

EXECUTIVE SUMMARY

This Final Report of TERC Project H61 pertains to analysis of selected data (two case studies) of the Northeast Texas Plume Study of August 2005. NETPS was conducted to explore the various contributions to the peak daily ozone in DFW on high-ozone days in summer. A particular goal was to assess the contributions of the Ellis CO cement plant sources (Priority 1) and of powerplant sources farther away (upto 250 km from DFW, Priority 2), relative to the local impact of DFW emissions, on the DFW peak.

An intensive field study, centered around 3-D aircraft quasi-Lagrangian sampling in the plumes of interest (DFW, Ellis CO, upwind powerplants), was carried out in August 2005. Unfortunately, the environmental conditions during that month turned out to be most atypical and much less conducive to high ozone production in the target plumes than is believed to be the normal climatological case. The background in E. Texas, indeed in most of eastern USA, that month was unusually clean chemically, and the local flow field during the month was also atypical, with higher than expected wind speeds and wind directions which did not bring the upwind plumes from farther upwind than Ellis CO to the DFW area. Nevertheless, we did get some good case studies of the direct impact of the Ellis CO sources on DFW, and we have performed a detailed data analysis including diagnostic modeling and source apportionment study for one such case study, that of 24 August. We have also performed a detailed case study, including diagnostic modeling, to test and verify the fidelity of our Lagrangian Reactive Plume Model, for a scenario of the transport and chemistry of two large powerplants, Limestone and Big Brown, about 150 km to the SE of DFW. We also applied the model to perform some hypothetical simulations of Limestone and Big Brown emissions impacting DFW under more normal polluted regional background conditions.

Our overall conclusion is that the largest contributor to peak daily hourly ozone in DFW (in mid-late afternoon) is likely to be the regional background shaped jointly by (a) continental-scale processes (e.g., intercontinental transport, subsidence from the free troposphere, etc), and (b) regional scale processes (regional transport from beyond 250 km). Such regional background appears to contribute 50-70% of the observed afternoon ozone peak downwind of DFW, the range covering day-to-day variations. The next largest contributor is emissions from the local DFW area itself, i.e., the local 4-county ozone non-attainment area, which appears to contribute between 25 and 45%. Ellis CO emissions appear to have a maximum contribution of less than 10% of the peak downwind of DFW (on the upwind side of DFW, these emissions may sometimes even bring in a deficit of ozone). Similarly, the contributions of the larger, but farther, Limestone and Big Brown power plants also appear to contribute up to about 10% of the peak on the downwind side of DFW, even though they appear to contribute upto 20% or so at the upwind end of DFW. By then, they are exhausted of NO_x, and the ozone they bring into DFW thereafter appears to dilute and impact a larger area downwind, but at a diminished level in terms of peak concentration of ozone, while during that same time, the DFW local impact is in a growing phase. Our results pertaining to the impact of these upwind point-source emissions on DFW ozone were all for wind directions such that there was no substantial alignment and source intensification present. It is likely that if such intensification were to occur and coincide with the location of the peak ozone downwind of DFW, their combined impact may be somewhat higher than in the case studies presented.

We were unable to perform studies of the DFW ozone impact of the larger NO_x and VOC emission sources in the Tyler-Longview area. We understand that such measurements were made, under conducive conditions, during the summer of 2006 as part of a NETAC-sponsored project. We recommend that a similar thorough quantitative diagnostic modeling and analysis study be performed with that dataset, in order to obtain a more complete picture. We also recommend similar analysis of the NETPS case study of August 26 2005 measurements.

Going one step beyond spatially, we also recommend an observation-based Lagrangian data analysis with diagnostic modeling project aimed at exploring the impact of HGA emissions on DFW, utilizing the data of SETTS (2005) and appropriate data of the NOAA-WPR aircraft during TexAQS II (2006).