

**REVIEW OF TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
EMISSION PROJECTION METHODS**

FINAL REPORT

Prepared for:

Texas Environmental Research Consortium (TERC)
and the
Houston Advanced Research Center
4800 Research Forest Drive
The Woodlands, TX 77381

Prepared by:

E.H. Pechan & Associates, Inc.
5528-B Hempstead Way
Springfield, VA 22151

April 2009

08.12.001/9461.000

CONTENTS

	<u>Page</u>
ACRONYMS	vii
CHAPTER I. INTRODUCTION	1
A. STUDY PURPOSE	1
B. REPORT ORGANIZATION	1
C. ACKNOWLEDGEMENTS	1
D. REFERENCES	1
CHAPTER II. POINT SOURCES – ELECTRIC GENERATING UNITS (EGUs)	3
A. TEXAS SOURCES	3
1. HGB, DFW, and Beaumont-Port Arthur (BPA) Nonattainment Areas	4
2. Texas EGUs in Attainment Areas	6
B. STATES OUTSIDE OF TEXAS	9
C. CANADA	11
D. MEXICO	11
E. GULF OF MEXICO (OFFSHORE) SOURCES	11
F. REFERENCES	11
CHAPTER III. POINT SOURCES – NON-ELECTRICITY GENERATING UNITS	13
A. TEXAS SOURCES	13
1. DFW, HGB, and BPA Sub-areas	15
2. Attainment Areas Within Texas	16
B. STATES OUTSIDE OF TEXAS	17
C. CANADA	19
D. MEXICO	20
E. GULF OF MEXICO (OFFSHORE) SOURCES	20
F. REFERENCES	20
CHAPTER IV. AREA SOURCES	21
A. TEXAS SOURCES	21
1. DFW, HGB, and BPA Sub-areas	22
2. Attainment Areas Within Texas	23
B. STATES OUTSIDE OF TEXAS	24
C. CANADA	26
D. MEXICO	26
E. GULF OF MEXICO (OFFSHORE) SOURCES	27
F. REFERENCES	27
CHAPTER V. NONROAD (EPA NONROAD MODEL) SOURCES	29
A. TEXAS SOURCES	29
1. DFW, HGB, and BPA Sub-areas	30
2. Attainment Areas Within Texas	31
B. STATES OUTSIDE OF TEXAS	31
C. CANADA	32
D. MEXICO	32
E. GULF OF MEXICO (OFFSHORE) SOURCES	32
F. REFERENCES	32

CHAPTER VI. MARINE, AIRCRAFT, AND RAILROAD SOURCES (MAR)35

 A. TEXAS SOURCES..... 35

 1. DFW, HGB, and BPA Sub-areas..... 35

 2. Attainment Areas Within Texas..... 36

 B. STATES OUTSIDE OF TEXAS..... 37

 C. CANADA 37

 D. MEXICO..... 37

 E. GULF OF MEXICO (OFFSHORE) SOURCES 37

 F. REFERENCES 38

CHAPTER VII. ONROAD VEHICLES41

 A. TEXAS SOURCES..... 41

 1. DFW, HGB, and BPA Sub-Areas..... 42

 2. Attainment Areas Within Texas..... 48

 B. STATES OUTSIDE OF TEXAS..... 50

 C. CANADA 50

 D. MEXICO..... 50

 E. REFERENCES 51

TABLES

Table II-1. Summary of Texas 2009 Future-Year Base EGU NO_x Emissions
(tons per day [tpd])..... 3

Table II-2. Texas 2009 Future-Year Base EGU NO_x Emissions (tpd)..... 5

Table II-3. New Texas EGUs (3Q05 to 2009) as of June 2006..... 8

Table II-4. Non-Texas U.S. State NO_x Emissions 10

Table III-1. Summary of Texas Base Year and 2009 Year Non-EGU Point Source NO_x
Emissions (tons per day [tpd]) 14

Table III-2. Summary of Texas Base Year and 2009 Year Non-EGU Point Source VOC
Emissions (tons per day [tpd]) 15

Table III-3. Non-EGU Point Source Controls Modeled in CAIR Projections 18

Table IV-1. Area Source Emission Projection Methods for Texas 21

Table IV-2. 2000 and 2009 DFW Weekday Area Source Emissions before SIP Controls (tpd) 22

Table IV-3. 2009 DFW Nine-County Area Source Control Measures Applied..... 23

Table IV-4. Counties Modeled with East Texas Combustion Rule Reductions..... 24

Table IV-5. SICs with Improved Growth Factors Compared with REMI 5.5..... 25

Table IV-6. Non-Texas State Area Source Controls for CAIR 26

Table V-1. Nonroad Mobile Source Emission Projection Methods for Texas 29

Table V-2. DFW Nonroad Weekday Totals (2000, 2009) before SIP Controls..... 30

Table V-3. 2009 DFW Nine-County Non-road Weekday Emissions with Control Measures
Applied..... 31

Table VI-1. Marine, Aircraft and Railroads Source Emission Projection Methods 35

Table VI-2. 2000 and 2009 DFW Weekday Emissions for Aircraft and Locomotive, before SIP
Controls (tpd)..... 36

Table VI-3. Listing of Mobile Source Non-Platform Categories in 2000 Offshore Inventory ... 37

Table VII-1. On-Road Mobile Emission Inventory Projection Methodology for Texas..... 41

Table VII-2. MOBILE6 Inputs and Vehicle Activity for Developing Projected On-road Emissions 41

Table VII-3. DFW Nonattainment Area VMT and Annual Growth Rate for All Counties – 1999 versus 2009 43

Table VII-4. DFW Nonattainment Area Midweek VMT and Annual Growth Rate – Individual Counties 43

Table VII-5. DFW 2009 On-road Emission Inventory (tpd) 44

Table VII-6. HGB Nonattainment Area VMT and Annual Growth Rate for All Counties..... 45

Table VII-7. HGB Nonattainment Area Midweek VMT and Annual Growth Rate 45

Table VII-8. HGB 2009 On-road Emission Inventory (tpd)..... 46

Table VII-9. BPA Nonattainment Area VMT and Annual Growth Rate for All Counties 47

Table VII-10. BPA Nonattainment Area Midweek VMT and Annual Growth Rate 47

Table VII-11. BPA 2009 On-road Emission Inventory (tpd) 48

Table VII-12. Texas Statewide Attainment Area Average VMT and Annual Growth Rate 49

Table VII-13. Texas Statewide Attainment Area 2009 On-road Emission Inventory (tpd) 50

[This page intentionally left blank.]

ACRONYMS

3Q04	third quarter 2004
3Q05	third quarter 2005
ARPDB	Acid Rain Program Database
ATP	Anti-Tampering Programs
BEA	Bureau of Economic Analysis
BLS	Bureau of Labor Statistics
BPA	Beaumont-Port Arthur
CAIR	Clean Air Interstate Rule
CAMD	Clean Air Markets Division
CEM	continuous emission monitoring
CMVs	commercial marine vessels
CO	carbon monoxide
CO ₂	carbon dioxide
DERC	Discrete Emission Reduction Credit
DFW	Dallas-Ft. Worth
DFWRTM	Dallas-Ft. Worth Regional Travel Model
EBT	Emissions Banking and Trading
EGAS	Economic Growth Analysis System
EGF	Electricity Generating Facility
EGUs	electric generating units
EI	emission inventory
EPA	U.S. Environmental Protection Agency
ERC	Emission Reduction Credit
ERCOT	Electric Reliability Council of Texas
ESADs	Emission Specifications for Attainment Demonstration
GWEI	Gulf-wide Emissions Inventory
HGAC	Houston/Galveston Area Council
HGB	Houston-Galveston-Brazoria
HON	Hazardous Organic NESHAP
HPMS	Highway Performance Monitoring System
HRVOC	Highly Reactive VOC
I/M	inspection and maintenance
IPM	Integrated Planning Model
LED	Low Emission Diesel
LOOP	Louisiana Offshore Oil Platform
MACT	maximum achievable control technology
MAR	marine, aircraft, and railroads
MECT	Mass Emissions Cap and Trade
MMS	Minerals Management Service
NAAQS	National Ambient Air Quality Standards
NCTCOG	North Central Texas Council of Governments
NEI	National Emissions Inventory
NESHAP	National Emission Standards for Hazardous Air Pollutants
NMIM	National Mobile Emissions Model

NO _x	oxides of nitrogen
NSR	New Source Review
OSD	ozone season daily
PSDB	Point Source Database
RACT	reasonably available control technology
REMI	Regional Economic Model, Inc.
RFG	reformulated gasoline
RICE	Reciprocating Internal Combustion Engines
SCCs	Source Classification Codes
SIC	standard industrial classification
SIP	State Implementation Plan
SO ₂	sulfur dioxide
SOCMI	Synthetic Organic Chemical Manufacturing Industry
STARS	State of Texas Air Reporting System
TCEQ	Texas Commission on Environmental Quality
TDMs	travel demand models
TERP	Texas Emission Reduction Plan
TIPI	Texas Industrial Production Index
tpd	tons per day
TTI	Texas Transportation Institute
TxDOT	Texas Department of Transportation
TxLED	Texas Low-Emission Diesel
VMEP	Voluntary Mobile Emissions Reduction Program
VMT	vehicle miles traveled
VOC	volatile organic compound

CHAPTER I. INTRODUCTION

A. STUDY PURPOSE

The study purpose was to review and document the current methods that the Texas Commission on Environmental Quality (TCEQ) uses to project emissions for all major source sectors (i.e., all mobile on-road, mobile off-road, stationary point, and stationary area sources). Information on current projection methods was obtained from documentation and contacts provided by TCEQ. At project initiation, it was decided that TCEQ's most current methods were those described in the Dallas-Ft. Worth (DFW) State Implementation Plan (SIP) adopted by the TCEQ in May 2007 (TCEQ, 2007). Therefore, much of the information in this report originates from that SIP document.

B. REPORT ORGANIZATION

This report is organized by sector, with a separate chapter being devoted to each source sector. The source sectors are:

1. Electric generating units (EGUs);
2. Non-EGU point sources;
3. Area;
4. Nonroad (U.S. Environmental Protection Agency [EPA] NONROAD model categories);
5. Marine, aircraft, and railroads (MAR); and
6. Onroad vehicles.

The chapter sub-headings are according to the different geographic areas, which are (1) Texas nonattainment areas, (2) Texas attainment areas, (3) U.S. States outside of Texas, (4) Canada and Mexico, and (5) Gulf of Mexico.

C. ACKNOWLEDGEMENTS

Study funding was provided by the Houston Advanced Research Center (HARC) through a grant from TCEQ.

D. REFERENCES

TCEQ, 2007: Texas Commission on Environmental Quality, "Revisions to the State Implementation Plan (SIP) for the Control of Ozone Air Pollution, Dallas-Fort Worth Eight-Hour Ozone Nonattainment Area Attainment Demonstration," Austin, TX, May 23, 2007.

[This page intentionally left blank.]

CHAPTER II. POINT SOURCES – ELECTRIC GENERATING UNITS (EGUs)

This chapter describes the methods used to estimate point source EGU emissions for Texas and other areas within the domain modeled for the DFW SIP adopted by the TCEQ in May 2007 (TCEQ, 2007a). Most of the information in this chapter is taken from the SIP document.

A. TEXAS SOURCES

Within the State of Texas, the TCEQ's emission projections to 2009 for EGUs use one of two methods. For the Houston-Galveston-Brazoria (HGB) area, there is an oxides of nitrogen (NO_x) emission trading program in place, so all EGU NO_x emissions in that area are limited in 2009 by that cap. For the remainder of the State, 2009 EGU emissions are based on third quarter 2005 emissions data reported to EPA's Clean Air Markets Division (CAMD) plus adding to that the expected emissions from the newly permitted EGUs list. These methods are described in more detail below. Table II-1 summarizes Texas 2009 EGU NO_x emissions by geographic area.

Table II-1. Summary of Texas 2009 Future-Year Base EGU NO_x Emissions (tons per day [tpd])

Geographic Area	Data Source	Base Year Start	2009 Post-Control	Percentage of 2009 Post-Control Emissions by Area
DFW	ARDB	9.56	9.56	
	OSD	30.86	2.39	
	New	0	0	
<i>Subtotal</i>		<i>40.42</i>	<i>11.95</i>	<i>2%</i>
HGB	ARDB	48.24	40.71	
	OSD	51.54	9.90	
	New	0	0	
<i>Subtotal</i>		<i>99.78</i>	<i>50.61</i>	<i>9</i>
BPA	ARDB	14.18	14.18	
	OSD	0	0	
	New	0.64	0.64	
<i>Subtotal</i>		<i>14.82</i>	<i>14.82</i>	<i>3</i>
East TX Attainment Counties within Model Domain	ARDB	388.30	376.04	
	OSD	107.85	12.36	
	New	15.99	15.99	
<i>Subtotal</i>		<i>512.14</i>	<i>404.39</i>	<i>69</i>
West TX Attainment Counties, outside of Model Domain	ARDB	96.48	96.48	
	OSD	7.47	2.87	
	New	1.62	1.62	
<i>Subtotal</i>		<i>105.57</i>	<i>100.97</i>	<i>17</i>
Grand Total		772.74	582.75	100%

ARDB: Acid Rain Database, hourly emissions third quarter 2005, 22-day average
 BPA: Beaumont-Port Arthur
 OSD: Ozone Season Day, 2000 Point Source Database (PSDB)
 New: Newly-permitted EGUs (post third quarter 2005)

1. HGB, DFW, and Beaumont-Port Arthur (BPA) Nonattainment Areas

All of these ozone nonattainment areas have NO_x emission caps that are implemented via emission trading programs. Therefore the NO_x emission forecasts focus primarily on estimating what the nonattainment area NO_x emissions will be under these caps in 2009 combined with straightforward assumptions about how the caps might be met at the plant or unit-level.

a. HGB Nonattainment Area

In HGB, the primary focus of the forecasting methods was to simulate how Chapter 101 Mass Emissions Cap and Trade (MECT) program emission limits would influence emissions in 2009. The MECT program incorporates the Emission Specifications for Attainment Demonstration (ESADs) from Chapter 117 and specifies the annual post-2002 NO_x allowances. Any NO_x increases at existing or new sources that are subject to Chapter 117 ESADs in the HGB area are accounted for in the MECT cap. No new growth can occur in the HGB area for those source types (pieces of equipment) for which Chapter 117 ESADs exist.

Acid rain units within the HGB ozone nonattainment area (that are not cogenerators) were in compliance with MECT by May 2005 (their compliance date), so the 2009 forecast year NO_x emissions were estimated using third quarter 2005 NO_x emissions reported to EPA's CAMD. Hourly acid rain data for the third quarter of 2005 was used to create the modeling inventory for 2009 with no additional growth at those EGUs. Acid rain data was averaged over the 22-day high ozone period of August 20 through September 10, 2005 for each hour to estimate hourly NO_x emissions at each EGU. The period average for each hour was used for the future year modeling inventory.

EPA's Acid Rain Program affects existing utility units serving generators with an output capacity of greater than 25 megawatts and all new utility units. Under the Acid Rain Program, each unit must continuously measure and record its emissions of sulfur dioxide (SO₂), NO_x, and carbon dioxide (CO₂) as well as volumetric flow and capacity. In most cases, a continuous emission monitoring (CEM) system must be used. Units report hourly emissions data to EPA on a quarterly basis. This data is then stored in the Emissions Tracking System which serves as a repository of emissions data for the utility industry.

For non-acid rain units, TCEQ estimated base year emissions from the 2000 emission inventory (EI). The "Electricity Generating Facility (EGF) 11" rules apply to entire accounts/sites (TCEQ, 2007b). For the NO_x emitters at these 11 sites that do not report to EPA CAMD, the 2009 NO_x emissions were estimated by multiplying the 2000 ozone season daily (OSD) emissions by 0.156 to account for MECT compliance. This factor was developed in order to obtain the expected 30 tpd NO_x emission reductions from the MECT program being applied to these sources. The Hiram Clarke and Webster units were retired in 2000, so their emissions in 2009 are zero.

For the HGB EGF 11 accounts, the 2000 calendar year ozone season daily NO_x emissions were 40.28 tpd. With the EGF 11 retirements, the pre-control NO_x emissions are 35.69 tpd. In equation form, this is: $35.69 \text{ tpd} * (0.156) = 5.57 \text{ tpd}$.

For the non-11 EGUs in HGB, compliance with MECT is required, but not until 2008 - the last step down phase-in of this program. These are mostly cogeneration units. The MECT 11 EGF accounts had to have controls in-place by May 2005. They were given a fixed portion of the NO_x cap to estimate their 2009 NO_x emissions.

There were mothballed units in the HGB area, but since the area is under a NO_x cap, those emissions are assumed to be constant and eligible for other units to use within the HGB area - therefore, the NO_x emissions from mothballed units in the HGB area were not retired. Mothballed units are those that have suspended operations. For current reserve margin calculations, the Electric Reliability Council of Texas (ERCOT) assumes that a mothballed unit could return after one year. The probability of return depends on the efficiency and technology of the unit, the length of time mothballed, and location (attainment or nonattainment area).

Table II-2 shows how the different EGU types and control programs are separated to influence NO_x emissions in the HGB area (and other areas within Texas). The right-most column in Table II-2 has the 2009 emissions estimates used in the DFW SIP modeling.

Table II-2. Texas 2009 Future-Year Base EGU NO_x Emissions (tpd)

Geographic Area	Data Source	Start	Delete Retired EGUs	Senate Bill 7 (SB7)/ Ch117 Controls	MECT 11-EGFs Controls	MECT Non-11 Controls	MECT Non-11 Acid Rain Division Controls	Delete Mothball Units
DFW	ARDB	9.56	9.56	9.56	9.56	9.56	9.56	9.56
	OSD	30.86	24.63	6.59	6.59	6.59	6.59	2.39
	New	0	0	0	0	0	0	0
<i>Subtotal</i>		<i>40.42</i>	<i>34.19</i>	<i>16.15</i>	<i>16.15</i>	<i>16.15</i>	<i>16.15</i>	<i>11.95</i>
HGB MECT, 11 EGFs	ARDB	23.19	23.19	23.19	23.19	23.19	23.19	23.19
	OSD	40.28	35.69	35.69	5.57	5.57	5.57	5.57
	New	0	0	0	0	0	0	0
HGB MECT, non-11	ARDB	25.05	25.05	25.05	25.05	25.05	17.52	17.52
	OSD	11.26	11.26	11.26	11.26	4.33	4.33	4.33
	New	0	0	0	0	0	0	0
<i>Subtotal</i>		<i>99.78</i>	<i>95.19</i>	<i>95.19</i>	<i>65.07</i>	<i>58.14</i>	<i>50.61</i>	<i>50.61</i>
BPA	ARDB	14.18	14.18	14.18	14.18	14.18	14.18	14.18
	OSD	0	0	0	0	0	0	0
	New	0.64	0.64	0.64	0.64	0.64	0.64	0.64
<i>Subtotal</i>		<i>14.82</i>	<i>14.82</i>	<i>14.82</i>	<i>14.82</i>	<i>14.82</i>	<i>14.82</i>	<i>14.82</i>
TX Attainment Counties within Model Domain	ARDB	388.30	388.30	388.30	388.30	388.30	388.30	376.04
	OSD	107.85	82.31	46.28	46.28	46.28	46.28	12.36
	New	15.99	15.99	15.99	15.99	15.99	15.99	15.99
<i>Subtotal</i>		<i>512.14</i>	<i>486.6</i>	<i>450.57</i>	<i>450.57</i>	<i>450.57</i>	<i>450.57</i>	<i>404.39</i>
Within TX, outside of Model Domain	ARDB	96.48	96.48	96.48	96.48	96.48	96.48	96.48
	OSD	7.47	5.16	2.87	2.87	2.87	2.87	2.87
	New	1.62	1.62	1.62	1.62	1.62	1.62	1.62
<i>Subtotal</i>		<i>105.57</i>	<i>103.26</i>	<i>100.97</i>	<i>100.97</i>	<i>100.97</i>	<i>100.97</i>	<i>100.97</i>
Grand Total		772.74	734.05	677.71	647.58	640.66	633.13	582.75
ARDB: Acid Rain Database, hourly emissions third quarter 2005, 22-day average OSD: Ozone Season Day, 2000 PSDB New: Newly-permitted EGUs (post third quarter 2005)								

b. Dallas-Fort Worth Area

The DFW 8-hour EGU rule maintains the one-hour DFW Chapter 117 ESADs for Small Utility Systems and Large Utility Systems, but eliminates the system cap that allowed system owners to average across their units to meet the ESAD on average. Each EGU unit in the 9-county DFW area must meet the Chapter 117 ESAD individually, such that all units meet an ESAD that is equivalent to the current applicable ESAD for the 4-county area (the 1-hour average ozone nonattainment area). The new EGU rule also includes an output or efficiency-based emission limit as a voluntary alternate compliance option. In addition, the current 1-hour reasonably available control technology (RACT) specifications have been expanded to auxiliary steam boilers and stationary gas turbines at EGUs in the five new nonattainment counties (under the 8-hour average ozone National Ambient Air Quality Standards [NAAQS]). Furthermore, based on comments received by the TCEQ, the rule allows for a system wide heat input weighted average. The expected NO_x emission reductions from this rule are 0.4 tpd.

c. BPA Area

The BPA EGU emissions in 2009 were estimated using the same methods described below for Texas attainment areas.

2. Texas EGUs in Attainment Areas

2009 EGU emissions were based on third quarter 2005 (3Q05) acid rain data from EPA's Acid Rain Program Database (ARPDDB). These ARPDDB records were averaged over the 22-day high ozone period of August 20 through September 10, 2005, for each hour for each unit. The period average for each hour was used for the future year modeling inventory. Corresponding hourly average carbon monoxide (CO) and volatile organic compound (VOC) emissions were computed from 2004 State of Texas Air Reporting System (STARS) NO_x-to-CO and NO_x-to-VOC ratios reported for each Acid Rain unit.

This 3Q05 data is suitable, because it includes all of the EGU controls required (SB7 and Chapter 117) by the TCEQ on units across the State (with the exception of some cogeneration units in the HGB area, which are addressed in the previous section), requiring no additional controls to be modeled on existing Acid Rain units, which make up approximately 85 percent of the EGU NO_x in the State. 3Q05 is representative of 2009 level emissions for the Acid Rain units.

EGUs that were retired or shutdown since 2000 were removed from the future EI. No Acid Rain units were removed from the EI; however, approximately 25 tpd of non-acid rain NO_x has been removed from the inventory due to retirement or shutdown.

If the ARPDDB contained zero emissions for a non-retired EGU, the TCEQ checked with the facility to obtain its current operational status. For example, if a facility reported it was temporarily shut-down (e.g., for maintenance) during 3Q05, and third quarter 2004 (3Q04) ARDB data was available, the 3Q04 data was used, since it was more representative of the future emissions of that particular unit.

EGUs with the status of Reliability Must Run in 3Q05 have applied to ERCOT to curtail operations. With new capacity coming online in the future, the TCEQ expects that these EGUs will receive approval for shutdown of these units, and therefore, the TCEQ removed these emissions from the 2009 EI.

EGUs with an official status of “mothballed” within ERCOT or Southeast Electric Reliability Council Reliability Corporation (Entergy grid in far southeast Texas) or Southwest Power Pool covering far northeast Texas and most of the Panhandle), have also been removed from the 2009 future case EI. Based on ERCOT’s *Report on the Capacity, Demand, and Reserves in the ERCOT Region, June 2005* (ERCOT, 2005), TCEQ has concluded that the 2009 EGU inventory has sufficient capacity to meet the ERCOT forecasted demand (plus ERCOT’s reserve margin) for 2010. Including the mothballed units in the 2009 inventory would therefore result in excess emissions being modeled in 2009. Table II-2 shows that deleting mothballed units in Texas results in approximately a 50 tpd NO_x decrease Statewide.

To estimate the 2009 emissions for the non-Acid Rain EGUs in the attainment counties of Texas, TCEQ applied the individual or system-average SB7 expected reductions to EGUs that have SB7 allowances, and applied Chapter 117 system cap allowances to the remainder of the EGUs that do not report to the ARDB.

The growth in EGUs is accounted for via the addition of permitted new EGUs that are expected to be operational between 2005 and 2009. This growth should not be in excess of the electricity demand that the State requires (plus ERCOT’s reliability margin). ERCOT’s megawatts demand projections (as of October 2005) through 2009 were used, and it was verified that the megawatt demand between 2005 and 2009 will be met with the megawatt capacity provided by the newly permitted EGUs. All newly-permitted EGUs that are expected to be operational by 2009 are modeled at their permitted NO_x emission levels.

These newly-permitted EGUs total 29 units/stacks at 10 facilities. All are gas-fired, except the Sandow 5 units (lignite-fired, to be operated by Luminant) at ALCOA in Milam County. As of June 2006, all 29 of these units have been issued permits, and all are scheduled to be operational prior to October 2009. The newly-permitted units add approximately 19 tpd of NO_x to the 2009 inventory.

Whenever available from a permit Maximum Allowable Emission Rate Table, the 30-day-pounds per hour emissions limitation was used. These limitations on some Maximum Allowable Emission Rate Tables represent a compromise between the standard short-term allowable pounds per hour (that often includes maintenance, startup and shutdown emissions) and the standard long-term permit allowable tpd. The short term, when converted to tpd, is often substantially more than a unit would realistically emit in any day; the long-term, when converted to tpd may often under-represent what a unit could emit during any one day, especially during a summer day during the ozone season. Therefore, a 30-day average pounds per hour limitation is a reasonable representation of the emissions during the modeled ozone episode.

In developing a future EI, TCEQ has historically modeled only those units that (1) have been issued a permit, and (2) are expected to be operational prior to the attainment date.

Approximately 16 additional solid fuel-fired (lignite, Powder River Basin coal, or petroleum coke) units have submitted permit applications to TCEQ, as of July 2006. Much of the emissions from these proposed units will be offset by reductions/curtailments/retirement of existing, less-efficient, units that have higher emissions rates.

As stated above, the 2009 EGU inventory includes the growth due to the newly-permitted natural gas-fired units and the Sandow 5 lignite coal boilers (that replace the units that are included in the 2009 EI as shutdown, due to the ALCOA Agreed Order), but does not include any of the proposed solid fuel-fired EGUs for which TCEQ received applications after November 2003, because not enough information was known about those units.

In fact, CPS Energy has “netted-out” their newly-proposed unit, JK Spruce 2, with reductions at its other local units; hence, the net effect of the CPS JK Spruce 2 unit would be zero emissions increase. This is likely also the case for the majority of the proposed Luminant units. Table II-3 provides a list of the newly-permitted EGUs and represents modeled EGU growth in the State.

Table II-3 shows no VOC controls on emissions for EGUs. The only EGU VOC reductions that occur are coincident with the retirement of a unit.

Table II-3. New Texas EGUs (3Q05 to 2009) as of June 2006

Account ¹	Facility	FIN/EPN	In Grid? ²	County	NO _x (tpd)	VOC (tpd)	CO (tpd)
JE0005H	Port Arthur Texas Refinery	AUXBOIL1/N14A	Yes	Jefferson	0.16	0.02	0.19
JE0005H	Port Arthur Texas Refinery	GTG-HRSG1/N20A	Yes	Jefferson	0.18	0.05	0.65
JE0005H	Port Arthur Texas Refinery	GTG-HRSG2/N20B	Yes	Jefferson	0.29	0.05	0.65
JE0005H Total					0.64	0.11	1.48
CB0028T	Union Carbide	COGEN/1180	Yes	Calhoun	0.50	0.04	0.64
CB0028T Total					0.50	0.04	0.64
CB0038Q	Formosa Plastics	COGEN6/7G	Yes	Calhoun	0.46	0.01	0.74
CB0038Q Total					0.46	0.01	0.74
HV0000X	Cobissa – Greenville	GTDB1/GTDB1	Yes	Hunt	0.68	4.43	1.11
HV0000X	Cobissa – Greenville	GTDB1/GTDB1	Yes	Hunt	0.68	4.43	1.11
HV0000X	Cobissa – Greenville	GTDB2/GTDB2	Yes	Hunt	0.68	4.43	1.11
HV0000X	Cobissa – Greenville	GTDB3/GTDB3	Yes	Hunt	0.68	4.43	1.11
HV0000X	Cobissa – Greenville	GTDB4/GTDB4	Yes	Hunt	0.68	4.43	1.11
HV0000X	Cobissa – Greenville	GTDB5/GTDB5	Yes	Hunt	0.68	4.43	1.11
HV0000X Total					4.08	26.56	6.65
JC0003K	MeadWestvaco Evadale	T-01/T-01	Yes	Jasper	0.18	0.03	0.26
JC0003K	MeadWestvaco Evadale	T-02/T-02	Yes	Jasper	0.10	0.03	0.25
JC0003K Total					0.27	0.05	0.50
MM0001T	Sandow Station	P17CFB1/17CFB	Yes	Milam	3.55	0.18	3.55
MM0001T	Sandow Station	P17CFB2/17CFB	Yes	Milam	3.55	0.18	3.55
MM0001T Total					7.10	0.36	7.10
NE0462W	Corpus Christi Cogeneration	AB1/AB1	Yes	Nueces	0.23	0.03	0.34
NE0462W	Corpus Christi Cogeneration	AB2/AB2	Yes	Nueces	0.23	0.03	0.34
NE0462W	Corpus Christi Cogeneration	AB3/AB3	Yes	Nueces	0.23	0.03	0.34
NE0462W	Corpus Christi Cogeneration	CU3/CU3	Yes	Nueces	1.98	0.24	1.40
NE0462W Total					2.66	0.34	2.41
WF0000X	Navasota Wharton		Yes	Wharton	0.28	0.89	0.04
WF0000X	Navasota Wharton		Yes	Wharton	0.28	0.89	0.04
WF0000X	Navasota Wharton		Yes	Wharton	0.28	0.89	0.04
WF0000X	Navasota Wharton		Yes	Wharton	0.28	0.89	0.04

Account ¹	Facility	FIN/EPN	In Grid? ²	County	NO _x (tpd)	VOC (tpd)	CO (tpd)
WF0000X Total					1.14	3.58	0.18
EB0000X	Navasota Ector		No	Ector	0.26	0.82	0.04
EB0000X	Navasota Ector		No	Ector	0.26	0.82	0.04
EB0000X	Navasota Ector		No	Ector	0.26	0.82	0.04
EB0000X	Navasota Ector		No	Ector	0.26	0.82	0.04
EB0000X Total					1.03	3.29	0.17
YA0000X	Golden Spread Elec Coop	TURB1/TURB1	No	Yoakum	0.68	0.03	0.35
YA0000X	Golden Spread Elec Coop	GEN1/GEN1	No	Yoakum	0.09	0.00	0.01
YA0000X Total					0.77	0.04	0.36
Grand Total					18.64	34.37	20.23
¹ New units at new accounts may have a placeholder account number assigned for completeness purposes only. ² "In Grid?" indicates whether the account is within the modeling domain.							

B. STATES OUTSIDE OF TEXAS

EPA's 2010 Clean Air Interstate Rule (CAIR) modeling files, dated October 2005, were used for EGU emission estimates in States outside of Texas (EPA, 2005). Phase I CAIR controls were included in these emission projections. EPA conducted revised final Integrated Planning Model (IPM) modeling that reflects the final CAIR control strategy. The final IPM modeling includes regional annual SO₂ and NO_x caps on the 23 States and the District of Columbia for States required to make annual reductions, and includes a regional ozone season NO_x cap on the 25 States and DC required to make ozone season reductions. EPA modeled the final CAIR NO_x strategy as an annual NO_x cap with a nested, separate ozone season NO_x cap.

IPM has been used for evaluating the economic and emission impacts of environmental policies for over a decade. The model's base case incorporates Title IV of the Clean Air Act (the acid rain program), the NO_x SIP Call, various New Source Review (NSR) settlements, and several State rules affecting SO₂ and NO_x emissions that were completed prior to April 2004. The NSR settlements include agreements between EPA and Southern Indiana Gas and Electric Company (Vectren), Public Service Enterprise Group, Tampa Electric Company, We Energies (WEPCO), Virginia Electric and Power Company (Dominion), and Santee Cooper. IPM also includes current and expected future State emission control programs in Connecticut, Illinois, Maine, Massachusetts, Minnesota, New Hampshire, North Carolina, New York, Oregon, Texas, and Wisconsin. IPM includes States rules that were on-the-books and/or approved by a State's legislature or environmental agency.

The results of the EPA CAIR Modeling show that significant NO_x emission reductions occur across the control region, and with CAIR, ozone season NO_x emissions are lower than they would have been with the NO_x SIP Call. For NO_x, the annual CAIR NO_x cap achieves greater emission reductions during the ozone season than the NO_x SIP Call summer requirement. EPA estimates that CAIR reduces CAIR region annual NO_x emissions by 1.3 million tons and ozone season emissions by 0.2 million tons from a base case that includes the Title IV Acid Rain Program, the NO_x SIP Call, and State rules as of March 2004. Table II-4 has post-control 2010 ozone season (5-month) NO_x tons.

While Table II-4 does not include Texas estimates, EPA estimated 2010 Texas EGU ozone season NO_x emissions to be 80.5 thousand tons. This compares with TCEQ's 2009 EGU NO_x estimate of 582.75 tpd. If the TCEQ daily emissions were constant throughout a 153 day ozone

season, the TCEQ ozone season (5 month) estimate would be 89.2 thousand tons. These Texas EGU NO_x estimates are comparable because the OSD times 153 day estimate would be expected to be higher than the ozone season estimate that accounts for weekday-weekend emission differences.

Table II-4. Non-Texas U.S. State NO_x Emissions

State	2010 Ozone Season NO_x (thousand tons)*
Alabama	29.0
Arkansas	14.4
Connecticut	3.2
Delaware	3.6
District of Columbia	0.0
Florida	32.9
Georgia	47.4
Illinois	29.1
Indiana	53.4
Iowa	20.1
Kansas	40.0
Kentucky	43.4
Louisiana	15.9
Maine	0.8
Maryland	6.5
Massachusetts	8.4
Michigan	37.6
Minnesota	16.5
Mississippi	13.9
Missouri	29.5
Nebraska	21.9
New Hampshire	1.2
New Jersey	5.6
New York	16.9
North Carolina	25.6
North Dakota	29.4
Ohio	39.9
Oklahoma	36.5
Pennsylvania	37.9
Rhode Island	0.2
South Carolina	15.9
South Dakota	6.4
Tennessee	15.9
Vermont	0.0
Virginia	18.5
Washington	11.5
West Virginia	25.8
Wisconsin	22.5
Total	777.3
*Ozone season tons are for the May-September 5-month period.	

C. CANADA

The 1995 Ontario point source emissions file was obtained from Environment Canada. The 2009 Canadian EGU emissions were assumed to be equivalent to the 1995 emissions. Not enough information was available to project this inventory to the future.

D. MEXICO

The 2009 EGU emissions for Mexico were assumed to be equivalent to the 1999 calendar year Mexico emission inventory (ERG and Trans Engineering, 2006). Not enough information was available to project this inventory to the future.

E. GULF OF MEXICO (OFFSHORE) SOURCES

The 2000 Gulf-wide Emissions Inventory (GWEI), developed under contract to the Minerals Management Service (MMS), was used to estimate point source emissions (Wilson et al., 2004). It is unlikely that any EGUs are offshore.

F. REFERENCES

EPA, 2005: U.S. Environmental Protection Agency, "Regulatory Impact Analysis for the Final Clean Air Interstate Rule," Office of Air and Radiation, Research Triangle Park NC, EPA-452/R-05-002, March 2005.

ERCOT, 2005: ERCOT, "Report on the Capacity, Demand, and Reserves in the ERCOT Region," Taylor, TX, June 2005.

ERG and Trans Engineering, 2006: Eastern Research Group, Inc., Sacramento, CA and Trans Engineering, El Paso, TX, "Mexico National Emission Inventory, 1999: Final," prepared for Secretariat of the Environment and Natural Resources and the National Institute of Ecology of Mexico, with sponsorship of: U.S. Environmental Protection Agency, Western Governors' Association, and the North American Commission for Environmental Cooperation, October 11, 2006.

TCEQ, 2007a: Texas Commission on Environmental Quality, "Revisions to the State Implementation Plan (SIP) for the Control of Ozone Air Pollution, Dallas-Fort Worth Eight-Hour Ozone Nonattainment Area Attainment Demonstration," Austin, TX, May 23, 2007.

TCEQ, 2007b: Texas Commission on Environmental Quality, "Chapter 101 General Air Quality Rules, Subchapter H: Emissions Banking and Trading," Austin, TX, effective August 16, 2007.

Wilson et al., 2004: Wilson, D.L., J.N. Fanjoy, and R.S. Billings, "Gulfwide Emission Inventory Study for the Regional Haze and Ozone Modeling Effort: Final Report," U.S. Dept. of

Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA,
OCS Study MMS 2004-072, 273 pp, 2004.

CHAPTER III. POINT SOURCES – NON-ELECTRICITY GENERATING UNITS

This chapter describes the methods used to project non-EGU point source emissions for Texas and other areas within the domain modeled for the DFW SIP adopted by the TCEQ in May 2007. The information in this chapter is taken from the DFW and HGB SIP documents (TCEQ, 2007 and TCEQ, 2004), and additional information provided by TCEQ staff.

A. TEXAS SOURCES

Within the State of Texas, 2009 non-EGU point source emission projection methods are specific to each of five geographic areas to account for the geographic applicability of control programs affecting non-EGU point source categories. While no controls are modeled in West Texas attainment counties, the following control programs are modeled in each of the other four geographic areas:

- DFW nonattainment area: Chapter 117 controls,¹ 5% Increment of Progress Plan (Industrial, Commercial, Institutional [ICI] Gas-fired Stationary, Reciprocating Internal Combustion Engine² and Surface Coating³) controls, Cement Kiln controls,⁴ and Major ICI Combustion source controls.⁵
- HGB nonattainment area: Mass Emissions Cap and Trade (MECT) Program⁶ and Highly Reactive VOC (HRVOC) Emissions Cap and Trade Program.⁷
- BPA nonattainment area: Agreed Orders/Consent Decrees for Premcor, Exxon Chemicals, and Motiva in Jefferson County; and

¹ 30 TAC Chapter 117-Control of Air Pollution from Nitrogen Compounds, Subchapter D-Combustion Control at Minor Sources in Ozone Nonattainment Areas, Division D-Dallas-Fort Worth Eight-Hour Ozone Nonattainment Area Minor Sources, §§117.2100-117.2145.

² 30 TAC Chapter 117-Control of Air Pollution from Nitrogen Compounds, Subchapter B-Combustion Control at Major Industrial, Commercial, and Institutional Sources in Ozone Nonattainment Areas, Division 2-DFW Ozone Nonattainment Area Major Sources; §§117.200-117.256.

³ 30 TAC Chapter 115-Control of Air Pollution from Volatile Organic Compounds; Subchapter E-Solvent-Using Processes; Division 2-Surface Coating Processes; §§101.420-101.429.

⁴ 30 TAC Chapter 117-Control of Air Pollution from Nitrogen Compounds; Subchapter E-Multi-Region Combustion Controls; Division 2-Cement Kilns; §§117.3100-117.3145.

⁵ 30 TAC Chapter 117-Control of Air Pollution from Nitrogen Compounds; Subchapter B-Combustion Control at Major Industrial, Commercial, and Institutional Sources in Ozone NAAs; Division 4-DFW 8-Hour Ozone NAA Major Sources; §§117.400-117.456.

⁶ 30 TAC Chapter 101-General Air Quality Rules; Subchapter H-Emissions Banking and Trading; Division 3-Mass Emissions Cap and Trade Program; §§101.350-101.363.

⁷ 30 TAC Chapter 115-Control of Air Pollution from Volatile Organic Compounds; Subchapter H-Highly-Reactive Volatile Organic Compounds; Division 1-Vent Gas Control; §§115.720-117.729, Division 2-Cooling Tower Heat Exchange Systems; §§115.760-117.769, and Division 3-Fugitive Emissions; §§115.780-117.789.

- East Texas attainment area: Agreed Orders/Consent Decrees⁸ and East Texas Combustion rule.⁹

Table III-1 summarizes Texas base year and projected post-control 2009 non-EGU point source NO_x emissions by geographic area. Table III-2 presents Texas base year and projected post-control 2009 non-EGU point source VOC emissions by geographic area.

Table III-1. Summary of Texas Base Year and 2009 Year Non-EGU Point Source NO_x Emissions (tons per day [tpd])

Geographic Area	Data Source	Base Year (2000)	2009 Year	Percentage of 2009 Emissions by Geographic Area
DFW	OSD	17.16	12.76	
	MidloKilns	32.33	16.37	
<i>Subtotal</i>		<i>49.49</i>	<i>29.13</i>	<i>3.4%</i>
HGB	OSD	201.44	77.55	
	SI	74.46	28.67	
<i>Subtotal</i>		<i>275.90</i>	<i>106.22</i>	<i>12.4%</i>
BPA	OSD	59.34	50.94	
	SI	29.35	21.23	
<i>Subtotal</i>		<i>88.69</i>	<i>72.17</i>	<i>8.4%</i>
East Texas	<i>Subtotal</i>	<i>457.21</i>	<i>399.93</i>	<i>46.7%</i>
West Texas	<i>Subtotal</i>	<i>265.78</i>	<i>248.29</i>	<i>29.0%</i>
State Total		1,137.07	855.74	

OSD: Ozone Season Day, 2000 Point Source Database (PSDB)

MidloKilns: 10 cement kiln stacks in Midlothian, Ellis County.

SI: Texas AQS 2000 Special Inventory

⁸ Eastman Kodak agreed orders 2000-0033-SIP (2000) and 2001-0880-RUL (2001) and Alcoa consent decree 68 FR 20171 (April 24, 2003).

⁹ 30 TAC Chapter 117-Control of Air Pollution from Nitrogen Compounds; Subchapter E-Multi-Region Combustion Controls; Division 4-East Texas Combustion; §§117.3300-117.3345.

Table III-2. Summary of Texas Base Year and 2009 Year Non-EGU Point Source VOC Emissions (tons per day [tpd])

Geographic Area	Data Source	Base Year (2000)	2009 Year	Percentage of 2009 Emissions by Geographic Area
DFW	OSD	28.72	29.32	
	MidloKilns	2.28	2.00	
<i>Subtotal</i>		<i>31.00</i>	<i>31.32</i>	<i>4.5%</i>
HGB	OSD	175.98	207.44	
	SI	27.61	44.36	
<i>Subtotal</i>		<i>203.59</i>	<i>251.8</i>	<i>36.4%</i>
BPA	OSD	58.46	60.31	
	SI	9.62	9.92	
<i>Subtotal</i>		<i>68.08</i>	<i>70.23</i>	<i>10.1%</i>
East Texas	<i>Subtotal</i>	<i>194.37</i>	<i>216.43</i>	<i>31.3%</i>
West Texas	<i>Subtotal</i>	<i>114.53</i>	<i>122.69</i>	<i>17.7%</i>
State Total		611.57	692.47	

OSD: Ozone Season Day, 2000 Point Source Database (PSDB)

MidloKilns: 10 cement kiln stacks in Midlothian, Ellis County.

SI: Texas AQS 2000 Special Inventory

1. DFW, HGB, and BPA Sub-areas

With the exception of NO_x emissions in the HGB area, the first step in projecting VOC and NO_x emissions for each ozone nonattainment area was to estimate the use of banked emission reduction credits in 2009 (credits are needed to obtain New Source Review emissions offsets when existing facilities expand or new facilities come on-line). TCEQ's projection procedure assumed that each area's total banked VOC and NO_x emission credits would be used in the 2009 ozone season.

The procedure for incorporating the banked emissions was to first extract the banked emissions by nonattainment area as found in TCEQ's Emissions Banking and Trading (EBT) Emission Reduction Credit (ERC) and Discrete Emission Reduction Credit (DERC) Registries. TCEQ used the August 17, 2005 ERC and DERC totals for each of the nonattainment areas in this step. Because Chapter 101 of 30 TAC requires that an ERC must be surplus to any federal, state or local rule, TCEQ devalued the credits to reflect the amount of reduction that is surplus to the Chapter 117 Emission Specifications for Attainment Demonstration (ESADs). In addition, TCEQ incorporated the Chapter 101 Mass Emissions Cap and Trading (MECT) program DERC use restrictions into computing banked NO_x emissions. Finally, TCEQ adjusted the banked emission totals for the DFW and BPA areas to reflect both the required offset ratios of 1.15:1 and 1.10:1, respectively, as well as the Chapter 101 requirement to retire an additional 10 percent of DERCs as an environmental contribution.

Carbon monoxide emissions in each nonattainment area were projected using growth factors developed from data compiled from the Dallas Federal Reserve Bank's Texas Industrial Production Index (TIPI) and EPA's Economic Growth Analysis System (EGAS) Version 4.0. The TIPI/EGAS growth factors were developed and applied at the Standard Industrial Classification (SIC) code level. While EGAS develops forecast year growth factors representing projected changes in emission activity, the TIPI data provide historical production indices. The TCEQ developed forecasts for these indices via simple linear extrapolation of the historical data. The TIPI-based growth rates were applied to all sources with SIC codes that matched the available data from TIPI. All other projections were based on EGAS data.

a. DFW Area

In addition to reflecting the ERCs and DERCs for the DFW nonattainment area, the 2009 projections incorporated the effect of:

- Chapter 117 controls (0.32 tpd NO_x reduction);
- Controls incorporated into the 5 percent Increment of Progress Plan (2.72 tpd NO_x reduction and 0.08 tpd VOC reduction); and
- Major ICI Combustion source controls (10.4 tpd NO_x reduction from cement kilns and 9 tpd NO_x reduction from other major sources).

b. HGB Area

For NO_x emission sources in the HGB area affected by the MECT program, TCEQ held 2009 emissions constant at base year levels reflecting the NO_x-constraining effect of the MECT program. A no growth assumption was assumed for non-MECT NO_x sources because they are a very small portion of the overall NO_x emissions inventory in the HGB area. For VOC emission sources, TCEQ incorporated the effect of the HRVOC (ethylene, propylene, 1,3-butadiene, and butenes) emission cap and trade program.

c. BPA Area

After reflecting the ERCs and DERCs in the BPA area, TCEQ modeled NO_x reductions of 26.25 tpd from Chapter 117 controls. In addition, 0.21 tpd of NO_x reductions and VOC reductions of 0.02 tpd were incorporated reflecting the Agreed Orders for three companies in Jefferson County (Premcor, Exxon Chemicals, and Motiva).

2. Attainment Areas Within Texas

For the Texas attainment area counties in the modeling domain, TCEQ projected emissions growth using the same approach that was used to forecast CO emissions in nonattainment areas. In particular, TCEQ first compiled historical state-level production indices by SIC code from the Dallas Federal Reserve Bank's Texas Industrial Production Index (TIPI). Next, TCEQ forecast these indices to 2009 using a simple linear extrapolation of the historical data back to 1964. The 2009/2000 ratios were then computed and applied by 2-digit SIC code to base year inventory

sources. In cases where a particular SIC code was not available from TIPI, TCEQ compiled and applied growth factors from EPA's EGAS Version 4.0.

a. East Texas

Incorporating the effect of Eastman Kodak and Alcoa Agreed Orders resulted in a 50.61 tpd reduction in projected NO_x emissions and a 0.42 reduction in projected VOC emissions in the East Texas attainment area. TCEQ also estimated point source reductions of 16.5 tpd in NO_x from the East Texas Combustion rule, which applies to rich-burn stationary gas-fired point source engines in 33 identified attainment counties.¹⁰

b. West Texas

There were no control programs modeled in the 2009 DFW SIP projections for the West Texas attainment area.

B. STATES OUTSIDE OF TEXAS

The EPA's 2010 Clean Air Interstate Rule (CAIR) modeling files, dated October 2005, were used for non-EGU point source emission estimates in States outside of Texas (EPA, 2005). Phase I CAIR controls were included in these emission projections.

Emission Activity Growth Projections

EPA used three data sources to project non-EGU point source emissions:

- Regional and national fuel-use forecast data from the U.S. Department of Energy for SCCs that map to fuel use sectors (e.g., commercial coal, industrial natural gas).
- State-specific growth rates from the Regional Economic Model, Inc. (REMI) Policy Insight® model, version 5.5 (also used in version 5.0 of the Economic Growth Analysis System [EGAS]). Assigned to sources by state and standard industrial code (SIC), unless the inventory SIC was invalid or missing, in which case state and SCC were used.
- A review of REMI-based rates led to changes to the growth rates for some sectors. In particular, EPA made specific changes to industries with significant emissions and unexplainably large growth rates relative to industry group forecasts, Bureau of Labor Statistics (BLS) projections, and historical industry growth computed from 1997-2002 Bureau of Economic Analysis (BEA) data.

Emission Control Projections

Table III-3 summarizes the non-EGU point source NO_x and VOC control programs modeled in EPA's CAIR emission projections.

¹⁰ This rule also resulted in NO_x reductions of 5.9 tpd from area sources in the East Texas attainment area.

Table III-3. Non-EGU Point Source Controls Modeled in CAIR Projections

Major Control Description	Specific Control Description	Pollutants Affected
NO _x SIP Call (Phase II)		NO _x
Solid waste rules (Sections 129/111(d))	Hospital/Medical/Infectious Waste Incinerator Regulations	NO _x
DOJ Settlements		NO _x
1-hr ozone non-attainment SIPs		NO _x , VOC
Reciprocating Internal Combustion Engines (RICE) MACT (10-year)		NO _x , VOC
2-year rules MACTs affecting VOC	Synthetic Organic Chemical Manufacturing Industry (SOCMI)	VOC
	Hazardous Organic NESHAP (HON)	
	Acrylonitrile manufacture	
	Ethylene manufacture	
	Ethylene oxide manufacture	
	Phenol manufacture	
	Polyethylene manufacture	
	Polypropylene manufacture	
	SOCMI fugitives (equipment leak detection and repair)	
	SOCMI processes	
	SOCMI wastewater	
	Volatile organic liquid storage	
Dry cleaning		
Benzene National Emission Standards for Hazardous Air Pollutants (NESHAP)		VOC
4-year MACTs affecting VOCs	Aircraft surface coating (aerospace)	VOC
	Polymers and resins II	
	Polymers and resins IV	
	Shipbuilding and repair	
	Styrene-butadiene rubber manufacture (polymers & resins group I)	
	TSDFs (offsite waste operations)	
	Wood furniture surface coating	
Petroleum Refineries: Other Sources		VOC
Degreasing Organic Cleaners (Halogenated Solvent Cleaners)		VOC
Printing and Publishing		VOC
Gasoline Distribution (Stage 1)		VOC
7/10-year MACTs affecting VOCs	Pesticide Active Ingredient Production	VOC
	Alkyd resins	
	Chelating agents	
	Explosives	
	Fabric Printing, Coating, and Dyeing	
	Flatwood surface coating	

Major Control Description	Specific Control Description	Pollutants Affected
	Green tire spray	
	Large Appliances	
	Nylon 6 production	
	Oil and natural gas production	
	Paint and varnish manufacture	
	Paper surface coating	
	Petroleum refineries - fluid catalytic cracking	
	Pharmaceutical production	
	Phthalate plasticizers	
	Plywood/particle board	
	Polyester resins	
	Polyesters	
	Polymers and resins III	
	Polyvinyl chloride	
	Publicly-Owned Treatment Works (POTWs)	
	Pulp and paper production	
	Rayon production	
	Reinforced plastics	
	Rubber tire manufacture	
	Spandex production	
Post-2002 MACT	Asphalt Processing and Roofing MACT	VOC
	Auto and Light-Duty Truck Manufacturing MACT	
	Coke Ovens MACT	
	Combustion Sources at Kraft, Soda and Sulfite Paper Mills MACT	
	Fabric Printing, Coating and Dyeing MACT	
	Iron & Steel Foundries MACT	
	Metal Can MACT	
	Metal Coil MACT	
	Metal Furniture MACT	
	Misc. Metal Parts and Products MACT	
	Municipal Solid Waste Landfills MACT	
	Paper and Other Web MACT	
	Plastic Parts MACT	
	Plywood & Composite Wood Products MACT	
	Wet Formed Fiberglass Production MACT	
	Wood Building Products MACT	

C. CANADA

A 1995 point source emissions file was obtained from Environment Canada. Because information was not available to project this inventory to the future, 2009 Canadian non-EGU point source emissions were assumed to be equivalent to the 1995 emissions.

D. MEXICO

The 2009 non-EGU emissions for Mexico were assumed to be equivalent to the 1999 calendar year Mexico emission inventory that was produced by ERG (ERG and Trans Engineering, 2006). Not enough information was available to project this inventory to the future.

E. GULF OF MEXICO (OFFSHORE) SOURCES

In lieu of any information on projected emission changes, the 2000 Gulf-wide Emissions Inventory, developed under contract to the Minerals Management Service, was used to estimate 2009 point source emissions (Wilson, D.L., J.N. Fanjoy, and R.S. Billings, 2004).

F. REFERENCES

- EPA, 2005: U.S. Environmental Protection Agency, "Clean Air Interstate Rule Emissions Inventory Technical Support Document," Office of Air and Radiation, Research Triangle Park NC, March 4, 2005.
- ERG and Trans Engineering, 2006: Eastern Research Group, Inc., Sacramento, CA and Trans Engineering, El Paso, TX, "Mexico National Emission Inventory, 1999: Final," prepared for Secretariat of the Environment and Natural Resources and the National Institute of Ecology of Mexico, with sponsorship of : U.S. Environmental Protection Agency, Western Governors' Association, and the North American Commission for Environmental Cooperation, October 11, 2006.
- TCEQ, 2004: Texas Commission on Environmental Quality, "Revisions to the State Implementation Plan (SIP) for the Control of Ozone Air Pollution, Houston/Galveston/Brazoria Ozone Nonattainment Area," Austin, TX, December 1, 2004.
- TCEQ, 2007: Texas Commission on Environmental Quality, "Revisions to the State Implementation Plan (SIP) for the Control of Ozone Air Pollution, Dallas-Fort Worth Eight-Hour Ozone Nonattainment Area Attainment Demonstration," Austin, TX, May 23, 2007.
- Wilson, D.L., J.N. Fanjoy, and R.S. Billings, 2004: "Gulfwide Emission Inventory Study for the Regional Haze and Ozone Modeling Effort: Final Report," U.S. Dept. of Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA, OCS Study MMS 2004-072, 273 pp, 2004.

CHAPTER IV. AREA SOURCES

Area sources include commercial, small-scale industrial and residential categories of sources that use materials or operate processes that can generate emissions. These sources of emissions fall below the point source reporting levels and are too numerous or too small to identify individually. Emissions from these sources are estimated on a source category or group basis. These emissions are typically calculated by multiplying an established emission factor by the appropriate activity (or suitable surrogate) responsible for generating emissions.

This chapter describes the methods used to project area source emissions for Texas and other areas within the modeling domain for the 2007 DFW SIP. The information in this chapter is taken from the DFW SIP document (TCEQ, 2007) and additional information provided by TCEQ.

A. TEXAS SOURCES

Texas 2009 area source emission projections were developed by using growth factors available from EPA's Economic Growth Analysis System (EGAS), version 4.0. EGAS 4.0 incorporates State-specific growth rates from the Regional Economic Model, Inc. (REMI) Policy Insight® model. EGAS contains individual growth factors for each area source category for specific years. Table IV-1 summarizes the projection methods used for area source category emissions for Texas. From available documentation, it appears that area sources in all areas of the State, including the DFW, HGB, and BPA sub-areas, were grown using REMI-EGAS (Torres, 2008).

Table IV-1. Area Source Emission Projection Methods for Texas

Pollutant	Area Source Subcategory	Projection Methodology
VOC	Architectural Coating	REMI/EGAS 4.0
VOC	Asphalt Paving	REMI/EGAS 4.0
VOC	Auto Refinishing	REMI/EGAS 4.0
VOC	Bakeries+Breweries	REMI/EGAS 4.0
VOC	Dry Cleaning	REMI/EGAS 4.0
VOC	Graphic Arts	REMI/EGAS 4.0
VOC, NO _x	Industrial Fuel Use	REMI/EGAS 4.0
VOC	Leaking Underground Storage Tanks	REMI/EGAS 4.0
VOC, NO _x	Oil+Gas Production	REMI/EGAS 4.0, with East Texas Combustion controls for select counties
VOC, NO _x	Open Burning	REMI/EGAS 4.0
VOC	Pesticide Use	REMI/EGAS 4.0
VOC	Petroleum Transport+Refueling	REMI/EGAS 4.0, with controls on portable gas containers Statewide, and Stage I for 5 surrounding DFW counties
VOC, NO _x	Residential Fuel Use	REMI/EGAS 4.0
VOC	Solvent Use	REMI/EGAS 4.0
VOC	Surface Cleaning	REMI/EGAS 4.0
VOC	Surface Coating	REMI/EGAS 4.0, with controls on selected coatings for 5 surrounding DFW counties
VOC	Traffic Marking	REMI/EGAS 4.0
VOC	Waste Treatment	REMI/EGAS 4.0

In certain cases, additional controls were applied to 2009 emissions for the entire State, or for specific areas of the modeling domain (MacKay, 2008a).

EGAS 4.0 provided Texas growth factors for the following geographic areas (nonattainment areas were defined as of November 6, 1991).

1. HGB nonattainment area;
2. BPA nonattainment area;
3. El Paso nonattainment area; and
4. Rest-of-State.

Additional details for estimating 2009 area source emissions in each region of the State are provided below.

1. DFW, HGB, and BPA Sub-areas

a. DFW Area

The DFW 2009 area source emission inventory projections cover the DFW nine-county nonattainment area of Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, and Tarrant Counties. Table IV-2 presents the base year 2000 and forecast 2009 NO_x and VOC weekday emissions by area source category for the DFW area (TCEQ, 2007).

Table IV-2. 2000 and 2009 DFW Weekday Area Source Emissions before SIP Controls (tpd)

Area Source Subcategory	2000 NO_x	2009 NO_x	2000 VOC	2009 VOC
Architectural Coating	0	0	29.37	31.79
Asphalt Paving	0	0	5.36	6.57
Auto Refinishing	0	0	3.6	3.83
Bakeries+Breweries	0	0	0.85	1
Dry Cleaning	0	0	4.59	5.35
Graphic Arts	0	0	1.75	2.21
Industrial Fuel	24.07	26.83	0.64	0.71
Leaking Underground	0	0	2.96	3.56
Oil+Gas Producers	11.92	14.27	6.98	8.36
Open Burning	0.47	0.52	3.13	3.38
Pesticide Use	0	0	0.01	0.01
Petro Transport+Refueling	0	0	33.26	35.37
Residential Fuel Use	3.35	3.41	0.19	0.2
Solvent use	0	0	57.53	66.56
Surface Cleaning	0	0	1.42	2.19
Surface Coating	0	0	64.49	88.78
Traffic Marking	0	0	0.65	0.71
Waste Treatment	0	0	9.28	11.14
Totals	39.81	45.03	226.06	271.72

In conducting the SIP modeling, area source controls were modeled using conventional control packets applied to 2009 emissions for the appropriate area source Source Classification Codes (SCCs) and counties. Area source control measures included the surface coating rule and Stage I vapor recovery for the five surrounding DFW area counties, including Ellis, Johnson, Kaufman, Parker, and Rockwall counties. Reductions associated with the DFW minor source rule were applied to the nine-county DFW area. The minor source rule reductions were applied for non-point industrial and commercial boilers and engines, as well as oil and gas production SCCs. Finally, VOC portable fuel container reductions were modeled for the entire State of Texas, using an assumed control efficiency of 28 percent. Table IV-3 displays the typical daily VOC emission reductions achieved in the DFW area after these control measures were applied (TCEQ, 2007).

Table IV-3. 2009 DFW Nine-County Area Source Control Measures Applied

Control Measure	VOC Emissions Reductions (tpd)
Stage I vapor recovery for surrounding 5 counties	0.33
Surface coating requirements for the surrounding 5 counties	1.1
DFW Minor Source	2.9
Clean portable fuel containers	5.9
Total Reductions	10.23
2009 Total VOC Emissions (from Table IV-2)	271.72
2009 Total After Reductions	261.49

b. HGB Area

Control measures applied to the area source sector in the eight-county HGB area included a 28 percent VOC reduction in 2009 for clean portable fuel containers. In addition, a small amount of reductions for water heaters and stationary diesel engines associated with the Texas Emission Reduction Plan (TERP) program were also modeled.

c. BPA Area

Area source emissions for the BPA area were developed similar to area source emissions for the rest of the State. Growth was performed using REMI/EGAS4.0, and reductions associated with the portable fuel container rule were applied to the 2009 estimates.

2. Attainment Areas Within Texas

For the rest of the State, area source emissions were grown using REMI/EGAS4.0 growth factors. In addition, the Statewide portable fuel reductions were modeled as controls for the appropriate SCCs for all areas of the State. Controls specific to East Texas are described below.

a. East Texas

For multiple counties in eastern Texas, East Texas Combustion rules were modeled in 2009, resulting in NO_x emissions reductions of 5.9 tpd. Reductions were applied to the counties listed

in Table IV-4 for the non-point industrial oil and gas production category (SCC 2310001000). No controls were uniquely applied to counties in West Texas.

Table IV-4. Counties Modeled with East Texas Combustion Rule Reductions

FIPS Code	County	FIPS Code	County
48001	Anderson	48293	Limestone
48041	Brazos	48313	Madison
48051	Burleson	48315	Marion
48063	Camp	48343	Morris
48067	Cass	48347	Nacogdoches
48073	Cherokee	48349	Navarro
48159	Franklin	48365	Panola
48161	Freestone	48379	Rains
48183	Gregg	48395	Robertson
48185	Grimes	48401	Rusk
48203	Harrison	48419	Shelby
48213	Henderson	48423	Smith
48217	Hill	48449	Titus
48223	Hopkins	48459	Upshur
48231	Hunt	48467	Van Zandt
48287	Lee	48499	Wood
48289	Leon		

B. STATES OUTSIDE OF TEXAS

2009 emission projections from States outside of Texas were based on 2010 CAIR data (EPA, 2005). CAIR estimated growth for the area source sector as follows:

- Regional and national fuel-use forecast data from the U.S. Department of Energy was used for SCCs that map to fuel use sectors (e.g., commercial coal, industrial natural gas). These were assigned to sources by State/SCC.
- For the remaining SCCs, used State-specific growth rates from REMI and EGAS, version 5.0, assigned to sources by State and standard industrial classification (SIC) code, or by SCC in cases where the inventory SIC was invalid or missing.
- A review of REMI-based rates led to changes to the growth rates for some sectors. EPA made specific changes to industries with significant emissions and unexplainably large growth rates relative to industry group forecasts, Bureau of Labor Statistics projections, and Bureau of Economic Analysis data. Table IV-5 lists these improved growth rates by SIC classification.

Table IV-5. SICs with Improved Growth Factors Compared with REMI 5.5

SIC	SIC Description	2010/2001 GF
1311	Crude Petroleum and Natural Gas	0.96
1321	Natural Gas Liquids	0.96
2821	Plastics Material, Synthetic Resins and nonfulcanizable elastomers	1.19
2822	Synthetic Rubber	1.19
2823	Cellulosic Manmade Fibers	1.19
2851	Paints Varnishes, Lacquers, Enamels and Allied Products	1.19
2873	Nitrogenous Fertilizers	1.18
2874	Phosphatic Fertilizers	1.18
2895	Carbon Black	1.22
3011	Tires and Inner Tubes	1.2
3211	Flat Glass	1.19
3221	Glass Containers	1.19
3229	Pressed and Blown Glass and Glassware	1.19
3241	Cement, Hydraulic	1.19
3321	Gray and Ductile Iron Foundries	1.17
3325	Steel Foundries, NEC	1.17
3331	Primary Smelting and Refining of Copper	1.17
3334	Primary Production of Aluminum	1.17
3339	Primary Smelting and Refining of Nonferrous Metals, Except Copper and Aluminum	1.17
3411	Metal Cans	1.13
3441	Fabricated Structural Metal	1.13
3471	Electroplating, Plating, Polishing, Anodizing and Coloring,	1.13
3479	Coating, Engraving, and Allied Services, NEC	1.13
3497	Metal Foil and Leaf	1.13
3499	Fabricated Metal Products, NEC	1.13
3711	Motor Vehicles and Passenger Car Bodies	1.24
3713	Truck and Bus Bodies	1.24
3714	Motor Vehicle Parts and Accessories	1.24
3715	Truck Trailers	1.24

Table IV-6 summarizes the area source control programs modeled in EPA's CAIR emission projections.

Table IV-6. Non-Texas State Area Source Controls for CAIR

Control Strategies (Grouped by Affected Pollutants or Standard)	Pollutants Affected
1-hr ozone non-attainment SIPs	NO _x , VOC
Federal Control Measures (National) Consumer Solvents Onboard Vapor Recovery Systems; and Stage II for Gasoline Service Stations	VOC
Title III MACT (National) Wood Furniture Surface Coating Aerospace Surface Coating Marine Vessel Surface Coating (Shipbuilding) Halogenated Solvent Cleaners (Cold Cleaning) Petroleum Refinery Fugitives Synthetic Organic Chemical Manufacturing Industry Fugitives (Hazardous Organic National Emission Standards for Hazardous Air Pollutants) Motor Vehicle Surface Coating Large Appliances Wood Building Products Open Top & Conveyorized Degreasing Publicly Owned Treatment Works Metal Furniture & Appliances Surface Coating Miscellaneous Metal Parts Electronic Coating	VOC
Title I RACT Petroleum Dry Cleaning Paper Surface Coating	VOC
Residential Wood Combustion	CO, PM, VOC

C. CANADA

Canadian emissions estimates are derived from a year 2000 Environment Canada Inventory of NO_x and VOCs. TCEQ did not develop projections from the year 2000, but rather used year 2000 emissions estimates for their 2009 simulation. The assumption was made that given the distance between Canada and Texas, any difference between projected and actual emissions will have a minimal impact on the overall results (MacKay, 2008b).

D. MEXICO

VOC and NO_x emissions for Mexico are based on a 1999 Mexican National Emissions Inventory (NEI) (ERG and Trans Engineering, 2006). TCEQ used year 1999 emissions estimates for their 2009 modeling simulation. It was assumed that given the prevailing winds between Mexico and Texas, any difference between projected and actual emissions will have a minimal impact on the modeling (MacKay, 2008b).

E. GULF OF MEXICO (OFFSHORE) SOURCES

Stationary area sources were not included in the Gulf region offshore inventory (MMS, 2008).

F. REFERENCES

- EPA, 2005: U.S. Environmental Protection Agency, "Clean Air Interstate Rule Emissions Inventory Technical Support Document," Office of Air and Radiation, Research Triangle Park, March 4, 2005, <http://www.epa.gov/cair/pdfs/finaltech01.pdf>, accessed September 5, 2008.
- ERG and Trans Engineering, 2006: Eastern Research Group, Inc., Sacramento, CA and Trans Engineering, El Paso, TX, "Mexico National Emission Inventory, 1999: Final," prepared for Secretariat of the Environment and Natural Resources and the National Institute of Ecology of Mexico, with sponsorship of: U.S. Environmental Protection Agency, Western Governors' Association, and the North American Commission for Environmental Cooperation, October 11, 2006.
- MacKay, 2008a: Jim MacKay, Texas Commission on Environmental Quality, 2009 modeling files for the DFW 2007 SIP, transmitted via email from J. MacKay to J. Wilson, E.H. Pechan & Associates, Inc., September 5, 2008, and posted at: ftp://ftp.tceq.state.tx.us/pub/OEPAA/TAD/Modeling/file_transfer/TXareaNR/files/.
- MacKay, 2008b: Jim MacKay, Texas Commission on Environmental Quality, Personal communication with Jim Wilson, E.H. Pechan & Associates, Inc., September 2008.
- MMS, 2008: Minerals Management Service, U.S. Department of the Interior, "NIF Access Database of Non-point Sources Inventory," revised 2006, accessed September 5, 2008, http://www.gomr.mms.gov/homepg/regulate/environ/airquality/gulfwide_emission_inventory/2000GulfwideEmissionInventory.html.
- TCEQ, 2007: Texas Commission on Environmental Quality, "Revisions to the State Implementation Plan (SIP) for the Control of Ozone Air Pollution, Dallas-Fort Worth Eight-Hour Ozone Nonattainment Area Attainment Demonstration," Austin, TX, May 23, 2007.
- Torres, 2008: Melinda Torres, Texas Commission on Environmental Quality, personal communication with K. Thesing, E.H. Pechan & Associates, Inc., October 24, 2008.

[This page intentionally left blank.]

CHAPTER V. NONROAD (EPA NONROAD MODEL) SOURCES

This chapter addresses projection methods for nonroad engines included in EPA's NONROAD emission estimation model (hereafter called "NONROAD sources"). NONROAD sources include: outdoor power equipment, recreational vehicles, farm and construction machinery, lawn and garden equipment, aircraft and rail support equipment, and many other applications. NONROAD sources encompass a broad range of engine types and sizes, as well as fuel types (diesel, gasoline, liquefied petroleum gas, and compressed natural gas).

A. TEXAS SOURCES

NONROAD source projections for 2009 were generally developed using EPA's NONROAD2004 model. Calculation methods incorporated into NONROAD are based on information concerning equipment populations, engine horsepower, annual usage, load factor, and emission factors. Projection year inventories generated by NONROAD account for both future growth in activity and emissions reductions that will be achieved as a result of Federal engine and fuel-based standards. Table V-1 summarizes the methods used to develop 2009 forecasts for nonroad equipment subcategories in Texas. All of these sources contribute to ozone precursor emissions. Exceptions to the use of NONROAD2004 and its associated defaults are noted in the projection methodology column.

Table V-1. Nonroad Mobile Source Emission Projection Methods for Texas

Source Subcategory	Projection Methodology
Agriculture	NONROAD2004
Commercial vehicles, e.g., fork lifts	NONROAD2004
Construction	NONROAD2004, with local inputs for HGB counties
Ground Support Equipment	NONROAD2004
Industrial	NONROAD2004
Commercial Lawn+Garden	NONROAD2004, with local inputs Statewide
Residential Lawn+Garden	NONROAD2004, with local inputs Statewide
Railroad Maintenance	NONROAD2004
Logging	NONROAD2004
Other Oil Field Equipment	NONROAD2004, with revised county allocation Statewide based on active oil wells
Recreational Equipment	NONROAD2004
Recreational Boating	NONROAD2004, with local inputs Statewide

It should be noted that for the Other Oil Field equipment category, the county allocation in NONROAD2004 was revised using an alternate surrogate based on production data for active producing wells for each county. The NONROAD model allocates populations to counties based on the number of employees in the oil and gas industry, which includes office workers not involved in field operations, and overestimates the activity in counties with corporate offices (e.g., Harris County). There is some possibility that REMI/EGAS4.0 was used to prepare 2009 forecasts for this category, but no evidence was provided that an alternate projection method to NONROAD was actually used (Rubick, 2008).

The following sections provide more information about how the 2009 NONROAD source emissions were estimated for each area. The spatial improvements for oil field equipment apply to all areas of Texas discussed below.

1. DFW, HGB, and BPA Sub-areas

a. DFW Area

2009 NONROAD source emission estimates for the nine-county DFW area were prepared using the NONROAD2004 model. In addition, for several categories, Statewide equipment populations were updated in NONROAD based on surveys (ERG, 2003; Wells, 2002). These included commercial and residential lawn and garden equipment, as well as pleasure craft (i.e., recreational marine boating) (Iyer, 2008).

Table V-2 provides the nonroad sector weekday emission estimates for the DFW area for 2000 and 2009, before SIP controls were applied. Note that this table includes estimates for two categories not covered by NONROAD, including aircraft and locomotive, which are discussed in more detail in Chapter VI (TCEQ, 2007).

Table V-2. DFW Nonroad Weekday Totals (2000, 2009) before SIP Controls

Nonroad Category	2000 NO _x	2009 NO _x	2000 VOC	2009 VOC
Agriculture	4.3	3.72	0.65	0.42
Aircraft	14.75	21.01	2.72	3.87
Commercial	7.39	7.19	9.99	6.43
Construction	60.27	48.56	11.36	6.86
GSE	2.13	3.04	0.69	0.98
Industrial	21.37	12.57	5.31	2.51
Commercial Lawn+Garden	1.9	2.08	14.41	6.46
Residential Lawn+Garden	1.39	1.26	12.38	7.35
RR Maintenance	0.14	0.14	0.04	0.03
Logging	0.12	0.06	0.06	0.04
Locomotives	22.57	26.81	0.91	1.08
Oil+Gas	5.68	2.96	1.47	0.77
Recreational Equipment	0.23	0.26	3.8	6.8
Recreational Boating	0.19	0.3	4.06	2.29
Total	142.43	129.96	67.85	45.89

The future control case inventory includes the base 2009 emissions summarized in Table V-2, plus additional SIP controls listed in Table V-3. These include NO_x reductions from the TERP, and NO_x and VOC reductions from the North Central Texas Council of Governments (NCTCOG) Voluntary Mobile Emission Reduction Program (VMEP). Finally, Texas Low-Emission Diesel (TxLED) fuel NO_x reductions were applied to NONROAD model diesel SCCs, as well as locomotive switchers (SCC 2285002015).

Table V-3. 2009 DFW Nine-County Non-road Weekday Emissions with Control Measures Applied

Control Measure	NO_x (tpd)	VOC (tpd)
TERP	22.8	0
NCTCOG VMEP	1	0.25
Texas Low Emission Diesel	4.7	0
Total Control Measures	28.5	0.25
2009 subtotal (From Table V-2)	129.96	45.89
Total With Controls	101.46	45.64

b. HGB Area

Estimates of 2009 emissions for the eight-county HGB area were developed using the NONROAD2004 model. For several categories, local equipment populations were estimated based on equipment use surveys, including construction equipment, residential and commercial lawn and garden equipment, and recreational marine vessels (ERG, 2000; 2003; Wells, 2002). Based on these studies' findings, updated equipment population input files were generated for use in EPA's NONROAD model. In addition, for the construction equipment category, activity estimates in hours of use per year were also revised to reflect changes from the model defaults (Iyer, 2008).

Control measures modeled for NONROAD model categories in the HGB area included controls similar to the DFW area. These included NO_x reductions from the TxLED and TERP programs, and NO_x and VOC reductions from the Voluntary Mobile Emission Reduction Program (MacKay, 2008; TCEQ, 2004).

c. BPA Area

For the 3-county BPA area, 2009 NONROAD source emissions were prepared using the NONROAD2004 model. Updated equipment populations for the lawn and garden category were reflected in the 2009 control case (ERG, 2003). In addition, reductions for the TERP program and the Statewide TxLED requirements were applied to the forecasted 2009 BPA NONROAD emissions (MacKay, 2008).

2. Attainment Areas Within Texas

For all attainment areas within Texas, the NONROAD2004 model was used to project emissions into the future since it accounts for both growth and Federal controls for nonroad sources. Updated populations for the lawn and garden equipment category were reflected in the 2009 forecasts for the attainment areas of the State (ERG, 2003).

B. STATES OUTSIDE OF TEXAS

NONROAD model emission estimates for States outside of Texas were based on EPA's 2010 CAIR inventory (EPA, 2005). The 2010 NONROAD inventories for CAIR were developed by

EPA's Office of Transportation and Air Quality using the National Mobile Emission Model (NMIM). The NMIM model relies on calculations and data from the NONROAD 2004 model.

C. CANADA

Emissions estimates for Canada were developed from a 2000 Environment Canada Inventory of NO_x and VOCs (EC, 2004). Information was not available to project this inventory to the future. It was assumed that given the distance between Canada and Texas, any difference between projected and actual emissions will have a minimal impact on the overall results.

D. MEXICO

The 2009 NONROAD source emissions for Mexico were assumed to be equivalent to the 1999 calendar year Mexico emission inventory that was produced by ERG (ERG and Trans Engineering, 2006). Not enough information was available to project this inventory to the future.

E. GULF OF MEXICO (OFFSHORE) SOURCES

The 2000 GWEL, developed under contract to the MMS, was used to estimate off-shore oil and gas activity emissions (Wilson et al., 2004). While mobile source categories such as commercial marine vessels and helicopters were included in the non-platform portion of the inventory; no additional nonroad mobile engines are in operation offshore.

F. REFERENCES

- EC, 2004: Environment Canada, Canadian 2000 area, nonroad, and mobile files, provided to the U.S. Environmental Protection Agency by Environment Canada, December 14, 2004, <http://www.epa.gov/ttn/chief/net/canada.html>.
- EPA, 2005: U.S. Environmental Protection Agency, "Clean Air Interstate Rule Emissions Inventory Technical Support Document," Office of Air and Radiation, Research Triangle Park, March 4, 2005, <http://www.epa.gov/cair/pdfs/finaltech01.pdf>, accessed September 5, 2008.
- ERG, 2000: Eastern Research Group, Inc., "Development of a Revised Emissions Inventory for Construction Equipment in the Houston-Galveston Ozone Non-Attainment Area, Final Report," prepared by Eastern Research Group, Inc. and Starcrest Consulting Group, LLC, for the Houston-Galveston Area Council and TNRCC, April 20, 2000.
- ERG, 2003: Eastern Research Group, Inc., "Development of Commercial Lawn and Garden Emissions Estimates for the State of Texas and Selected Metropolitan Areas, Final Report," prepared by Eastern Research Group, Inc. and Starcrest Consulting Group, LLC, for the Texas Commission on Environmental Quality, November 24, 2003.

- ERG and Trans Engineering, 2006: Eastern Research Group, Inc., Sacramento, CA and Trans Engineering, El Paso, TX, "Mexico National Emission Inventory, 1999: Final," prepared for Secretariat of the Environment and Natural Resources and the National Institute of Ecology of Mexico, with sponsorship of : U.S. Environmental Protection Agency, Western Governors' Association, and the North American Commission for Environmental Cooperation, October 11, 2006.
- Iyer, 2008: Anusuya Iyer, Texas Commission on Environmental Quality, 2009 NONROAD modeling files for the DFW 2007 SIP, transmitted via e-mail to K. Thesing, E.H. Pechan & Associates, Inc., October 28, 2008.
- MacKay, 2008: Jim MacKay, Texas Commission on Environmental Quality, 2009 modeling files for the DFW 2007 SIP, transmitted via email from J. MacKay to J. Wilson, E.H. Pechan & Associates, Inc., September 5, 2008, and posted at:
ftp://ftp.tceq.state.tx.us/pub/OEPAA/TAD/Modeling/file_transfer/TXareaNR/files/.
- Rubick, 2008: Charles Rubick, Texas Commission on Environmental Quality, email entitled "Further questions about 2009 DFW SIP Area Projections," sent to K. Thesing, E.H. Pechan & Associates, Inc., November 6, 2008.
- TCEQ, 2004: Texas Commission on Environmental Quality, "Revisions to the State Implementation Plan (SIP) for the Control of Ozone Air Pollution, Houston/Galveston/Brazoria Ozone Nonattainment Area," Austin, TX, December 1, 2004.
- TCEQ, 2007: Texas Commission on Environmental Quality, "Revisions to the State Implementation Plan (SIP) for the Control of Ozone Air Pollution, Dallas-Fort Worth Eight-Hour Ozone Nonattainment Area Attainment Demonstration," Austin, TX, May 23, 2007.
- Wells, 2002: S. Wells, Starcrest Consulting Group, R. Baker, R. Feldman, ERG, Inc., "Recreational Marine Emissions Inventory," August 2002.
- Wilson and Billings, 2004: Wilson, D.L., J.N. Fanjoy, and R.S. Billings, "Gulfwide Emission Inventory Study for the Regional Haze and Ozone Modeling Effort: Final Report," U.S. Dept. of Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA, OCS Study MMS 2004-072, 273 pp, 2004.

[This page intentionally left blank.]

CHAPTER VI. MARINE, AIRCRAFT, AND RAILROAD SOURCES (MAR)

This chapter describes the methods used to project Marine, Aircraft and Railroad (MAR) emissions for Texas and other areas within the domain modeled for the 2007 DFW SIP. The MAR category consists of emissions sources from commercial non-road transportation, and includes commercial marine vessels, commercial, commuter and military aircraft, and line-haul and switch locomotives.

A. TEXAS SOURCES

Table VI-1 shows the different methods used to project emissions in the MAR category for the 2007 DFW Attainment Demonstration. Projections for several areas of Texas were based on TCEQ-sponsored projects to improve base year and future year estimates for the category. A 2007 commercial marine inventory was used as the basis for projections for this category in the HGB and BPA areas. Alternate growth rates were also applied for aircraft for the DFW area and railroads Statewide (Torres, 2008). REMI/EGAS growth rates were used as defaults in lieu of any area-specific growth rates listed below.

Table VI-1. Marine, Aircraft and Railroads Source Emission Projection Methods

Source Subcategory	Projection Methodology
Commercial Marine	HGB and BPA - 2009 shipping emissions based on a 2007 inventory prepared for 2000 HGB SIP. For 2009, a 2.5 percent per year growth factor was applied to 2007 emissions. Remaining areas were based on REMI/EGAS.
Aircraft	For DFW area, aircraft grown based on alternate growth rate of 2 percent per year. REMI/EGAS 4.0 was used for rest of the State.
Railroads	Locomotives grown Statewide based on alternate growth rate of 2 percent per year.

1. DFW, HGB, and BPA Sub-areas

a. DFW Area

The DFW 2009 MAR emission inventory projections cover the DFW nine-county nonattainment area of Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, and Tarrant Counties. As shown in Table VI-2, only emissions from aircraft and locomotives occur in the DFW area (there are no commercial marine emissions). Consistent with the rest of the State of Texas, an annual growth rate of 2 percent was applied Statewide for the locomotive category. This growth rate was based on information from a study performed by ERG. In addition, aircraft emissions were projected to 2009 using an assumed growth rate of 2 percent per year (Torres, 2008). Also, as mentioned in Chapter V, control measures applied to the locomotive 2009 projections included the Texas Low Emission Diesel provisions, which affected locomotive switchyard emissions Statewide (MacKay, 2008).

Table VI-2. 2000 and 2009 DFW Weekday Emissions for Aircraft and Locomotive, before SIP Controls (tpd)

Category	2000 NO _x	2009 NO _x	2000 VOC	2009 VOC
Aircraft	14.75	21.01	2.72	3.87
Locomotives	22.57	26.81	0.91	1.08
Total	37.32	47.82	3.63	4.95

b. HGB Area

Emissions for ships were estimated based on a 2000 study developed specifically for the eight-county HGB area as part of the December 2000 HGB SIP Revision (TNRCC, 2000). The counties that have significant commercial marine emissions are Harris, Galveston, Brazoria, and Chambers. The project involved development of a bottom-up inventory of the types and numbers of vessels traversing the various shipping lanes within the Galveston Bay system and in the segment of Intracoastal Waterway within the HGA nonattainment area. Underway emissions along each segment of the waterway system were estimated as well as *hotelling* emissions from docked vessels. To more accurately model the commercial marine activity, ship emissions were modeled as *pseudostacks* spaced along the major waterways within the Galveston Bay region. Stack parameters were assigned to each stack based on the characteristics of the ships that travel the shipping lanes.

The 2000 study also included projections for 2007. To estimate 2009 emissions, a 2.5 percent per year growth factor was used.

The HGB aircraft and locomotive emissions were projected using the same methods described below for Texas attainment areas.

c. BPA Area

The discussion in the HGB Area section describes the development of the HGB commercial marine vessel inventories. A similar set of data for 2000 and 2007 were developed for commercial marine activity in the three BPA counties. The ports of Beaumont and Port Arthur were added to the initial 2000 HGB study because the BPA shipping routes within Federal waters overlap with those routes from Houston (Starcrest, 2003). This 2007 inventory was then forecast to 2009 using a growth rate of 2.5 percent per year. The BPA aircraft and locomotive emissions in 2009 were estimated using the same methods described below for Texas attainment areas.

2. Attainment Areas Within Texas

The few commercial marine emissions occurring outside of HGB and BPA area waterways were projected to 2009 using EGAS (Torres, 2008). Similar to nonattainment areas, locomotive emissions were grown to 2009 assuming a 2 percent growth rate per year. Aircraft emissions for the rest of the State were projected using REMI/EGAS4.0 growth factors.

B. STATES OUTSIDE OF TEXAS

Estimated 2009 emissions for MAR sources outside of the State were based on EPA's 2010 CAIR inventory (EPA, 2005). The CAIR 2001 base year emissions for these categories were consistent with EPA rulemaking, and were forecasted to 2009 using methods described in full in supporting documentation called "CommercialMarine_Airports_Trains_Approach.pdf."

C. CANADA

Emissions estimates for Canada were developed from a 2000 Environment Canada Inventory of NO_x and VOCs (EC, 2004). Information was not available to project this inventory to the future. It was assumed that given the distance between Canada and Texas, any difference between projected and actual emissions will have a minimal impact on the overall results.

D. MEXICO

The 1999 NEI for Mexico was used as surrogate for 2009 projections (ERG and Trans Engineering, 2006). Not enough information was available to project this inventory to the future.

E. GULF OF MEXICO (OFFSHORE) SOURCES

The 2000 GWEI, developed under contract to the MMS, was used to estimate offshore emissions for commercial marine vessels and helicopters (Wilson et al., 2004). Table VI-3 provides a listing of mobile source categories and the SCCs under which they are reported in the non-platform portion of the inventory (MMS, 2008).

Table VI-3. Listing of Mobile Source Non-Platform Categories in 2000 Offshore Inventory

Non-Platform Category	SCC
Helicopters	2275050000
Commercial marine vessels (CMVs)	2280002200
Drilling rigs	2280002200
Fishing	2280002200
Lightering	2280002200
Louisiana Offshore Oil Platform (LOOP)_Approach	2280002200
LOOP_CMV_Platform	2280002200
Military vessels	2280002200
Pipe laying	2280002200
Platform construction and removal vessels	2280002200
Support vessels	2280002200
Survey vessels	2280002200
CMV steam	2280003200

The activity data used for several of the marine vessels were based on adjustments made to activity developed for the *Gulf of Mexico Air Quality Study* (MMS, 1995). Much of the activity data used in the 1995 study was derived from a 1992 Survey of Offshore Operators undertaken

by the Offshore Operators Committee. Marine engine emissions were estimated using emission factor equations developed by EPA's Office of Transportation and Air Quality for their 2002 Diesel Marine Vessel Rule. Average horsepower and load factors obtained from the 1995 *Gulf of Mexico Air Quality Study* were used in the equations. Survey activity for active lease blocks is considered confidential and could not be tracked by MMS. As such, actual Gulfwide vessel activity is larger than the activity quantified in this inventory.

F. REFERENCES

- EC, 2004: Environment Canada, Canadian 2000 area, nonroad, and mobile files, provided to the U.S. Environmental Protection Agency by Environment Canada, December 14, 2004, <http://www.epa.gov/ttn/chief/net/canada.html>.
- EPA, 2005: U.S. Environmental Protection Agency, "Clean Air Interstate Rule Emissions Inventory Technical Support Document," Office of Air and Radiation, Research Triangle Park, March 4, 2005, <http://www.epa.gov/cair/pdfs/finaltech01.pdf>, accessed September 5, 2008.
- ERG and Trans Engineering, 2006: Eastern Research Group, Inc., Sacramento, CA and Trans Engineering, El Paso, TX, "Mexico National Emission Inventory, 1999: Final," prepared for Secretariat of the Environment and Natural Resources and the National Institute of Ecology of Mexico, with sponsorship of : U.S. Environmental Protection Agency, Western Governors' Association, and the North American Commission for Environmental Cooperation, October 11, 2006.
- MacKay, 2008: Jim MacKay, Texas Commission on Environmental Quality, 2009 modeling files for the DFW 2007 SIP, transmitted via email from J. MacKay to J. Wilson, E.H. Pechan & Associates, Inc, September 5, 2008, and posted at: ftp://ftp.tceq.state.tx.us/pub/OEPAA/TAD/Modeling/file_transfer/TXareaNR/files/.
- MMS, 1995: Minerals Management Service, U.S. Department of the Interior, "Gulf of Mexico Air Quality Study (GMAQS): Final Report, Volumes I-III," Gulf of Mexico, OCS Region, New Orleans, LA, OCS Study MMS 95-0038, 95-0039, and 95-0040, 1995.
- MMS, 2008: Minerals Management Service, U.S. Department of the Interior, "NIF Access Database of Non-point Sources Inventory," revised 2006, accessed September 5, 2008, http://www.gomr.mms.gov/homepg/regulate/environ/airquality/gulfwide_emission_inventory/2000GulfwideEmissionInventory.html.
- Starcrest, 2003: Starcrest Consulting Group LLC, "Improvements to the Commercial Marine Vessel Emission Inventory in the Vicinity of Houston, Texas," Starcrest Consulting Group LLC and Eastern Research Group, Inc., prepared for the Houston Advanced Research Center (HARC), July 28, 2003.
- TNRCC, 2000: Texas Natural Resource Conservation Commission, "Revisions to the State Implementation Plan (SIP) for the Control of Ozone Air Pollution Post-1999 Rate-Of-

Progress and Attainment Demonstration SIP for the Houston/Galveston Ozone Nonattainment Area, Appendix C: HGB Area Vessel Emissions Inventory,” Austin, Texas, December 6, 2000.

Torres, 2008: Melinda Torres, Texas Commission on Environmental Quality, personal communication with K. Thesing, E.H. Pechan & Associates, Inc., October 24, 2008.

Wilson et al., 2004: Wilson, D.L., J.N. Fanjoy, and R.S. Billings, “Gulfwide Emission Inventory Study for the Regional Haze and Ozone Modeling Effort: Final Report,” U.S. Dept. of Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA, OCS Study MMS 2004-072, 2004.

[This page intentionally left blank.]

CHAPTER VII. ONROAD VEHICLES

On-road vehicles include cars, light trucks, heavy trucks, buses, and motorcycles. On-road vehicle emission forecasts for Texas are developed by the Texas Transportation Institute (TTI) and local Metropolitan Planning Organizations. Emission forecasts for non-Texas U.S. States are based on EPA forecasts, while forecasts for Canada and Mexico are based on historical emission inventories.

A. TEXAS SOURCES

Texas 2009 on-road emission projections are calculated by taking vehicle miles traveled (VMT) projections and multiplying by emission factors estimated from EPA's MOBILE6.2 Mobile Source Emission Factor Model. The VMT estimates are projected using either urban scale travel demand models (TDMs), or from historic Highway Performance Monitoring System (HPMS) data, depending on the region. HPMS data are measurements of actual vehicle volumes on a sample of roadways in each geographic area. Table VII-1 summarizes the projection methods used for on-road vehicle emissions for Texas sources.

Table VII-1. On-Road Mobile Emission Inventory Projection Methodology for Texas

Description	Projection Methodology
Emission Factor Projections	MOBILE6.2.03
Activity Projections - Urban Counties	TDM with HPMS Adjustment
Activity Projections - Rural Counties	By County Using Historical HPMS and Projected Population
SOURCE: McGarry-Barber, 2008.	

The MOBILE6.2 model uses 2009 assumptions for vehicle activity for estimating 2009 emission factors. Table VII-2 shows a summary of the level of detail of MOBILE6 inputs.

Table VII-2. MOBILE6 Inputs and Vehicle Activity for Developing Projected On-road Emissions

Parameter	Description	Impact
Day Types	Mon Weekday (Tues-Thurs) Friday Saturday Sunday	Vehicle Volume, VMT Adjustment Factors
External Conditions	Temperature, Humidity	Locality-specific MOBILE6 Inputs
VMT - Urban	TDM, Hourly, Link-Based	Activity Levels
VMT - Rural	HPMS, Virtual Link ¹¹	Activity Levels
SOURCE: McGarry-Barber, 2008.		

¹¹ Virtual links are links that have no physical coordinates, used for estimating on-road emissions in rural areas where there are no link-based TDMs. The level of disaggregation and the spatial allocations of the modeled VMT, speeds, and emission estimates using the virtual link method are defined by the combination of HPMS functional classification and area type.

For urban areas that use link-based TDMs, VMT is distributed to the links that make up the roadway network in a metropolitan planning area. The speed for each link is determined based on the traffic volume on the link and the link capacity. The inventory is developed for each link within the county. For rural areas in the State, VMT is distributed to a set of roadway types, such as urban highway, rural highway, major arterial, and minor arterial. A speed is determined for each roadway type, and the inventory is developed at the county level for each roadway type. The following sections provide further detail for estimating 2009 on-road emissions in each area.

1. DFW, HGB, and BPA Sub-Areas

a. DFW Area

The DFW 2009 on-road mobile source emission inventory projections cover the DFW nine-county nonattainment area of Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, and Tarrant Counties. The emission inventory covers a 10-day episode period in 2009 from August 14 (Friday) through August 23 (Sunday).

i. VMT Estimation

For modeling 2009 travel demand, the DFW area was divided into two categories: (1) Core Counties (which include Collin, Dallas, Denton, Tarrant, and Rockwall) and (2) Perimeter Counties (which include Ellis, Johnson, Kaufman, and Parker). The Core counties used the Dallas-Fort Worth Regional Travel Model (DFWRTM), which is a link-based bottom-up modeling approach. The Perimeter counties used a top-down approach consisting of the Texas Department of Transportation's (TxDOT's) HPMS data and population forecasts for each county.

The Core Counties used the DFWRTM to estimate VMT and speeds for each link, time period, and episode day (NCTCOG, 2005). The transportation network in the model was specifically developed for the 2009 emission projections. The inputs for the model are socio-economic demographic data, which includes population, number of households, and employment type for each county. Speed was estimated for each link and adjusted for congestion delay in a post-processing program within the DFWRTM.

For the Perimeter counties, VMT and speeds by county was estimated using historical HPMS data, Roadway Inventory Function Class Records, and population forecasts. Year 2003 functional class distribution of VMT was applied to the 2009 VMT values to obtain 2009 VMT estimates by functional class. Speeds were estimated using a volume-delay equation similar to the estimation method of speeds for the Core Counties (NCTCOG, 2005).

For both Core and Perimeter counties, adjustments to vehicle activity were made to better reflect regional conditions. For seasonal, daily, and hourly adjustments, the vehicle activity data used were representative of August 2003. A comparison was also made between Core counties VMT estimates and appropriate Perimeter counties HPMS data. The purpose of this comparison was to adjust the travel demand model to reflect the HPMS data for consistent reporting across the

State. An adjustment factor established in the 1999 model was also applied to year 2009. A 1999 congestion adjustment factor was also applied to 2009.

Table VII-3 shows a comparison between 1999 and 2009 total VMT from all counties in the DFW area. Table VII-4 shows the annual VMT growth rate applied to each county from 1999 to 2009. This table shows that the highest expected VMT growth rates are in the core DFW counties.

Table VII-3. DFW Nonattainment Area VMT and Annual Growth Rate for All Counties – 1999 versus 2009

Days of the Week	1999 Total VMT (Thousands)	2009 Total VMT (Thousands)	Annual Growth Rate
Sunday	97,797	141,223	3.74%
Monday	134,109	183,276	3.17%
Mid-Week	135,349	187,988	3.34%
Friday	147,828	205,978	3.37%
Saturday	116,356	166,302	3.64%
SOURCE: NCTCOG, 2003; 2005.			

Table VII-4. DFW Nonattainment Area Midweek VMT and Annual Growth Rate – Individual Counties

County	1999 VMT (Thousands)	2009 VMT (Thousands)	Annual Growth Rate
Collin	11,334	19,419	5.53%
Dallas	61,820	80,872	2.72%
Denton	11,018	17,937	4.99%
Tarrant	37,969	52,865	3.37%
Rockwall	1,445	2,161	4.11%
Ellis	3,537	4,483	2.40%
Johnson	2,574	3,252	2.37%
Kaufman	3,127	3,969	2.41%
Parker	2,525	3,031	1.84%
9-County Total	135,349	187,989	3.34%
SOURCE: NCTCOG, 2003; 2005.			

ii. *Emission Factor Estimation*

EPA's MOBILE6.2 model was used to develop the DFW area 2009 vehicle emission factors. The model is equipped with national default modeling values for a wide range of conditions that affect emission factors. Area-specific inputs that replace defaults in MOBILE6 include vehicle registration distribution, diesel fractions, hourly VMT, and trip length distribution.

Vehicle Registration Distribution: For 2009, vehicle age distributions were calculated from TxDOT vehicle registration data. July 2005 registration data sets were used for light- and heavy-duty vehicle classes and MOBILE6.2 default values were used for bus categories.

Diesel Fractions: Diesel fractions for heavy-duty vehicle categories used nine-county summed July 2005 registration data. Light-duty and bus categories used MOBILE6.2 default values (NCTCOG, 2005).

Hourly VMT: Hourly VMT was calculated from 2002 TxDOT Automatic Traffic Recorders (ATRs).

Trip Length Distributions: The DFWRTM was used to develop trip length distributions, which were used in the same way for both Core and Perimeter Counties.

Adjustments to emission factors were made to better reflect regional vehicle emissions control programs; they include Inspection and Maintenance (I/M) and Anti-Tampering Programs (ATP), and Low Emission Diesel (LED) NO_x Adjustment. VMT mix fractions are also used to adjust emission factors. VMT mix affects emission factors in that it enables the assignment of emission factors by vehicle type to a total volume to calculate emissions on a link or functional class. These adjustments were made using the Texas Mobile Source Emission Software developed by TTI.

Final emissions estimates were also calculated using the same emissions software, where it combined vehicle activity and emission factors to create emission estimates. Emissions were estimated for NO_x, VOC, and CO for 26 time periods and 10 episode days for each of the nine DFW counties. Table VII-5 shows the 2009 on-road emission projections for the DFW area for each day of the week.

Table VII-5. DFW 2009 On-road Emission Inventory (tpd)

Days of the Week	VOC	CO	NO _x
Sunday	65.4	875.5	100.4
Monday	96.2	112.1	190.0
Mid-Week	100.2	1,173.8	190.8
Friday	108.4	1,271.7	209.8
Saturday	77.4	1,002.6	129.5
SOURCE: NCTCOG, 2005.			

b. HGB Area

The HGB 2009 on-road mobile source emission forecast was developed by TTI. The forecast period for the emission estimates was the 20-day ozone episode sequence, Friday August 18 through Wednesday, September 6, 2000.

TTI used a TDM link-based methodology for developing episode-day emission estimates for the HGB area. The emissions were estimated using a series of TTI computer programs that post-processes TDM data, adjusts the VMTs to various seasonal and hourly factors, etc., estimates link speeds, and multiplies MOBILE6 emission factors by VMT to produce emission estimates.

i. VMT Estimation

The 2009 link-based VMT was estimated by post-processing the Houston/Galveston Area Council's (HGAC) 2009 TDMs by using the TRANSVMT program. Key inputs to the HGAC's TDMs were demographic, socioeconomic, and land-use data, as well as multi-modal transportation network data. As part of the post-processing, the 2009 TDM VMT was adjusted for HPMS consistency. This was done by applying a 2002 HPMS adjustment factor. Also, seasonal adjustment factors were applied to the 2009 projection year; the TxDOT ATR data from 1999-2003 for the HGB area were used to develop these estimates. Weekend day adjustment factors and hourly travel factors used for 2002 were applied to 2009. Operational speeds for each link were estimated in the TRANSVMT program using the Houston speed model. Table VII-6 compares 2002 and 2009 total VMT from all counties in the HGB area. Table VII-7 shows the annual VMT growth rate applied to each county from 2002 to 2009.

Table VII-6. HGB Nonattainment Area VMT and Annual Growth Rate for All Counties

Days of the Week	2002 VMT (Thousands)	2009 VMT (Thousands)
Sunday	93,421	108,775
Monday	128,379	149,477
Mid-Week	128,379	149,477
Friday	143,790	167,422
Saturday	117,806	137,168
SOURCE: TCEQ, 2005a.		

Table VII-7. HGB Nonattainment Area Midweek VMT and Annual Growth Rate

County	2002 VMT (Thousands)	2009 VMT (Thousands)	Annual Growth Rate
Brazoria	5,583	6,329	1.8%
Chambers	2,175	2,666	2.9%
Fort Bend	7,765	10,788	4.8%
Galveston	5,753	5,807	0.1%
Harris	93,699	107,486	2.0%
Liberty	2,207	2,533	2.0%
Montgomery	9,325	11,451	3.0%
Waller	1,872	2,416	3.7%
8-County Total	128,379	149,477	2.2%
SOURCE: TCEQ, 2005a.			

ii. Emission Factor Estimation

The MOBILE6 model was used to calculate the emissions factors for VOC, CO, and NO_x for 2009. Emission factors were estimated by speed, emissions type, hour, MOBILE6 road type, and average vehicle class for each HGB area county. Locality-specific inputs for the HGB area are described below.

Vehicle Registration Distribution and Diesel Fractions: TTI developed vehicle registration distributions and diesel fractions inputs using mid-year TxDOT registration data sets. The latest available dataset at the time was 2004, and that was what the 2009 vehicle registration distributions and diesel fractions were based on. In cases where the TxDOT registrations data were not available, MOBILE6 default age distributions and diesel fraction inputs were used.

VMT Mixes: 2009 VMT mixes were estimated using 1999-2003 TxDOT vehicle classification data and 2004 TxDOT registration data. Local registration data were used to separate vehicle categories by fuel type. They were supplemented with MOBILE6 defaults where necessary.

Trip Length Distributions: HGAC developed a HGB regional trip length distribution dataset based on their most recent TDM, and that was used for the 2009 analysis.

Instead of using the MOBILE6 default for estimating reformulated gasoline (RFG) benefits, TTI used an alternative technique for modeling RFG. This alternative technique was recommended by the EPA due to inconsistencies found in the MOBILE6 default RFG option. The alternative option required analyst-specified sulfur content, oxygenated fuel parameters, and gasoline Reid vapor pressure values. For 2009, these values were taken from the table, “Reformulated Gasoline Parameters – Summer (1),” found in Section 2.8.10.1 of the MOBILE6 User’s Guide (TCEQ, 2005a).

Similar to the DFW methodology, adjustments to MOBILE6 emission factors were made to better reflect the HGB area conditions. The effects of the I/M and ATP programs, as well as the Texas LED NO_x effects were adjusted for 2009 emission factors.

The IMPSUM62 program was used to apply the emissions factors and VMT mixes to the VMT and speed estimates to calculate on-road emissions. Table VII-8 shows the 2009 on-road emission projections for the HGB area for each day of the week.

Table VII-8. HGB 2009 On-road Emission Inventory (tpd)

Days of the Week	VOC	CO	NO _x
Sunday	50.3	687.9	71.7
Monday	69.2	872.9	133.9
Mid-Week	77.4	952.4	163.2
Friday	88.3	1,085.7	149.1
Saturday	63.1	851.0	100.9
SOURCE: TCEQ, 2005a.			

c. BPA Area

The BPA 2009 on-road mobile source emission forecast was also developed by TTI. The forecast period for the emission estimates was 17 episode days between August 10, 2000 and September 6, 2000. The methodology employed is the same as that for the HGB nonattainment area.

i. VMT Estimation

The latest available BPA 2009 TDMs were used to estimate VMT for each link in the transportation network. The TDM VMT was adjusted to be consistent with HPMS VMT using 2002 HPMS factors. Seasonal adjustment and hourly travel factors were developed using aggregated episode period, multi-year (1999 through 2003) ATR data (TCEQ, 2005b). For each link in the TDM, the link volume was multiplied by the HPMS factor, the seasonal adjustment factor, and the link's length to achieve day-type-specific VMT. The hourly factors were used to distribute the VMT over each hour of the day. The TRANSVMT program was used to compute hourly VMTs and estimate speeds for each link. Tables VII-9 and VII-10 show the 2002 and 2009 VMT and the annual growth rates for VMT applied. Table VII-9 provides nonattainment area level information, while Table VII-10 shows the county-level VMT differences.

Table VII-9. BPA Nonattainment Area VMT and Annual Growth Rate for All Counties

Days of the Week	2002 VMT (Thousands)	2009 VMT (Thousands)
Sunday	8,997	9,874
Monday	11,002	12,074
Mid-Week	11,002	12,074
Friday	13,024	14,293
Saturday	10,880	11,941
SOURCE: TCEQ, 2005b.		

Table VII-10. BPA Nonattainment Area Midweek VMT and Annual Growth Rate

County	2002 VMT (Thousands)	2009 VMT (Thousands)	Annual Growth Rate
Jefferson	6,725	7,164	0.91%
Orange	2,841	3,201	1.72%
Hardin	1,436	1,708	2.52%
3-County Total	11,002	12,074	1.34%
SOURCE: TCEQ, 2005b.			

ii. Emission Factor Estimation

The BPA area emission factor estimation methods are essentially the same as those for HGB and DFW areas. MOBILE6 default parameters were used with the exception of local input values; they are described below.

Vehicle Registration Distributions and Diesel Fractions: TTI developed vehicle registration distributions and diesel fractions inputs using mid-year TxDOT registration data sets. The 2004 calendar year data were used to estimate 2009 vehicle registration distributions and diesel fractions. In cases where the TxDOT registration data were not available, MOBILE6 default age distributions and diesel fractions inputs were used.

VMT Mixes: 2009 VMT mixes were estimated using 1999-2003 TxDOT vehicle classification data and 2004 TxDOT registration data. Local registration data were used to separate vehicle categories by fuel type and they were supplemented with MOBILE6 defaults where necessary.

Emission factor post-processing was done to account for the effects of the TxLED program. The IMPSUM62 program was used to apply the emissions factors and VMT mixes to the VMT and speed estimates to calculate on-road emissions. Table VII-11 shows the 2009 on-road emission projections for the BPA area for each day of the week.

Table VII-11. BPA 2009 On-road Emission Inventory (tpd)

Days of the Week	VOC	CO	NO _x
Sunday	6.4	90.2	10.9
Monday	7.6	99.3	17.7
Mid-Week	8.7	107.4	24.8
Friday	10.2	129.4	23.0
Saturday	7.6	105.3	15.4
SOURCE: TCEQ, 2005b.			

2. Attainment Areas Within Texas

The 2009 on-road mobile source emissions estimates for attainment areas in Texas were developed by TTI and they use inputs consistent with the HGB 2009 projections (TCEQ, 2005c). The forecast period for the emission estimates were based on August 10, 2000 through September 6, 2000. The hourly emission projections were based on virtual-link HPMS data (the same data source used for DFW Perimeter counties).

i. VMT Estimation

The two major traffic data sources used for developing VMT estimates (and their associated adjustment and allocation factors) were ATR counts and HPMS VMT estimates. In addition to these traffic data, U.S. Census and Texas State Data Center county population statistics and projections were also used in the development of the VMT forecasts.

TTI used a HPMS and a population-based VMT forecasting method which combines the population-based and historical VMT-based forecast runs with equal weight, and then calibrates the combined forecast result to 2003 HPMS historical VMT data using a step-function adjustment (TCEQ, 2005c). The VMT per-capita-based forecasts were developed using VMT-to-population ratios (based on 2003 population and 2003 VMT) applied to 2009 official Texas State Data Center population projections. The growth trend VMT forecasts were developed using traditional regression analyses on historical HPMS VMT data from 1990-2003 (TCEQ, 2005c). Seasonal day-type VMT factors were developed based on 1999-2003 ATR vehicle counts.

A speed model was applied to each link VMT for each hour and direction. The capacities and freeflow speeds all come from the *Highway Capacity Manual*. Freeflow speeds were also

adjusted for congestion using a congested speed model. Table VII-12 shows the Texas average VMT by day type, and the annual VMT growth rates from 2002 to 2009.

Table VII-12. Texas Statewide Attainment Area Average VMT and Annual Growth Rate

Days of the Week	2002 VMT (Thousands)	2009 VMT (Thousands)	Annual Growth
Weekday	611,010	691,597	1.79%
Friday	695,327	786,980	1.78%
Saturday	582,291	658,847	1.78%
Sunday	502,144	568,001	1.78%
SOURCE: TCEQ, 2005c.			

ii. *Emission Factor Estimation*

Emissions factors were modeled with MOBILE6, and the methodology is the same as the other areas described above, with the exception that the different Texas counties were grouped into 58 or so MOBILE6 input data aggregation categories.

Vehicle Registration Distributions and Diesel Fractions: 2004 registration data from TxDOT were used as input for MOBILE6 age distributions and diesel fractions. MOBILE6 default age distributions and diesel fraction inputs were used for the vehicle classes where the TxDOT registration data were not available.

VMT Mixes: The 2009 VMT mixes were estimated using 1999-2003 TxDOT vehicle classification data and 2004 TxDOT registration data.

Trip Length Distributions: MOBILE6 default trip length distributions were used for all attainment area counties. No weekend day trip length distributions data were available, so the weekday values were applied for all day types (TCEQ, 2005c).

All of the Federal motor vehicle control programs included in MOBILE6 were modeled, using MOBILE6 defaults. Exhaust and evaporative I/M Programs and ATPs were modeled for subject counties. Fuel program controls were modeled by using MOBILE6 fuel commands and inputs to include conventional gasoline and RFG Reid vapor pressure inputs, gasoline sulfur content, oxygenate input parameters for RFG, and average diesel sulfur content (TCEQ, 2005c). TxLED fuel was modeled for 110 counties under the TxLED program by post-processing MOBILE6 emissions factors.

The IMPSUM62 program was used to apply the emissions factors and VMT mixes to the VMT and speed estimates to calculate on-road emissions. Table VII-13 shows the 2009 on-road emission projections for the Texas attainment areas for each day of the week.

Table VII-13. Texas Statewide Attainment Area 2009 On-road Emission Inventory (tpd)

Days of the Week	VOC	CO	NO_x
Weekday	453	5,195	1,128.70
Friday	526	6,090	1,041.80
Saturday	393	4,934	707
Sunday	346	4,405	537.3
SOURCE: TCEQ, 2005c.			

B. STATES OUTSIDE OF TEXAS

For non-Texas areas contained within the modeling domain, EPA's NMIM was used to develop daily on-road emission estimates by county for an average Summer Weekday (TCEQ, 2007).

MOBILE6.2 model emission rates in units of grams per mile were multiplied by VMT activity data to obtain the final on-road emission inventory estimates. NMIM does the multiplication of VMT by the MOBILE6.2 emission rates for the user. However, the available database inputs contain only 1999 and 2002 VMT data for every U.S. County for the twelve HPMS roadway types. To estimate VMT growth for 2009 and beyond, TCEQ staff projected linear trends from 2007-2050 based on historical VMT by State for years 1980-2006 available from the U.S. Federal Highway Administration. These VMT projections were imported into the NMIM database.

Different VMT adjustment factors were not provided for every county within each State. However, different growth rates for both the urban and rural roadway types within each State were available. For projecting on-road activity into the future, it was necessary to develop VMT adjustment factor ratios based on calendar year 2002, which was the latest year for which VMT data were included within the NMIM database. VMT ratios for each State and roadway type for 2005/2002; 2006/2002; 2007/2002; and 2050/2002 were developed. VMT estimates were then linearly interpolated between the end points of 2007 and 2050.

C. CANADA

Canadian emission projections for 2009 come from Canada's 1995 emissions inventory used in CAIR Emissions Inventory Technical Support Document. Emissions for 1995 were applied to 2009 with no growth assumptions.

D. MEXICO

The 1999 Mexican NEI on-road emissions were used as surrogate for 2009 projections.

E. REFERENCES

- McGarry-Barber, 2008: Mary McGarry-Barber, Texas Commission on Environmental Quality, Air Quality Division, E.H. Pechan & Associates, Inc., July 7, 2008.
- NCTCOG, 2003: North Central Texas Council of Governments, "Dallas/Fort Worth 1999 Episodic Emissions Inventory," Arlington, TX, July, 2003.
- NCTCOG, 2005: North Central Texas Council of Governments, "Dallas/Fort Worth 2009 Episodic Emissions Inventory: On-Road Mobile," Arlington, TX, September, 2005.
- TCEQ, 2005a: Texas Commission on Environmental Quality, "2002, 2009, and 2012 Emissions Inventories for the Houston/Galveston Eight-Hour Nonattainment Counties," Austin, TX, August, 2005.
- TCEQ, 2005b: Texas Commission on Environmental Quality, "2002, 2009, and 2012 Emissions Inventories for the Beaumont/Port Arthur Eight-Hour Ozone Nonattainment Counties," Austin, TX, August, 2005.
- TCEQ, 2005c: Texas Commission on Environmental Quality, "2002, 2009, and 2012 On-Road, Episode Specific Emissions Inventories For All 254 Counties in Texas," Austin, TX, August, 2005.
- TCEQ, 2007: Texas Commission on Environmental Quality, "Introduction to Air Quality Modeling: Emissions Modeling," Austin, TX, August 16, 2007, retrieved August 18, 2008 from: http://www.tceq.state.tx.us/implementation/air/airmod/overview/am_ei.html.

[This page intentionally left blank.]