

Risk and Exposure Assessment to Support the Review of the SO₂ Primary National Ambient Air Quality Standards: First Draft

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Estimating 5-Minute Peak Exposures

- Short-term fluctuations of SO₂ are highly variable and difficult to estimate
- Relation of peak 5-minute concentrations to 1-hour average measurements or modeling depends on:
 - Spatial distribution of sources
 - Distances of sources to receptors
 - Intermittency of emissions
 - Dispersion environment
 - Relative contributions from various source types, e.g.,
 - Point or area
 - Elevated or ground level
 - Atmospheric stability

Large Uncertainty in Estimating 5-minute Exposure

- Monitoring data indicates a large PMR variability
- Peak to Mean Ratio (PMR) statistical model for 5-minute concentrations
 - Site specific and meteorological PMR factors are not addressed
 - Overestimation in areas where emissions are widespread
 - Underestimation for localized sources
- Dispersion models not designed or validated for averaging times of less than 1-hour
- Short-term emission variations are not well-characterized

Method Used to Develop Peak-to-Mean Ratio (PMR)

- Based on limited available measurement data
 - 13 states plus DC had 5-minute data
 - Most had only peak hourly 5-minute concentration
- Statistical PMR Model
 - Model provides probability distribution for 3 categories of
 - 1-hourly Coefficient of Variance (COV)
 - 1-hour concentration
 - Does not account for
 - temporal variations in atmospheric turbulence
 - source types and distances

Evaluation of Just Meeting Current NAAQS

- Roll-up Method for Ambient Measurements
 - Assumes all sources increase proportionately
 - Mostly limited by 24-hour concentrations
 - Applies PMR model to estimate 5-minute concentrations
 - Equivalent benchmark roll-down applied in exposure assessment
- Issues
 - Large extrapolation for most regions because ambient concentrations are well below current NAAQS
 - Proportionate increase is unlikely
 - □ Just meeting annual standard would probably involve increase in distributed emission sources
 - □ Just meeting 24-hour standard probably involve increase in localized emissions
 - □ National and state programs (e.g., BART) to reduce SO₂ emissions will likely result in even lower future levels

Conclusion

- Due to the substantial uncertainties in measuring and modeling short-term ambient concentrations, estimating exposure and relating exposure to health effects; the analysis in the REA first draft is insufficiently robust to establish a 5-minute, NAAQS for SO₂
 - Estimation of peak 5-minute concentrations is highly uncertain due to factors that are not addressed in the PMR modeling method
 - Current dispersion models are not designed and meteorological as well as emissions data are not available to accurately simulate 5-minute concentration fluctuations
 - Methods used to roll-up measurement and modeling data to “just meeting” NAAQS are inherently approximate
 - Refinements to the methodology to estimate 5-minute concentrations should be investigated prior to conducting the health assessment