19 U.S. Cities	39 (15 - 63)	34 (13 - 55)	35 (13 - 57)	31 (12 - 50)	30 (11 - 48)	26 (10 - 42)	26 (10 - 42)	21 (8 - 34)
Philadelphia	Philadelphia	15 (1 - 28)	14 (1 - 26)	13 (1 - 26)	12 (1 - 23)	11 (1 - 22)	10 (0 - 20)	10 (0 - 20)	8 (0 - 16)
	19 U.S. Cities	12 (5 - 19)	11 (4 - 18)	11 (4 - 18)	10 (4 - 16)	9 (4 - 15)	9 (3 - 14)	8 (3 - 13)	7 (3 - 11)

*All results are for cardiovascular and respiratory mortality (among all ages) associated with short-term exposures to O3. Results are based on single-pollutant single-city models or a single-pollutant multi-city model estimated in Huang et al. (2004).

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

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

Table 4-21. Estimated Cardiorespiratory Mortality per 100,000 Relevant Population Associated with O_3 Concentrations that Just Meet the Current and Alternative 8-Hour Daily Maximum Standards: April - September, Based on Adjusting 2004 O_3 Concentrations*

Risk Assessment Location	Study Location	Cardiorespiratory Mortality 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
Atlanta	Atlanta	0.4 (-0.1 - 0.9)	0.4 (-0.1 - 0.9)	0.4 (-0.1 - 0.8)	0.3 (-0.1 - 0.7)	0.3 (-0.1 - 0.7)	0.3 (-0.1 - 0.7)	0.3 (-0.1 - 0.6)	0.2 (-0.1 - 0.5)
	19 U.S. Cities	0.4 (0.2 - 0.7)	0.4 (0.2 - 0.7)	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)	0.2 (0.1 - 0.4)
Chicago	Chicago	0.3 (-0.3 - 0.8)	0.3 (-0.2 - 0.8)	0.3 (-0.2 - 0.7)	0.2 (-0.2 - 0.7)	0.2 (-0.2 - 0.6)	0.2 (-0.2 - 0.5)	0.2 (-0.2 - 0.5)	0.1 (-0.1 - 0.4)
	19 U.S. Cities	0.5 (0.2 - 0.8)	0.4 (0.2 - 0.7)	0.4 (0.2 - 0.7)	0.4 (0.1 - 0.6)	0.3 (0.1 - 0.5)	0.3 (0.1 - 0.5)	0.3 (0.1 - 0.4)	0.2 (0.1 - 0.3)
Cleveland	Cleveland	0.8 (0 - 1.6)	0.8 (0 - 1.5)	0.7 (0 - 1.5)	0.6 (0 - 1.3)	0.6 (0 - 1.2)	0.6 (0 - 1.2)	0.5 (0 - 1.1)	0.4 (0 - 0.9)
	19 U.S. Cities	0.7 (0.3 - 1.1)	0.6 (0.2 - 1)	0.6 (0.2 - 1)	0.5 (0.2 - 0.9)	0.5 (0.2 - 0.8)	0.5 (0.2 - 0.8)	0.5 (0.2 - 0.7)	0.4 (0.1 - 0.6)
Detroit	Detroit	0.5 (-0.1 - 1.1)	0.5 (-0.1 - 1)	0.5 (-0.1 - 1)	0.5 (-0.1 - 1)	0.4 (0 - 0.8)	0.4 (0 - 0.8)	0.3 (0 - 0.7)	0.3 (0 - 0.5)
	19 U.S. Cities	0.5 (0.2 - 0.8)	0.4 (0.2 - 0.7)	0.4 (0.2 - 0.7)	0.4 (0.2 - 0.7)	0.4 (0.1 - 0.6)	0.3 (0.1 - 0.5)	0.3 (0.1 - 0.5)	0.2 (0.1 - 0.4)
Houston	Houston	0.2 (0 - 0.5)	0.2 (0 - 0.4)	0.2 (0 - 0.4)	0.2 (0 - 0.4)	0.2 (0 - 0.4)	0.2 (0 - 0.3)	0.1 (0 - 0.3)	0.1 (0 - 0.2)
	19 U.S. Cities	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 - 0.2)	0.1 (0.1 - 0.2)	0.1 (0 - 0.1)
Los Angeles	Los Angeles	0.5 (0 - 1)	0.5 (0 - 1)	0.5 (0 - 0.9)	0.4 (0 - 0.7)	0.3 (0 - 0.7)	0.3 (0 - 0.6)	0.3 (0 - 0.5)	0.2 (0 - 0.3)
	19 U.S. Cities	0.6 (0.2 - 1)	0.6 (0.2 - 0.9)	0.5 (0.2 - 0.9)	0.4 (0.2 - 0.7)	0.4 (0.2 - 0.6)	0.4 (0.1 - 0.6)	0.3 (0.1 - 0.5)	0.2 (0.1 - 0.3)
New York	New York	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 - 0.5)
	19 U.S. Cities	0.4 (0.2 - 0.7)	0.4 (0.1 - 0.6)	0.4 (0.2 - 0.6)	0.3 (0.1 - 0.6)	0.3 (0.1 - 0.5)	0.3 (0.1 - 0.5)	0.3 (0.1 - 0.5)	0.2 (0.1 - 0.4)
Philadelphia	Philadelphia	1 (0 - 1.9)	0.9 (0 - 1.7)	0.9 (0 - 1.7)	0.8 (0 - 1.5)	0.8 (0 - 1.5)	0.7 (0 - 1.3)	0.7 (0 - 1.3)	0.5 (0 - 1.1)
	19 U.S. Cities	0.8 (0.3 - 1.3)	0.7 (0.3 - 1.2)	0.7 (0.3 - 1.2)	0.6 (0.2 - 1)	0.6 (0.2 - 1)	0.6 (0.2 - 0.9)	0.5 (0.2 - 0.9)	0.4 (0.2 - 0.7)

*All results are for cardiovascular and respiratory mortality (among all ages) associated with short-term exposures to O3. Results are based on single-pollutant single-city models or a single-pollutant multi-city model estimated in Huang et al. (2004).

**Incidence was quantified down to estimated policy relevant background levels. Incidences per 100,000 relevant population are rounded to the nearest tenth.

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

Table 4-22. Estimated Percent of Total Incidence of Cardiorespiratory Mortality Associated with O_3 Concentrations that Just Meet the Current and Alternative 8-Hour Daily Maximum Standards: April - September, Based Adjusting on 2004 O_3 Concentrations*

Risk Assessment Location	Study Location	Percent of Total Incidence of Cardiorespiratory 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	Atlanta	0.6% (-0.2% - 1.4%)	0.6% (-0.2% - 1.4%)	0.6% (-0.2% - 1.3%)	0.5% (-0.2% - 1.1%)	0.5% (-0.2% - 1.1%)	0.5% (-0.2% - 1.1%)	0.4% (-0.1% - 0.9%)	0.3% (-0.1% - 0.8%)
	19 U.S. Cities	0.6% (0.2% - 1%)	0.6% (0.2% - 1%)	0.6% (0.2% - 0.9%)	0.5% (0.2% - 0.8%)	0.5% (0.2% - 0.8%)	0.5% (0.2% - 0.8%)	0.4% (0.2% - 0.7%)	0.3% (0.1% - 0.6%)
Chicago	Chicago	0.3% (-0.3% - 0.9%)	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%)	0.2% (-0.2% - 0.5%)	0.1% (-0.1% - 0.4%)
	19 U.S. Cities	0.5% (0.2% - 0.8%)	0.5% (0.2% - 0.8%)	0.4% (0.2% - 0.7%)	0.4% (0.1% - 0.6%)	0.4% (0.1% - 0.6%)	0.3% (0.1% - 0.5%)	0.3% (0.1% - 0.5%)	0.2% (0.1% - 0.3%)
Cleveland	Cleveland	0.6% (0% - 1.2%)	0.6% (0% - 1.1%)	0.5% (0% - 1.1%)	0.5% (0% - 1%)	0.5% (0% - 0.9%)	0.4% (0% - 0.9%)	0.4% (0% - 0.8%)	0.3% (0% - 0.7%)
	19 U.S. Cities	0.5% (0.2% - 0.8%)	0.5% (0.2% - 0.8%)	0.5% (0.2% - 0.7%)	0.4% (0.2% - 0.7%)	0.4% (0.1% - 0.6%)	0.4% (0.1% - 0.6%)	0.3% (0.1% - 0.6%)	0.3% (0.1% - 0.4%)
Detroit	Detroit	0.5% (-0.1% - 0.9%)	0.4% (0% - 0.9%)	0.4% (0% - 0.8%)	0.4% (0% - 0.8%)	0.3% (0% - 0.7%)	0.3% (0% - 0.6%)	0.3% (0% - 0.6%)	0.2% (0% - 0.5%)
	19 U.S. Cities	0.4% (0.2% - 0.7%)	0.4% (0.1% - 0.6%)	0.4% (0.1% - 0.6%)	0.4% (0.1% - 0.6%)	0.3% (0.1% - 0.5%)	0.3% (0.1% - 0.5%)	0.3% (0.1% - 0.4%)	0.2% (0.1% - 0.3%)
Houston	Houston	0.4% (0% - 0.8%)	0.3% (0% - 0.7%)	0.3% (0% - 0.7%)	0.3% (0% - 0.6%)	0.3% (0% - 0.6%)	0.2% (0% - 0.5%)	0.2% (0% - 0.5%)	0.1% (0% - 0.3%)
	19 U.S. Cities	0.4% (0.1% - 0.6%)	0.3% (0.1% - 0.6%)	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%)	0.1% (0.1% - 0.2%)
Los Angeles	Los Angeles	0.7% (0% - 1.3%)	0.6% (0% - 1.3%)	0.6% (0% - 1.2%)	0.5% (0% - 0.9%)	0.4% (0% - 0.9%)	0.4% (0% - 0.8%)	0.3% (0% - 0.7%)	0.2% (0% - 0.4%)
	19 U.S. Cities	0.8% (0.3% - 1.3%)	0.8% (0.3% - 1.2%)	0.7% (0.3% - 1.1%)	0.5% (0.2% - 0.9%)	0.5% (0.2% - 0.8%)	0.5% (0.2% - 0.8%)	0.4% (0.2% - 0.6%)	0.2% (0.1% - 0.4%)
New York	New York	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% - 0.5%)
	19 U.S. Cities	0.4% (0.2% - 0.7%)	0.4% (0.1% - 0.6%)	0.4% (0.2% - 0.6%)	0.3% (0.1% - 0.6%)	0.3% (0.1% - 0.5%)	0.3% (0.1% - 0.5%)	0.3% (0.1% - 0.5%)	0.2% (0.1% - 0.4%)
Philadelphia	Philadelphia	0.8% (0% - 1.5%)	0.7% (0% - 1.4%)	0.7% (0% - 1.4%)	0.6% (0% - 1.2%)	0.6% (0% - 1.2%)	0.6% (0% - 1.1%)	0.6% (0% - 1.1%)	0.4% (0% - 0.9%)
	19 U.S. Cities	0.7% (0.3% - 1.1%)	0.6% (0.2% - 1%)	0.6% (0.2% - 1%)	0.5% (0.2% - 0.8%)	0.5% (0.2% - 0.8%)	0.5% (0.2% - 0.8%)	0.5% (0.2% - 0.7%)	0.4% (0.1% - 0.6%)

*All results are for cardiovascular and respiratory mortality (among all ages) associated with short-term exposures to O3. Results are based on single-pollutant single-city models or a single-pollutant multi-city model estimated in Huang et al. (2004).

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

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

Table 4-23. Estimated Cardiorespiratory Mortality Associated with O_3 Concentrations that Just Meet the Current and Alternative 8-Hour Daily Maximum Standards: April - September, Based on Adjusting 2002 O_3 Concentrations*

Risk Assessment Location	Study Location	Cardiorespiratory 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	Atlanta	9 (-3 - 20)	9 (-3 - 20)	8 (-3 - 19)	8 (-3 - 18)	7 (-2 - 17)	7 (-2 - 17)	7 (-2 - 15)	6 (-2 - 13)
	19 U.S. Cities	9 (4 - 15)	9 (4 - 15)	9 (3 - 14)	8 (3 - 13)	8 (3 - 12)	8 (3 - 12)	7 (3 - 11)	6 (2 - 9)
Chicago	Chicago	26 (-23 - 73)	25 (-22 - 70)	24 (-21 - 68)	22 (-20 - 64)	21 (-19 - 60)	20 (-18 - 57)	19 (-17 - 54)	16 (-14 - 46)
	19 U.S. Cities	42 (16 - 68)	40 (15 - 65)	39 (15 - 63)	36 (14 - 59)	34 (13 - 55)	33 (13 - 53)	31 (12 - 50)	26 (10 - 43)
Cleveland	Cleveland	30 (-1 - 59)	28 (-1 - 57)	28 (-1 - 56)	26 (-1 - 52)	25 (-1 - 51)	24 (-1 - 49)	24 (-1 - 47)	21 (-1 - 42)
	19 U.S. Cities	25 (10 - 40)	24 (9 - 39)	24 (9 - 38)	22 (8 - 35)	21 (8 - 34)	21 (8 - 33)	20 (8 - 32)	18 (7 - 29)
Detroit	Detroit	21 (-2 - 44)	20 (-2 - 41)	19 (-2 - 40)	19 (-2 - 40)	17 (-2 - 36)	16 (-2 - 33)	16 (-2 - 33)	13 (-2 - 28)
	19 U.S. Cities	19 (7 - 31)	18 (7 - 29)	18 (7 - 29)	17 (7 - 28)	16 (6 - 25)	15 (6 - 24)	14 (5 - 23)	12 (5 - 20)
Houston	Houston	6 (-1 - 13)	6 (-1 - 12)	6 (-1 - 12)	5 (-1 - 10)	5 (-1 - 10)	4 (-1 - 9)	4 (0 - 8)	2 (0 - 5)
	19 U.S. Cities	6 (2 - 10)	6 (2 - 10)	6 (2 - 9)	5 (2 - 8)	5 (2 - 7)	4 (2 - 7)	4 (1 - 6)	2 (1 - 4)
Los Angeles	Los Angeles	38 (0 - 76)	37 (0 - 73)	33 (0 - 66)	24 (0 - 48)	24 (0 - 47)	22 (0 - 43)	18 (0 - 35)	11 (0 - 21)
	19 U.S. Cities	45 (17 - 72)	43 (16 - 69)	39 (15 - 62)	28 (11 - 45)	27 (10 - 44)	25 (10 - 41)	20 (8 - 33)	12 (5 - 20)
New York	New York	102 (33 - 170)	93 (30 - 155)	95 (31 - 159)	89 (28 - 148)	86 (27 - 143)	78 (25 - 130)	79 (25 - 133)	70 (22 - 116)
	19 U.S. Cities	75 (29 - 120)	68 (26 - 109)	70 (27 - 113)	65 (25 - 105)	63 (24 - 101)	57 (22 - 92)	58 (22 - 94)	51 (19 - 82)
Philadelphia	Philadelphia	26 (1 - 51)	25 (1 - 48)	25 (1 - 48)	23 (1 - 44)	23 (1 - 44)	21 (1 - 41)	21 (1 - 41)	19 (1 - 36)
	19 U.S. Cities	22 (8 - 35)	21 (8 - 33)	21 (8 - 33)	19 (7 - 30)	19 (7 - 30)	18 (7 - 28)	17 (7 - 28)	15 (6 - 25)

*All results are for cardiovascular and respiratory mortality (among all ages) associated with short-term exposures to O3. Results are based on single-pollutant single-city models or a single-pollutant multi-city model estimated in Huang et al. (2004).

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

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

Table 4-24. Estimated Cardiorespiratory Mortality per 100,000 Relevant Population Associated with O_3 Concentrations that Just Meet the Current and Alternative 8-Hour Daily Maximum Standards: April - September, Based on Adjusting 2002 O_3 Concentrations*

Risk Assessment Location	Study Location	Cardiorespiratory Mortality 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
Atlanta	Atlanta	0.6 (-0.2 - 1.4)	0.6 (-0.2 - 1.4)	0.6 (-0.2 - 1.3)	0.5 (-0.2 - 1.2)	0.5 (-0.2 - 1.1)	0.5 (-0.2 - 1.1)	0.4 (-0.1 - 1)	0.4 (-0.1 - 0.9)
	19 U.S. Cities	0.6 (0.2 - 1)	0.6 (0.2 - 1)	0.6 (0.2 - 0.9)	0.5 (0.2 - 0.9)	0.5 (0.2 - 0.8)	0.5 (0.2 - 0.8)	0.5 (0.2 - 0.7)	0.4 (0.1 - 0.6)
Chicago	Chicago	0.5 (-0.4 - 1.4)	0.5 (-0.4 - 1.3)	0.4 (-0.4 - 1.3)	0.4 (-0.4 - 1.2)	0.4 (-0.3 - 1.1)	0.4 (-0.3 - 1.1)	0.4 (-0.3 - 1)	0.3 (-0.3 - 0.9)
	19 U.S. Cities	0.8 (0.3 - 1.3)	0.7 (0.3 - 1.2)	0.7 (0.3 - 1.2)	0.7 (0.3 - 1.1)	0.6 (0.2 - 1)	0.6 (0.2 - 1)	0.6 (0.2 - 0.9)	0.5 (0.2 - 0.8)
Cleveland	Cleveland	2.1 (-0.1 - 4.2)	2 (-0.1 - 4.1)	2 (-0.1 - 4)	1.9 (0 - 3.7)	1.8 (0 - 3.6)	1.8 (0 - 3.5)	1.7 (0 - 3.4)	1.5 (0 - 3)
	19 U.S. Cities	1.8 (0.7 - 2.9)	1.7 (0.7 - 2.8)	1.7 (0.6 - 2.7)	1.6 (0.6 - 2.5)	1.5 (0.6 - 2.5)	1.5 (0.6 - 2.4)	1.4 (0.5 - 2.3)	1.3 (0.5 - 2.1)
Detroit	Detroit	1 (-0.1 - 2.1)	1 (-0.1 - 2)	0.9 (-0.1 - 2)	0.9 (-0.1 - 1.9)	0.8 (-0.1 - 1.7)	0.8 (-0.1 - 1.6)	0.8 (-0.1 - 1.6)	0.6 (-0.1 - 1.3)
	19 U.S. Cities	0.9 (0.4 - 1.5)	0.9 (0.3 - 1.4)	0.9 (0.3 - 1.4)	0.8 (0.3 - 1.4)	0.8 (0.3 - 1.2)	0.7 (0.3 - 1.1)	0.7 (0.3 - 1.1)	0.6 (0.2 - 1)
Houston	Houston	0.2 (0 - 0.4)	0.2 (0 - 0.4)	0.2 (0 - 0.4)	0.1 (0 - 0.3)	0.1 (0 - 0.3)	0.1 (0 - 0.3)	0.1 (0 - 0.2)	0.1 (0 - 0.1)
	19 U.S. Cities	0.2 (0.1 - 0.3)	0.2 (0.1 - 0.3)	0.2 (0.1 - 0.3)	0.1 (0.1 - 0.2)	0.1 (0.1 - 0.2)	0.1 (0 - 0.2)	0.1 (0 - 0.2)	0.1 (0 - 0.1)
Los Angeles	Los Angeles	0.4 (0 - 0.8)	0.4 (0 - 0.8)	0.4 (0 - 0.7)	0.3 (0 - 0.5)	0.2 (0 - 0.5)	0.2 (0 - 0.5)	0.2 (0 - 0.4)	0.1 (0 - 0.2)
	19 U.S. Cities	0.5 (0.2 - 0.8)	0.4 (0.2 - 0.7)	0.4 (0.2 - 0.7)	0.3 (0.1 - 0.5)	0.3 (0.1 - 0.5)	0.3 (0.1 - 0.4)	0.2 (0.1 - 0.3)	0.1 (0 - 0.2)
New York	New York	1.1 (0.4 - 1.9)	1 (0.3 - 1.7)	1.1 (0.3 - 1.8)	1 (0.3 - 1.7)	1 (0.3 - 1.6)	0.9 (0.3 - 1.5)	0.9 (0.3 - 1.5)	0.8 (0.2 - 1.3)
	19 U.S. Cities	0.8 (0.3 - 1.3)	0.8 (0.3 - 1.2)	0.8 (0.3 - 1.3)	0.7 (0.3 - 1.2)	0.7 (0.3 - 1.1)	0.6 (0.2 - 1)	0.7 (0.2 - 1.1)	0.6 (0.2 - 0.9)
Philadelphia	Philadelphia	1.7 (0.1 - 3.4)	1.6 (0.1 - 3.2)	1.6 (0.1 - 3.2)	1.5 (0.1 - 2.9)	1.5 (0.1 - 2.9)	1.4 (0.1 - 2.7)	1.4 (0.1 - 2.7)	1.2 (0.1 - 2.4)
	19 U.S. Cities	1.4 (0.5 - 2.3)	1.4 (0.5 - 2.2)	1.4 (0.5 - 2.2)	1.2 (0.5 - 2)	1.2 (0.5 - 2)	1.2 (0.4 - 1.9)	1.1 (0.4 - 1.8)	1 (0.4 - 1.6)

*All results are for cardiovascular and respiratory mortality (among all ages) associated with short-term exposures to O3. Results are based on single-pollutant single-city models or a single-pollutant multi-city model estimated in Huang et al. (2004).

**Incidence was quantified down to estimated policy relevant background levels. Incidences per 100,000 relevant population are rounded to the nearest tenth.

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

Table 4-25. Estimated Percent of Total Incidence of Cardiorespiratory Mortality Associated with O_3 Concentrations that Just Meet the Current and Alternative 8-Hour Daily Maximum Standards: April - September, Based on Adjusting 2002 O_3 Concentrations*

Risk Assessment Location	Study Location	Percent of Total Incidence of Cardiorespiratory 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	Atlanta	0.9% (-0.3% - 2.1%)	0.9% (-0.3% - 2.1%)	0.8% (-0.3% - 1.9%)	0.8% (-0.3% - 1.8%)	0.7% (-0.2% - 1.7%)	0.7% (-0.2% - 1.7%)	0.7% (-0.2% - 1.6%)	0.6% (-0.2% - 1.3%)
	19 U.S. Cities	0.9% (0.4% - 1.5%)	0.9% (0.4% - 1.5%)	0.9% (0.3% - 1.4%)	0.8% (0.3% - 1.3%)	0.8% (0.3% - 1.2%)	0.8% (0.3% - 1.2%)	0.7% (0.3% - 1.1%)	0.6% (0.2% - 1%)
Chicago	Chicago	0.5% (-0.5% - 1.4%)	0.5% (-0.4% - 1.4%)	0.5% (-0.4% - 1.3%)	0.4% (-0.4% - 1.2%)	0.4% (-0.4% - 1.2%)	0.4% (-0.4% - 1.1%)	0.4% (-0.3% - 1.1%)	0.3% (-0.3% - 0.9%)
	19 U.S. Cities	0.8% (0.3% - 1.3%)	0.8% (0.3% - 1.3%)	0.8% (0.3% - 1.2%)	0.7% (0.3% - 1.2%)	0.7% (0.3% - 1.1%)	0.6% (0.2% - 1%)	0.6% (0.2% - 1%)	0.5% (0.2% - 0.8%)
Cleveland	Cleveland	1.6% (0% - 3.2%)	1.5% (0% - 3%)	1.5% (0% - 3%)	1.4% (0% - 2.8%)	1.4% (0% - 2.7%)	1.3% (0% - 2.6%)	1.3% (0% - 2.5%)	1.1% (0% - 2.3%)
	19 U.S. Cities	1.3% (0.5% - 2.1%)	1.3% (0.5% - 2.1%)	1.3% (0.5% - 2%)	1.2% (0.4% - 1.9%)	1.1% (0.4% - 1.8%)	1.1% (0.4% - 1.8%)	1.1% (0.4% - 1.7%)	1% (0.4% - 1.5%)
Detroit	Detroit	0.9% (-0.1% - 1.8%)	0.8% (-0.1% - 1.7%)	0.8% (-0.1% - 1.7%)	0.8% (-0.1% - 1.6%)	0.7% (-0.1% - 1.5%)	0.7% (-0.1% - 1.4%)	0.6% (-0.1% - 1.3%)	0.5% (-0.1% - 1.1%)
	19 U.S. Cities	0.8% (0.3% - 1.3%)	0.7% (0.3% - 1.2%)	0.7% (0.3% - 1.2%)	0.7% (0.3% - 1.2%)	0.6% (0.2% - 1%)	0.6% (0.2% - 1%)	0.6% (0.2% - 1%)	0.5% (0.2% - 0.8%)
Houston	Houston	0.3% (0% - 0.6%)	0.3% (0% - 0.6%)	0.3% (0% - 0.6%)	0.2% (0% - 0.5%)	0.2% (0% - 0.5%)	0.2% (0% - 0.4%)	0.2% (0% - 0.4%)	0.1% (0% - 0.2%)
	19 U.S. Cities	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% - 0.3%)	0.2% (0.1% - 0.3%)	0.1% (0% - 0.2%)
Los Angeles	Los Angeles	0.5% (0% - 1%)	0.5% (0% - 1%)	0.5% (0% - 0.9%)	0.3% (0% - 0.7%)	0.3% (0% - 0.6%)	0.3% (0% - 0.6%)	0.2% (0% - 0.5%)	0.1% (0% - 0.3%)
	19 U.S. Cities	0.6% (0.2% - 1%)	0.6% (0.2% - 0.9%)	0.5% (0.2% - 0.8%)	0.4% (0.1% - 0.6%)	0.4% (0.1% - 0.6%)	0.3% (0.1% - 0.6%)	0.3% (0.1% - 0.4%)	0.2% (0.1% - 0.3%)
New York	New York	1.1% (0.4% - 1.9%)	1% (0.3% - 1.7%)	1.1% (0.3% - 1.8%)	1% (0.3% - 1.7%)	1% (0.3% - 1.6%)	0.9% (0.3% - 1.5%)	0.9% (0.3% - 1.5%)	0.8% (0.2% - 1.3%)
	19 U.S. Cities	0.8% (0.3% - 1.4%)	0.8% (0.3% - 1.2%)	0.8% (0.3% - 1.3%)	0.7% (0.3% - 1.2%)	0.7% (0.3% - 1.1%)	0.6% (0.2% - 1%)	0.7% (0.2% - 1.1%)	0.6% (0.2% - 0.9%)
Philadelphia	Philadelphia	1.4% (0.1% - 2.8%)	1.4% (0.1% - 2.6%)	1.4% (0.1% - 2.6%)	1.2% (0.1% - 2.4%)	1.2% (0.1% - 2.4%)	1.2% (0.1% - 2.2%)	1.1% (0.1% - 2.2%)	1% (0% - 2%)
	19 U.S. Cities	1.2% (0.5% - 1.9%)	1.1% (0.4% - 1.8%)	1.1% (0.4% - 1.8%)	1% (0.4% - 1.7%)	1% (0.4% - 1.6%)	1% (0.4% - 1.5%)	0.9% (0.4% - 1.5%)	0.8% (0.3% - 1.3%)

*All results are for cardiovascular and respiratory mortality (among all ages) associated with short-term exposures to O3. Results are based on single-pollutant single-city models or a single-pollutant multi-city model estimated in Huang et al. (2004).

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

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

Table 4-26. Estimated Incidence of Health Risks Associated with O_3 Concentrations that Just Meet the Current and Alternative 8-Hour Daily Maximum Standards: New York, NY, April - September, Based on Adjusting 2004 O_3 Concentrations

Health Effects*	Study	Ages	Lag	Exposure Metric	Other Pollutants in Model	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
Mortality, non-accidental	Bell et al. -- 95 US Cities (2004)*****	all	distributed lag	24 hr avg.	none	43 (15 - 72)	38 (13 - 63)	39 (13 - 65)	35 (12 - 58)	33 (11 - 55)	29 (10 - 48)	29 (10 - 49)	24 (8 - 39)
Mortality, cardiorespiratory	Huang et al. (2004)*****	all	distributed lag	24 hr avg.	none	53 (17 - 89)	47 (15 - 78)	48 (15 - 80)	43 (14 - 71)	41 (13 - 68)	36 (11 - 60)	36 (11 - 60)	29 (9 - 49)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)*****	all	distributed lag	24 hr avg.	none	39 (15 - 63)	34 (13 - 55)	35 (13 - 57)	31 (12 - 50)	30 (11 - 48)	26 (10 - 42)	26 (10 - 42)	21 (8 - 34)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)*****	all	0-day lag	24 hr avg.	CO	22 (6 - 37)	19 (6 - 32)	20 (6 - 33)	17 (5 - 29)	17 (5 - 28)	14 (4 - 25)	15 (4 - 25)	12 (3 - 20)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)*****	all	0-day lag	24 hr avg.	NO2	19 (3 - 34)	16 (3 - 30)	17 (3 - 31)	15 (3 - 27)	14 (3 - 26)	13 (2 - 23)	13 (2 - 23)	10 (2 - 19)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)*****	all	0-day lag	24 hr avg.	PM10	23 (-9 - 55)	20 (-8 - 48)	21 (-8 - 50)	19 (-7 - 44)	18 (-7 - 42)	16 (-6 - 37)	16 (-6 - 37)	13 (-5 - 30)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)*****	all	0-day lag	24 hr avg.	SO2	16 (0 - 32)	14 (0 - 28)	14 (0 - 29)	13 (0 - 25)	12 (0 - 24)	11 (0 - 21)	11 (0 - 22)	9 (0 - 17)
Hospital admissions (unscheduled), respiratory illness	Thurston et al. (1992)******	all	3-day lag	1 hr max.	none	366 (89 - 644)	334 (81 - 588)	341 (82 - 599)	314 (76 - 551)	304 (73 - 534)	279 (67 - 490)	278 (67 - 489)	241 (58 - 424)
Hospital admissions (unscheduled), asthma	Thurston et al. (1992)******	all	1-day lag	1 hr max.	none	313 (66 - 559)	286 (61 - 510)	291 (62 - 520)	268 (57 - 479)	259 (55 - 464)	238 (51 - 425)	238 (51 - 425)	206 (44 - 368)

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

**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 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.

*****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.

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

Table 4-27. Estimated Incidence of Health Risks per 100,000 Relevant Population Associated with O_3 Concentrations that Just Meet the Current and Alternative 8-Hour Daily Maximum Standards: New York, NY, April - September, Based on Adjusting 2004 O_3 Concentrations

Health Effects*	Study	Ages	Lag	Exposure Metric	Other Pollutants in Model	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
Mortality, non-accidental	Bell et al. -- 95 US Cities (2004)*****	all	distributed lag	24 hr avg.	none	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 - 0.6)	0.3 (0.1 - 0.5)	0.3 (0.1 - 0.5)	0.3 (0.1 - 0.4)
Mortality, cardiorespiratory	Huang et al. (2004)*****	all	distributed lag	24 hr avg.	none	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 - 0.5)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)*****	all	distributed lag	24 hr avg.	none	0.4 (0.2 - 0.7)	0.4 (0.1 - 0.6)	0.4 (0.2 - 0.6)	0.3 (0.1 - 0.6)	0.3 (0.1 - 0.5)	0.3 (0.1 - 0.5)	0.3 (0.1 - 0.5)	0.2 (0.1 - 0.4)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)*****	all	0-day lag	24 hr avg.	CO	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 - 0.3)	0.2 (0 - 0.3)	0.1 (0 - 0.2)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)*****	all	0-day lag	24 hr avg.	NO2	0.2 (0 - 0.4)	0.2 (0 - 0.3)	0.2 (0 - 0.3)	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)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)*****	all	0-day lag	24 hr avg.	PM10	0.3 (-0.1 - 0.6)	0.2 (-0.1 - 0.5)	0.2 (-0.1 - 0.6)	0.2 (-0.1 - 0.5)	0.2 (-0.1 - 0.5)	0.2 (-0.1 - 0.4)	0.2 (-0.1 - 0.4)	0.1 (-0.1 - 0.3)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)*****	all	0-day lag	24 hr avg.	SO2	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 - 0.2)
Hospital admissions (unscheduled), respiratory illness	Thurston et al. (1992)******	all	3-day lag	1 hr max.	none	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)
Hospital admissions (unscheduled), asthma	Thurston et al. (1992)******	all	1-day lag	1 hr max.	none	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)

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

**Incidence was quantified down to estimated policy relevant background levels. Incidences per 100,000 relevant population 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.

*****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.

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

Table 4-28. 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: New York, NY, April - September, Based on Adjusting 2004 O_3 Concentrations

Health Effects*	Study	Ages	Lag	Exposure Metric	Other Pollutants in Model	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
Mortality, non-accidental	Bell et al. -- 95 US Cities (2004)*****	all	distributed lag	24 hr avg.	none	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%)
Mortality, cardiorespiratory	Huang et al. (2004)*****	all	distributed lag	24 hr avg.	none	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% - 0.5%)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)*****	all	distributed lag	24 hr avg.	none	0.4% (0.2% - 0.7%)	0.4% (0.1% - 0.6%)	0.4% (0.2% - 0.6%)	0.3% (0.1% - 0.6%)	0.3% (0.1% - 0.5%)	0.3% (0.1% - 0.5%)	0.3% (0.1% - 0.5%)	0.2% (0.1% - 0.4%)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)*****	all	0-day lag	24 hr avg.	CO	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% - 0.3%)	0.2% (0% - 0.3%)	0.1% (0% - 0.2%)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)*****	all	0-day lag	24 hr avg.	NO2	0.2% (0% - 0.4%)	0.2% (0% - 0.3%)	0.2% (0% - 0.3%)	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%)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)*****	all	0-day lag	24 hr avg.	PM10	0.3% (-0.1% - 0.6%)	0.2% (-0.1% - 0.5%)	0.2% (-0.1% - 0.6%)	0.2% (-0.1% - 0.5%)	0.2% (-0.1% - 0.5%)	0.2% (-0.1% - 0.4%)	0.2% (-0.1% - 0.4%)	0.1% (-0.1% - 0.3%)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)*****	all	0-day lag	24 hr avg.	SO2	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% - 0.2%)
Hospital admissions (unscheduled), respiratory illness	Thurston et al. (1992)******	all	3-day lag	1 hr max.	none	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%)
Hospital admissions (unscheduled), asthma	Thurston et al. (1992)******	all	1-day lag	1 hr max.	none	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%)

*Health effects are 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.

*****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.

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

Table 4-29. Estimated Incidence of Health Risks Associated with O_3 Concentrations that Just Meet the Current and Alternative 8-Hour Daily Maximum Standards: New York, NY, April - September, Based on Adjusting 2002 O_3 Concentrations

Health Effects*	Study	Ages	Lag	Exposure Metric	Other Pollutants in Model	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
Mortality, non-accidental	Bell et al. -- 95 US Cities (2004)*****	all	distributed lag	24 hr avg.	none	84 (28 - 139)	76 (25 - 126)	78 (26 - 130)	73 (24 - 121)	70 (23 - 116)	64 (21 - 106)	65 (22 - 108)	57 (19 - 95)
Mortality, cardiorespiratory	Huang et al. (2004)*****	all	distributed lag	24 hr avg.	none	102 (33 - 170)	93 (30 - 155)	95 (31 - 159)	89 (28 - 148)	86 (27 - 143)	78 (25 - 130)	79 (25 - 133)	70 (22 - 116)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)*****	all	distributed lag	24 hr avg.	none	75 (29 - 120)	68 (26 - 109)	70 (27 - 113)	65 (25 - 105)	63 (24 - 101)	57 (22 - 92)	58 (22 - 94)	51 (19 - 82)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)*****	all	0-day lag	24 hr avg.	CO	42 (12 - 71)	38 (11 - 64)	39 (11 - 66)	36 (11 - 61)	35 (10 - 59)	32 (9 - 54)	32 (9 - 55)	28 (8 - 48)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)*****	all	0-day lag	24 hr avg.	NO2	36 (6 - 66)	33 (6 - 60)	34 (6 - 61)	31 (6 - 57)	30 (5 - 55)	28 (5 - 50)	28 (5 - 51)	25 (4 - 45)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)*****	all	0-day lag	24 hr avg.	PM10	45 (-17 - 105)	41 (-16 - 96)	42 (-16 - 98)	39 (-15 - 91)	37 (-14 - 88)	34 (-13 - 80)	35 (-13 - 82)	30 (-12 - 72)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)*****	all	0-day lag	24 hr avg.	SO2	31 (0 - 61)	28 (0 - 56)	29 (0 - 57)	27 (0 - 53)	26 (0 - 51)	23 (0 - 47)	24 (0 - 48)	21 (0 - 42)
Hospital admissions (unscheduled), respiratory illness	Thurston et al. (1992)******	all	3-day lag	1 hr max.	none	513 (124 - 902)	472 (114 - 830)	483 (117 - 850)	452 (109 - 795)	439 (106 - 772)	404 (98 - 710)	410 (99 - 721)	365 (88 - 642)
Hospital admissions (unscheduled), asthma	Thurston et al. (1992)******	all	1-day lag	1 hr max.	none	438 (93 - 783)	403 (86 - 720)	413 (88 - 738)	386 (82 - 690)	375 (80 - 670)	345 (73 - 617)	350 (75 - 626)	312 (66 - 558)

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

**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 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.

*****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.

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

Table 4-30. Estimated Incidence of Health Risks per 100,000 Relevant Population Associated with O_3 Concentrations that Just Meet the Current and Alternative 8-Hour Daily Maximum Standards: New York, NY, April - September, Based on Adjusting 2002 O_3 Concentrations

Health Effects*	Study	Ages	Lag	Exposure Metric	Other Pollutants in Model	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
Mortality, non-accidental	Bell et al. -- 95 US Cities (2004)*****	all	distributed lag	24 hr avg.	none	0.9 (0.3 - 1.6)	0.9 (0.3 - 1.4)	0.9 (0.3 - 1.5)	0.8 (0.3 - 1.4)	0.8 (0.3 - 1.3)	0.7 (0.2 - 1.2)	0.7 (0.2 - 1.2)	0.6 (0.2 - 1.1)
Mortality, cardiorespiratory	Huang et al. (2004)*****	all	distributed lag	24 hr avg.	none	1.1 (0.4 - 1.9)	1 (0.3 - 1.7)	1.1 (0.3 - 1.8)	1 (0.3 - 1.7)	1 (0.3 - 1.6)	0.9 (0.3 - 1.5)	0.9 (0.3 - 1.5)	0.8 (0.2 - 1.3)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)*****	all	distributed lag	24 hr avg.	none	0.8 (0.3 - 1.3)	0.8 (0.3 - 1.2)	0.8 (0.3 - 1.3)	0.7 (0.3 - 1.2)	0.7 (0.3 - 1.1)	0.6 (0.2 - 1)	0.7 (0.2 - 1.1)	0.6 (0.2 - 0.9)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)*****	all	0-day lag	24 hr avg.	CO	0.5 (0.1 - 0.8)	0.4 (0.1 - 0.7)	0.4 (0.1 - 0.7)	0.4 (0.1 - 0.7)	0.4 (0.1 - 0.7)	0.4 (0.1 - 0.6)	0.4 (0.1 - 0.6)	0.3 (0.1 - 0.5)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)*****	all	0-day lag	24 hr avg.	NO2	0.4 (0.1 - 0.7)	0.4 (0.1 - 0.7)	0.4 (0.1 - 0.7)	0.4 (0.1 - 0.6)	0.3 (0.1 - 0.6)	0.3 (0.1 - 0.6)	0.3 (0.1 - 0.6)	0.3 (0 - 0.5)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)*****	all	0-day lag	24 hr avg.	PM10	0.5 (-0.2 - 1.2)	0.5 (-0.2 - 1.1)	0.5 (-0.2 - 1.1)	0.4 (-0.2 - 1)	0.4 (-0.2 - 1)	0.4 (-0.1 - 0.9)	0.4 (-0.1 - 0.9)	0.3 (-0.1 - 0.8)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)*****	all	0-day lag	24 hr avg.	SO2	0.3 (0 - 0.7)	0.3 (0 - 0.6)	0.3 (0 - 0.6)	0.3 (0 - 0.6)	0.3 (0 - 0.6)	0.3 (0 - 0.5)	0.3 (0 - 0.5)	0.2 (0 - 0.5)
Hospital admissions (unscheduled), respiratory illness	Thurston et al. (1992)******	all	3-day lag	1 hr max.	none	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)
Hospital admissions (unscheduled), asthma	Thurston et al. (1992)******	all	1-day lag	1 hr max.	none	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)

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

**Incidence was quantified down to estimated policy relevant background levels. Incidences per 100,000 relevant population 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.

*****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.

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

Table 4-31. 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: New York, NY, April - September, Based on Adjusting 2002 O_3 Concentrations

Health Effects*	Study	Ages	Lag	Exposure Metric	Other Pollutants in Model	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
Mortality, non-accidental	Bell et al. -- 95 US Cities (2004)*****	all	distributed lag	24 hr avg.	none	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%)
Mortality, cardiorespiratory	Huang et al. (2004)*****	all	distributed lag	24 hr avg.	none	1.1% (0.4% - 1.9%)	1% (0.3% - 1.7%)	1.1% (0.3% - 1.8%)	1% (0.3% - 1.7%)	1% (0.3% - 1.6%)	0.9% (0.3% - 1.5%)	0.9% (0.3% - 1.5%)	0.8% (0.2% - 1.3%)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)*****	all	distributed lag	24 hr avg.	none	0.8% (0.3% - 1.4%)	0.8% (0.3% - 1.2%)	0.8% (0.3% - 1.3%)	0.7% (0.3% - 1.2%)	0.7% (0.3% - 1.1%)	0.6% (0.2% - 1%)	0.7% (0.2% - 1.1%)	0.6% (0.2% - 0.9%)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)*****	all	0-day lag	24 hr avg.	CO	0.5% (0.1% - 0.8%)	0.4% (0.1% - 0.7%)	0.4% (0.1% - 0.7%)	0.4% (0.1% - 0.7%)	0.4% (0.1% - 0.7%)	0.4% (0.1% - 0.6%)	0.4% (0.1% - 0.6%)	0.3% (0.1% - 0.5%)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)*****	all	0-day lag	24 hr avg.	NO2	0.4% (0.1% - 0.7%)	0.4% (0.1% - 0.7%)	0.4% (0.1% - 0.7%)	0.4% (0.1% - 0.6%)	0.3% (0.1% - 0.6%)	0.3% (0.1% - 0.6%)	0.3% (0.1% - 0.6%)	0.3% (0% - 0.5%)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)*****	all	0-day lag	24 hr avg.	PM10	0.5% (-0.2% - 1.2%)	0.5% (-0.2% - 1.1%)	0.5% (-0.2% - 1.1%)	0.4% (-0.2% - 1%)	0.4% (-0.2% - 1%)	0.4% (-0.1% - 0.9%)	0.4% (-0.1% - 0.9%)	0.3% (-0.1% - 0.8%)
Mortality, cardiorespiratory	Huang et al. -- 19 US Cities (2004)*****	all	0-day lag	24 hr avg.	SO2	0.3% (0% - 0.7%)	0.3% (0% - 0.6%)	0.3% (0% - 0.6%)	0.3% (0% - 0.6%)	0.3% (0% - 0.6%)	0.3% (0% - 0.5%)	0.3% (0% - 0.5%)	0.2% (0% - 0.5%)
Hospital admissions (unscheduled), respiratory illness	Thurston et al. (1992)******	all	3-day lag	1 hr max.	none	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%)
Hospital admissions (unscheduled), asthma	Thurston et al. (1992)******	all	1-day lag	1 hr max.	none	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%)

*Health effects are 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.

*****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.

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

The results in this portion of the risk assessment follow the same patterns as the results discussed in Section 4.2.1 for risks associated with "as is" O_3 concentrations, because they are largely driven by the same C-R function coefficient estimates and confidence or credible intervals.

All results discussed below are for April through September. The top graph on each page shows results based on 2004 air quality, and the bottom graph shows results based on 2002 air quality. Figures 4-9a and b show estimated percent of non-accidental mortality related to O_3 concentrations that just meet the current 8-hour O_3 standard, based on single-pollutant, single-city models across all locations for which such models were available. Tables 4-14, 4-15, and 4-16 show estimates of incidence, incidence per 100,000 relevant population, and percent of total incidence, respectively, of non-accidental mortality related to O_3 concentrations that just meet the current and alternative 8-hour O_3 standards, based on both single-city and multi-city models, using air quality data for 2004. Tables 4-17, 4-18, and 4-19 show estimates of the same measures of non-accidental mortality risk, using air quality data for 2002.

Using 2004 O_3 concentrations, estimates of O_3-related non-accidental mortality related to O_3 concentrations that just meet the current 8-hour O_3 standards ranged from 0.3 per 100,000 relevant population in Atlanta (Bell et al., 2004), Houston (Bell et al., 2004 – 95 U.S. Cities), and Los Angeles (Bell et al., 2004) to 5.8 per 100,000 relevant population in Chicago (Schwartz, 2004). The corresponding results based on 2002 O_3 concentrations ranged from 0.3 per 100,000 relevant population in Houston (Bell et al., 2004 – 95 U.S. Cities), and Los Angeles (Bell et al., 2004) to 7.9 per 100,000 relevant population in Chicago (Schwartz, 2004). As was the case for the analysis of effects associated with "as is" O_3 concentrations, estimated O_3-related (non-accidental) mortality reported by Schwartz (2004) for Chicago, Detroit, and Houston, based on both the single-city and the multi-city C-R functions, tend to be higher than other estimates in those locations in large part because Schwartz used the 1-hr maximum O_3 concentration, rather than the 24-hour average, as the exposure metric. The changes from 1-hr maximum O_3 concentrations that just meet the current 8-hour O_3 standard to PRB 1-hr maximum O_3 concentrations were generally larger in the assessment locations than the corresponding changes using the 24-hr average metric.

As a percent of total incidence, estimated non-accidental mortality related to O_3 concentrations that just meet the current 8-hour O_3 standard, based on 2004 O_3 concentrations, ranged from 0.1 percent in several locations (Atlanta, Chicago, Detroit, Houston, Los Angeles, New York, and St. Louis) to 1.5 percent in Chicago (Schwartz, 2004). The corresponding results based on 2002 O_3 concentrations ranged from 0.1 percent in Houston and Los Angeles to 2 percent in Chicago. Although 7 of the 12 estimates from single-city single-pollutant models shown in Figures 4-9a and b were not statistically significant, all 12 were positive.

Figures 4-10a and b show estimated percent of cardiorespiratory mortality and cases per 100,000 relevant population related to O_3 concentrations that just meet the current 8-hour O_3 standard, based on multi-city single-pollutant versus multi-pollutant

models from Huang et al. (2004) across all locations for which such models were available. Tables 4-20, 4-21, and 4-22 show estimates of incidence, incidence per 100,000 relevant population, and percent of total incidence, respectively, of cardiorespiratory mortality related to O_3 concentrations that just meet the current and alternative 8-hour O_3 standards in all risk assessment locations covered in Huang et al. (2004), using air quality data for 2004. Tables 4-23, 4-24, and 4-25 show estimates of the same measures of cardiorespiratory mortality risk, using air quality data for 2002.

Using 2004 O_3 concentrations, estimates of O_3-related cardiorespiratory mortality related to O_3 concentrations that just meet the current 8-hour O_3 standards ranged from 0.2 per 100,000 relevant population in Houston (using both the single-city and the multi-city C-R functions) to 1.0 per 100,000 relevant population in Philadelphia (using the single-city C-R function). The corresponding results based on 2002 O_3 concentrations ranged from 0.2 per 100,000 relevant population in Houston to 2.1 per 100,000 relevant population in Cleveland.

As a percent of total incidence, using 2004 O_3 concentrations, estimated O_3-related cardiorespiratory mortality ranged from 0.3 percent in Chicago (using the single-city C-R function) to 0.8 percent in Los Angeles (using the multi-city C-R function) and Philadelphia (using the single-city C-R function). The corresponding results based on 2002 O_3 concentrations ranged from 0.3 percent in Houston to 1.6 percent in Cleveland.

All of the estimates of O_3-related cardiorespiratory mortality based on Huang et al. (2004), from both single-pollutant and multi-pollutant models (see Figures 10a and b) and from both single-city and multi-city models (see Tables 4-20 through 4-25) were positive. Five of the single-city single-pollutant "shrinkage" estimates (for Atlanta, Chicago, Cleveland, Detroit, and Houston) and the estimate from the multi-city multi-pollutant model with PM_{10} were not statistically significant. All the rest of the estimates of O_3-related cardiorespiratory mortality based on Huang et al. (2004) were statistically significant.

Figures 4-11a and b show estimated percent of non-accidental mortality and cases per 100,000 relevant population related to O_3 concentrations that just meet the current 8-hour O_3 standard, based on single-city versus multi-city models across all locations for which both types of model were available. The results followed the same patterns as were observed in the analysis of effects associated with "as is" O_3 concentrations above PRB levels, discussed in Section 4.2.1 above (see also Figures 4-5a and b). Similarly, the results seen in Figures 4-12a and b, for cardiorespiratory mortality, followed the same patterns as are evident in the corresponding analysis of "as is" O_3 concentrations (see Figures 4-5a and b).

The effect of O_3 lag structure on O_3-related unscheduled hospital admissions in Detroit (Ito 2003), shown in Figures 4-13a and b, followed the same patterns as were evident in the analysis of risks associated with "as is" O_3 concentrations. Estimated pneumonia hospital admissions associated with O_3 concentrations that just meet the current 8-hour O_3 standard increased monotonically with increasing lag, with the greatest

estimate predicted by a 3-day lag model. None of the estimates of O_3-related unscheduled hospital admissions in Detroit were statistically significant.

Figures 4-14a and b and 4-15a and b show the estimated annual percent of non-accidental mortality and cardiorespiratory mortality, respectively, associated with short-term exposure to O_3 concentrations that just meet the current 8-hour daily maximum standard that fall within specified ranges. The pattern of results was similar to the pattern seen for "as is" O_3 concentrations. Using simulated O_3 concentrations that just meet the current 8-hour standard based on 2004 air quality data, all O_3-related non-accidental mortality was associated with 24-hr average O_3 concentrations less than 0.06 ppm, and most of that was associated with 24-hr average O_3 concentrations less than 0.04 ppm. Using simulated O_3 concentrations that just meet the current 8-hour standard based on 2002 air quality data, all O_3-related non-accidental mortality was associated with 24-hr average O_3 concentrations less than 0.08 ppm, and the great majority was associated with 24-hr average O_3 concentrations less than 0.06 ppm. The results for cardiorespiratory mortality follow a similar pattern.

Comparisons of alternative 8-hour daily maximum standards to the current standard are shown in Figures 4-16a and b and 4-17a and b for non-accidental and cardiorespiratory mortality, respectively. At the most stringent standard shown (0.064 ppm 4^{th} daily maximum), the aggregate O_3-related non-accidental mortality is estimated to be 55 percent of what it would be at the current standard, using simulated O_3 concentrations that just meet the current and alternative 8-hour standards based on 2004 air quality data. Using 2002 air quality data, the corresponding result is 40 percent. The patterns for cardiorespiratory mortality are similar. The aggregate O_3-related cardiorespiratory mortality at the most stringent standard shown is estimated to be about 57 percent of what it would be at the current standard, using simulated O_3 concentrations that just meet the current and alternative 8-hour standards based on 2004 air quality data. Using 2002 air quality data, the corresponding result is about 42 percent.

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