

1 Executive Summary

1.1 Project Goals

The U.S. EPA has produced a new guidance document describing procedures for demonstrating attainment with the eight-hour ozone standard of 0.08 ppm. This procedure combines *averaged* observations at monitors with *relative* model results to predict future ozone values at the monitors [EPA, 2007]. The Texas Commission on Environmental Quality (TCEQ) is applying this procedure in Houston for the first time. The TCEQ modelers have been following the guidance closely.

The objective of this report was to investigate the consequences to the Houston attainment demonstration of several critical assumptions made by EPA in producing this guidance. Our focus was to evaluate whether this attainment guidance, when applied to Houston, results in an accurate depiction of the conditions under which high ozone is formed, and thus will likely result in effective control strategies. We further investigated alternatives to supplement the existing modeling work of TCEQ.

1.2 Report Organization

Chapter 2 provides context for this investigation by describing the relevant regulations adopted by the State of Texas in its midcourse review State Implementation Plan (SIP). These regulations were approved by the EPA and implemented by the TCEQ in 2005. The impacts that these regulations had on O_3 concentrations is critical for understanding the results presented in this report.

Chapter 3 describes in detail the 2007 EPA attainment guidance and the assumptions EPA used to define the two critical metrics needed to show attainment: the observation based metric called the *baseline Design Value* (DV_B), and the modeling based metric called the *relative reduction factor* RRF_M . These assumptions are then evaluated in Chapters 4 and 5 using the same observational and modeling data sets used by the TCEQ.

Chapter 4 focuses on seven monitors, four that were described by TCEQ in their work as “problem monitors” and three more monitors with long history of operation. The observed conditions at these monitors in the period 2000 to 2008 were analyzed and the results are displayed in plots and tables. The highest ozone days data set at these monitors were investigated (sometimes down to the tenth highest day) seeking to understand “typical” behavior as assumed by the EPA guidance. The monitor design values were computed using data from 2003 to 2008 and the components that result in the baseline design value as part of the attainment demonstration are shown graphically and in tables. Analysis of “typical” and “non-typical ozone” are presented. The consequences of using “non-typical ozone” observations with modeling based on “typical emissions” are discussed.

Chapter 5 uses model predictions supplied by TCEQ and new cases simulated in this project to evaluate the EPA methodology for calculating a RRF_M . The various emission inventories used in the EPA guidance and produced by TCEQ are examined and compared. The effect of emission variations between weekends and weekdays and the effect of model simulation of mixing depth rise rates were examined in detail. The RRF_M are shown to be sensitive to these phenomena. Process Analysis of a series of simulations with mixed emissions and meteorology were conducted to explain the model’s sensitivity.

Chapter 6 uses the findings from Chapters 4 and 5 to create a weight of evidence argument to support an alternative attainment methodology that emphasizes the existing Texas regulations already in place from the 2004 SIP. This method does demonstrate attainment at all monitors.

1.3 Future Work

The unique conditions found in the Houston region require a different approach to assess attainment of the O_3 standard. Future efforts will be aimed at developing a more rigorous attainment demonstration suitable for Houston. This will include a model performance evaluation of every modeling day used in the RRF_M , ensuring that the source receptor relationship observed in the DV_B measurements is reasonably simulated. We would also explore using process analysis techniques and quantify the reasons for the difference in responses in the eastern and western sides of Houston. These would include radical sensitivity studies aimed at the NO_x inhibited eastern region of Houston. Additional investigation of the role of emission events in the attainment demonstration should also be explored such as whether these events be included in the baseline emission inventory, or excluded in the baseline design value calculation.

The data presented in this report was based on the current configuration of the model, and we were not able to complete a full model performance evaluation of the model. This should be the major focus of future investigations. More details on work needed to evaluate the model's mixing height dynamics are described in Appendix D.