

**Comments to CASAC on  
Draft #2 of the SO<sub>2</sub> Risk and Exposure Assessment**

**Public Comments Session  
CASAC Meeting  
April 16-17, 2009**

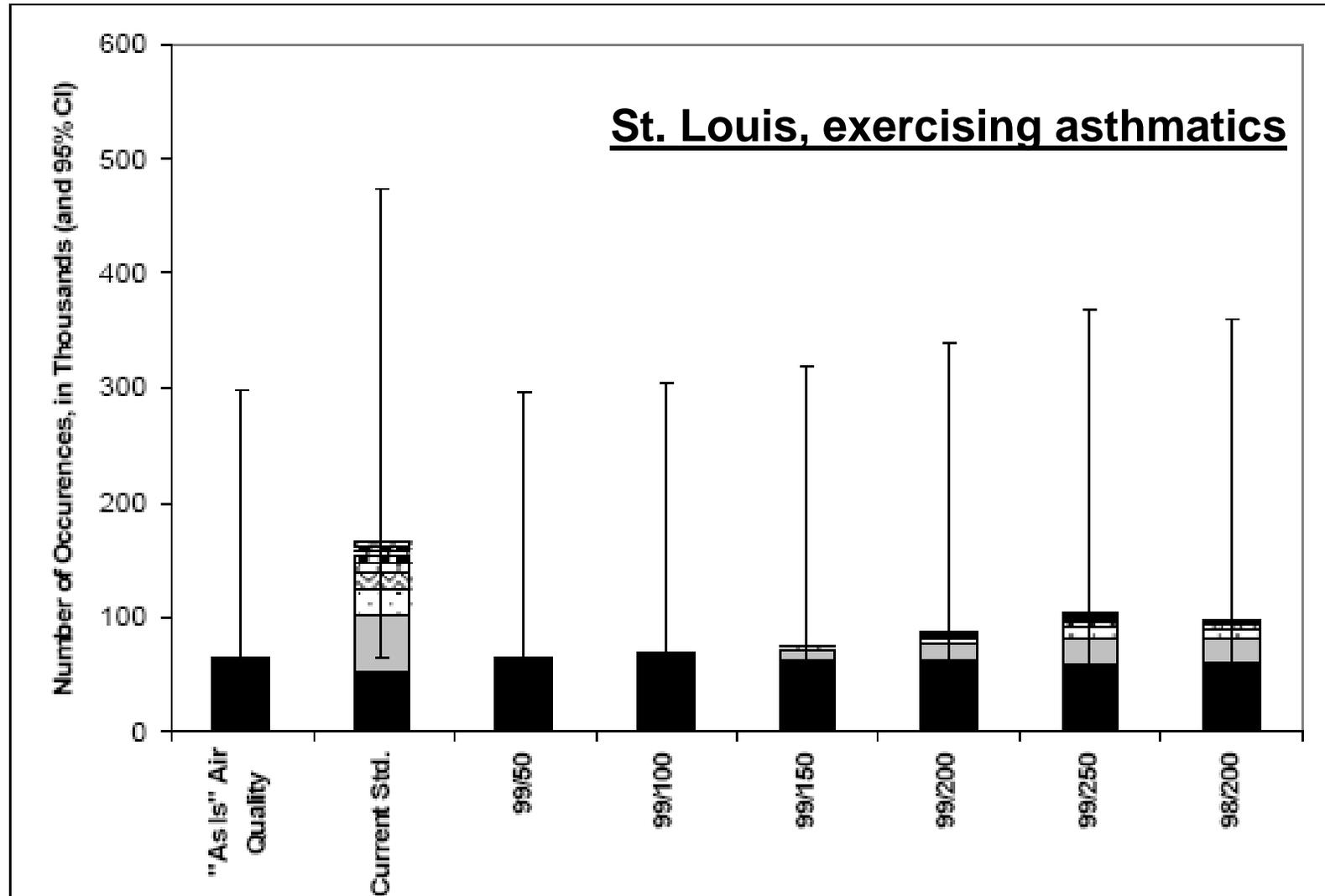


INTERNATIONAL

**Dr. Anne E. Smith, Ph.D.  
Vice President**

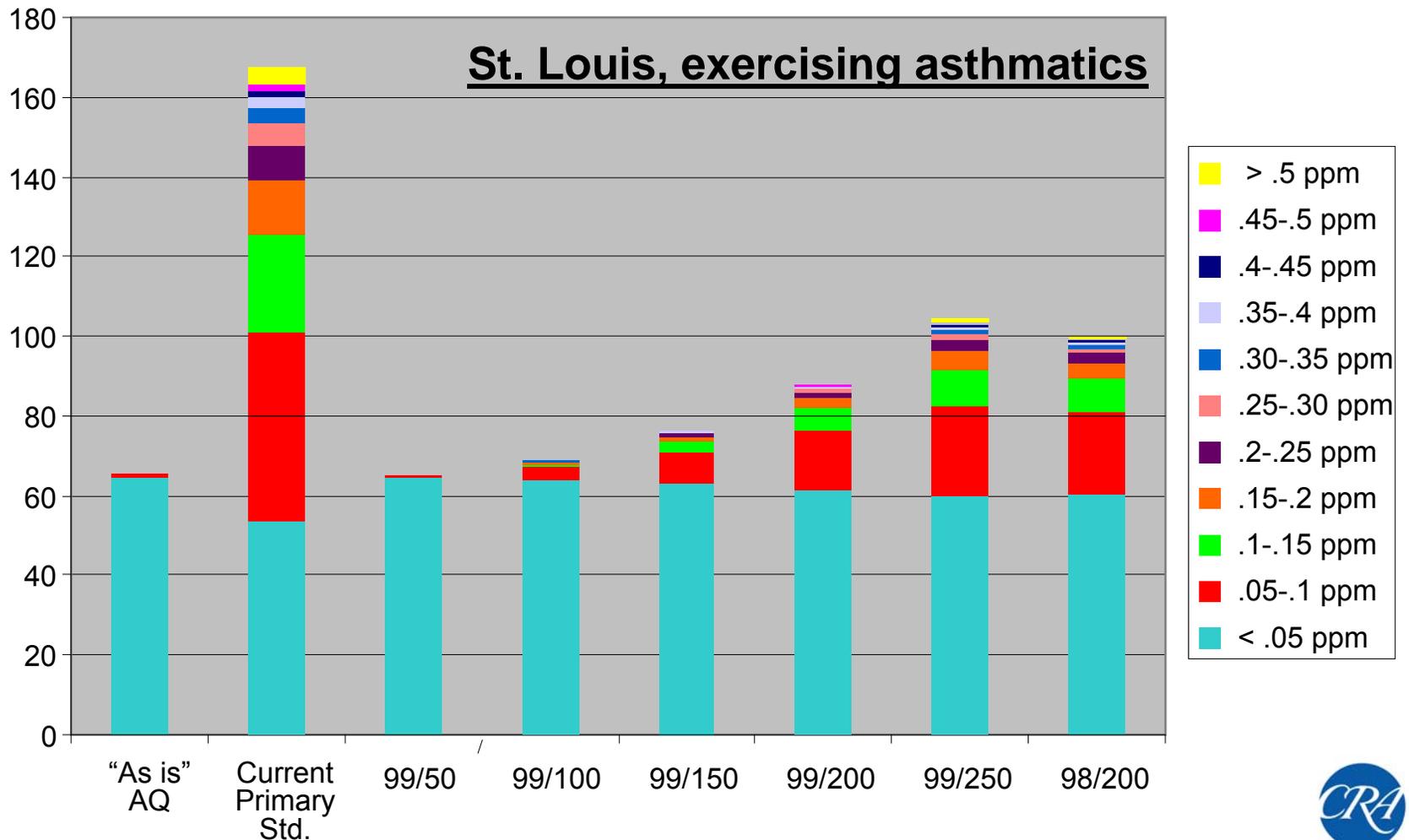
***Comments prepared on behalf of UARG***

## A Key Result Reported in REA: # Occurrences >100% sRaw from 5-Minute Exposures by Exposure Range

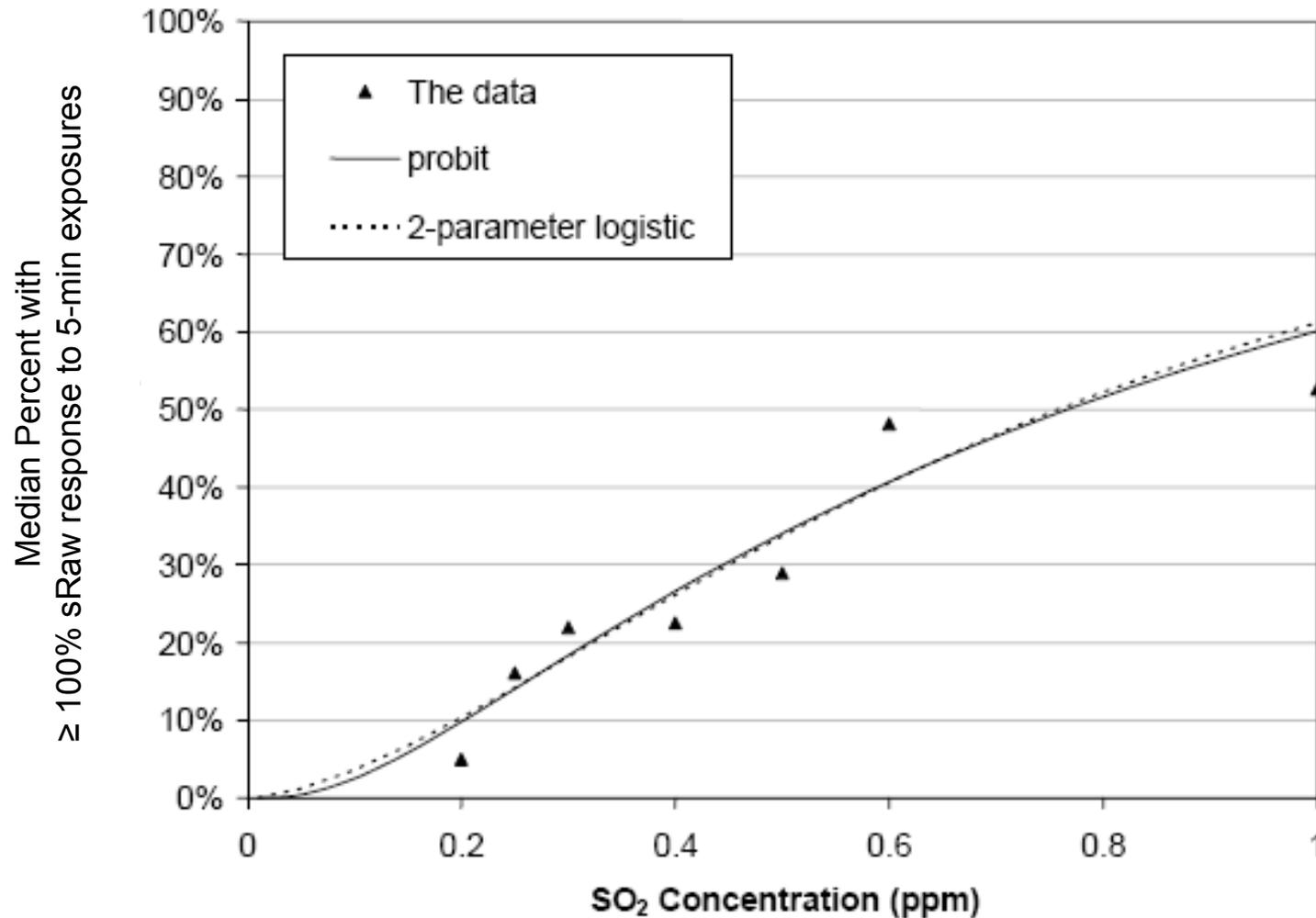


# Figure 9-7 (a) -- Replicated in Color & Zoomed In

000's of Annual Occurrences of > 100% sRaw

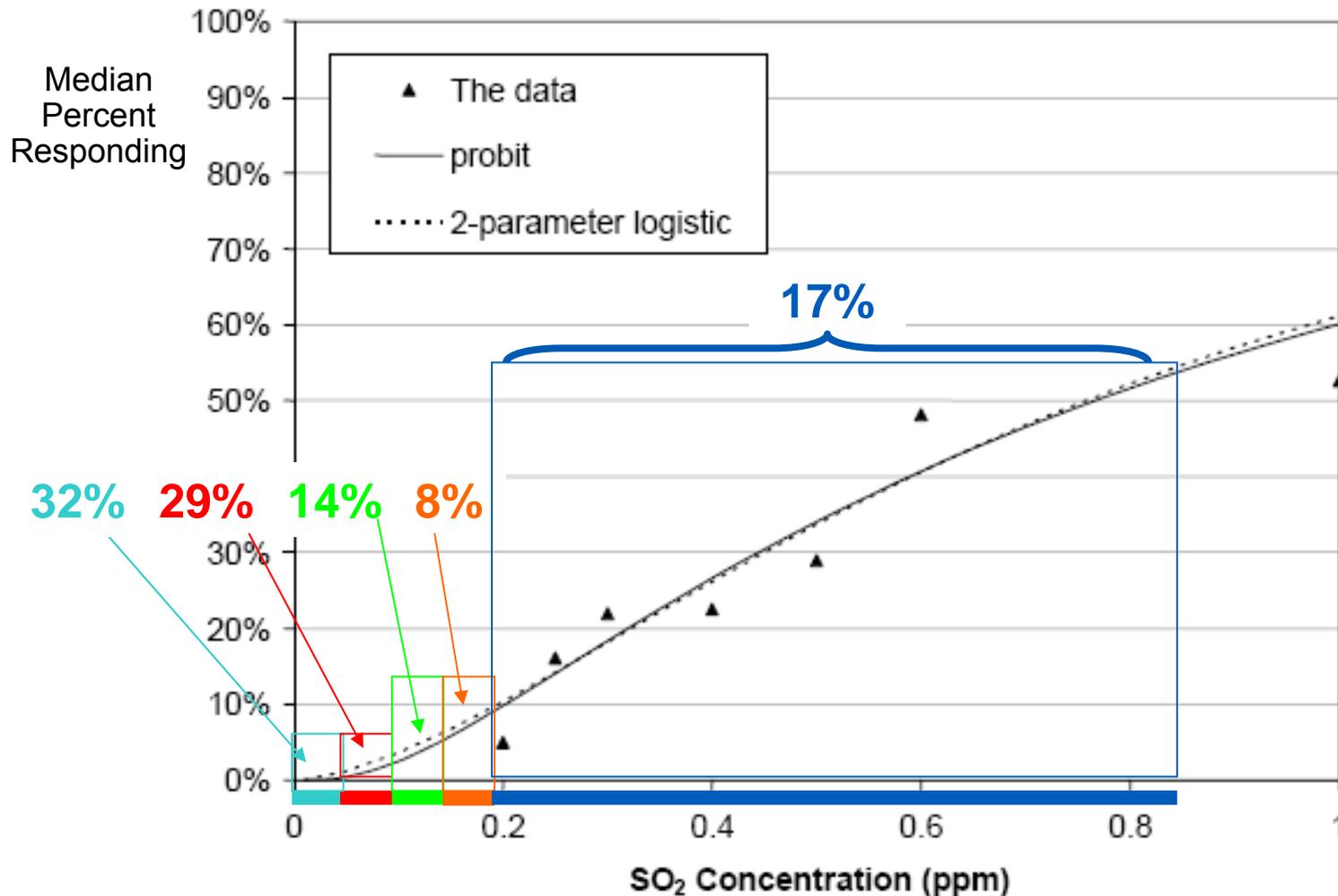


# Impacts Estimates Are Based on Logistic Dose-Response Curve that Assumes Zero Threshold



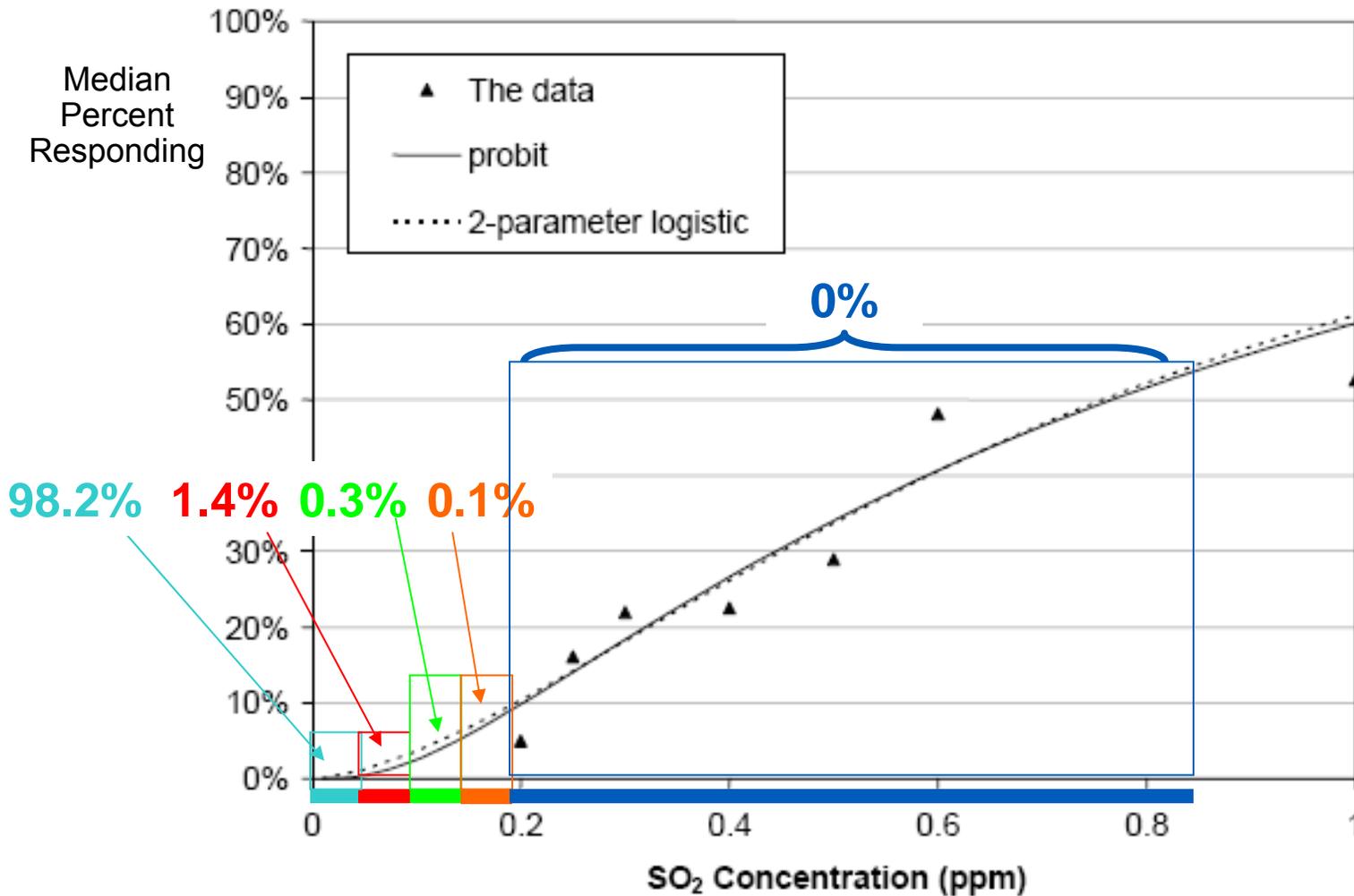
# Percent of Estimated Impacts (at Current Standard) for Exposures on Different Parts of Dose-Response Curve

Over 60% of the impacts at the Current Standard are due to 5-minute exposures below 0.1 ppm, which is less than half of the lowest observed response level.



# Percent of Estimated Impacts (under “As Is” AQ) for Exposures on Different Parts of Dose-Response Curve

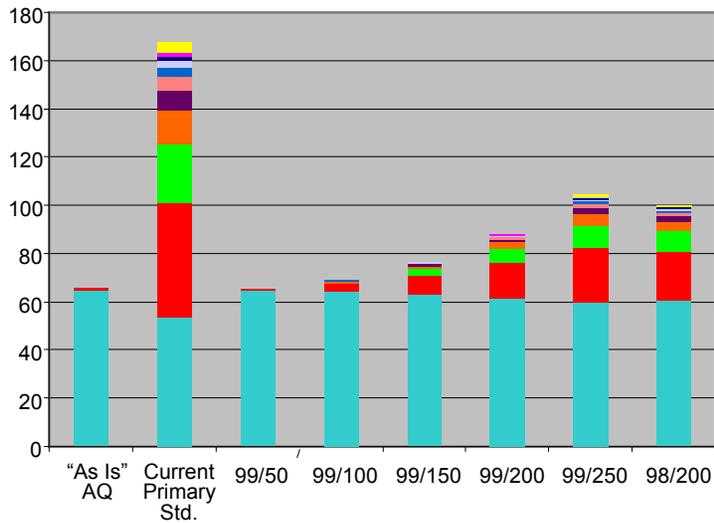
99.6% of the impacts for “As Is” air quality are due to exposures < 0.1 ppm.



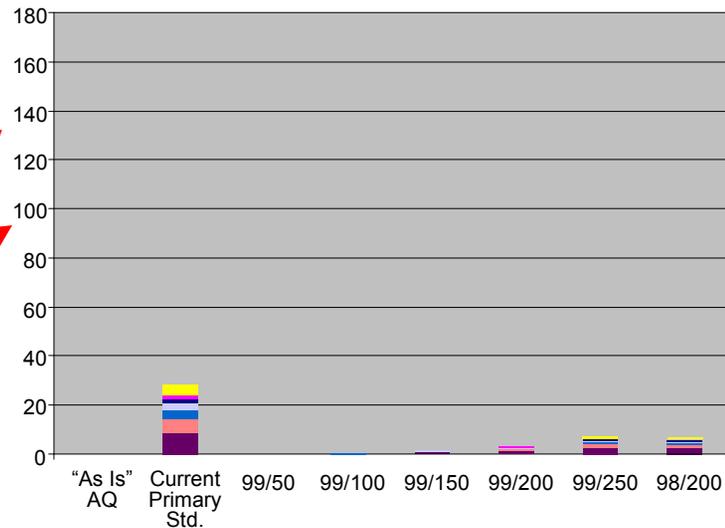
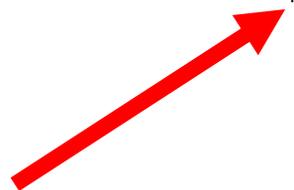
# Sensitivity of Impacts to Alternative No-Effects Levels

St. Louis, exercising asthmatics -- 000's of Annual Occurrences of > 100% sRaw

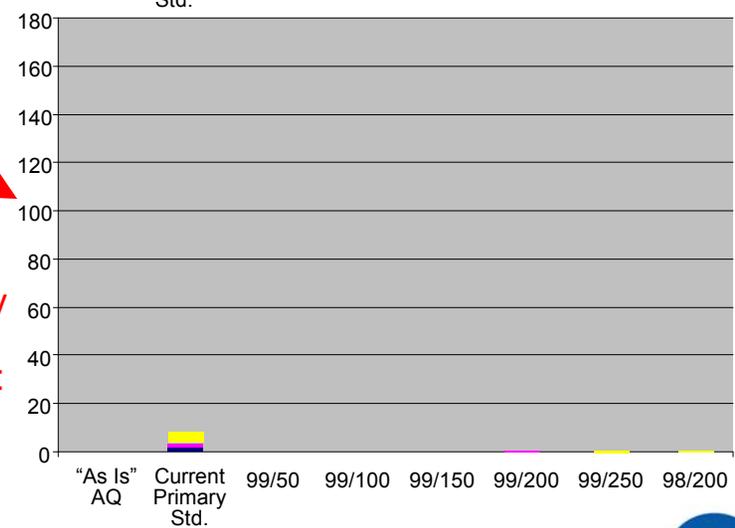
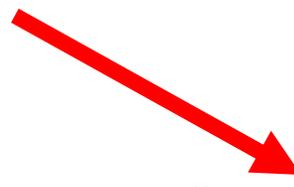
Reproduced REA Figure 9-7(a)



Estimated effects above 0.2 ppm (lowest level of any detected effect):



Estimated effects above 0.4 ppm (lowest level of any ATS-defined "adverse" effect <sup>1/</sup>):

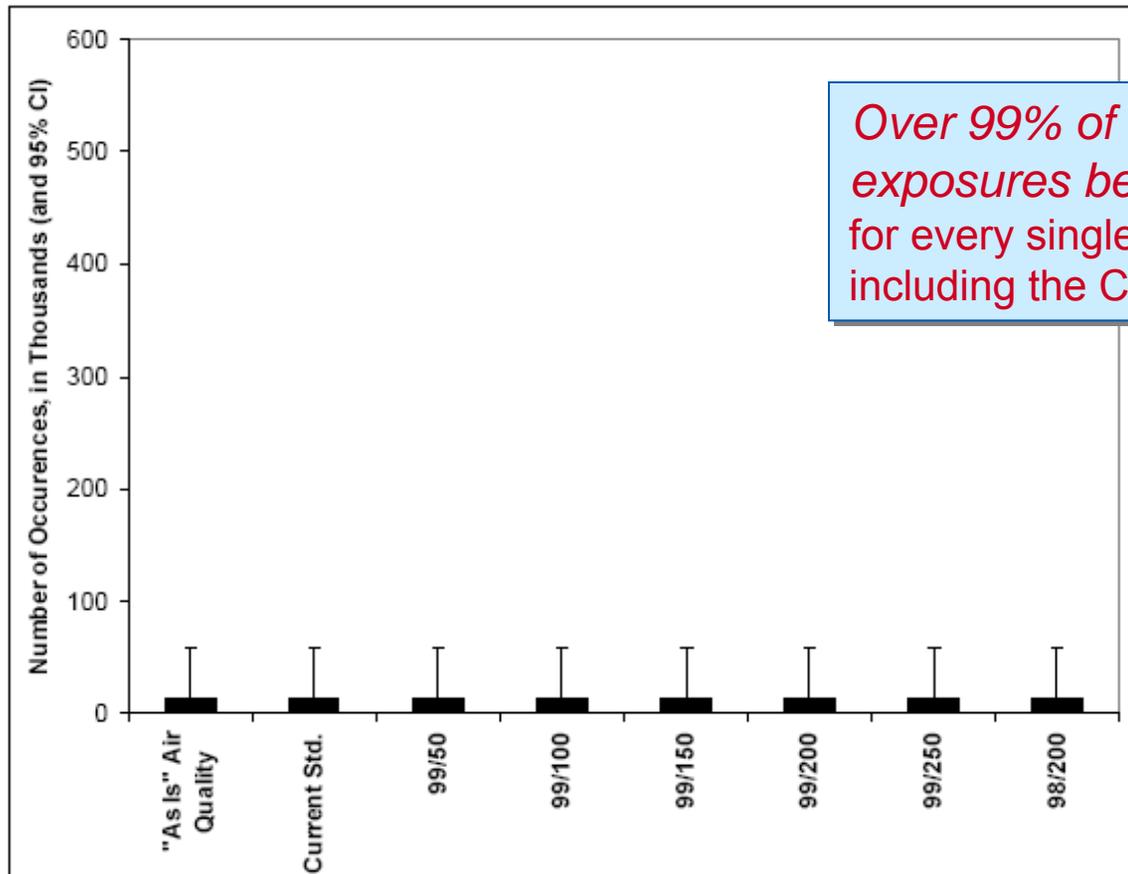


<sup>1/</sup> ATS defines reversible lung function effects as "adverse" if they are statistically significant *and* accompanied by symptoms. ("What Constitutes an Adverse Health Effect of Air Pollution?" *Am J Respir Crit Care Med*, Vol. 161, pp. 665-673.)



# Comparable Results for Greene Co. Are Buried Deep in Appendix C of the REA

## Greene Co., exercising asthmatics



*Over 99% of the impacts are due to exposures below 0.1 ppm, for every single alternative standard, including the Current Standard.*

# The Uncertainty Analysis is Incomplete and Erroneous

Uncertainty	Direction of Bias	Level of Uncertainty	Comments
AERMOD Inputs and Algorithms	Unknown	Low-Medium	See Table 8-13 and section 8.12.1
Exposure Model (APEX) Inputs and Algorithms	Unknown	Medium	See Table 8-13 and section 8.12.2
Spatial representation	Unknown	Medium - High	See discussion in section 7.4.4
Air quality adjustment	Unknown	Medium	See discussion in section 7.4.5
Causality	<del>None</del>		SO <sub>2</sub> -related lung function responses have been observed in controlled human exposure studies and, thus there is little uncertainty that SO <sub>2</sub> exposures are responsible for the observed lung function responses.
Use of 2-parameter logistic model to estimate probabilistic exposure-response relationships	Overestimate	Low – within range of data Medium – for levels well below 200 ppb	It was necessary to estimate responses at SO <sub>2</sub> levels both within the range of exposure levels tested (i.e., 200 to 1,000 ppb) as well as below the lowest exposure levels used in free-breathing controlled human exposure studies (i.e., below 200 ppb). We have developed probabilistic exposure-response relationships using two different functional forms (i.e., probit and 2-parameter logistic). As shown in Figures 9-2 through 9-5, the two functional forms result in very similar probabilistic exposure-response relationships for the four health response definitions, and therefore, we used only the logistic model to estimate risks. For the risks attributable to exposure levels below 200 ppb, there is greater uncertainty.
Use of 5- and 10-minute lung function response data to estimate 5-minute lung function risk estimates	Overestimate	Low	The 5-minute lung function risk estimates are based on a combined data set from several controlled human exposure studies, most of which evaluated responses associated with 10-minute exposures. However, since some studies which evaluated responses after 5-minute exposures found responses occurring as early as 5-minutes after exposure, we are using all of the 5- and 10-minute exposure data to represent responses associated with 5-minute exposures. We do not believe that this approach appreciably impacts the risk estimates.
Use of exposure-response data from studies of mild/moderate asthmatics to	<del>Underestimate</del>		Unknown – because more severe asthmatics may be more likely to protect themselves with medication before exercising in the U.S. population. As indicated in the ISA (p. 3-9), the subjects studied

Missing uncertainty: Effect of medication among mild/moderate asthmatics in daily life  
 Direction of bias: Overestimate