Executive Summary
December 13, 2002

Background: In August and September of 2000, more than two hundred scientists participated in an intensive field study in the Houston-Galveston area (HGA) to study ozone and other air pollution issues. The findings from the study are constantly evolving and have raised questions about the formation of high ozone in the HGA. Coincidentally, as a result of lawsuit settlement negotiations with the BCCA-AG, TCEQ staff has focused on the following questions:

1. Can industrial VOC controls be substituted for some of the last 10% of reductions required by industrial NOx emission limit rules?
2. If industrial VOC controls are found to be effective, which VOCs should be controlled?

Conclusions: Photochemical grid modeling and analysis of ambient VOC data indicate that it is possible to achieve the same level of air quality benefits with reductions in industrial VOC emissions, combined with an overall 80% reduction in NOx emissions from industrial sources, as would be realized with a 90% reduction in industrial NOx emissions. This conclusion is based on results from several studies, including photochemical grid modeling of the August-September 2000 episode using a top - down emissions inventory adjustment to point source highly-reactive VOC (HRVOC) emissions, and analyses of ambient HRVOC measurements made by TCEQ automated gas chromatographs and airborne canisters using the MIR and OH reactivity scales. Four HRVOCs clearly play important roles in Houston's ozone formation, and these four–ethylene, propylene, 1,3-butadiene, and butenes–seem to be the best candidates for the first round of HRVOC controls. Additional HRVOC controls will likely be needed to meet attainment. Further refinements and enhancements are described in this document and additional modeling and analysis will be conducted in the next few months to support the Mid-Course Review.

Question 1 assessment:

The question of equivalence was been investigated by TCEQ scientists using photochemical grid modeling for the August-September 2000 ozone episode. Meteorological and chemical data collected during the TexAQS 2000 study was employed to ensure that the modeling was accurately simulating the observed phenomena. In order to match observed data, the industrial emissions inventory of light olefins was adjusted upward substantially. Several methods can be used to impute the emissions required to produce the high concentrations of HRVOCs seen in both aircraft and ground-level ambient samples. When one of these methods was used to adjust the inventory, the photochemical model used by TCEQ was able to reproduce observed ozone concentrations in the HGA very accurately on some of the days modeled. Model performance overall was judged to be acceptable for performing analysis of a possible VOC-NO_X tradeoff.

The modeling indicates that a reduction of approximately 36% of industrial

HRVOC emissions, combined with overall point source NO_X reductions of approximately 80%, will achieve air quality benefits commensurate with those achieved by the current NO_X reductions (approximately 90%) in the 2007 attainment year. The modeling also shows that significant additional reductions in both VOC and NO_X may be necessary to demonstrate attainment in the Mid-Course Review.

TCEQ will continue to make improvements and enhancements to the photochemical air quality modeling and emissions inventory, and will analyze new data as it becomes available.

Question 2 Assessment:

Ethylene, propylene, 1,3-butadiene, and butenes have been found to frequently cause high total reactivity conditions, and often dominate the total reactivity. Substantial emission reductions of these compounds are likely to make a large impact on high ozone, rapid ozone formation, and transient high ozone observed in the Houston area. This finding is the result of analyzing 57,307 hours of TCEQ routine VOC monitoring data collected between 1996-2001, and 666 airborne VOC samples collected by TexAQS 2000 scientists. Modeling analysis indicates that emission reductions in these four compounds alone can compensate for the change of industrial NOx controls to 80% reductions, but additional controls on many VOC sources will be necessary to reach attainment. TCEQ will continue to study VOC data available now and in upcoming years to determine whether additional compounds should be added.