APPENDIX 11

EMISSION REDUCTION EFFICIENCY FOR NITROGEN OXIDES AND VOLATILE ORGANIC COMPOUNDS

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Background

As described in Section 3.5: *Reasonable Further Progress (RFP) Demonstration* of the proposed Dallas-Fort Worth (DFW) RFP state implementation plan (SIP) revision, excess nitrogen oxides (NO_X) were added to the NO_X controlled RFP forecast and subtracted from the volatile organic compounds (VOC) controlled RFP forecast. Due to the absence of United States Environmental Protection Agency (EPA) guidance concerning this type of NO_X substitution, the Texas Commission on Environmental Quality (TCEQ) conducted a modeling analysis to estimate its effects on monitored ozone values in the DFW nonattainment area to determine if such an approach is appropriate.

Previous modeling studies have shown that NO_X emission reductions are more effective at reducing eight-hour ozone design values than VOC reductions (TCEQ, 2008). Process analysis of modeling conducted for the 2011 Dallas-Fort Worth Attainment Demonstration State Implementation Plan Revision for the 1997 Eight-Hour Ozone Nonattainment Area indicates that ozone formation is generally NO_X sensitive, and that NO_X controls would be more effective at reducing ozone concentrations (TCEQ, 2011). This Appendix describes DFW photochemical modeling analyses used to estimate the relative efficacy of reductions of VOC compared to reductions of NO_X emissions in reducing ozone concentrations in the DFW area.

Methodology

Photochemical modeling analyses for the DFW area were conducted to determine the model's sensitivity to NO_X and VOC reductions. The analyses were conducted using the extended June 2006 DFW episode. Baseline emissions were projected to 2012 with a MOVES-approximated mobile source emission inventory (TCEQ, 2011). This base CAMx run is referenced as *fy12_06jun.cs03a_m62toMVS*. In four subsequent modeling sensitivity runs, NO_X or VOC emissions were separately reduced by various percentages. Results of the runs with reduced emissions were compared to the results of *fy12_06jun.cs03a_m62toMVS* as shown in Table A-1: *2012 Model Runs with NO_X and VOC Reductions*. For 2012, a 15% VOC emission reduction and a 20% NO_X emission reduction both produce approximately 80 tons per day (tpd) of reductions.

Table A-1: 2012 Model Runs with NO_x and VOC Reductions

Model Run	% Reduction (NO_x or VOC)	TPD Reduction
fy12_06jun.cs03a_m62toMVS	-	-
fy12_06jun.cs03a_m62toMVS_dfw100n085v	15% VOC	80.17
fy12_06jun.cs03a_m62toMVS_dfw095n100v	5% NO_X	19.60
fy12_06jun.cs03a_m62toMVS_dfw090n100v	10% NO_X	39.11
fy12_06jun.cs03a_m62toMVS_dfw080n100v	20% NO_X	78.31

Future eight-hour ozone design values (DV_Fs) were calculated using the runs listed in Table A-1, the 2006 baseline case, and baseline design value (TCEQ, 2011). Table A-2: *Future Design*

Values with NO_X and VOC Reductions shows the resultant DV_Fs and change in DV_F compared to the *fy12_06jun.cs03a_m62toMVS* base run for the emission reduction scenarios. By reducing anthropogenic VOC emissions 15% or approximately 80 tpd, the DV_F is reduced 0.12 parts per billion (ppb). By reducing anthropogenic NO_X emissions only 5% or 19.6 tpd, the DV_F is reduced 0.81 ppb. With a similar ton per day reduction in NO_X emissions (approximately 78 tpd or 20%) as VOC emissions, the DV_F drops 3.43 ppb.

Table A-2: Future Design Values with NO_x and VOC Reductions

Model Run	Calculated DV_F (ppb)	DV_F Reduction (ppb)
fy12_06jun.cs03a_m62toMVS	77.71	-
fy12_06jun.cs03a_m62toMVS_dfw100n085v	77.59	0.12
fy12_06jun.cs03a_m62toMVS_dfw095n100v	76.90	0.81
fy12_06jun.cs03a_m62toMVS_dfw090n100v	76.05	1.66
fy12_06jun.cs03a_m62toMVS_dfw080n100v	74.28	3.43

Conclusion

Based on photochemical modeling analysis for the DFW area, reducing NO_X emissions is expected to be more effective in reducing the ozone design value than VOC reductions. For similar reductions of NO_X (78 tpd) and VOC (80 tpd) emissions in 2012, the DFW eight-hour future design value is reduced substantially more from NO_X emissions (-3.43 ppb) than VOC (-0.12 ppb). Therefore, the method of NO_X substitution described in Section 3.5: *RFP Demonstration* of this proposed DFW RFP SIP revision would be an appropriate approach for demonstrating RFP. Although a reduction of one ton of NO_X is predicted to be more efficient in reducing ozone than one ton of VOC for the DFW area, the NO_X substitution used for this proposed DFW RFP SIP revision substitutes only one ton of NO_X for each ton of VOC, a more conservative approach.

References

TCEQ, 2008. Eight-Hour Ozone Redesignation Request and Maintenance Plan for the Beaumont-Port Arthur Ozone Nonattainment Area. (http://www.tceq.texas.gov/assets/public/implementation/air/sip/bpa/08006sip_ado_complete.pdf)

TCEQ, 2011. Dallas-Fort Worth Attainment Demonstration State Implementation Plan Revision for the 1997 Eight-Hour Ozone Nonattainment Area.