

ON-ROAD EMISSIONS SUPPLEMENT TO THE PROPOSED DALLAS-FORT WORTH ATTAINMENT DEMONSTRATION STATE IMPLEMENTATION PLAN REVISION FOR THE 1997 EIGHT-HOUR OZONE STANDARD NONATTAINMENT AREA

This supplement provides additional technical detail regarding Motor Vehicle Emission Simulator (MOVES) model-based on-road mobile emissions estimates that became available after the Dallas-Fort Worth (DFW) Attainment Demonstration State Implementation Plan (SIP) Revision for the 1997 Eight-Hour Ozone Standard was approved for proposal by the Commission on June 8, 2011 (TCEQ, 2011). The Texas Commission on Environmental Quality (TCEQ) is taking comment from June 24 through July 25, 2011 on using MOVES-based on-road emission inventories in photochemical modeling for the DFW attainment demonstration SIP revision.

1 Background

The United States Environmental Protection Agency (EPA) officially released the MOVES2010 version of the model as a replacement to MOBILE6.2 for SIP applications on March 2, 2010 (EPA, 2011). A revised version named MOVES2010a was provided by EPA on September 23, 2010¹. During the period of time that the SIP revision was developed for proposal, it was not feasible to include MOVES2010a-based on-road emission inventories that contained the spatial and temporal resolution needed for SIP submissions. Instead of relying solely on the use of MOBILE6.2 inventories for the SIP proposal, the TCEQ elected to perform a sensitivity analysis in which the MOBILE6.2 emission estimates were adjusted to county-level totals based on an approximate MOVES2010 analysis done by the North Central Texas Council of Governments (NCTCOG) (NCTCOG, 2010). Section 3.7.6 on page 3-62 of the proposed SIP revision discusses the possible use of the MOVES model for the DFW Attainment Demonstration SIP Revision for the 1997 Eight-Hour Ozone Standard.

2 MOVES On-Road Emission Inventory Development

In May and June of 2011, the following on-road emission inventory development projects were completed using the most recently available MOVES2010a version of the model:

- 2006 and 2012 on-road emission inventories from NCTCOG for the DFW area based on vehicle miles traveled (VMT) estimates from the local travel demand model;
- 2006 and 2012 on-road emission inventories for all 254 Texas counties from the Texas Transportation Institute based on VMT estimates from Highway Performance Monitoring System data collected by the Texas Department of Transportation; and
- 2006 and 2012 on-road emission inventories for all non-Texas U.S. states based on MOVES2010a default runs performed by TCEQ staff.

¹ Page 8 of the policy guidance (<http://www.epa.gov/otaq/models/moves/420b09046.pdf>) released with the MOVES2010 version of the model states that “as required by Clean Air Act section 172(c)(3) and EPA’s regulation at 40 CFR 51.112(a), states must use the latest planning assumptions available at the time that the SIP is developed...”

These on-road emission inventory components were processed to obtain speciated and gridded photochemical modeling inputs that are spatially and temporally allocated throughout the modeling domain. The 2006 and 2012 summer weekday summaries of these on-road emissions in tons per day (tpd) for the nine-county DFW area are provided below in Table 2-1: *2006 Summer Weekday On-Road Emission Estimates with MOVES2010a* and Table 2-2: *2012 Summer Weekday On-Road Emission Estimates with MOVES2010a*.

Table 2-1: 2006 Summer Weekday On-Road Emission Estimates with MOVES2010a

DFW Area County	NO _x (tpd)	VOC (tpd)
Collin	23.92	10.68
Dallas	104.06	46.18
Denton	22.37	9.29
Ellis	12.50	3.70
Johnson	9.10	3.65
Kaufman	10.29	2.83
Parker	9.60	2.94
Rockwall	4.04	1.42
Tarrant	63.23	30.33
Total	259.11	111.02

Note: Values are rounded

Table 2-2: 2012 Summer Weekday On-Road Emission Estimates with MOVES2010a

DFW Area County	NO _x (tpd)	VOC (tpd)
Collin	17.74	8.39
Dallas	69.27	31.83
Denton	16.18	7.14
Ellis	9.42	2.75
Johnson	6.41	2.56
Kaufman	8.32	2.20
Parker	7.76	2.23
Rockwall	3.00	1.10
Tarrant	43.30	22.28
Total	181.40	80.48

Note: Values are rounded.

Summaries of how these MOVES2010a summer weekday NO_x and VOC emission estimates differ from those previously calculated with EPA's MOBILE6.2 model are provided below in

Table 2-3: *Changes in Summer Weekday On-Road NO_x Emissions for the Nine-County DFW Area* and Table 2-4: *Changes in Summer Weekday On-Road VOC Emissions for the Nine-County DFW Area*.

Table 2-3: Changes in Summer Weekday On-Road NO_x Emissions for the Nine-County DFW Area

Calendar Year	MOBILE 6.2 (tpd)	MOVES 2010a (tpd)	Difference (tpd)	Relative Change
2006	225.31	259.11	33.80	15%
2012	122.47	181.40	58.93	48%
Difference	-102.84	-77.71		
Change	-46%	-30%		

Table 2-4: Changes in Summer Weekday On-Road VOC Emissions for the Nine-County DFW Area

Calendar Year	MOBILE 6.2 (tpd)	MOVES 2010a (tpd)	Difference (tpd)	Relative Change
2006	105.04	111.02	5.98	6%
2012	79.77	80.48	0.71	1%
Difference	-25.27	-30.54		
Change	-24%	-28%		

In addition to the summer weekday scenario, MOVES2010a was used to develop on-road emission inventories for the remaining Friday, Saturday, Sunday, and Monday day types. The 2006 and 2012 summaries of MOVES2010a revised emission totals for the nine-county DFW area by day type are provided below in Table 2-5: *2006 On-Road Emission Estimates with MOVES2010a by Day-Type for the Nine-County DFW Area* and Table 2-6: *2012 On-Road Emission Estimates with MOVES2010a by Day-Type for the Nine-County DFW Area*.

Table 2-5: 2006 On-Road Emission Estimates with MOVES2010a by Day-Type for the Nine-County DFW Area

Day Type	NO _x (tpd)	VOC (tpd)
Weekday	259.11	111.02
Friday	264.31	114.61
Saturday	189.98	103.25
Sunday	168.95	96.60
Monday	252.43	109.12

Table 2-6: 2012 On-Road Emission Estimates with MOVES2010a by Day-Type for the Nine-County DFW Area

Day Type	NO _x (tpd)	VOC (tpd)
Weekday	181.40	80.48

Day Type	NO _x (tpd)	VOC (tpd)
Friday	182.24	81.87
Saturday	136.68	74.80
Sunday	124.84	71.37
Monday	175.33	78.97

Additional detail on NCTCOG's development of the DFW area on-road emission inventories with MOVES2010a can be found in the following FTP directories:

- ftp://amdaftp.tceq.texas.gov/pub/Mobile_EI/DFW/mvs/2006/
- ftp://amdaftp.tceq.texas.gov/pub/Mobile_EI/DFW/mvs/2012/

Additional detail on the TCEQ's photochemical model emissions processing of these on-road inventories can be found in these FTP directories:

- ftp://amdaftp.tceq.texas.gov/pub/Mobile_EI/DFW/eps3/2006/
- ftp://amdaftp.tceq.texas.gov/pub/Mobile_EI/DFW/eps3/2012/

Detailed information on the development of the on-road inventories outside of the DFW nonattainment area with MOVES2010a can be found in these FTP directories:

- ftp://amdaftp.tceq.texas.gov/pub/Mobile_EI/Statewide/mvs/2006/
- ftp://amdaftp.tceq.texas.gov/pub/Mobile_EI/Statewide/mvs/2012/
- ftp://amdaftp.tceq.texas.gov/pub/Mobile_EI/USA/mvs/2006/
- ftp://amdaftp.tceq.texas.gov/pub/Mobile_EI/USA/mvs/2012/

Detailed information on the photochemical model emissions processing of these non-DFW area on-road inventories can be found in these FTP directories:

- ftp://amdaftp.tceq.texas.gov/pub/Mobile_EI/Statewide/eps3/2006/
- ftp://amdaftp.tceq.texas.gov/pub/Mobile_EI/Statewide/eps3/2012/
- ftp://amdaftp.tceq.texas.gov/pub/Mobile_EI/USA/eps3/2006/
- ftp://amdaftp.tceq.texas.gov/pub/Mobile_EI/USA/eps3/2012/

Since these MOVES2010a emission estimates have very recently been developed, they are still undergoing a quality assurance review process and are subject to change if any errors are detected. If the TCEQ elects to use these MOVES2010a figures, the 2012 motor vehicle emissions budget (MVEB) for the attainment demonstration SIP revision adoption would be 181.40 NO_x tpd and 80.48 VOC tpd.

3 Photochemical Modeling with MOVES2010a

The MOVES2010a inventories were included in photochemical modeling runs for the 2006 base case, 2006 baseline, and the 2012 future case. Modeled ozone levels in the base case increased as a result of the addition of mobile source NO_x emissions from the MOVES2010a emission estimates as shown in Figure 3-1: *Peak Monitored versus Modeled Eight-Hour Ozone Concentrations with MOVES2010a for May 31 - June 15, 2006* and Figure 3-2: *Peak Monitored versus Modeled Eight-Hour Ozone Concentrations with MOVES2010a for June 16 - July 2, 2006*. The orange bars represent the observed peak concentrations, the green bars represent the base model run with MOBILE6.2 emissions, and the blue bars represent the modeled peak eight-hour ozone concentrations with MOVES2010a. The error bars on the daily peak observed eight-hour ozone concentrations represent the ± 20% Unpaired Peak Accuracy (UPA) range for comparison with the daily maximum modeled eight-hour ozone concentrations. Since many of the eight-hour exceedance days were underestimated by the photochemical model with the base emissions, the use of MOVES2010a on-road mobile inventories improves performance on those eight-hour exceedance days. Days that overpredicted the observed peak concentrations with MOBILE6.2 now overpredict slightly more with MOVES2010a emissions. However, it is possible that the monitoring network does not capture the actual domain-wide peak so modeling slightly above the observed peak is not considered a modeling deficiency.

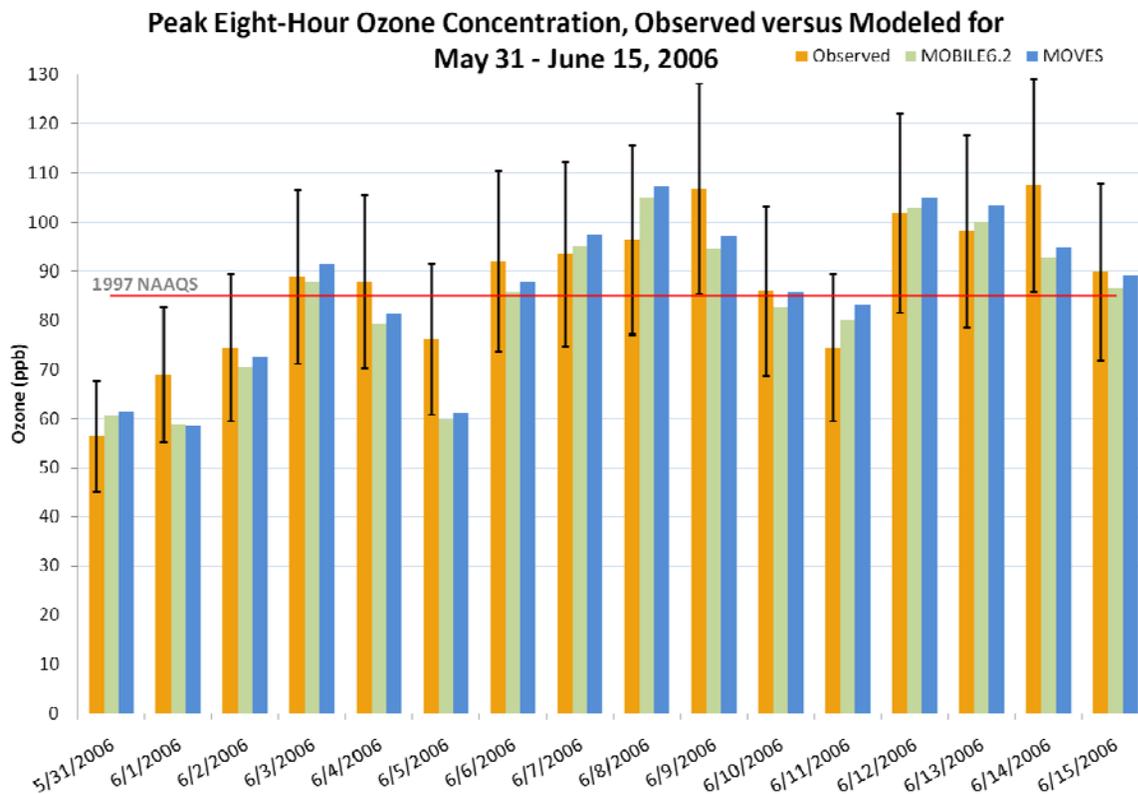


Figure 3-1: Peak Monitored versus Modeled Eight-Hour Ozone Concentrations with MOVES2010a for May 31 - June 15, 2006

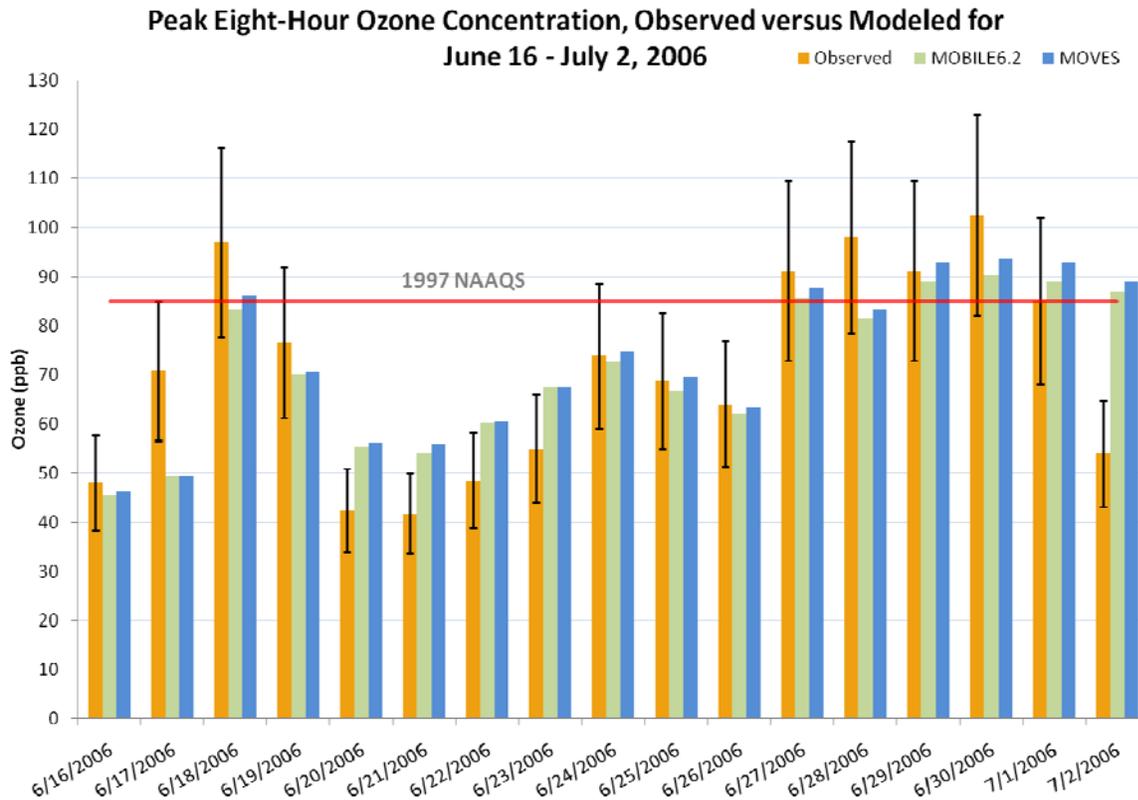


Figure 3-2: Peak Monitored versus Modeled Eight-Hour Ozone Concentrations with MOVES2010a for June 16 - July 2, 2006

This improvement in performance on eight-hour ozone exceedance days is also noted in the daily mean normalized bias (MNB) and mean normalized gross error (MNGE) statistics (Figure 3-3: *Daily MNB and MNGE Statistics for MOVES2010a and MOBILE6.2 Photochemical Model Runs*). The blue bars representing the MOVES2010a run show less bias and error than the MOBILE6.2 run (green bars) for the eight-hour ozone exceedance days (starred). EPA’s MNG and MNGE benchmarks are shown as red dashed bars (EPA, 2007). Two eight-hour ozone exceedance days (June 18 and July 1) do not comply with the EPA benchmarks with MOBILE6.2 or MOVES.

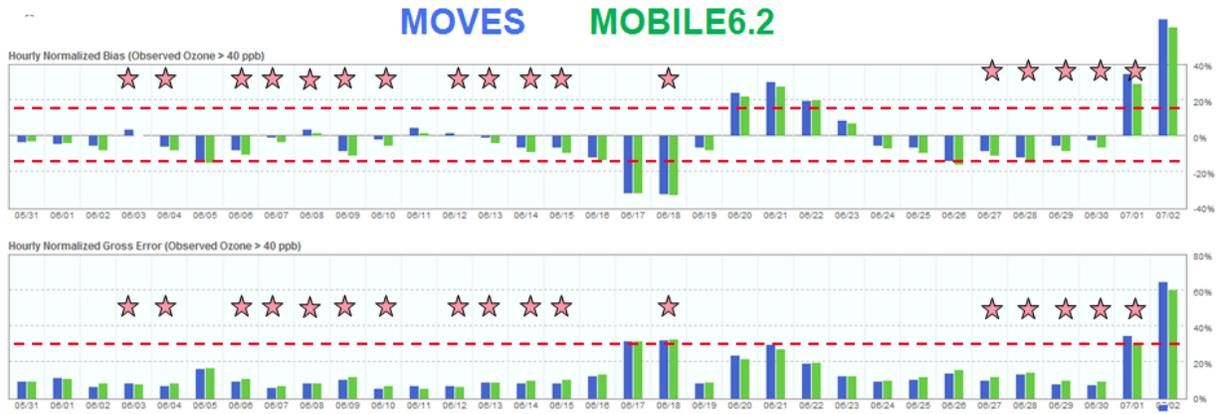


Figure 3-3: Daily MNB and MNGE Statistics for MOVES2010a and MOBILE6.2 Photochemical Model Runs

Performance was also improved on a monitor-by-monitor basis with the MOVES2010a emissions as shown in Figure 3-4: *Soccer-Style Plot of Eight-Hour MNGE and MNB by Monitor with MOVES2010a and MOBILE6.2*. Each marked plotted is a monitor. While still under-predicting the eight-hour ozone concentrations, the MOVES2010a run (blue circles) has improved the bias and gross error statistics compared to the MOBILE6.2 emissions run (green triangles). All monitors fall within the performance benchmarks using the MOVES2010a emissions while Eagle Mountain Lake’s bias exceeds the -15% goal with MOBILE6.2.

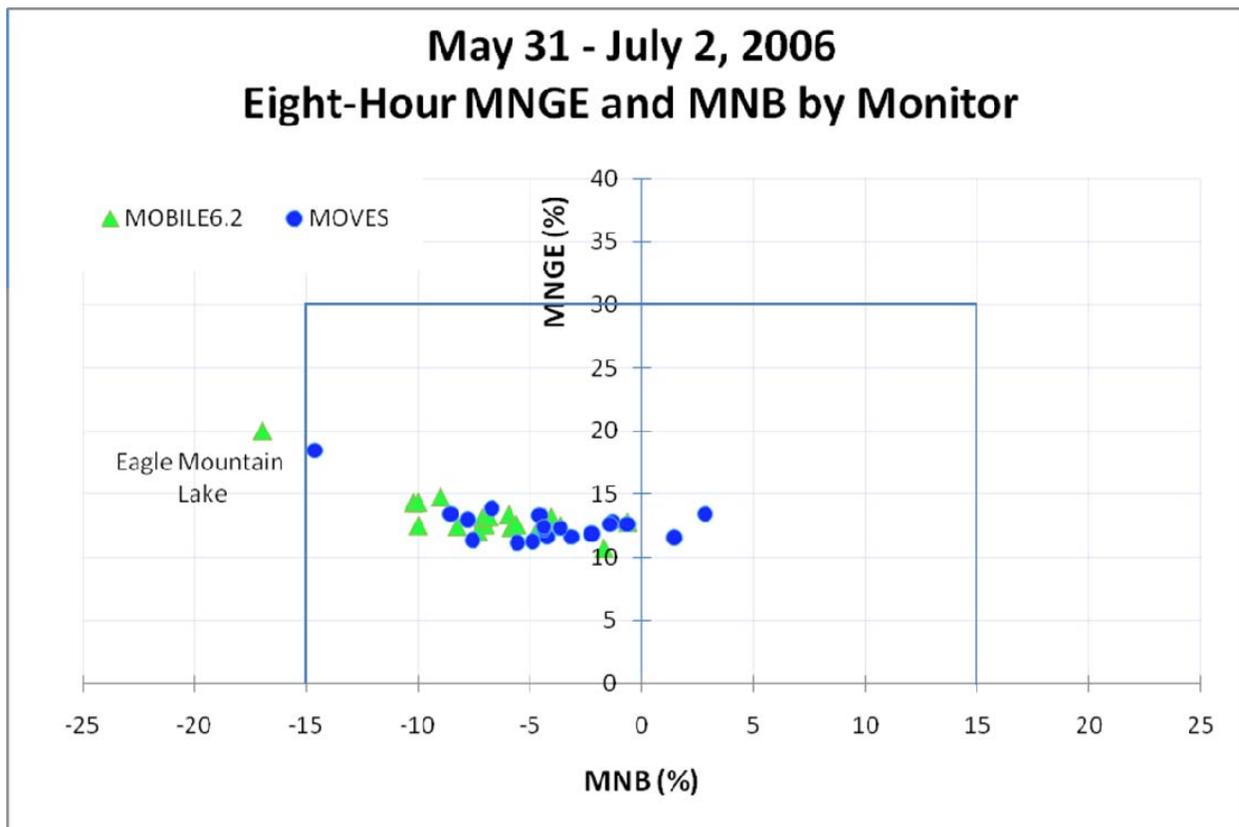


Figure 3-4: Soccer-Style Plot of Eight-Hour MNGE and MNB by Monitor with MOVES2010a and MOBILE6.2

Using the MOVES2010a emissions also impacted the future design values (DV_Fs). The change in mobile source emissions in the base and future resulted in higher future design values at all monitors as shown in Table 3-1: *2012 Future Design Values with MOVES2010a*. Final DV_Fs will be truncated to whole numbers, though they are presented with two decimals to exhibit the differences between runs with MOBILE6.2 and MOVES2010a. All monitors are predicted to have a 2012 future design value less than 85 parts per billion (ppb).

Table 3-1: 2012 Future Design Values with MOVES2010a

Site	Monitor	2012 DV _F w/ MOBILE6.2 (ppb)*	2012 DV _F w/ MOVES2010a (ppb)*	DV _F Diff. (ppb)
DENT	Denton C56	75.37	77.03	1.66
EMTL	Eagle Mountain Lake C75	76.05	78.06	2.01
KELC	Keller C17	74.83	76.45	1.62
GRAP	Grapevine Fairway C70	74.67	76.17	1.50
FWMC	Fort Worth Northwest C13	73.78	75.36	1.58
FRIC	Frisco C31	72.93	74.45	1.52
WTFD	Weatherford Parker County C76	71.30	72.71	1.41
DALN	Dallas North C63	69.64	71.15	1.51
REDB	Dallas Exec Airport C402	69.40	70.58	1.18
CLEB	Cleburne C77	70.26	70.85	0.59
ARLA	Arlington C61	68.95	70.32	1.37
DHIC	Dallas Hinton C401	66.52	67.89	1.37
PIPT	Pilot Point C1032	65.97	67.35	1.38
MDLT	Midlothian Tower C94	65.31	66.63	1.32
RKWL	Rockwall Heath C69	62.47	63.27	0.80
MDLO	Midlothian OFW C52	61.09	62.24	1.15
KAUF	Kaufman C71	59.27	60.42	1.15
GRAN	Granbury C73	68.18	69.66	1.48
GRVL	Greenville C1006	58.97	59.96	0.99

* Values 85 ppb or greater are shown in red.

Granbury C73 and Greenville C1006 are outside the 1997 eight-hour ozone NAAQS DFW nonattainment area.

4 Summary

The TCEQ is taking comment on using the MOVES2010a on-road emission inventories in the DFW Attainment Demonstration SIP Revision for the 1997 Eight-Hour Ozone Standard. The use of MOVES2010a increases NO_x and VOC emissions in the base (2006) and future (2012) years compared to the MOBILE6.2 on-road estimates. The increase in emissions has improved the 2006 base case performance of the photochemical modeling and increased the 2012 DV_Fs for all DFW area monitors. All monitors are predicted to attain the 1997 eight-hour ozone standard in 2012.

5 References

EPA, 2007. Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, PM_{2.5}, and Regional Haze, <http://www.epa.gov/scram001/guidance/guide/final-03-pm-rh-guidance.pdf>.

EPA, 2011. MOVES (Motor Vehicle Emission Simulator), <http://www.epa.gov/otaq/models/moves/>.

NCTCOG, 2010. Emission Inventories Development Using MOVES Model: A Dallas-Fort Worth, Texas Area Case Study, 19th International Emission Inventory Conference, http://www.epa.gov/ttn/chief/conference/ei19/session6/venugopal_pres.pdf, September 29, 2010.

TCEQ, 2011. Proposed Dallas-Fort Worth Attainment Demonstration State Implementation Plan Revision for the 1997 Eight-Hour Ozone Standard Nonattainment Area (2010-022-SIP-NR), <http://www.tceq.texas.gov/airquality/sip/dfw/dfw-latest-ozone#executive-director-s-recommended>, June 8, 2011.