4. Future Directions

The TCEQ plans to incorporate a number of enhancements to the modeling and analysis for the upcoming 2004 Mid-Course Review. These enhancements include work on the meteorological characterization used in modeling, enhancements to the modeling inventory, additional analysis of ambient hydrocarbon data to better characterize the emissions, and extending the episode modeled to encompass a broader set of meteorological conditions. Some of the specific enhancements planned are:

- *Heat island effects*: An area that may be included in the modeling of the 2000 episode prior to mid-course review is the impact of urban and industrial heat island effects. Recent work by EPA's contractors indicates marginal performance (according to EPA standards) has been achieved using air quality models. TCEQ staff are involved in the discussions regarding the modeling.

- *Top-down emission estimation:* The TCEQ staff are pursuing a number of analyses comparing reported hydrocarbon emissions with ambient measurements. These comparisons involve data collected from both airborne and ground-based monitoring equipment. Comparing pollutant concentrations sampled in a variety of ways with reported emissions will allow TCEQ staff to develop more sophisticated adjustments for the reported emissions. Also, the Houston Advanced Research Center (HARC) has awarded contracts for a number of techniques to perform ambient-to-inventory comparisons.

- *Bottom-up emission estimation:* Complementing the top-down approach to improving emissions estimates is a series of "bottom up" approaches - trying to identify sources of emissions such as cooling towers and better defining the emissions that are more representative of real world conditions. TCEQ and HARC will continue to work with local plants to improve methods of reporting emissions inventories.

- *Analysis of less-reactive hydrocarbon emissions:* Throughout the Phase I Mid-Course Review work, TCEQ and most scientists have focused on the more highly-reactive emissions, primarily olefins. However, several ambient samples acquired during TexAQS showed high levels of reactivity due to large concentrations of other chemical species. For the Mid-Course Review, TCEQ plans to perform an in-depth analysis of the contributions of the less-reactive compounds and to perform top-down analyses similar to those used for the highly reactive VOCs. If warranted, appropriate adjustment factors will be developed for less-reactive VOCs.

- *Inventory improvements:* The TCEQ staff continually upgrade and improve the modeling inventory. Several projects are planned for the Mid-Course Review, including employing MOBILE6 emissions throughout the modeling domain, development of a fully-resolved one-kilometer inventory, chlorine emissions, and emissions from individual ships as they move along the waterways in the HGA. The staff plan to treat both ship and aircraft emissions as elevated sources (similar to the way smokestacks are modeled) to more accurately simulate the vertical placement of these emissions Additionally, the peer review contractor reported two areas that might not be included in the inventory and that should be studied - emissions from rail tank cars and underground pipelines carrying petroleum products. These suggestions will be provided to the Interim Science Committee for future funding. It is unlikely that projects could be incorporated and funded prior to the Mid-Course Review.

- *Treatment of vertical mixing:* During the course of the Phase I modeling, a number of issues

involving the model's treatment of vertical mixing have arisen. The TCEQ staff will continue to investigate the model's treatment of this important input to the photochemical model and will make improvements as warranted.

- *Extended modeling episode:* TCEQ and HARC are working on a joint project with Environ to extend the modeling period for the 2000 episode. As the modeling for Phase I of the Mid-Course Review progressed, it became increasingly more apparent that we needed as many ground and aircraft measurements as possible to explain the complex ozone formation seen in the area. TCEQ thus determined to focus it's resources on extending the 2000 modeling episode rather than attempting to model the 1998 episode for the Mid-Course Review. The new modeling period will extend from August 18 through September 6, 2000, and falls within the intensive study period of the TexAQS. It includes several additional exceedance days and covers a broader range of meteorological conditions than the current episode.

In summary, TCEQ is committed to developing the best science possible to understand the causes of high ozone in the HGA. The application of the science to the HGA ozone problem will proceed along two lines:

- Continue to improve the conceptual description of the ozone problem. The conceptual description, or model, represents the broad scientific understanding of the causes for high ozone concentrations in the area, including meteorology, emissions, chemistry, and the interactions among these components. TCEQ considers the conceptual model (Appendix B) to be a living document that will be updated frequently as our understanding evolves.

- Continue to develop air quality models that more accurately simulate the physical processes leading to high ozone concentrations in the area. This document has described numerous changes that are being developed for improving the modeling for the Mid-Course Review. As these and other improvements are incorporated into the modeling process, model performance should generally improve as model inputs increasingly mirror reality. With a sounder model formulation, it will be possible to investigate new control strategies with a higher degree of confidence in the analysis.

Both the conceptual model and the air quality model can build upon each other. As the conceptual model develops, the improved understanding will be incorporated into the air quality model formulation. Similarly, as the air quality model develops, its successes (and failures) add to our knowledge of the atmospheric dynamics associated with high ozone concentrations, which in turn refines our conceptual understanding.