# 2022 Transportation Conformity

## Appendix 12.6:
## Applicable SIP Excerpts

Revisions to the State Implementation Plan (SIP)
for the Control of Ozone Air Pollution

# DALLAS-FORT WORTH EIGHT-HOUR OZONE NONATTAINMENT AREA ATTAINMENT DEMONSTRATION

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
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Adoption
May 23, 2007

PROJECT NO.  2006-013-SIP-NR

## EXECUTIVE SUMMARY

This state implementation plan addresses ozone formation in the Dallas-Fort Worth (DFW) area, the precursor emissions of nitrogen oxides ($NO_X$)and volatile organic compounds (VOC), what control strategies are to be implemented, how much emission reduction are associated with each strategy, when these reductions will occur. Based on photochemical modeling and an evaluation of corroborative evidence, ozone measurements in DFW will be compliant with the national ambient air quality standard (NAAQS) by June 15, 2010.

Following promulgation of the 1990 Federal Clean Air Act (FCAA) Amendments, The United States Environmental Protection Agency (EPA) classified the DFW area as moderate nonattainment for the one-hour ozone standard. Since then, the Texas Commission on Environmental Quality (TCEQ) and DFW area local governments have taken steps to improve DFW air quality through the implementation of numerous control measures targeting attainment of the one-hour ozone NAAQS. These control strategies have resulted in significant improvements to DFW's air quality as demonstrated by the decrease in the DFW area's one-hour ozone design value over the past 15 years. The one-hour design value has decreased about 11.4 percent since 1991, and the eight-hour ozone design value has decreased by approximately 8.6 percent. On June 15, 2005, the one-hour ozone NAAQS was revoked, leaving only an eight-hour ozone standard, effective June 15, 2004. In 2006, the one-hour ozone design value was measured at 124 ppb, which demonstrates attainment of the former one-hour ozone standard. The design value for eight-hour ozone was 96 ppb in 2006. The DFW area is required to attain the new eight-hour ozone standard by June 15, 2010. This SIP revision demonstrates attainment of the eight-hour ozone NAAQS in the DFW area.

Despite the significant decreases in one-hour and eight-hour ozone design values and in $NO_X$ and VOC emissions in the DFW area, the increased stringency of the eight-hour ozone standard requires further reductions to bring the area into attainment of the eight-hour ozone standard. Rapid population growth and economic development in the DFW nonattainment area present numerous and complex challenges to reducing $NO_X$ and VOC emissions. However, despite the increasing population in the DFW nine-county area and along with other factors, such as increased vehicle miles traveled, the DFW area continues to experience decreasing trends in ambient ozone and its precursor emissions, $NO_X$ and VOC.

Analysis of VOC and $NO_X$ sensitivity to the ozone formation indicate that the optimum path to attainment is through $NO_X$ reductions. Accordingly, this SIP submittal contains $NO_X$ control strategies, which are summarized below in Table ExSum-1: *Summary of Control Strategy $NO_X$ Reduction Estimates for the DFW Eight-Hour Ozone Attainment Demonstration* and estimated $NO_X$ reductions in Table ExSum-2: *DFW Baseline, Future Base, and Control Case $NO_X$ Emissions.*

**Table ExSum-1: Summary of Control Strategy $NO_X$ Reduction Estimates for the DFW Eight-Hour Ozone Attainment Demonstration**

| TCEQ Rules | Estimated $NO_X$ Reductions by June 15, 2010 |
|---|---|
| | *tpd* |
| DFW Industrial, Commercial, and Institutional Sources Rule | 8.88 [1] |
| DFW Electric Generating Facilities (EGF) | 0.4 |
| DFW Minor Sources | 2.9 |
| Cement Kilns | 9.69 [2] |
| East Texas Combustion Sources | 22.4 |
| Total | 44.27 [3] |

[1] The final control strategy modeled assumed 9.0 tpd $NO_X$ reduction from DFW industrial, commercial, and institutional sources.
[2] The final control strategy modeled assumed 10.4 tpd $NO_X$ reduction from the cement kiln rule.
[3] Collectively, the final control strategy modeled assumed a 45.1 tpd $NO_X$ reduction from the Chapter 117 rules for major and minor sources (including EGFs, cement kilns and East Texas combustion sources). These rules, as adopted, are expected to reduce $NO_X$ by 44.27 tpd. The 0.83 tpd additional $NO_X$ from rule changes predicts modeled ozone to increase approximately 0.04 ppb at the monitor showing the greatest change, Fort Worth C13. Increases at other monitors will be less and this change does not affect the number of monitors predicted to be at or above 85 ppb.

| DFW Local Initiatives | Estimated $NO_X$ Reductions in 2009 |
|---|---|
| | *tpd* |
| Voluntary Mobile Emissions Reduction Program (VMEP) in nine counties | 2.63 |
| Transportation Control Measures (TCMs) in nine counties | 1.53 |
| Total | 4.16 |

| Federal Measures | Estimated $NO_X$ Reductions in 2009 |
|---|---|
| | *tpd* |
| On-Road | 217.52 |
| Non-Road | 21.49 |

**Table ExSum-2: DFW Baseline, Future Base, and Control Case $NO_X$ Emissions**

| Weekday (August 17, 1999) Emissions Inventory | 1999 Baseline Emissions | 2009.a2 Future Year Baseline Inventory | 2009.a2 Future Year Combo 10 Inventory |
|---|---|---|---|
| | *tpd* | *tpd* | *tpd* |
| Area sources | 34 | 44 | 41 |
| Non-road sources | 148 | 107 | 105 |
| Point Sources | 134 | 59 | 40 |
| On-road mobile sources | 437 | 193 | 187 |
| Biogenic sources | 52 | 52 | 52 |
| **Total NOx Emissions** | **805** | **455** | **425** |

This plan demonstrates attainment using photochemical modeling that includes the above control strategies. The demonstration also relies on weight of evidence (WoE) (see Chapter 3) and additional control measures not explicitly accounted for in the photochemical modeling.

This SIP revision includes 1999 base and baseline case modeling and 2009 future case modeling with and without the control strategies identified in Table ExSum-1: *Summary of Control Strategy $NO_X$ Reduction Estimates for the DFW Eight-Hour Ozone Attainment Demonstration*. Only two monitors remain above 85 ppb once the control package has been applied. Because photochemical modeling is an evaluation tool and not an absolute prediction of future ozone concentrations, additional data must be considered to draw conclusions about the validity of the final predicted design value and whether the attainment demonstration satisfies the requirements of the FCAA.

**Table ExSum-3: Future Design Value Calculations with Controls from Table ExSum-1**

| Site Name | 2009 Baseline | | | 2009 Combo #10 | | | |
|---|---|---|---|---|---|---|---|
| | Baseline DV | Average RRF | Future DV | Baseline DV | Average RRF | Future DV | |
| | *ppb* | | *ppb* | *ppb* | | *ppb* | truncated |
| Frisco C31 | 100.3 | 0.890 | **89.3** | 100.3 | 0.884 | **88.7** | **88** |
| Dallas Hinton C60 | 92.0 | 0.936 | **86.1** | 92.0 | 0.930 | **85.6** | **85** |
| Dallas North C63 | 93.0 | 0.917 | **85.3** | 93.0 | 0.912 | **84.8** | **84** |
| Dallas Exec C402 | 88.0 | 0.905 | **79.7** | 88.0 | 0.896 | **78.8** | **78** |
| Denton C56 | 101.5 | 0.878 | **89.1** | 101.5 | 0.873 | **88.6** | **88** |
| Midlothian C94 | 92.5 | 0.918 | **84.9** | 92.5 | 0.907 | **83.9** | **83** |
| Arlington C57 | 90.5 | 0.909 | **82.2** | 90.5 | 0.894 | **80.9** | **80** |
| FtW NW C13 | 98.3 | 0.884 | **86.9** | 98.3 | 0.871 | **85.6** | **85** |
| FtW Keller C17 | 96.3 | 0.887 | **85.4** | 96.3 | 0.881 | **84.8** | **84** |
| Average | 94.7 | -- | **85.4** | -- | -- | **84.6** | **83.9** |

This SIP provides ozone reduction trends analyses and supplementary data to demonstrate that the DFW nine-county nonattainment area will attain the 0.08 ppm eight-hour ozone standard. The corroborative analysis in Chapter 3 and Additional Measures in Chapter 4 Section 4.2.6 not included in the model support a conclusion that this DFW SIP demonstrates attainment of the eight-hour ozone NAAQS. These additional measures include the EPA's SmartWay and Blue SkyWays Programs, energy efficiency measures, Clean School Bus Program, stationary diesel and dual-fuel engine control measures, additional Texas Emissions Reduction Plan (TERP) and Low Income Vehicle Repair Assistance, Retrofit, and Accelerated Vehicle Retirement Program (LIRAP) commitments, and fleet turnover from 2009 to June 15, 2010.

Anthropogenic $NO_X$ and VOC emissions fall into four categories: point source, on-road mobile sources, non-road mobile sources, and area sources, with the largest source of $NO_X$ emissions in the DFW area being from on-road mobile sources. Over the past 14 years, point source $NO_X$ emissions decreased by 44 percent. This decreasing trend in reported emissions is corroborated by the decrease in measured ambient $NO_X$ concentrations over the past 15 years. The VOC emissions in the DFW area come primarily from on-road mobile sources and area sources.

Reported VOC emissions decreased by about 30 percent in the past 14 years, with ambient VOC concentrations also decreasing over the last nine years.

On-road and non-road mobile sources are the largest $NO_X$ contributors in the DFW area. The TCEQ's 2009 future case emissions inventory shows that on-road and non-road mobile sources contribute 74 percent of the $NO_X$ emissions. The trends in total $NO_X$ emissions are dependent upon trends in the $NO_X$ emissions from on-road mobile sources, a source category for which the TCEQ does not have direct legal authority to set emission standards. Even though DFW area population and vehicle miles traveled have increased, $NO_X$ emissions from on-road mobile sources, as well as the total $NO_X$ emissions from all source categories have decreased since 1999. Decreases in the on-road source category are in part attributed to fleet turnover and the implementation of programs such as TERP, the Vehicle Inspection and Maintenance (I/M) Program in the DFW area, and Texas Low Emission Diesel (TxLED) in East and Central Texas.

This revision includes details regarding the control strategies identified in Table ExSum-1: *Summary of Control Strategies $NO_X$ Reduction Estimates for the DFW Attainment Demonstration*, data showing progress that the DFW area has made toward attainment, a reasonably available control measures (RACM) analysis, a reasonably available control technology (RACT) analysis, and a motor vehicle emissions budget (MVEB). For the MVEB, see Table ExSum-4: 2009 *Attainment Demonstration Motor Vehicle Emissions Budget for the Nine-County DFW Area*.

**Table ExSum-4: 2009 Attainment Demonstration Motor Vehicle Emissions Budget for the Nine-County DFW Area**

| Nine-County DFW Area | Total Emissions | |
|---|---|---|
| | $NO_x$ | VOC |
| | *tpd* | *tpd* |
| DFW motor vehicle emissions budget | 186.81 | 99.09 |

SECTION V: LEGAL AUTHORITY

A. General

The TCEQ has the legal authority to implement, maintain, and enforce the national ambient air quality standards.

The first air pollution control act, known as the Clean Air Act of Texas, was passed by the Texas Legislature in 1965. In 1967, the Clean Air Act of Texas was superseded by a more comprehensive statute, the Texas Clean Air Act (TCAA), found in Article 4477-5, Vernon's Texas Civil Statutes. The Legislature amended the TCAA in 1969, 1971, 1973, 1979, 1985, 1987, 1989, 1991, 1993, 1995, 1997, 1999, 2001, 2003, and 2005. In 1989, the TCAA was codified as Chapter 382 of the Texas Health & Safety Code.

Originally, the TCAA stated that the Texas Air Control Board (TACB) is the state air pollution control agency and is principal authority in the state on matters relating to the quality of air resources. In 1991, the Legislature abolished the TACB effective September 1, 1993, and its powers, duties, responsibilities and functions were transferred to the Texas Natural Resource Conservation Commission (TNRCC). With the creation of the TNRCC, the authority over air quality is found in both the Texas Water Code and the TCAA. Specifically, the authority of the TNRCC is found in Chapters 5 and 7. Chapter 5, Subchapters A - F, H – J, and L, include the general provisions, organization and general powers and duties of the TNRCC, and the responsibilities and authority of the Executive Director. This Chapter also authorizes the TNRCC to implement action when emergency conditions arise, and to conduct hearings. Chapter 7 gives the TNRCC enforcement authority. In 2001, the 77$^{th}$ Texas Legislature continued the existence of the TNRCC until September 1, 2013, and changed the name of the TNRCC to the Texas Commission on Environmental Quality (TCEQ).

The TCAA specifically authorizes the TCEQ to establish the level of quality to be maintained in the state's air and to control the quality of the state's air by preparing and developing a general, comprehensive plan. The TCAA, Subchapters A - D, also authorize the TCEQ to collect information to enable the commission to develop an inventory of emissions; to conduct research and investigations; to enter property and examine records; to prescribe monitoring requirements; to institute enforcement proceedings; to enter into contracts and execute instruments; to formulate rules; to issue orders taking into consideration factors bearing upon health, welfare, social and economic factors, and practicability and reasonableness; to conduct hearings; to establish air quality control regions; to encourage cooperation with citizens' groups and other agencies and political subdivisions of the state as well as with industries and the Federal Government; and to establish and operate a system of permits for construction or modification of facilities.

Local government authority is found in Subchapter E of the TCAA. Local governments have the same power as the TCEQ to enter property and make inspections. They also may make recommendations to the Commission concerning any action of the TCEQ that affects their territorial jurisdiction, may bring enforcement actions, and may execute cooperative agreements with the TCEQ or other local governments. In addition, a city or town may enact and enforce ordinances for the control and abatement of air pollution not inconsistent with the provisions of the TCAA and the rules or orders of the Commission.

Subchapters F, G, and H of the TCAA authorize the TCEQ to establish low emission vehicle requirements for mass transit authorities, local government fleets, and private fleets; create a mobile emissions reduction credit program; establish vehicle inspection and maintenance programs in certain areas of the state, consistent with the requirements of the federal Clean Air Act; establish gasoline volatility and low emission diesel standards; and fund and authorize participating counties to implement low-income vehicle repair assistance, retrofit, and accelerated vehicle retirement programs.

B. Applicable Law

The following statutes and rules provide necessary authority to adopt and implement the SIP. The rules listed below have previously been submitted as part of the SIP.

Statutes

| | |
|---|---|
| TEXAS HEALTH & SAFETY CODE, Chapter 382 | September 1, 2005 |
| TEXAS WATER CODE | September 1, 2005 |

All sections of each subchapter are included, unless otherwise noted.

Chapter 5: Texas Natural Resource Conservation Commission
Subchapter A: General Provisions
Subchapter B: Organization of the Texas Natural Resource Conservation Commission
Subchapter C: Texas Natural Resource Conservation Commission
Subchapter D: General Powers and Duties of the Commission
Subchapter E: Administrative Provisions for Commission
Subchapter F: Executive Director (except §§ 5.225, 5.226, 5.227, 5.2275, 5.232, and 5.236)
Subchapter H: Delegation of Hearings
Subchapter I: Judicial Review
Subchapter J: Consolidated Permit Processing
Subchapter L: Emergency and Temporary Orders (§§ 5.514, 5.5145 and 5.515 only)

Chapter 7: Enforcement
Subchapter A: General Provisions (§§ 7.001, 7.002, 7.0025, 7.004, 7.005 only)
Subchapter B: Corrective Action and Injunctive Relief (§ 7.032 only)
Subchapter C: Administrative Penalties
Subchapter E Criminal Offenses and Penalties: §§ 7.177, 7.179-7.181

Rules

All of the following rules are found in Title 30, Texas Administrative Code, as of the following effective dates:

| | |
|---|---|
| Chapter 7, Memoranda of Understanding, §§ 7.110 and 7.119 | May 2, 2002 |
| Chapter 35, Subchapters A-C, K: Emergency and Temporary Orders and Permits; Temporary Suspension or Amendment of Permit Conditions | December 10, 1998 |
| Chapter 39, Public Notice, §§ 39.201; 39.401; 39.403(a) and (b)(8)-(10); 39.405(f)(1) and (g);39.409; 39.411 (a), (b)(1)-(6) and (8)-(10) and (c)(1)-(6) and (d); 39.413(9), (11), (12) and (14); | August 15, 2002 |

| | |
|---|---|
| 39.418(a) and (b)(3) and (4); 39.419(a), (b),(d) and (e); 39.420(a), (b) and (c)(3) and (4); 39.423 (a) and (b); 39.601; 39.602; 39.603; 39.604; and 39.605 | |
| Chapter 55, Request for Contested Case Hearings; Public Comment, §§ 55.1; 55.21(a) - (d), (e)(2), (3) and (12), (f) and (g); 55.101(a), (b), (c)(6) - (8); 55.103; 55.150; 55.152(a)(1), (2) and (6) and (b); 55.154; 55.156; 55.200; 55.201(a) - (h); 55.203; 55.205; 55.206; 55.209 and 55.211 | August 29, 2002 |
| Chapter 101: General Air Quality Rules | June 23, 2005 |
| Chapter 106: Permits by Rule, Subchapters A | June 30, 2004 |
| Chapter 111: Control of Air Pollution from Visible Emissions and Particulate Matter | November 18, 2004 |
| Chapter 112: Control of Air Pollution from Sulfur Compounds | July 16, 1997 |
| Chapter 113, Standards of Performance for Hazardous Air Pollutants and for Designated Facilities and Pollutants | June 15, 2005 |
| Chapter 114: Control of Air Pollution from Motor Vehicles | May 19, 2005 |
| Chapter 115: Control of Air Pollution from Volatile Organic Compounds | May 5, 2005 |
| Chapter 116: Permits for New Construction or Modification | June 15, 2005 |
| Chapter 117: Control of Air Pollution from Nitrogen Compounds | May 19, 2005 |
| Chapter 118: Control of Air Pollution Episodes | March 5, 2000 |
| Chapter 122, § 122.122: Potential to Emit | December 11, 2002 |

SECTION VI. CONTROL STRATEGY

A. Introduction (No Change)

B. Ozone (Revised )

1. *Dallas-Fort Worth* **(Revised May 23, 2007)**
   - Chapter 1: Background and Introduction
   - Chapter 2: Photochemical Modeling
   - Chapter 3: Corroborative Analysis
   - Chapter 4: Control Strategies and Required Elements
2. *Houston-Galveston-Brazoria* (**Revised May 23, 2007**)
3. *Beaumont-Port Arthur* (No change**)**
4. *El Paso* (No change)
5. *Regional Strategies* (No change)
6. *Northeast Texas* (No change)
7. *Austin Area* (No change)
8. *San Antonio Area* (No change)

C. Particulate Matter (No change)

D. Carbon Monoxide (No change)

E. Lead (No change)

F. Oxides of Nitrogen (No change)

G. Sulfur Dioxide (No change)

H. Conformity with the National Ambient Air Quality Standards (No change)

I. Site Specific (No change)

J. Mobile Sources Strategies (No change)

K. Clean Air Interstate Rule (No change)

LIST OF ACRONYMS

ACT -- Alternative Control Techniques
AF -- Air-to-Fuel
APU -- Auxiliary Power Units
ARPDB -- Acid Rain Program Data Base
ATCM – Airborne Toxic Control Measure
auto-GC -- Automated Gas Chromatograph
BACT -- Best Available Control Technology
BCCA-AG -- Business Coalition for Clean Air-Appeal Group
BMP -- Best Management Practices
BPA -- Beaumont-Port Arthur
Btu/hr -- British Thermal Units per Hour
Btu/scf -- British Thermal Units per Square Cubic Feet
CAE -- Cetane Additive Enhanced Diesel Fuel
CAIR -- Clean Air Interstate Rule
CAMx -- Comprehensive Air Model with Extensions
CARB -- California Air Resources Board
CBD -- Houston's Central Business District
CFR -- Code of Federal Regulations
CMAQ -- Congestion Mitigation and Air Quality
CO -- Carbon Monoxide
CTG -- Control Technique Guidelines
DECS -- Diesel Emission Control Strategy
DERC -- Discrete Emission Reduction Credits
DFW -- Dallas-Fort Worth
DPM -- Diesel Particulate Matter
DRRP -- Diesel Risk Reduction Program
DV -- Design Value
DVc -- Current Design Value
DVf -- Future Design Value
EAC -- Early Action Compact
EDMS -- Emissions and Dispersion Modeling System
E-GRID-2007 -- Emissions and Generation Resource Integrated Database
EE/RE -- Energy Efficiency/Renewable Energy
EGAS -- Economic Growth Analysis System
EGF -- Electric Generating Facilities
EGU -- Electric Generating Units
EI -- Emissions Inventory
EPA -- United States Environmental Protection Agency
EPS3 -- Emissions Processing System, version 3
ERC -- Emission Reduction Credits
ERCOT -- Electric Reliability Council of Texas
ESAD -- Emission Specification for Attainment Demonstration
ESL -- Energy Systems Laboratory, the Texas A&M University System
F -- Fahrenheit
FAA -- Federal Aviation Administration
FCAA -- Federal Clean Air Act
FCV -- Fuel Cell Vehicle
FGR -- Flue Gas Recirculation
FHWA -- Federal Highway Administration
FR -- Federal Register
FT -- Fischer-Tropsch Diesel Fuel

GIS -- Geographic Information System
GloBEIS -- Global Biosphere Emissions and Interactions System
gpm -- Gallons per Minute
GTM -- Gross Ton Mile
HAP -- Hazardous Air Pollutant
HARC -- Houston Advanced Research Center
HDT -- Heavy-Duty Truck
HECT -- Highly-Reactive Volatile Organic Compound Emissions Cap and Trade Program
HGB -- Houston-Galveston-Brazoria
H-GAC -- Houston-Galveston Area Council
HOV -- High Occupancy Vehicle
hp -- Horsepower
HPMS -- Highway Performance Monitoring System
HRVOC -- Highly-Reactive Volatile Organic Compound
HSC -- Houston Ship Channel
IC -- Internal Combustion
ICI -- Industrial, Commercial, and Institutional
IECC -- International Energy Conservation Code
I/M -- Inspection and Maintenance
km -- Kilometer
$K_V$s -- Vertical Exchange Coefficient
LAER -- Lowest Achievable Emission Rate
lb/MMBtu -- Pound per Million British Thermal Units
LDAR -- Leak Detection and Repair
LDIR -- Light Detection and Ranging
LDEQ -- Louisiana Department of Environmental Quality
LDGV -- Light-Duty Gasoline Vehicle
LDT -- Light-Duty Truck
LDV -- Light-Duty Vehicle
LED -- Low Emission Diesel
LEV -- Low Emission Vehicle
LEV II -- California's Low Emission Vehicle II Program
LIRAP -- Low Income Repair and Assistance Program
LNB -- Low Nitrogen Oxides ($NO_X$) Burners
LNC -- Low Nitrogen Oxides ($NO_X$) Combustors
LNG -- Liquefied Natural Gas
LTO -- Landing and Take-Off
MACT -- Maximum Achievable Control Technology
Mcf -- Thousand Cubic Feet
MCR -- Mid-Course Review
MDPV -- Medium-Duty Passenger Vehicle
MECT -- Mass Emissions Cap and Trade Program
MM5 -- Fifth Generation Meteorological Model
MMBtu/hr -- Million British Thermal Units per Hour
MMcf -- Million Cubic Feet
MMS -- Minerals Management Service
MOA -- Memorandum of Agreement
MON -- Miscellaneous Organic National Emission Standards for Hazardous Air Pollutants (NESHAP)
mph -- miles per hour
MVEB -- Motor Vehicle Emissions Budget
MW -- Megawatts
MY -- Model Year
NAAQS -- National Ambient Air Quality Standard

NEGF -- Non-Electric Generating Facility
NEI -- National Emissions Inventory
NESHAP -- National Emission Standards for Hazardous Air Pollutants
ng/J -- Nanogram per Joule
NMIM -- National Mobile Inventory Model
NOAA -- National Oceanic and Atmospheric Administration
$NO_X$ -- Nitrogen Oxides
$NO_y$ -- Nitrogen Species
NSCR -- Non-Selective Catalytic Reduction
NTRD -- New Technology Research and Development Program
$O_3$ -- Ozone
OGV -- Ocean-Going Vessel
PAYD -- Pay As You Drive
PBL -- Planetary Boundary Layer
PEI -- Periodic Emissions Inventory
PERP -- Portable Engine Registration Program
PiG -- Plume-in-Grid
PM -- Particulate Matter
$PM_{2.5}$ -- Particulate Matter less than 2.5 microns
ppb -- Parts Per Billion
ppbC -- Parts Per Billion Carbon
ppbv -- Parts Per Billion by Volume
ppm -- Parts Per Million
PSCF -- Potential Source Contribution Factors
PSDB -- Point Source Database
psia -- Pounds per Square Inch Absolute
PUC -- Public Utility Commission
RACT -- Reasonably Available Control Technology
RACM -- Reasonably Available Control Measure
RFP -- Reasonable Further Progress
RMSE -- Root Mean Square Error
ROP -- Rate-of-Progress
RRF -- Relative Reduction Factor
SB -- Senate Bill
SCAQMD -- South Coast Air Quality Management District
scfm -- Square Cubic Feet per Minute
SCR -- Selective Catalytic Reduction
SEP -- Supplemental Environmental Programs
SETPMTC -- Southeast Texas Photochemical Modeling Technical Committee
SIC -- Standard Industrial Classification
SIP -- State Implementation Plan
SNCR -- Selective Non-Catalytic Reduction
SOV -- Single Occupancy Vehicle
STP -- Surface Transportation Program
SWCV -- Solid Waste Collection Vehicle
TAC -- Texas Administrative Code
TACB -- Texas Air Control Board
TCAA -- Texas Clean Air Act
TCEQ -- Texas Commission on Environmental Quality (commission)
TCM -- Transportation Control Measure
TDM -- Travel Demand Model
TERP -- Texas Emission Reduction Plan
TexAQS 2000 -- Texas Air Quality Study 2000
TexAQS II -- Texas Air Quality Study 2006

TKE -- Turbulent Kinetic Energy
TNMHC -- Total Nonmethane Hydrocarbon
TNRCC -- Texas Natural Resource Conservation Commission
tpd -- tons per day
tpy -- tons per year
TSE -- Truck Stop Electrification
TTI -- Texas Transportation Institute
TUC -- Texas Utility Code
TxDOT -- Texas Department of Transportation
TxLED -- Texas Low Emission Diesel
USC -- United States Code
VMEP -- Voluntary Mobile Source Emissions Reduction Program
VMT -- Vehicle Miles Traveled
VOC -- Volatile Organic Compound
VRU -- Vapor Recovery Unit
ZEB -- Zero Emission Bus
ZEV -- Zero Emissions Vehicle

DALLAS-FORT WORTH OZONE NONATTAINMENT AREA
EIGHT-HOUR ATTAINMENT DEMONSTRATION

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# CHAPTER 1: BACKGROUND AND INTRODUCTION

## 1.1 GENERAL

"The History of the Texas State Implementation Plan (SIP)," a comprehensive overview of the SIP revisions submitted to Environmental Protection Agency (EPA) by the State of Texas, is available at the following web site:
http://www.tceq.state.tx.us/implementation/air/sip/sipintro.html#History.

**Eight-Hour Ozone Standard**

As of June 15, 2004, the Dallas-Fort Worth (DFW) eight-hour ozone nonattainment area is classified as a moderate area under the 1990 Federal Clean Air Act Amendments (FCAA) (42 United States Code (USC) §§7401 et. seq.). The DFW area is therefore required to attain the eight-hour ozone standard of 0.08 ppm by June 15, 2010, and to submit a state implementation plan (SIP) revision by June 15, 2007 (69 FR 23857). For the DFW area, defined as Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, and Tarrant Counties, the TCEQ has developed an attainment demonstration in accordance with 42 USC §7410. The one-hour ozone national ambient air quality standard (NAAQS), which preceded the eight-hour ozone standard, was revoked June 15, 2005 (69 FR 23951).

On April 30, 2004, the United States Environmental Protection Agency (EPA) published its Phase I Eight-Hour Implementation Rule. In 40 CFR §51.905(a)(ii) and subsequent guidance, the EPA provided three options for areas such as DFW that did not have an approved one-hour ozone attainment plan at the time of designation:

A. Submit a one-hour attainment demonstration no later than one year after designation (by June 15, 2005);
B. Submit an eight-hour ozone plan no later than one year after designation (by June 15, 2005) that provided a five percent increment of emissions reductions from the area's 2002 emissions baseline, in addition to federal and state measures already approved by the EPA and achieving those reductions by June 15, 2007; or
C. Submit an eight-hour ozone attainment demonstration by June 15, 2005.

Texas selected option B, the Five Percent Increment of Progress (IOP) plan, as a technically sound and expeditious approach to initiating the reductions ultimately needed for attainment of the eight-hour ozone standard.

**DFW Five Percent IOP SIP**

The Five Percent IOP SIP, adopted by the commission on April 27, 2005, contained several elements:

- 2002 Periodic Emissions Inventory (PEI) for the nine-county DFW eight-hour ozone nonattainment area;
- A five percent reduction in emissions from the 2002 emissions inventory baseline;
- Identification of the control measures to achieve the necessary nitrogen oxides ($NO_X$) and volatile organic compounds (VOC) emission reductions;
- Motor Vehicle Emissions Budgets (MVEBs) for use in transportation conformity demonstrations.

**DFW Eight-Hour Ozone Attainment Demonstration SIP**

This eight-hour ozone attainment demonstration for the DFW area contains photochemical modeling and weight of evidence, including corroborative analysis and additional measures not included in the model, to demonstrate attainment of the eight-hour ozone standard by June 15, 2010.

In addition to the existing control strategies in the DFW area, this SIP revision includes new rules for the following sources.

- DFW Cement Kilns
- DFW Electric Generating Facilities (EGFs)
- DFW Industrial, Commercial, and Institutional (ICI) Major Sources
- DFW Minor Sources
- East Texas Combustion Source in 33 Counties Beyond the DFW area

The revision includes additional commitments for voluntary mobile emissions reduction program (VMEP) and transportation control measures (TCM). The revision also contains the reasonably available control measures (RACM) analysis, reasonably available control technologies (RACT) analysis, contingency measures, emissions inventories, and motor vehicle emissions budgets (MVEB).

**DFW One-Hour Ozone Background**

An understanding of the previous DFW SIP and subsequent revisions is helpful in examining the current eight-hour ozone SIP revision. The DFW one-hour ozone nonattainment area (Collin, Dallas, Denton, and Tarrant Counties) was classified in 1991 as moderate in accordance with the 1990 FCAA amendment. As a moderate area, DFW was required to demonstrate attainment of the one-hour ozone standard by November 15, 1996. Ambient air monitoring data for the years 1994-96, however, showed that the one-hour ozone standard was exceeded more than one day per year over the three-year period. As a result, EPA reclassified the DFW area from moderate to serious (effective March 20, 1998) for failure to attain the one-hour ozone standard by the November 1996 deadline. EPA required the State of Texas to submit a SIP revision within one year that showed attainment of the NAAQS and addressed requirements for serious ozone nonattainment areas.

### 1.1.1 March 1999

The TCEQ submitted a SIP revision containing a Post-1996 Rate of Progress (ROP) SIP demonstration to the EPA on March 18, 1999. The photochemical modeling contained in the revision indicated that additional reductions in $NO_X$ emissions would be needed to attain the standard by November 1999. The following rules were developed and included in the SIP:

- Reasonably Available Control Technology (RACT) for $NO_X$ point sources;
- Nonattainment New Source Review (NSR) for $NO_X$ point sources; and
- Revisions resulting from the change in the major source threshold for RACT applicability for VOC.

Additionally, the commission indicated that, due to time constraints, the Post-1996 ROP SIP would not have all the rules adopted that were necessary to bring the DFW area into attainment by the November 1999 deadline and that a complete attainment demonstration would be submitted in the spring of 2000. The EPA determined that the Post-1996 ROP SIP was incomplete.

Additional local control strategies were necessary for DFW to reach attainment. To develop further control strategy options to augment the federal and state programs in the Post-1996 ROP SIP, the DFW area established the North Texas Clean Air Steering Committee (NTCASC). The committee members include local elected officials, business leaders, and other community stakeholders. This committee identified specific control strategies for review by technical subcommittee members.

After the attainment deadline of November 15, 1999, for serious areas under the one-hour ozone standard passed, the EPA had not made a determination regarding the DFW area's attainment status. Furthermore, technical data became available suggesting that DFW was significantly impacted by transport and regional background levels of ozone. Therefore, the commission began viewing the reductions for strategies needed for the Houston-Galveston-Brazoria (HGB) area and regional rules as a necessary and integral component in the strategy for DFW's attainment of the one-hour ozone strategy.

#### 1.1.2 April 2000

The Post-1996 ROP SIP was not yet approved by EPA by the next commission action. On April 19, 2000, the commission adopted a SIP revision and associated rules for the DFW one-hour ozone attainment demonstration. The April 2000 One-Hour Ozone Attainment Demonstration SIP contained a number of control strategies and the following elements:

- Photochemical modeling of specific control measures and future state and national rules for attainment of the one-hour ozone standard in the DFW area by the attainment deadline of November 15, 2007.
- A modeling demonstration that showed air quality in the DFW area was influenced at times by transport from the HGB nonattainment area. Under EPA's July 16, 1998, transport policy, if photochemical modeling demonstrated that emissions from an upwind area located in the same state and with a later attainment date interfered with the downwind area's ability to attain, the downwind area's attainment date could be extended to no later than that of the upwind area. For the DFW area, this would extend the attainment date to November 15, 2007, the same attainment date as the HGB area.
- Identification of the VOC and $NO_X$ emissions reductions necessary to attain the one-hour ozone standard by 2007. The reductions of 141 tpd $NO_X$ from federal measures and 225 tpd $NO_X$ from state measures resulted in a total of 366 tpd $NO_X$ reductions for the attainment demonstration.
- A 2007 MVEB for transportation conformity.
- A commitment to perform and submit a mid-course review by May 1, 2004.

At the time it was submitted, the April 2000 One-Hour Ozone Attainment Demonstration SIP would have allowed the EPA to determine that the DFW area should not be reclassified from serious to severe under the conditions of the EPA's July 16, 1998, transport policy.

#### 1.1.3 August 2001

The next commission action was required by legislative mandate. Senate Bill 5 (SB5), passed by the 77th Texas Legislature in May 2001, required the repeal of two rules contained in the April 2000 SIP revision. The first rule restricted the use of construction and industrial equipment (non-road, heavy-duty diesel equipment rated at 50 hp or greater). The second rule required the replacement of diesel-powered construction, industrial, commercial, and lawn and garden equipment rated at 50 hp or greater with newer Tier 2 or Tier 3 equipment. The Texas Emissions Reduction Plan (TERP) grant incentive program established by SB5 replaced the $NO_X$ emissions reductions previously claimed for the two programs. The commission implemented the legislative mandate of SB5 by submitting the rule repeals as part of a SIP revision adopted in August 2001.

#### 1.1.4 March 2003

On March 5, 2003, the SIP was further revised to include the following.

- The adoption of revised Chapter 117 $NO_X$ emission limits for cement kilns.
- The estimation of $NO_X$ reductions from energy efficiency measures, using a methodology that was to be further refined before energy efficiency credit was formally requested in the SIP.

- The commitment to perform modeling with MOBILE6, the latest version of the EPA's emission factor model for mobile sources.

Meanwhile, the EPA's July 16, 1998, transport policy, on which the extension of the DFW area's attainment to November 15, 2007, was based, was challenged by environmental groups. A suit was filed challenging the extension of the Beaumont-Port Arthur (BPA) area's attainment date based on transport from the HGB area. On December 11, 2002, the United States Fifth Circuit Court of Appeals ruled that the EPA was not authorized to extend BPA's attainment date based on transport. The EPA published a final action in the Federal Register on March 30, 2004, reclassifying BPA to serious with an attainment date of November 15, 2005, and requiring a new attainment demonstration to be submitted by April 30, 2005. Although the court decision was specifically for BPA, the direct implication for DFW was that the EPA could not approve extensions of the DFW one-hour ozone attainment date past 1999, the date mandated by the FCAA for serious areas. In addition, the EPA could not approve the April 2000 One-Hour Ozone DFW Attainment Demonstration SIP.

### 1.1.5 Progress to Date

Since the early 1990s, when the DFW area was designated as nonattainment for the one-hour ozone standard, much has been done to bring the area into attainment with federal air quality standards. Contributions to improved air quality in the DFW area include: TCEQ implemented control strategies, local control strategies adopted by the North Central Texas Council of Governments (NCTCOG), and on-road and non-road mobile source measures implemented by the EPA.

The control strategies implemented so far have significantly improved air quality in the DFW area. The one-hour and the eight-hour ozone design values both show decreasing trends over the past 15 years. The one-hour design value has decreased about 11.4 percent since 1991, and the eight-hour ozone design value has decreased by about 8.6 percent. In 2006, the one-hour ozone design value was measured at 124 ppb, which demonstrates attainment of the former one-hour ozone standard. The eight-hour ozone design value decreased from 105 ppb in 1991 to 96 ppb in 2006.

## 1.2 HEALTH EFFECTS

In 1997, the EPA revised the NAAQS for ozone from a one-hour to an eight-hour standard based on scientific data that indicated that the eight-hour standard provides better protection of public health from longer-term exposures to moderate levels of ozone. To support the eight-hour ozone standard, the EPA provided information that indicated that even low levels of ozone can significantly decrease lung capacity temporarily in some healthy adults and cause inflammation of lung tissue, aggravate asthma, and make people more susceptible to respiratory illnesses such as bronchitis and pneumonia.

Children are at a higher risk from exposure to ozone, since they breathe more air per pound of body weight than adults and because children's respiratory systems are still developing. Children also spend a considerable amount of time outdoors during summer and during the start of the school year (August-October) when ozone levels are typically higher. Adults most at risk to ozone exposure are outdoor workers, people outside exercising, and individuals with preexisting respiratory diseases.

## 1.3 PUBLIC/STAKEHOLDER PARTICIPATION

### 1.3.1 Control Strategy Development

The TCEQ contracted with the NCTCOG to evaluate and quantify potential control measures for the DFW eight-hour ozone attainment demonstration. The NCTCOG sought public comment throughout the entire control strategy development process. A series of public meetings were held in the DFW area during June and September 2005 and public stakeholder meetings were held in Fort Worth, Arlington, and Richardson in September and December 2005. In addition, control strategy development was discussed at public meetings of the NTCASC from June 2005 through late 2006. The NCTCOG Regional Transportation Council and Surface Transportation Technical Committee also discussed control strategy development at several of the groups' meetings. Public comment was also sought at a meeting of the Clean Cities Technical Coalition in July 2005. For more information regarding the NCTCOG's control strategy catalog, please see Chapter 4, Section 4.5.2 *Control Strategy Development to Determine Appropriate RACM* or visit the NCTCOG website at http://www.nctcog.org/trans/air/sip/future/presentations.asp.

### 1.3.2 SIP and Rule Development

The TCEQ held two open-participation DFW Eight-Hour Ozone SIP & Rules Stakeholder Group meetings to discuss concepts of potential rules for the nine-county DFW ozone nonattainment area and to hear the public's ideas on potential rulemaking concepts and the development of Texas' clean air plan. The meetings were held on June 20 and 21, 2006, in Irving. In these meetings, the TCEQ presented attendees with a brief background of the DFW SIP, a review of the technical work that had been completed to date, and an overview of the existing control measures for $NO_X$ and VOC. In addition to these meetings, the TCEQ held a meeting of the Northeast Texas Stakeholder Group to discuss a potential rulemaking that would implement $NO_X$ emission specifications for certain stationary, gas-fired, reciprocating internal combustion engines. This meeting was held on September 7, 2006, in Longview. For more information on public and stakeholder participation, please visit www.tceq.state.tx.us/implementation/air /sip/dfw.html.

### 1.3.3 Public Hearing Information

The commission held public hearings at the following times and locations:

| CITY | DATE | TIME | LOCATION |
|---|---|---|---|
| Houston | January 29, 2007 | 2:00 P.M. | Houston-Galveston Area Council<br>3555 Timmons Lane, Houston, TX 77027<br>Conference Room A, (2nd floor) |
| Houston | January 29, 2007 | 6:00 P.M. | Houston-Galveston Area Council,<br>3555 Timmons Lane, Houston, TX 77027,<br>Conference Room A, (2nd floor) |
| Dallas | January 31, 2007 | 7:00 P.M. | Dallas Public Library Auditorium<br>1515 Young St.,<br>Dallas, TX 75201 |
| Arlington | February 1, 2007 | 2:00 P.M. | Arlington City Hall<br>101 W. Abram Street,<br>Arlington, TX 76010 |
| Midlothian | February 1, 2007 | 6:00 P.M. | Midlothian Conference Center<br>1 Community Center Circle,<br>Midlothian, TX 76065 |
| Longview | February 6, 2007 | 2:00 P.M. | Longview Public Library<br>222 W. Cotton Street,<br>Longview, TX 75601 |
| Austin | February 8, 2007 | 2:00 P.M. | Texas Commission on Environmental Quality<br>12100 Park 35 Circle, Austin, TX 78753<br>Building E, Room 201S |

The public comment period opened on December 29, 2006, and closed on February 12, 2007. Written comments were accepted via mail, fax, or through the TCEQ e-comment system.

## 1.4 SOCIAL AND ECONOMIC CONSIDERATIONS

For a detailed explanation of the social and economic issues involved with any of the measures, please refer to the preambles that precede each proposed rule package accompanying this SIP.

## 1.5 FISCAL AND MANPOWER RESOURCES

The state has determined that its fiscal and manpower resources are adequate and will not be adversely affected through the implementation of this plan.

# CHAPTER 2: PHOTOCHEMICAL MODELING

## 2.1 INTRODUCTION

This chapter describes modeling conducted in support of the eight-hour ozone attainment demonstration SIP revision for the DFW nine-county nonattainment area. The 1990 FCAA requires that attainment demonstrations be based on photochemical grid modeling or any other analytical methods determined by the EPA to be at least as effective. The EPA's recent "Guidance on the Use of Models and Other Analyses in Attainment Demonstrations for the Eight-Hour Ozone NAAQS" (October 2005) recommends new procedures for determining whether a control strategy package will lead to attainment of the eight-hour NAAQS for ozone.

The guidance, which is the latest released by the EPA, recommends several qualitative methods for preparing attainment demonstrations that acknowledge the limitations and uncertainties of photochemical models when used to project ozone concentrations into future years. First, the guidance recommends using model outputs in a relative sense and applying the model response to the observed ozone data. Second, the guidance recommends using available air quality, meteorology, and emissions data to develop a conceptual model for eight-hour ozone formation and to use that analysis in episode selection. Third, the guidance recommends using supportive analyses (Weight of Evidence) to supplement and corroborate the model results and support the adequacy of a proposed strategy package.

In early 2003, as the TCEQ was preparing to move forward with the Mid-Course Review (MCR) for the DFW area, the EPA announced its plans to begin implementation of the eight-hour ozone standard. On June 2, 2003, the Federal Register published EPA's proposed Implementation Rule for the Eight-Hour Ozone Standard. In the same timeframe, EPA also formalized its intentions to designate areas for the eight-hour ozone standard by April 15, 2004, meaning states would need to reassess their efforts to date and control strategies to address the new standard by 2007.

Recognizing that existing one-hour ozone nonattainment areas would soon be subject to the eight-hour ozone standard, and in an effort to efficiently manage the state's limited resources, the TCEQ developed an approach that addressed the commitments made under the one-hour ozone standard while moving forward on the more stringent eight-hour ozone standard. Using the same episode for both one-hour and eight-hour modeling provided the opportunity to build upon a well-developed and properly performing foundation, as well as the opportunity to update emissions inventory data, use the most current modeling tools, enhance the photochemical grid modeling, and revise control strategies, if necessary.

This attainment demonstration uses photochemical modeling in combination with trends, transport analyses, and supplementary data to show that the DFW nine-county nonattainment area is on a path to attain the 0.08 ppm eight-hour ozone standard by June 15, 2010. The additional data and analysis in the Weight of Evidence (WoE) also supports the attainment conclusion.

### Overview of Ozone Photochemical Modeling Process

Ozone is a secondary pollutant; it is not generally emitted directly into the atmosphere. Ozone is created in the atmosphere by a complex chemical reaction between sunlight and several primary pollutants. The chemical reaction requires ultraviolet energy from sunlight. The primary pollutants fall into two groups, nitrogen oxides (known as $NO_x$) and volatile organic compounds (known as VOC). As a result of these multiple factors, ozone events are most common during the summer and concentrations peak during the day and fall during the night and early morning hours.

Ozone chemistry is complex, involving more than 80 chemical reactions and hundreds of chemical compounds. As a result, ozone cannot be evaluated using simple dilution and dispersion algorithms. Due to the chemical complexity and the requirement to evaluate the effectiveness of future controls, the EPA's guidance strongly recommends using photochemical computer models to analyze ozone issues. Computer simulations are the most effective tools to address both the chemical complexity and the future case evaluation.

**Ozone Modeling**

Ozone modeling involves two major phases, the base case and the future case (with substeps in each phase). The purpose of the base case is to evaluate procedures and to ensure that the model is performing correctly. The purpose of the future case is to evaluate the effectiveness of controls and to demonstrate attainment.

**Base Case Modeling**

Base case modeling involves several steps. First, historical episodes must be analyzed extensively to determine what factors are associated with ozone formation in the area, followed by development a conceptual model that identifies those factors. The technical team then selects an episode to model (a recent, real-world ozone event) that is representative of the factors, develops a modeling protocol (plan) that describes the process to be followed to evaluate the ozone in the urban area, and submits the plan to the EPA for approval.

The next step is to generate and quality assure the emissions and meteorological data for the episode. Then the meteorological data and $NO_X$ and VOC emissions information are added into the computer model and the ozone model output is evaluated. The final step is to validate the base case modeling results by comparing them to the real measurements for ozone and precursor compounds to be sure that the model is performing correctly. The model output is assessed based on subjective analysis and statistical tests described in the EPA's 2005 modeling guidance. Satisfactory performance of the base case model demonstrates that the model is giving right answers for the right reasons; then the model is ready to be used for future case modeling.

**Future Case Modeling**

Future case modeling is designed to evaluate how much ozone will be created in the future. The scientific question is: If the same meteorology were to occur in the future, how much ozone would be formed? To answer this question, a future case emissions inventory must be developed that includes the impact of economic growth in the region, as well as all of the state and federal emission reductions that will be in effect in the future.

The first step of the future base case is to run the model with the emissions projected into the future while applying only the existing emissions reduction strategies to determine how well the model responds to existing controls, including state and federal mandated measures. The relative response factor (RRF) is multiplied by the baseline ozone measured during the representative base period. If the product of the RRF and baseline ozone is less than 0.08 ppm, the attainment demonstration is satisfied. If the existing emission reduction strategies are not sufficient to offset the growth and reduce ozone to attainment levels, then additional controls may be needed. The second step of the future case modeling is to test new, additional strategies to determine what combination of reductions would be most effective to bring the area into attainment.

## 2.2 EPISODE SELECTION

The EPA's guidance for episode selection has evolved over the last several years as the focus has shifted from the one-hour ozone standard to the eight-hour ozone standard, as explained in Section 2.1. The current episode was selected to address both the one-hour and eight-hour ozone standards. The August 13-22, 1999, episode was selected because it included both one-hour and eight-hour ozone exceedance events and was consistent with the conceptual model for ozone formation in the DFW area. As required by the EPA (EPA, 2005 a, b) several different candidate episodes were considered, and the final selection was based on evaluation of the meteorology associated with the events, as well as the availability of real time emissions and precursor measurements.

Much of the early development work for this eight-hour episode was done in support of a planned one-hour ozone MCR before the EPA issued the draft eight-hour ozone guidance. The one-hour ozone MCR modeling provided a strong foundation for the eight-hour ozone modeling, and since that time, the August 13-22, 1999, eight-hour ozone episode has been further developed and improved. The development process evolved over time, and improvements were added in a continuous cycle involving the incorporation of technical insight, best practices, model upgrades, and performance evaluation.

The August 13-22, 1999, DFW ozone episode is ten days long and includes nine days with eight-hour ozone exceedances. The episode includes a full synoptic cycle with a sequential pattern of different daily wind directions reflecting wind directions associated with DFW ozone events. The episode also includes a full ozone cycle, low ozone concentrations at the beginning and end with a period of high ozone concentrations in the middle, reflecting near calm winds. Weekdays and weekends were both included to properly reflect the occurrence of eight-hour ozone events in the DFW area.

Since the episode was selected before the EPA's eight-hour ozone guidance was finalized, some of the DFW early one-hour ozone selection criteria are not in the most recent EPA guidance (2005). However, since a large body of work has been developed with the current DFW episode, and significant performance improvements have been made, the EPA approved the use of the August 1999 episode for this eight-hour ozone demonstration. The following discussion will address how the August 1999 episode meets the most recent EPA selection criteria (EPA-454/R-05-002, 2005).

**EPA Guidance for Episode Selection**

Since 1999, the EPA has recommended selecting ozone episodes that represent the most typical and frequent ozone events based upon analysis of the meteorological and geographical patterns associated with high ozone concentrations in the area. The EPA also recommends selecting extended episodes that encompass full synoptic cycles from ramp-up to a high ozone period to a ramp-down to allow for a more complete evaluation of model performance through the full cycle. The EPA recommends (EPA, 1999) that at least four criteria be used to select episodes that are appropriate to model:

- Choose a mix of episodes reflecting a variety of meteorological conditions that frequently correspond with observed eight-hour ozone daily maxima greater than 84 ppb at multiple monitoring sites.
- Model periods in which observed eight-hour ozone daily maximum concentrations are close to the average fourth high eight-hour ozone daily maximum ozone concentrations.
- Model periods for which extensive air quality data and meteorological databases exist.
- Model a sufficient number of days so that the modeled attainment test applied at each monitor violating the NAAQS is based on multiple days.

**DFW Ozone Episode Selection Process**

An episode selection analysis was performed to identify time periods with representative high one-hour and eight-hour ozone levels suitable for developing regional scale modeling (Environ, 2002 and Environ 2003b). Episode selection was based upon the considerations developed in those studies.

Ozone episodes selected for modeling should represent the most frequent, typical, and representative patterns associated with high ozone in the DFW area. Detailed analysis of individual ozone events for the conceptual model has shown that although DFW ozone is associated with winds on different days blowing from the northeast through the east, southeast, and south, the common factor in all ozone events is light wind speeds. Light winds are typically less than seven mph.

The TCEQ evaluated the following factors as part of the episode selection process in determining the best candidate was the period of August 13-22, 1999.

- The best time period from which to select additional episodes to model is during August-September when ozone episodes occur most frequently in Texas and when the highest design values are established at most of the area's monitors. The August 13-22, 1999, episode occurs during the core of the Texas ozone season, as shown by Figure 2-1: *Texas Ozone Season*.

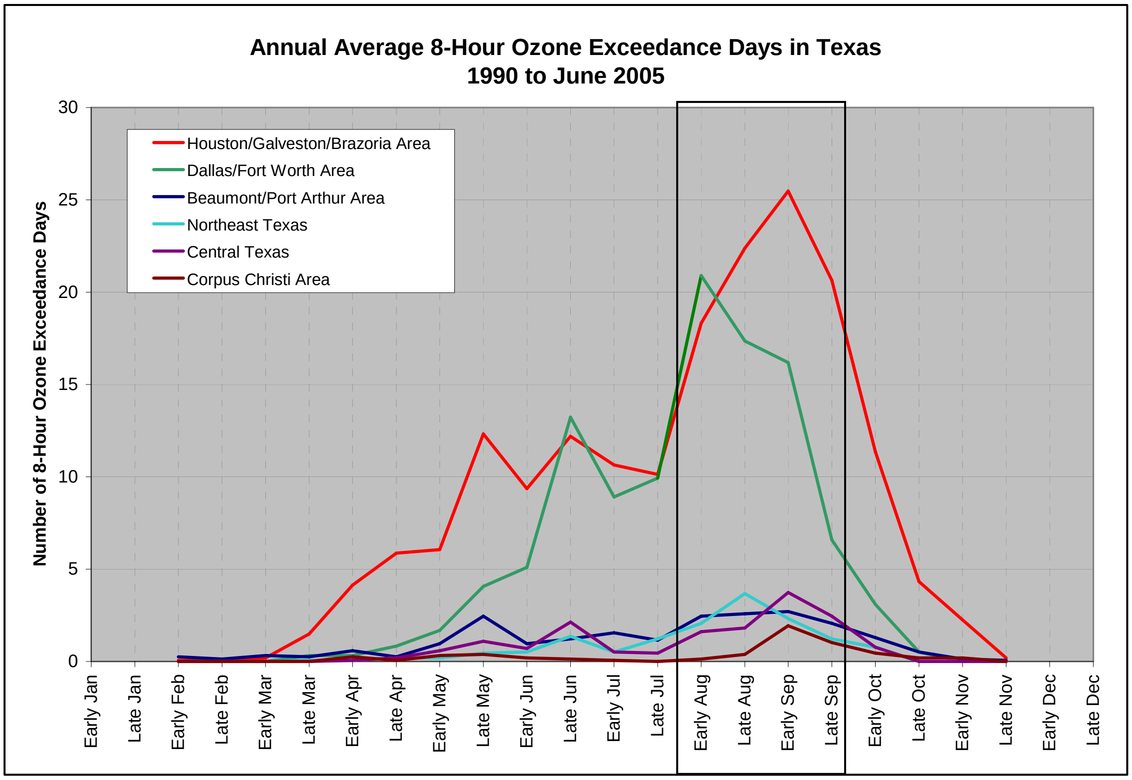



**Figure 2-1: Texas Ozone Season**

- Recent episodes are preferable to older episodes because recent episodes better represent the current emissions inventory, including mobile and point source configurations. At the time of the decision, August 13-22, 1999, was the most recent and representative episode.
- Well-monitored episodes (with more meteorology, VOC, and $NO_x$ data) are preferable to data-poor episodes. Additional data allow for a more thorough model evaluation and provide the information necessary to understand the processes leading to high ozone. During 1999, there were nine active ozone monitors, six $NO_x$ monitors, and one VOC monitoring gas chromatograph system.
- Episodes should include a variety of wind directions and speeds associated with high ozone concentrations. The August 13-22, 1999, episode included a variety of wind directions associated with a complete synoptic cycle, as shown by Figure 2-2: *Wind Directions Associated with DFW Eight-Hour Ozone Episodes.* The August 13-22, 1999, episode also included a variety of morning and afternoon wind speeds including near calm conditions, as shown by Figure 2-3: *DFW Ozone vs. Morning and Afternoon Wind Speeds.*

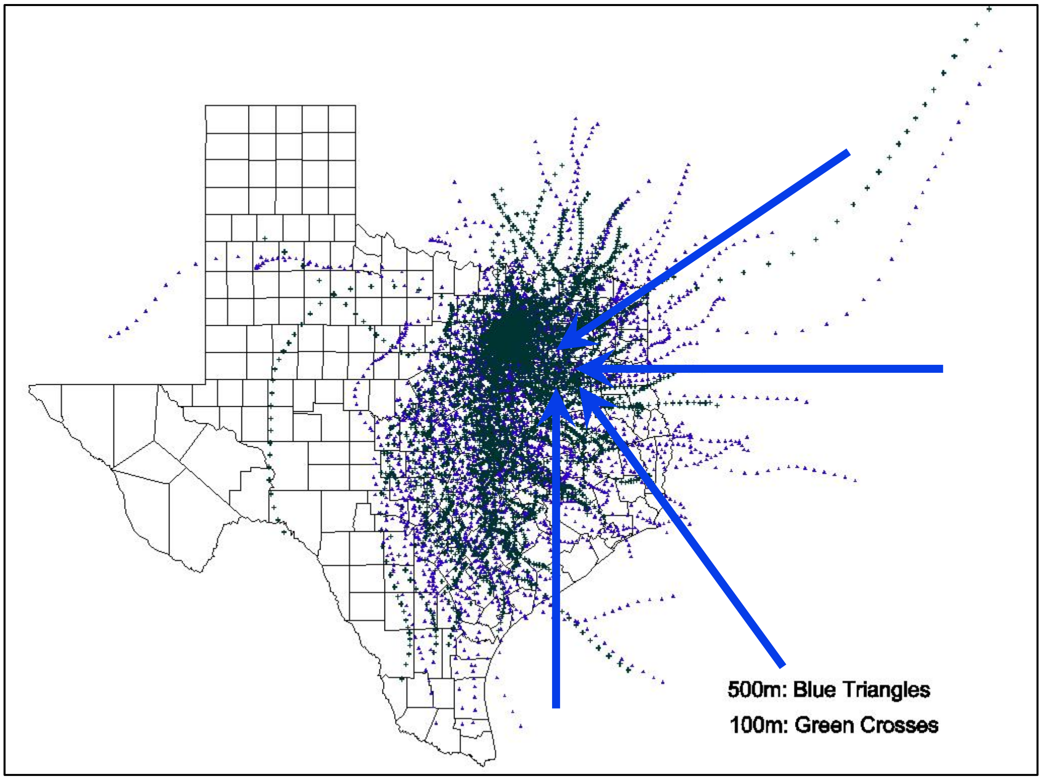



**Figure 2-2: Wind Directions Associated with DFW Eight-Hour Ozone Episodes**

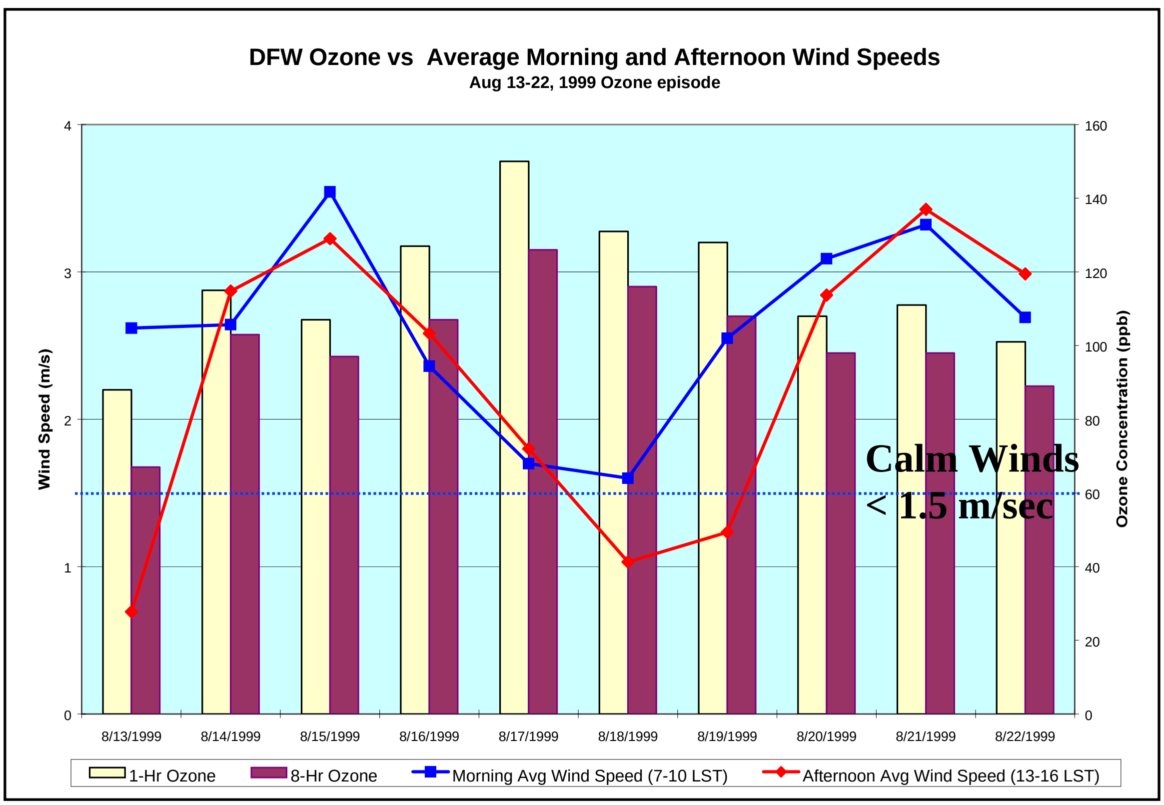



**Figure 2-3: DFW Ozone vs. Morning and Afternoon Wind Speeds**

- Episodes should include days that have high ozone concentrations in the geographical locations where high values typically occur. The Frisco, Denton, and Keller monitors experienced multiple exceedances during the August 13-22, 1999, period and are on the north and west side of the DFW area, the areas that most frequently experience high ozone, as shown in Figure 2-4: *DFW Sites with High Eight-Hour Ozone Design Values*.

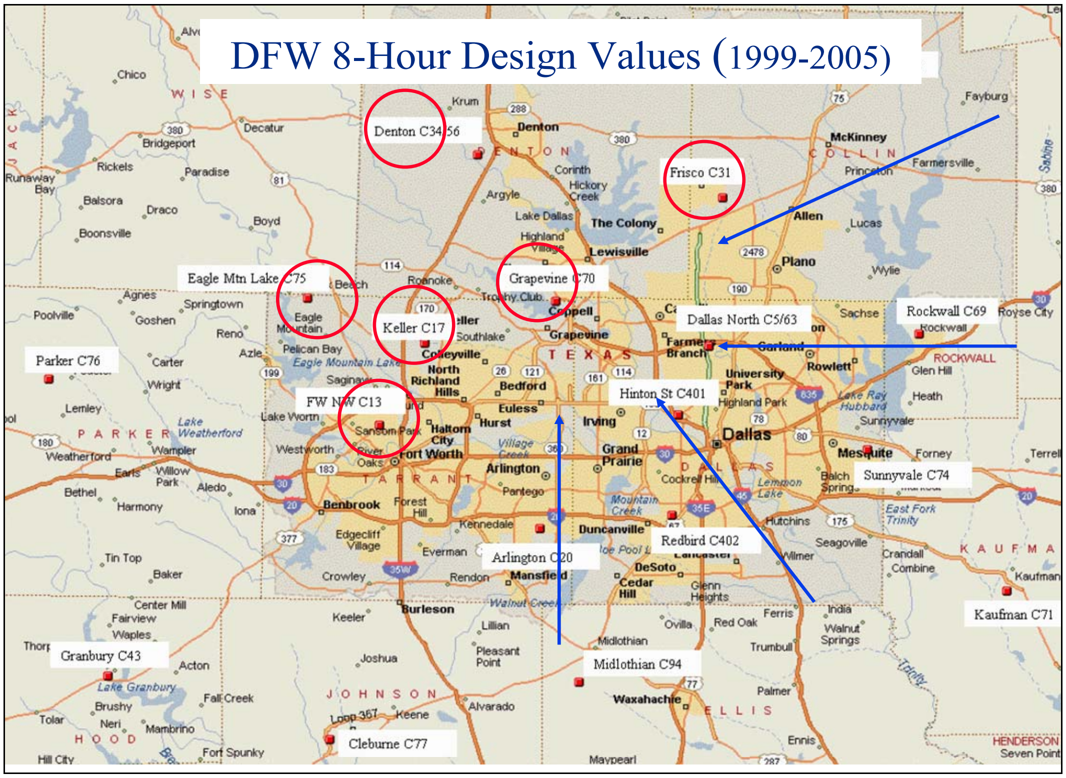



**Figure 2-4: DFW Sites with High Eight-Hour Ozone Design Values**

- Episodes should include days with monitored ozone concentrations within 10 ppb of the design value to represent the magnitude of ozone that must be controlled. There were 36 eight-hour ozone exceedances recorded during the August 13-22 period, and 22 of those measurements were within 10 ppb of the site specific design value.

- The August 13-22, 1999, period starts on a low ozone day, includes nine consecutive days with eight-hour ozone exceedances, with ozone concentrations declining at the end of the period.

- The highest monitored ozone occur on the days with lighter winds in the middle of the episode and at the Frisco and Denton monitors, which have the highest design values for the period, as illustrated by Figure 2-5: *August 13-22, 1999, Daily Max Ozone and Number of Stations with Exceedances.*

## DFW 8-Hour Ozone Episode

August 13 - August 22, 1999

| Day | Date | Max O3 | Site Name | # Sites | Remarks |
|---|---|---|---|---|---|
| F | Aug 13 | 67 | Frisco | 0 | SW Winds, Ramp Day |
| Sa | Aug 14 | 103 | Arlington | 4 | NE Winds |
| Sun | Aug 15 | 97 | Keller | 6 | East Winds |
| M | Aug 16 | 107 | Keller | 6 | East Winds |
| T | Aug 17 | **126** | Frisco, Denton | 7 | Light SE Winds |
| W | Aug 18 | 116 | Frisco | 4 | Light South Winds |
| Th | Aug 19 | 108 | Midlothian | 2 | Weak Front, N Winds |
| Fri | Aug 20 | 98 | Midlothian | 1 | NE Winds |
| Sa | Aug 21 | 98 | Arlington | 5 | East Winds |
| Sun | Aug 22 | 89 | Denton | 2 | SE Winds |
| Mon | Aug 23 | 59 | Denton | 0 | S Winds, Low Ozone |

TCEQ/Breitenbach January 26, 2006

**Figure 2-5: August 13-22, 1999, Daily Max Ozone and Number of Stations with Exceedances**

As a result of these considerations, the August 13-22, 1999, ozone episode was selected for one-hour ozone modeling for the DFW area. Additional review of the event confirmed that the August 13-22, 1999, episode was also typical of eight-hour ozone episodes. On February 1, 2005, TCEQ staff met with EPA Office of Air Quality Planning and Standards (OAQPS) and Region 6 staff and jointly agreed that the August 13-22, 1999, episode provided an acceptable platform for eight-hour ozone SIP development.

Since that time, the TCEQ has revisited the conceptual model (Dallas/Fort Worth Nonattainment Area Ozone Conceptual Model, TCEQ, November 2005) and confirmed that the meteorological and geographical patterns that occurred in the 1999 episode are still occurring. Therefore, the August 13-22, 1999, episode is still valid and represents both typical and current ozone events in the DFW area.

Finally, the TCEQ also performed preliminary modeling of additional ozone episodes to see if the additional data would assist in the attainment demonstration. Coarse grid (12 km) modeling using data from the Oklahoma extension period (August 23-September 1, 1999) indicated that the model performance during the extended period was not as reliable as the existing DFW core episode and that the extra days would not change the model response in the DFW area. Similarly, analysis of DFW 12 km results during the Houston 2000 episode indicated that the Houston modeling did not perform as well in the DFW area as the DFW core episode. In both cases, the extra time and effort to bring the modeling up to performance standards would commit staff resources and delay the schedule without significant benefit. Therefore, the TCEQ decided to focus only on the DFW core episode.

The details of the evolution and gradual improvement in the performance of this episode may be reviewed by referring to the supplementary documents in the appendices and the bibliography.

### 2.3 MODEL SELECTION AND SETUP

This section discusses the most recent formulation of the model, including selection of the air quality model, the modeling domain, and the initial and boundary conditions. As the result of some exploratory work done by Environ (Tai, 2005a) several upgrades were incorporated into the modeling, including an expanded modeling domain, more vertical layers, better low level mixing, and enhanced boundary conditions. These changes improved model performance and were incorporated into the DFW modeling.

#### 2.3.1 Selection of Air Quality Model

Guidance from the EPA requires that the air quality model selected must be scientifically appropriate for the intended application and be freely accessible to all stakeholders. The following three simple prerequisites were set for selecting the photochemical grid model to be used for SIP-related modeling. The model must:

- have a reasonably current, peer-reviewed, scientific formulation;
- be available at no or low cost to stakeholders; and
- not require the reformatting of available model inputs from earlier rounds of the study.

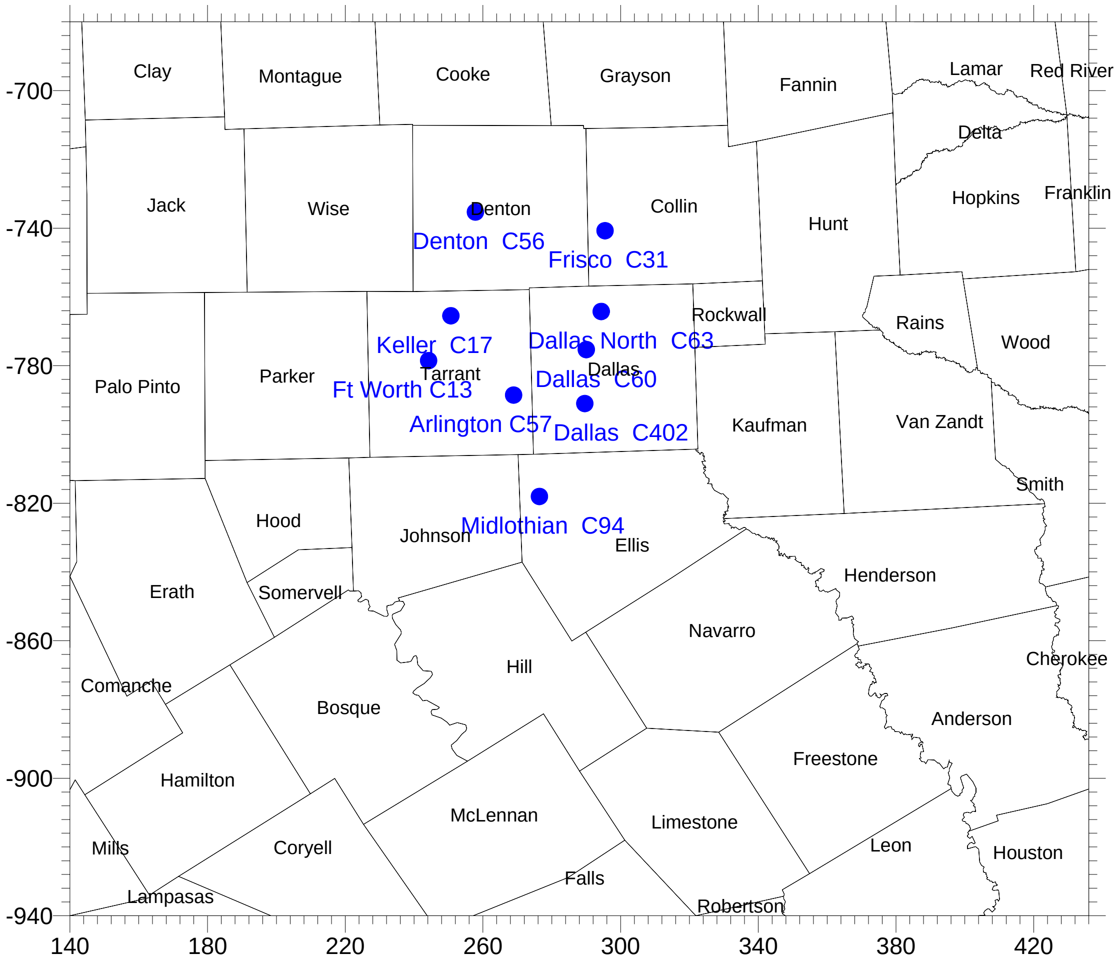
The only model to meet all three of these criteria is the Comprehensive Air Model with Extensions (CAMx). The model is based on well-established treatments of advection, diffusion, deposition, and chemistry. Another important feature is that $NO_x$ emissions from large point sources can be treated with the plume-in-grid sub-model that helps avoid the artificial diffusion that occurs when point source emissions are inserted into a grid volume. The model software and the CAMx user's guide are publicly available at http://www.camx.com.

Version 4.03 of CAMx was used for all of the base case diagnostics and performance analysis and for the future case modeling for the majority of the sensitivity tests in order to maintain continuity and consistency with previous results. However, in June 2006 a new version of CAMx was tested to incorporate the latest upgrades and to be consistent with the Houston modeling. The new version (CAMx version 4.31) improves the plume dispersion algorithms and adds full $NO_x$ and VOC chemistry in the plumes. CAMx 4.31 was tested in the base case and demonstrated improved performance, especially on August 17, the day with the highest monitored ozone concentrations. As a result of the improved base case performance in the DFW episode, CAMx 4.31 was used for the DFW future case modeling.

Similarly, the modeling emissions inventory underwent refinement over the course of the modeling analysis. The original emissions inventory, designated ".a0", was used for early modeling. The .a0 inventory was subsequently upgraded to the ".a1" inventory, which incorporated 2005 acid rain data for point source emissions. This .a1 inventory was then used for the future case sensitivity tests to maintain consistency and comparability. In June 2006, the final version of the emissions inventory, designated ".a2", was developed. This version of the inventory incorporated adjustments to the future case point source emissions for the Houston area cap and trade program and was used for all subsequent work.

#### 2.3.2 Modeling Domain and Horizontal Grid Cell Size

Early photochemical modeling for the DFW episode used the original DFW 36 km domain extending as far north as southern Nebraska and as far east as Georgia and the Florida Panhandle. The TCEQ expanded the modeling domain further east and north to reduce the influence of boundary conditions on ozone concentrations in the DFW area. The new domain expands the eastern boundary out to the Atlantic Ocean to include all of the eastern states and extends the northern boundary into North Dakota and part of Canada. The southern and western boundaries were unchanged.




**CAMx Grid Dimensions**
**LCP center at (40 N, 100 W), True latitudes at 30 N and 60 N**

**4 km grid (with buffers): 74 x 65 from (140, -940) to (436, -680)**

**Figure 2-6: DFW Main Modeling Fine (4-km) Grid with Ozone Monitor Sites**

Figure 2-6: *DFW Main Modeling Fine (4 km) Grid with Ozone Monitor Sites*, shows the DFW fine (4 x 4 km) grid used in all phases of the eight-hour ozone modeling of the August 1999 ozone episode. The grid shows the four core counties (Denton, Collin, Dallas, and Tarrant) as well as the surrounding five counties (Rockwall, Kaufman, Ellis, Johnson, and Parker) that were added as part of the eight-hour ozone standard nonattainment designation. The figure also shows the locations of the nine ozone monitors used in this modeling exercise.

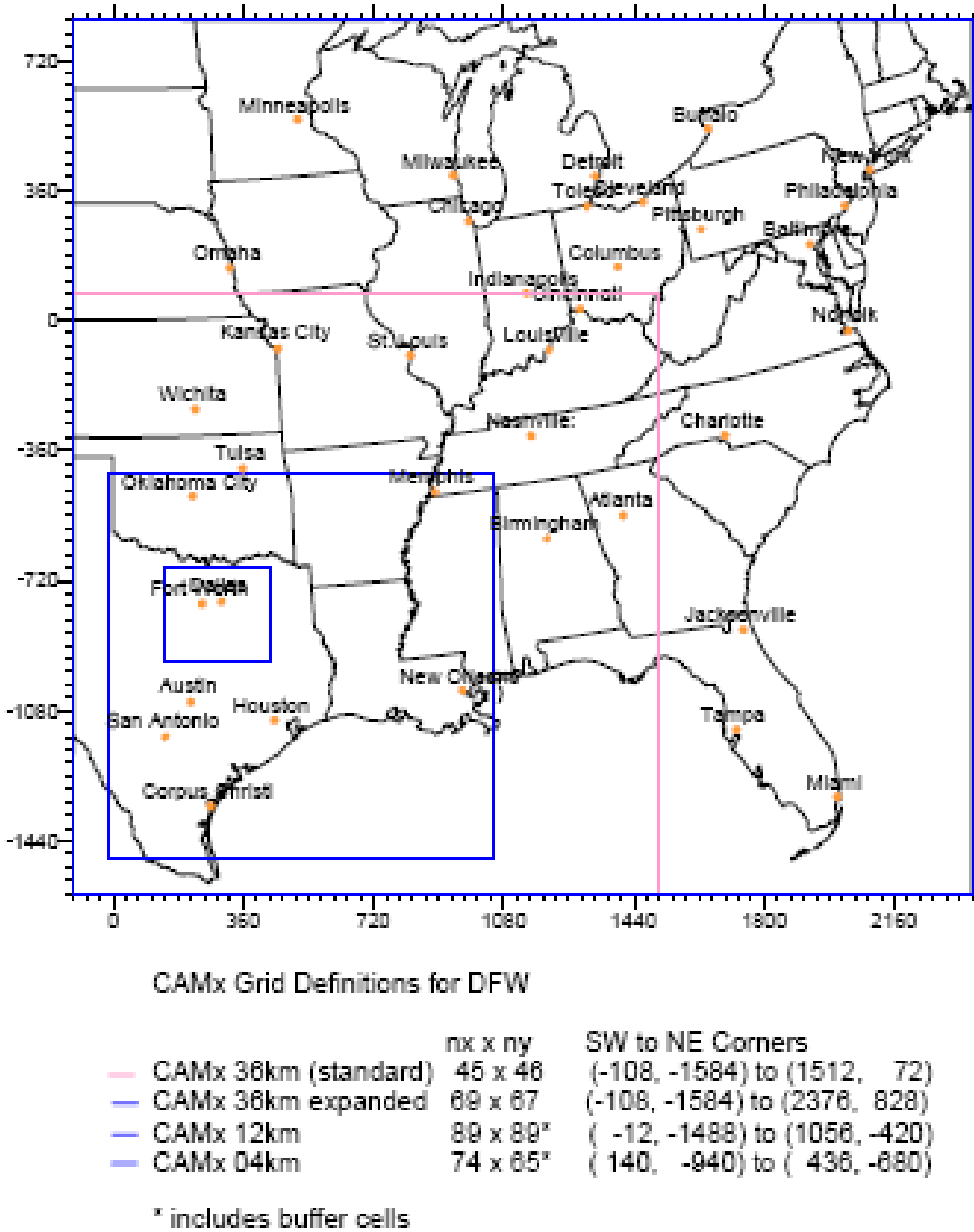



**Figure 2-7: DFW Modeling Grids, Original Nesting and Expanded Grids (From Tai 2005a, Figure 4-1)**

Figure 2-7: *DFW Modeling Grids, Original Nesting and Expanded Grids,* shows the original grid configuration as well as the extended domain used for the more recent modeling. The pink line shows the original smaller domain, and the blue lines show the current configuration. The expanded CAMx modeling domain consists of three nested grids depicted in blue. The finest grid (4 km × 4 km) encompasses the nine DFW nonattainment counties and is nested within a 12 km × 12 km grid covering the eastern part of Texas and extending into Louisiana and Mississippi. The outer 36 km × 36 km grid extends out to the Atlantic Ocean. The dimensions of the largest grid were selected based upon back trajectory analyses, which indicated that the expanded domain was large enough to minimize the impact of the contributions from the boundary conditions upon the 4 km inner grid while preserving reasonable model run times.

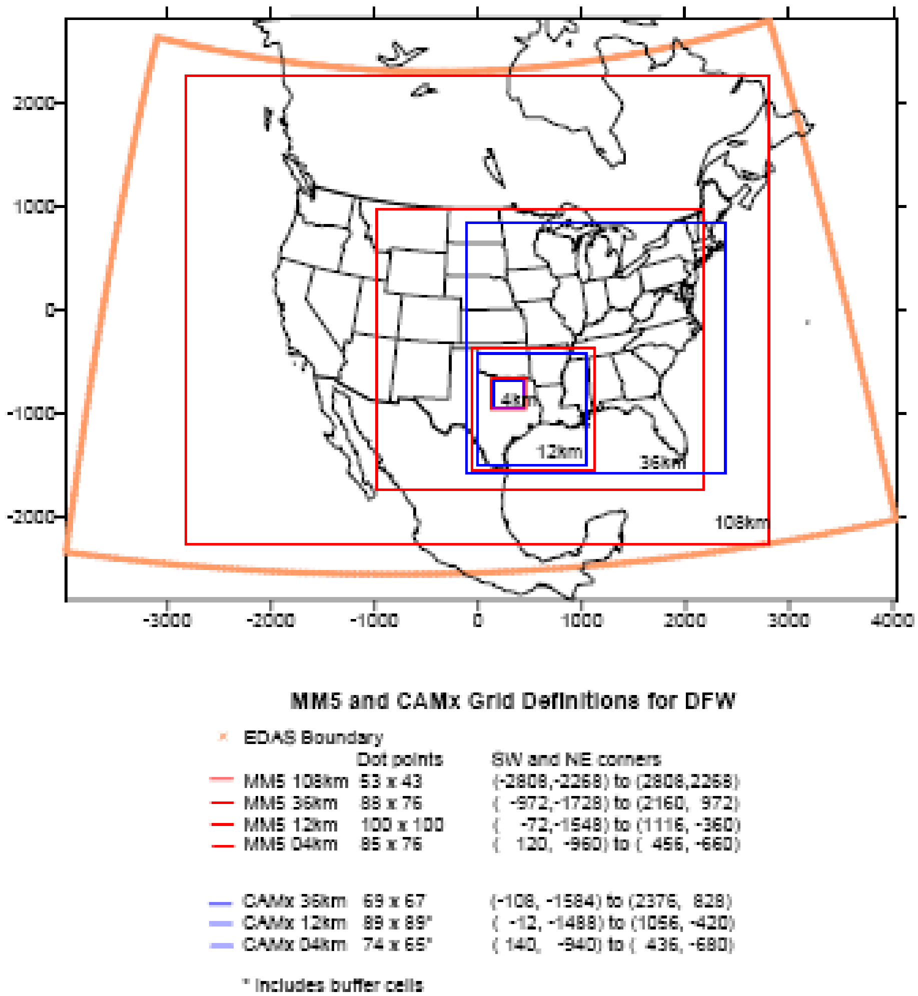



**Figure 2-8: MM5 and CAMx Modeling Grids with the Expanded Domain (From Tai 2005a, Figure 4-2)**

Figure 2-8: *MM5 and CAMx Modeling Grids with the Expanded Domain* shows both the NCAR/Penn State Mesoscale Model 5 (MM5) meteorological grid and the CAMx grids together. The meteorological grid is generally three cells larger than the CAMx grid, so that the interpolated meteorological conditions at the edge of each MM5 grid, which may not be balanced, are not used in the CAMx chemistry model.

### 2.3.3 Vertical Layer Structure

Determining the number of vertical layers for the modeling domain is a balance between including enough detail to accurately characterize the vertical layering of the atmosphere and managing the amount of computer time required to run the model. In the past, the first 15 vertical layers from MM5 and CAMx coincided, peaking at an altitude just below 4 km. Later work extended the model top to over 15 km by adding five additional layers, each spaced roughly 2 to 3 km apart.

The vertical layering structure from MM5 and CAMx is listed in Table 2-1: *MM5 and CAMx Vertical Layer Structure*. The layers are thinner near the surface and thicker at higher levels. The high level of vertical resolution in the lower layers helps the model to properly characterize the pollutant concentrations and the vertical gradients as the mixing depth changes throughout the day.

**Table 2-1: MM5 and CAMx Vertical Layer Structure**
**(From Tai, 2005a. Table 4-1)**

| MM5 Layers | sigma | pressure | height | thickness | CAMx Layers | IC/BC |
|---|---|---|---|---|---|---|
| 28 | 0.0000 | 50.00 | 18874.41 | 1706.76 | | |
| 27 | 0.0250 | 73.75 | 17167.65 | 1362.47 | | |
| ------------------------ | | | Extended | CAMx Top | ---------------- | |
| 26 | 0.0500 | 97.50 | **15805.17** | 2133.42 | --20--- | ˆ |
| 25 | 0.1000 | 145.00 | **13671.75** | 1664.35 | --19--- | \| |
| 24 | 0.1500 | 192.50 | 12007.40 | 1376.75 | | \| |
| 23 | 0.2000 | 240.00 | **10630.65** | 1180.35 | --18--- | \| |
| 22 | 0.2500 | 287.50 | 9450.30 | 1036.79 | | \| |
| 21 | 0.3000 | 335.00 | **8413.52** | 926.8 | --17--- | \| |
| 20 | 0.3500 | 382.50 | 7486.72 | 839.57 | | \| |
| 19 | 0.4000 | 430.00 | 6647.15 | 768.53 | | Clean IC |
| 18 | 0.4500 | 477.50 | **5878.62** | 709.45 | --16--- | \| |
| 17 | 0.5000 | 525.00 | 5169.17 | 659.47 | | \| |
| 16 | 0.5500 | 572.50 | 4509.70 | 616.58 | | \| |
| ------------------------ | | | Original | CAMx Top | ---------------- | \| |
| 15 | 0.6000 | 620.00 | **3893.12** | 579.34 | --15--- | \| |
| 14 | 0.6500 | 667.50 | **3313.78** | 546.67 | --14--- | \| |
| 13 | 0.7000 | 715.00 | **2767.11** | 517.77 | --13--- | \| |
| 12 | 0.7500 | 762.50 | **2249.35** | 491.99 | --12--- | |
| 11 | 0.8000 | 810.00 | **1757.36** | 376.81 | --11--- | ------------- |
| 10 | 0.8400 | 848.00 | **1380.55** | 273.6 | --10--- | ˆ |
| 9 | 0.8700 | 876.50 | **1106.95** | 266.37 | ---9--- | \| |
| 8 | 0.9000 | 905.00 | **840.58** | 259.54 | ---8--- | \| |
| 7 | 0.9300 | 933.50 | **581.04** | 169.41 | ---7--- | \| |
| 6 | 0.9500 | 952.50 | **411.63** | 166.65 | ---6--- | \| |
| 5 | 0.9700 | 971.50 | **244.98** | 82.31 | ---5--- | Moderate IC |
| 4 | 0.9800 | 981.00 | **162.67** | 65.38 | ---4--- | \| |
| 3 | 0.9880 | 988.60 | **97.29** | 56.87 | ---3--- | \| |
| 2 | 0.9950 | 995.25 | **40.43** | 20.23 | ---2--- | \| |
| 1 | 0.9975 | 997.62 | **20.19** | 20.19 | ---1--- | ˇ |
| 0 | 1.0000 | 1000.00 | **0.00** | ======== | Surface | ======== |

### 2.3.4 Initial and Boundary Conditions

ENVIRON developed the initial and boundary conditions for modeling conducted in the DFW and Northeast Texas areas. The EPA default concentrations were used for most species, but concentrations of several important ozone precursors, including isoprene and NO, were modified based on monitoring data collected at Kinterbish, Alabama, a rural site near the eastern border of the modeling domain. Additional details about boundary concentrations may be found in Mansell (2003), starting on page 6-23.

Boundary conditions are classified into three categories: clean, moderate, and dirty. The table in Figure 2-9: *Boundary Conditions Used for the Expanded Domain in DFW Modeling* shows the boundary concentrations associated with each category. Boundaries over the Gulf of Mexico and the Atlantic were assigned clean conditions. The western boundary, the southern boundary over Mexico, and the northern boundary over Nebraska were set to the moderate group up to 1700 m and clean farther aloft. The dirty category was used over land areas with the smaller domain but not used in the extended domain. Initial conditions were clean everywhere.

| Species | Dirty | Moderate | Clean |
|---|---|---|---|
| O3 | 40 | 40 | 40 |
| CO | 200 | 200 | 100 |
| NO | 0.1 | 0.1 | 0.1 |
| NO2 | 1 | 1 | 1 |
| HNO3 | 3 | 3 | 1 |
| HNO2 | 0.001 | 0.001 | 0.001 |
| ALD2 | 0.555 | 0.555 | 0.05 |
| ETH | 0.51 | 0.51 | 0.15 |
| HCHO | 2.1 | 2.1 | 0.05 |
| OLE | 0.3 | 0.3 | 0.05 |
| PAR | 14.9 | 14.9 | 7.6 |
| TOL | 0.18 | 0.18 | 0.0786 |
| XYL | 0.0975 | 0.0975 | 0.0688 |
| ISOP | 3.6 | 0.1 | 0.001 |
| PAN | 0.1 | 0.1 | 0.1 |
| H2O2 | 3 | 3 | 1 |
| MEOH | 8.5 | 0.001 | 0.001 |
| ETOH | 1.1 | 0.001 | 0.001 |

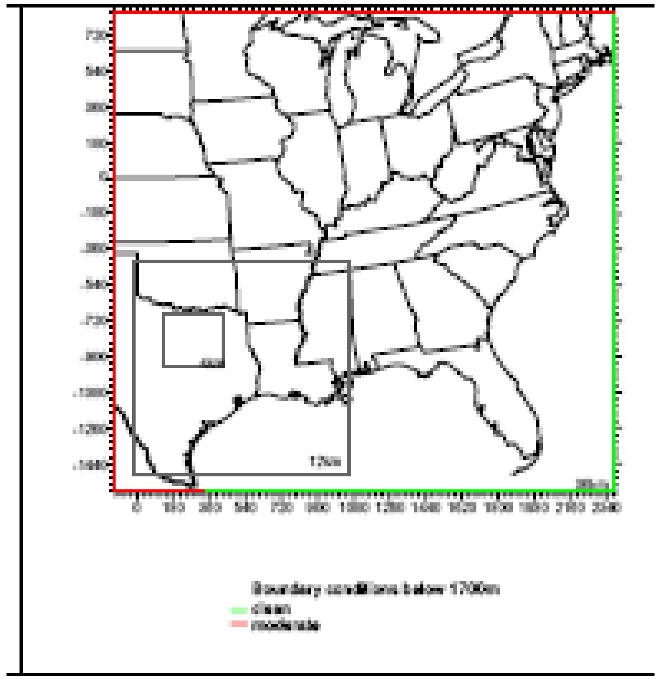


**Figure 2-9: Boundary Conditions Used for the Expanded Domain in DFW Modeling**

### 2.3.5 CAMx Model Options

CAMx has several user-selectable options that are specified for each simulation through the CAMx control file. Four model options must be decided for each project: the advection scheme, the plume-in-grid scheme, the chemical mechanism, and the chemistry solver. The selection for each option is decided during the base case model performance evaluation and then held fixed for the evaluation of any future year emission scenarios. The recommended choices for these options are discussed below. See the CAMx User's Guide (ENVIRON, 2000) for more details on these options.

*Advection Scheme*

CAMx version 4.02 has three optional methods for calculating horizontal advection (the movement of pollutants due to resolved horizontal winds). These are known as Smolarkiewicz, Bott, and the Piecewise Parabolic Method (PPM). The Smolarkiewicz scheme has been used for many years and was used in previous modeling for Northeast Texas (ENVIRON, 1999). The Smolarkiewicz scheme has been criticized for causing too much artificial diffusion of pollutants, tending to dilute features and artificially overstate transport. The Bott and PPM schemes are newer and have less artificial diffusion than the Smolarkiewicz scheme. The PPM scheme was used for this study because it was determined to be the least numerically diffusive; it runs at speeds similar to Smolarkiewicz; and it does not exhibit certain noisy features near sharp gradients that are apparent with the Bott approach.

*Plume-in-Grid*

CAMx includes an optional sub-grid scale plume model, which can be used to represent the dispersion and chemistry of major $NO_x$ point source plumes close to the source. The TCEQ used the Plume-in-Grid (PiG) sub-model for major $NO_x$ sources (i.e., point sources with episode-average $NO_x$ emissions greater than two tons per day (tpd) in the 4-km grid).

*Chemical Mechanism*

CAMx provides two alternatives for the chemical mechanisms used to describe the gas-phase chemistry of ozone formation: the Carbon Bond 4 (CB4) and SAPRC99 mechanisms. The most widely used mechanism for regional applications is CB4 with the updated isoprene and radical termination reactions. CB4 was used for this study.

*Chemistry Solver*
CAMx has two options for the numerical scheme used to solve the chemical mechanism. The first option is the Chemical Mechanism Compiler (CMC) fast solver, which has been used in every prior version of CAMx. The second option is an Implicit Explicit (IEH) solver. The CMC solver is faster and more accurate than most chemistry solvers used for ozone modeling. The IEH solver is even more accurate than the CMC solver, but slower. The CMC solver was used for this study.

## 2.4 METEOROLOGICAL MODELING

This section discusses the results of a series of studies designed to improve the meteorological modeling in support of the DFW August 13 - 22, 1999, ozone episode. The first meteorological modeling for this episode was done in 2003 (Mansell, 2003) in support of both one-hour and eight-hour ozone modeling requirements. That work used the following physics configuration:

- Simple-ice microphysics is employed for all domains;
- Kain-Fritsch cumulus parameterization scheme is invoked for 108 km, 36 km, and 12 km grids;
- No cumulus parameterization scheme is invoked for the 4 km domain, as convection is explicitly fully resolved at this resolution scale;
- The Rapid Radiative Transfer Model (RRTM) radiation scheme is used for all of the grids;
- Two-way interactive 108 km, 36 km, 12 km, and 4 km grids are used;
- The Pleim-Xiu Land Surface Model (LSM) with its own Planetary Boundary Layer (PBL) scheme; and
- 28 layers reaching up to 50 mb or 18,874 meters.

The early work was satisfactory but showed a general tendency to under predict ozone levels. The tendency to under predict was attributed to problems with high wind speed and wind direction errors that diluted ozone concentrations and carried the urban plume out of the DFW area. However, one CAMx sensitivity test also indicated that the CAMx model was not properly replicating the growth of the boundary layer and the afternoon maximum mixing height. Additional meteorological modeling was recommended to evaluate vertical mixing parameterization. Another CAMx sensitivity test indicated that ozone concentrations within the DFW area are particularly sensitive to the boundary conditions, highlighting the importance of setting the correct concentrations at the boundaries of the model. Due to these findings, the next round of modeling incorporated a larger modeling domain to allow the CAMx model to correct the boundary concentrations as they interact with emissions over a longer path before arriving in the DFW area.

### Second Round

A second round of MM5 modeling (Emery, 2004) was designed to address the generalized ozone under prediction by reducing the wind speeds and directional errors. The project focused primarily on enhancing the performance of the previous meteorological modeling with the ultimate goal of improving ozone model performance. The meteorological improvements were validated using statistical comparisons to the data measured during the episode.

Three MM5 sensitivity tests were conducted to test the effect of increasing surface roughness, the model performance without nudging, and nudging toward a different large scale analysis without increased surface roughness. Neither of the latter two tests significantly improved performance but the increased surface roughness feature was used in subsequent runs. In a fourth run, additional observed meteorological data (DFW radar profiler data, Oklahoma Mesonet data, and Sonic Detection and Ranging (SODAR) data) were incorporated to improve the wind performance. The fifth and final test run repeated this, except that the Environmental Data Assimilation System (EDAS) analyses were replaced with National Center for Environmental Prediction (NCEP)/National Center for Atmospheric Research (NCAR) Reanalysis Project (NNRP) analyses.

Follow-up tests with CAMx to compare the ozone generated with original meteorology and the different meteorological data fields did not significantly change CAMx model performance. Therefore, the choice of meteorological fields was reduced to determining which set of meteorology performed the best against the observed wind, temperature, and humidity data. The fifth run in this series of tests (Run 5 - with increased surface roughness, additional meteorological data, and NNRP analyses) was selected for future photochemical simulations.

**Recent Upgrades**

The next round of meteorological modeling was funded by the Houston Advanced Research Center (HARC) and reported in 2005 (Tai, 2005a). The goals of the HARC project were to improve ozone model performance for the August 13- 22, 1999, DFW episode and to investigate how changes in modeling inputs impact ozone formation. There were three components to this HARC project, but only the first component of the study discussed meteorology and is included in this section.

A key component of the HARC project sensitivity tests was to develop two alternative MM5 simulations and to investigate their impacts on CAMx performance. Statistical model performance was determined for the two alternative MM5 runs similarly to that reported by ENVIRON for the original MM5 configuration (Emery, 2004). For the purposes of this chapter, the original run will be called "Run 5," and the other simulations will be labeled "Run 6" and "Run 7," respectively. Run 6 replaces the Pleim-Xiu Land Surface Model (LSM)/Planetary Boundary Layer (PBL) schemes with Eta + Noah schemes. Run 7 replaces the Kain-Fritsch sub-grid cumulus convection scheme with the Grell scheme.

Several years ago, ENVIRON selected the Pleim-Xiu (P-X) LSM/PBL scheme for Texas MM5 modeling due to its improved performance for winds, temperature, and PBL depth over the original configuration (i.e., the simple 5-layer soil model with Gayno-Seaman and Medium Range Forecast model (MRF) PBL schemes). Recent MM5 modeling for DFW has indicated that PBL depths remain much too high using P-X, as indicated by comparison to real data. The TCEQ selected the Eta PBL scheme along with the Noah LSM, which is the only alternative soil model available that has technical capabilities on par with the P-X methodology.

Daily performance statistics for these runs are shown below in Figures 2-10: *Daily Site-Averaged MM5 Wind Performance for Runs 5, 6, and 7 in the DFW 4 km Modeling Domain,* 2-11: *Daily Site-Averaged MM5 Temperature Performance for Runs 5, 6, and 7 in DFW 4 km Modeling Domain*, and 2-12: *Daily Site-Averaged MM5 Humidity Performance for Runs 5, 6, and 7 in DFW 4 km Modeling Domain*. As expected, results from Run 5 and Run 7 are comparable for wind, temperature, and moisture. Both runs show slight over estimation of wind speed during most of the episode days, a relatively high warm bias for the daytime temperature, and a low humidity bias.

In Run 6, however, the over prediction of wind speed is reduced, and wind speed is biased low rather than high. The picture is not as clear with wind direction except that the gross error (total error) is comparable in all three runs. In Run 6 the temperatures run high since the heat is trapped in a shallower mixed layer, but the reduced mixing also improves the underestimation of moisture in Run 5 and 7. As a result of these tests and the importance of reducing wind speeds, Run 6 with the Eta/Noah PBL was selected for use in the DFW attainment demonstration modeling.

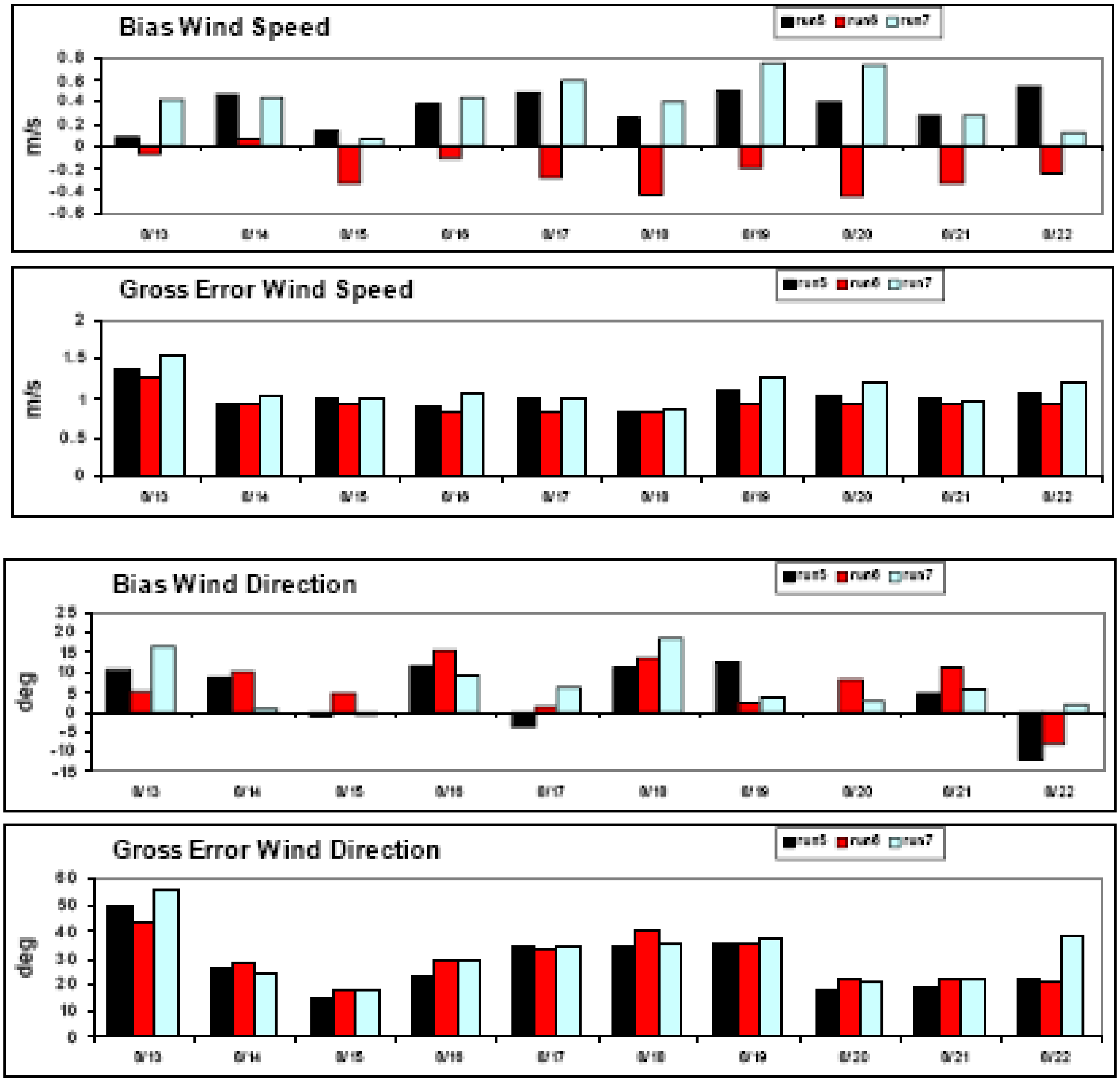



**Figure 2-10: Daily Site-Averaged MM5 Wind Performance for Runs 5, 6, and 7 in the DFW 4 km Modeling Domain. Chart from Tai, 2005a, Figure 2-2(a)**

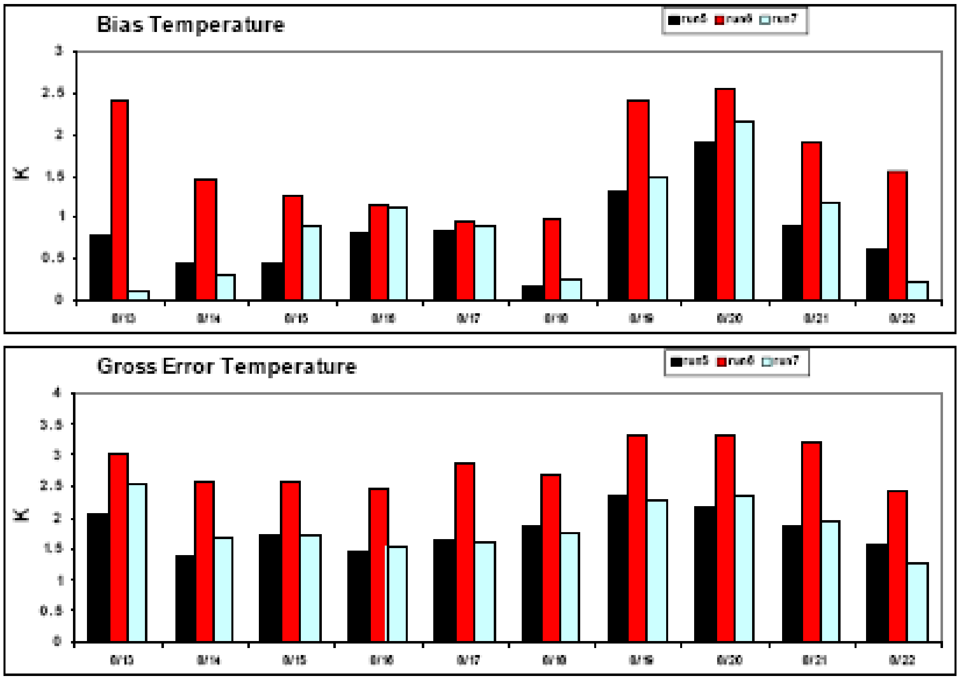



**Figure 2-11: Daily Site-Averaged MM5 Temperature Performance for Runs 5, 6, and 7 in the DFW 4 km Modeling Domain**

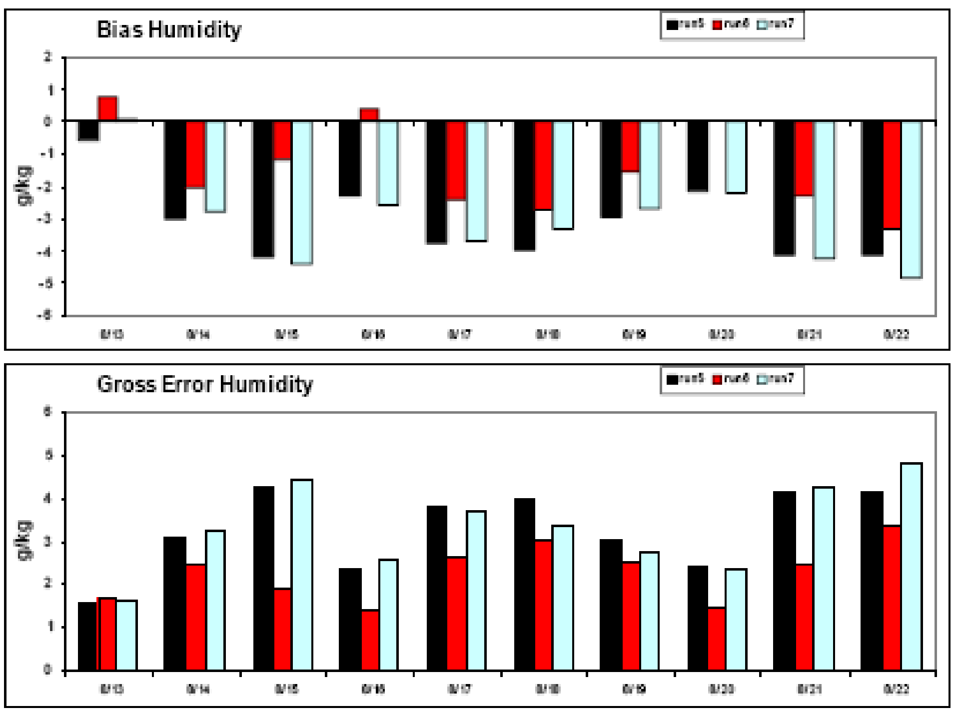



**Figure 2-12: Daily Site-Averaged MM5 Humidity Performance for Runs 5, 6, and 7 in the DFW 4 km Modeling Domain**

Comparisons between the observed and modeled vertical profiles also indicate vertical mixing problems with the Pleim-Xiu PBL scheme. The Pleim-Xiu method (Runs 5 and 7) develops relatively deep and uniform mixing all over the domain, whereas the Eta-Noah (Run 6) scheme develops variable mixing heights that are both lower and more realistic. The Eta-Noah scheme also predicted the vertical profiles for temperature and moisture, as well as the evening mixing height at the Fort Worth rawinsonde, better than the other two PBL schemes.

Ozone modeling results suggested that low level mixing problems might be the cause of low ozone production in the urban core. In particular, the modeled VOC and $NO_x$ concentrations were higher than the measured values at the Hinton monitor, while the VOC/$NO_x$ ratio was approximately correct. The mixing in the lowest layers of the model appeared too weak, trapping the emissions in the lowest layers of the model. The "Kv100" vertical mixing adjustment was applied in post-processing, which increased the mixing in the first three layers to match the mixing at 100 meters. The "Kv100" adjustment improved ozone predictions in the urban core by producing more ozone in areas with strong $NO_x$ emissions that had previously experienced low ozone production.

Overall, Run 6 resulted in better vertical wind speed, temperature, and humidity profiles with lower bias for most of the time periods examined. Hence, Run 6 meteorology and the "Kv100" adjustment were used in all later CAMx modeling.

## 2.5 EMISSIONS INVENTORY

The photochemical modeling process requires four emissions inventories:

- the *base case inventory*,
- the *baseline inventory*,
- the *future-year inventory*, and
- the *future-year control strategy inventory*.

### Base Case Inventory

The purpose of the base case emissions inventory is to validate both the meteorology and the emissions development procedures. Once the emissions and meteorology are generated, they are used in CAMx to model ozone concentrations during the episode. Model performance analyses are then conducted as described in the EPA modeling guidance (EPA 1999 and 2005). If the base case model performance is acceptable (correct concentrations, timing, and locations for every day of the episode), then the meteorology and emissions development procedures are considered to be sufficiently representative of the episode. Once the base case is accepted, the meteorology data are held constant through the next three phases of emission inventory development. The base case inventory for a typical episode day is summarized in Appendix A: *Emissions Inventories Used in Episode Modeling*.

### Baseline Inventory

The EPA's procedures require the development of an RRF to calculate future ozone concentrations. Future-year emissions are projected based upon the base case year's emissions. However, the base case emissions can include day-specific and hourly emissions data. In order to keep the base and future case results used in the RRF comparable, a generic baseline emissions inventory is developed using the same averaging and estimating procedures that will be used in the future case. This baseline inventory is used with the base case meteorology to calculate the ozone concentrations that would occur with a generalized emission inventory. The baseline inventory for a typical episode day is summarized Appendix A: *Emissions Inventories Used in Episode Modeling*.

### Future-Year Inventory

Emissions for the future-year inventory are generated by applying the projection growth estimates and controls that will be in effect in the future year to the baseline inventory. This projection provides the future base inventory, as opposed to the future controlled inventory discussed next. The same averaging procedures are used in both the baseline and future-year inventory to maintain comparability between the baseline and future-year ozone. The future-year inventory for a typical episode day is summarized in Appendix A: *Emissions Inventories Used in Episode Modeling*.

**Future-Year Control Strategy Inventory**
A future-year control strategy inventory (the future-year inventory with adopted control strategies applied) is required to determine the effectiveness of additional controls on modeled ozone concentrations. In this situation, a future-year emissions inventory with additional emissions reductions is generated. Control estimates are incorporated into the future-year emissions inventory, and the CAMx model is run to determine the effectiveness of the control strategies. The future-year control strategy inventory for a typical episode day is summarized in Appendix A: *Emissions Inventories Used in Episode* Modeling.

## 2.6 1999 BASE CASE, BASELINE, AND MODEL PERFORMANCE EVALUATION

### Overview
The purpose of the base case is to develop the best possible meteorological and emissions inputs and procedures before moving on to forecasting the future case ozone. As described in previous sections, the emissions inventory and the meteorological inputs are generated on a day- and hour-specific basis and should match the real meteorology and emissions as closely as possible. Once the emissions and meteorology are generated, they are used as input to the photochemical model and the ozone generated each day and hour during the episode period is determined. The model results are then compared to the real-world ozone measurements at each monitoring site in the area using a package of graphical evaluations and statistical benchmarks established by the EPA (EPA, 1999 and 2005). If the base case modeled ozone reproduces the measured ozone concentrations, timing, and locations within acceptable criteria specified in the EPA's guidance, both the meteorology and emissions development procedures are sufficiently representative to move to the future case.

In its 2005 eight-hour ozone modeling guidance, the EPA indicates that air quality model performance can be evaluated with two types of tests: 1) Operational tests - How well does the model replicate observed concentrations of ozone and precursors, and 2) Diagnostic tests - How well does the model respond to changes in emissions? The EPA recommends a suite of statistical tests and graphical tests for the operational evaluation that is based upon measured data. The EPA also encourages the use of diagnostic tests, but since diagnostic tests are more subjective, they are more difficult to quantify. Finally, the EPA acknowledges that there is no single definitive test or criterion for evaluating model performance.

### Background
The TCEQ began working on the August 13-22, 1999, DFW ozone episode before the EPA eight-hour ozone modeling guidance was finalized. Initially, work on this episode began in support of the one-hour ozone standard and the DFW one-hour ozone MCR. Over time, the negative bias (indicative of low ozone production) has been addressed, and the model performance has been significantly improved. Previous work regarding the August 13-22, 1999, DFW ozone episode, which was approved by the EPA, is listed in the bibliography (Environ, 2003; Mansell, 2003; Emery, 2004 and Environ, 2004, located on the web at: http://www.tceq.state.tx.us/implementation/air/airmod/data/dfw1.html). This section will discuss model improvements, starting with Run 20, focused on the 1999 base case and baseline performance, and a comparison of the model output data against the inventoried precursor concentrations and measured ozone.

A HARC project (Tai, 2005a) improved ozone model performance for the August 13-22, 1999, DFW SIP episode and investigated how various updated modeling assumptions impacted ozone formation. There were five components to the work:

- ten CAMx sensitivity runs were completed to investigate how changes in modeling inputs and assumptions affect ozone model performance;
- two MM5 runs were completed to support the CAMx sensitivity analysis;
- a revised 1999 base case (CAMx Run 34) was developed from the sensitivity tests;

- process analysis was used to investigate the revised 1999 base case and two related model scenarios; and
- the Anthropogenic Precursor Culpability Analysis (APCA) technique was used to investigate the effect of several modeling assumptions on ozone transport for 2010 future year scenarios.

After each group of tests, performance was assessed, and the best combination of factors incorporated into subsequent modeling. As a result of this series of sensitivity tests, eight-hour ozone model performance was further improved as demonstrated in Figure 2-13: *Bias and Gross Error Plotted in Error Space for Eight-Hour Ozone CAMx Modeling Runs.* Run 23 continues to show a strong negative bias, but Run 34 is inside the box on all, except ramp up days. The Run 46 cluster has only one ramp up day outside of the box and sits lower in the 'V' indicating even less total error than any of the other runs. Run 46 is the final 1999 baseline run and provides the basis for future work on the attainment demonstration.

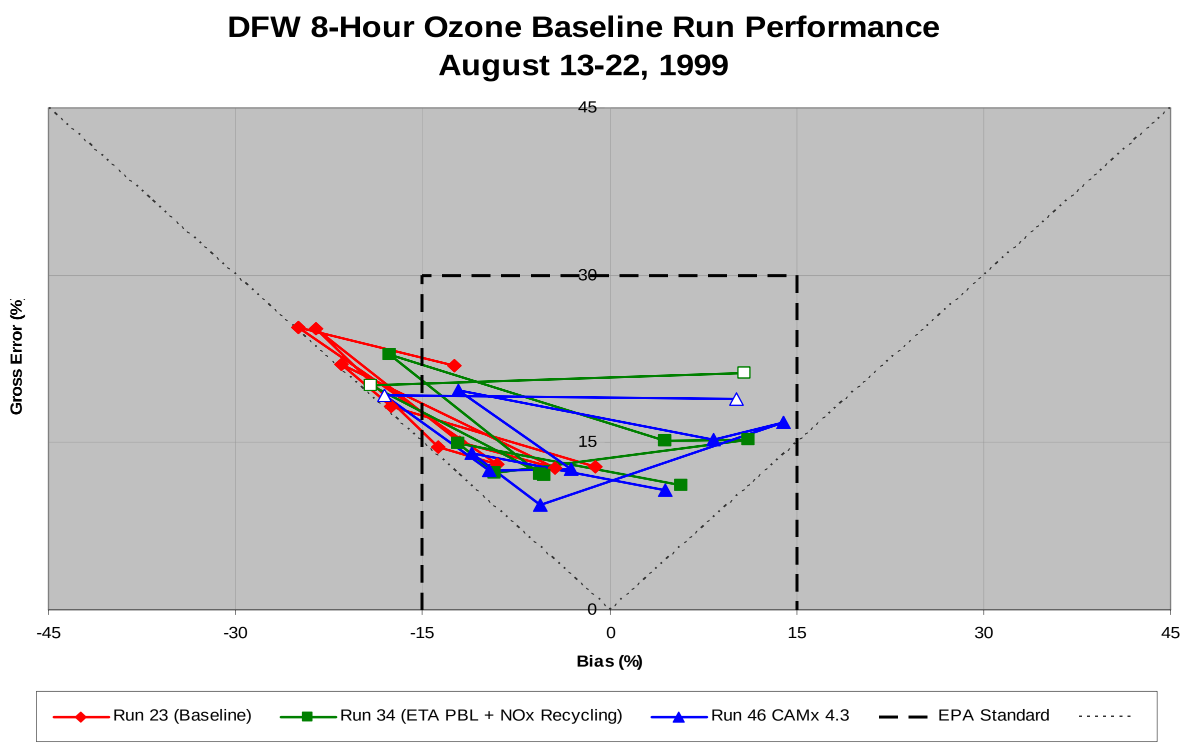



**Figure 2-13: Bias and Gross Error Plotted in Error Space for Eight-Hour Ozone CAMx Modeling Runs**

**Improving Model Performance**
The HARC project to improve model performance (Tai, 2005a) started from the CAMx base case that was developed for the DFW August 13-22, 1999, episode referred to as Run 17b (Emery et al., 2004). Ten modifications were applied separately to understand how model performance changed for both one-hour and eight-hour ozone, and how model performance might be improved. Sensitivity tests included changes in the size and top of the modeling domain, meteorology, emissions, and chemistry. All runs used CAMx version 4.03 and started from model inputs for the August 13-22, 1999, episode described by Emery et al. (2004).

*Domain Modifications*
Two of the modifications examined expanding the modeling domain. One test expanded the horizontal domain eastward into the Atlantic Ocean and northward into parts of Canada, yielding slightly improved model performance. The second modification extended the model top from 4

km to 14 km and also resulted in minor improvements in ozone performance. When both assumptions were applied, model performance improved even more. These modifications were judged to be improvements because they improved model performance and reduced dependence on boundary condition (BC) assumptions. As a result, all remaining sensitivity tests used the expanded horizontal domain and the higher model top.

*Alternative Meteorology*
As discussed in Section 2.4, *Meteorological Modeling*, ozone sensitivity to different CAMx meteorological input data was also examined. Overall, Run 24 (including MM5 Run 6) was judged to give superior meteorological and air quality model performance, so it was selected and carried forward into subsequent work.

*Emission Modifications*
Sensitivity tests were also conducted to evaluate model response to changes in the emissions. Ozone model performance in the DFW 4-km domain improved when the mobile source $NO_x$ emissions were reduced by 30 percent inside the four DFW core counties. This result may be due to intense surface $NO_x$ emissions in the DFW core area inhibiting ozone formation immediately downwind of the core where high ozone levels are observed. The peak ozone on August 17th was increased and shifted eastward closer to the observed peak location. Increasing biogenic emissions by 30 percent domain-wide also produced higher daytime ozone but did not systematically improve model performance. Doubling VOC emissions from non-EGF point sources had little impact on ozone levels and model performance.

The results of the sensitivity test showing improved ozone model performance with lower $NO_x$ emissions in the DFW core were not sufficient to justify changing the emission inventory. Ozone model performance in DFW also is sensitive to changes in meteorology and chemistry. However, comparing modeled precursor concentrations to monitored concentrations indicated that the vertical mixing in the lowest layers of the model was inadequate. Changes to vertical mixing were incorporated in Runs 34 and 46.

*Chemistry Mechanisms*
Two additional chemical mechanism changes were evaluated. The first test evaluated a revised version of the CB4 mechanism called CB2002. CB2002 reduced ozone levels relative to the standard CB4 mechanism, degraded model performance, and was not implemented further. The second test, called CB4xi, extended the CB4 mechanism by adding 17 inorganic chemistry reactions. The most important of the extra inorganic reactions in CB4xi are several $NO_x$ recycling reactions, which bring some of the $NO_x$ from terminal reactions back into the model chemistry. For short model runs, $NO_x$ recycling is negligible. However, for extended episodes and long transport paths, some of the $NO_x$ should be recycled. When the $NO_x$ recycling reactions were added to CB4, ozone concentrations were increased regionally by a few ppb both in the daytime and at night.

*Conclusions from the Sensitivity Tests*
The sensitivity tests improved model performance and better replicated monitored values by:

- increasing $NO_x$ in the DFW core counties;
- adding more biogenic emissions; and
- implementing the $NO_x$ recycling reactions in CB4.

These runs generally improved the normalized bias, the gross error and average paired peak accuracy, but reduced the accuracy of the unpaired peak. However, the unpaired peak accuracy is an old one-hour ozone test that evaluates the difference between two numbers: the maximum monitored ozone and the maximum modeled ozone. Since these two maxima are not matched in either time or space, the test only indicates whether the model is generating enough one-hour ozone somewhere in the domain. The unpaired peak test is not relevant in eight-hour ozone modeling since the focus is no longer on the one-hour worst-case modeled ozone peak, but instead on the relative reduction in the eight-hour ozone generated at each monitor. The use of the CMAQ-based vertical diffusivity profiles and the CB2002 chemical mechanism lowered ozone, which did not improve model performance. Therefore, these options were not pursued further.

**Revised Base Case: Run 34**

As a result of these sensitivity tests and the improvements in model performance, a revised base case was developed for the DFW August 13-22, 1999, SIP episode referred to as Run 34. Changes in Run 34 compared to the previous Run 17b base case include:

- expanded modeling domain extending to the Atlantic Ocean and Canada;
- higher model top at about 14 km;
- meteorology from MM5 Run 6 using the Noah/Eta PBL scheme;
- enhanced near surface mixing from the Kv100 adjustment; and
- extended inorganic chemistry (CB4xi) with $NO_x$ recycling reactions.

Run 34 shows improved ozone model performance compared to Run 17b. A tendency toward ozone under-prediction (negative bias) was improved by the updated meteorology "MM5 Run 6" and the chemistry updates ($NO_x$ recycling). The "Kv100" adjustment increased vertical mixing and improved the ozone predictions in areas with intense surface $NO_x$ emissions in the DFW core area.

The modeling grid was expanded as the result of several sensitivity tests (Tai, 2005a) that indicated the expansion of the modeling domain eastward and northward, as well as a higher model top, produced slightly improved model performance with less dependence upon boundary condition assumptions. Using the larger domain, additional sensitivity tests were run to evaluate the ozone response to changes in the emissions, meteorology, and chemistry. As previously discussed in the conclusions portion, these tests demonstrated that reducing excess $NO_x$ in the four core counties, adding more biogenic emissions, and implementing the $NO_x$ recycling reactions in CB4 consistently produced higher ozone and improved model performance, especially on the critical high ozone days.

On most days, these runs improved the normalized bias statistic and reduced the gross error statistics, which measures total error in the system. The test runs also improved the average accuracy of the paired peak statistic, which reflects the average peak ozone generated at all the sites in the domain.

**Supplemental Modeling Analysis**

Other supplementary tests were also run to address the evolving changes in the EPA's draft guidance. The EPA's latest draft of eight-hour ozone modeling guidance (EPA, 2005a) suggests that states should model an extended period that includes a complete synoptic cycle of ozone buildup through peak and decay. The DFW core episode period includes a complete synoptic cycle, but there also were additional high ozone days in late August 1999 after the core episode period that had been previously modeled for Oklahoma. This SIP evaluates the supplemental period from August 23 – September 1, 1999, as well as the TexAQS 2000 episode (August 22 through September 6, 2000) to evaluate the benefit of adding more high ozone days to the calculations.

*Oklahoma Extension*

Modeling results for the Oklahoma supplemental period were intended to be used to corroborate the primary results obtained for the core episode (August 13-22, 1999). This study used the same Run 34 CAMx configuration found to yield the best model performance in the previous work (Tai 2005a). Oklahoma emissions (Tai, 2005b) were available for the supplemental period, but detailed Texas emissions were not. Texas emissions for the supplemental period were linked on a day-of-the-week basis to the Texas emissions in the core period. The supplemental period results are considered less reliable than the core period results because they were modeled on a coarser grid with a less detailed emissions inventory. The meteorological performance for the supplemental period was also worse than the performance during the core period with under predicted (low) wind speeds and over predicted (high) temperatures.

In the supplemental period, Run 40 under predicted daytime ozone levels on August 25 and 26 at most monitoring stations. Run 40 vastly over predicted the ozone on August 31 and September 1 at the three most northern stations – Frisco (CAMS 31) and Denton (CAMS 56 and Colony). On one day, August 25, the supplemental modeling placed the peak ozone east of DFW, when the highest observed ozone was in Tarrant and Denton Counties. The poor ozone performance in the supplemental period is primarily related to the poor meteorological model performance discussed previously. In general, the supplementary episode was biased low and did not perform as well as the core episode. Review of the data indicated that the model results would not be as reliable as results from the core episode. Since considerable work would be required to bring the level of performance up to that of the core episode, further effort on this episode was terminated.

*Texas Air Quality Study (TexAQS) 2000 Episode*

The TCEQ also considered using the TexAQS 2000 modeling (for the Houston area) to generate more days for the EPA statistical test. The meteorology and the emissions were taken directly from the Houston work, but performance was evaluated in the 12 km grid in the DFW area. The TexAQS modeling performed poorly in the DFW area. The eight-hour ozone concentrations in the DFW area were biased consistently low on 14 of the 16 days during the episode, every day except the last two. A regression line through the scatter plot indicated that the ozone production was roughly one-half of the observed values, and the correlation coefficient (r2) was only 0.226. Since performance on this supplementary episode was not as good as performance during the DFW core episode and therefore would not be as reliable, further effort on this episode was also terminated.

**Final 1999 Base and Baseline Cases (Run 46)**

As a result of the series of previous base case sensitivity tests, base case modeling was temporarily frozen and further modeling efforts were redirected to evaluate the 2009 future case, and the model response to a series of sensitivity tests. While these sensitivity tests were being done, all of the future case emissions inputs were frozen to keep the results comparable. However, also during this period, the 2009 future emissions inventory was upgraded, and a newer version of CAMx became available. Once the sensitivity test series was complete, and the emissions upgrades were finalized, the base case was reevaluated with the new version of CAMx. Based on the improvement in base case model performance, all of the changes were made at once, updating to the newer version of CAMx as well as the updated inventory and several other minor changes.

The 1999 base and baseline cases with the new version of CAMx were then re-validated, so that the RRFs would be based on similar assumptions. The final base line model configurations for Run 34 and Run 46 are documented in Table 2-2: *1999 Baseline Model Inputs*.

**Table 2-2: 1999 Baseline Model Inputs**

| Model Input | Run 34 Configuration | Run 46 Configuration |
|---|---|---|
| CAMx Version | CAMx 4.03 | CAMx 4.31 |
| Plume in Grid Treatment | ----- | Full VOC/$NO_x$ Chemistry |
| Domain | Expanded Domain | No Change |
| Model Top | High Top (14 km) | No Change |
| Meteorology | MM5 Run 6<br>Using Noah/ETA PBL | No Change |
| MM5 to CAMx Extraction | ----- | Updated mm5-camx version includes cloud/rain inputs |
| Vertical Mixing Adjustment | Kv100 post processing<br>Increases low level mixing | Kv 100 Patch |
| Base Case Emissions | TCEQ Base/NEI Ver 2 | NEI Ver 3<br>Updated Mobile + Offshore |
| Chemistry | CB4xi w/$NO_x$ Recycling | No Change |

The most significant changes in model configuration were the CAMx upgrade from version 4.03 to version 4.31. CAMx version 4.2 had already included an upgraded plume-in-grid module to improve plume dispersion as well as full VOC and $NO_x$ chemistry. CAMx version 4.3 incorporated a more sophisticated second-order closure puff spread calculation that operates at sub-grid scales (Environ 2006).

*Model Performance*

Tests were run to compare the results of three different CAMx versions. Run 44 used CAMx 4.03; Run 46 used CAMx 4.31; and Run 50 used CAMx 4.4, a beta version. The beta version (4.40) increased the bias and gross error and was not selected. CAMX 4.31 performed better than both 4.03 and 4.40 and was selected for future case modeling. A full package of eight-hour performance statistics, time series, and tile plots showing the spatial distribution of ozone each day are included as Figure 2-14: *Base Case Model Performance Statistics for Eight-Hour Ozone in DFW*, Figure 2-15: *Hourly Time Series for the 1999 Baseline Comparing Three Versions of CAMx*, and Appendix C: *Spatial Plots of the Daily Maximum 8-hour Ozone in the DFW 4 km Domain Using Three Versions of CAMx for Each Episode Day.*

For a list of all of the base case and baseline sensitivity tests to date, please refer to Appendix E: *1999 Base Case/Baseline Run Log.*

*Conclusion*

As previously discussed and demonstrated in Figure 2-13: *Bias and Gross Error Plotted in Error Space for Eight-Hour ozone CAMx*, Run 46 (using CAMx 4.31) develops more ozone than the previous runs and thus improves performance with essentially the same meteorology and base case emissions inventory. The increased ozone production over the entire domain has almost completely removed the persistent negative bias that was present in previous model runs, as well as reduced the total error in the modeling system. Since the purpose of the base case and baseline modeling is to optimize model performance and thereby to increase confidence in the future case results, Run 44 is the best foundation for future case work and control strategy testing. From this point forward, the Run 44 configuration was used for all future case modeling.

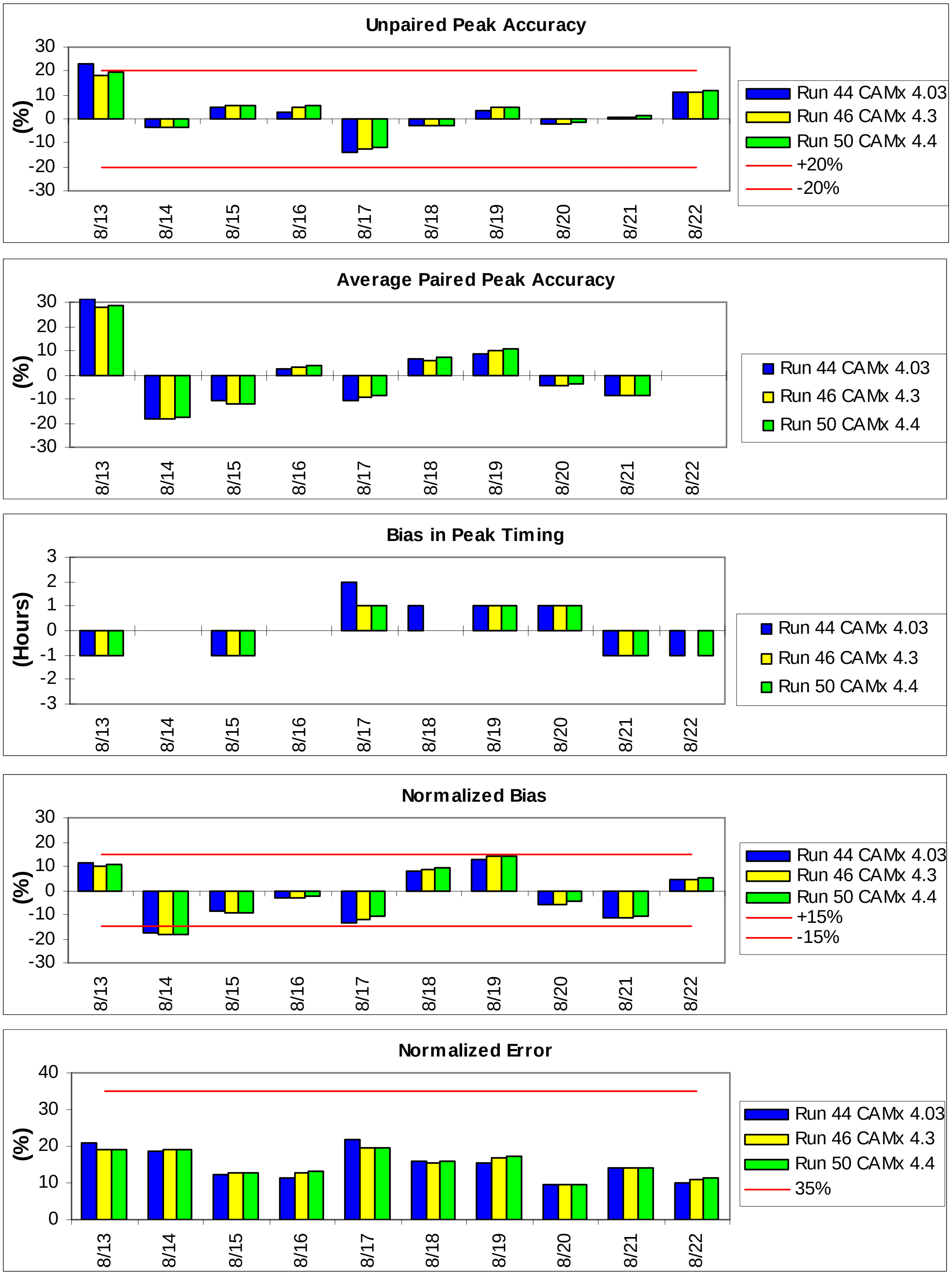



**Figure 2-14: Base Case Model Performance Statistics for Eight-Hour Ozone in DFW**

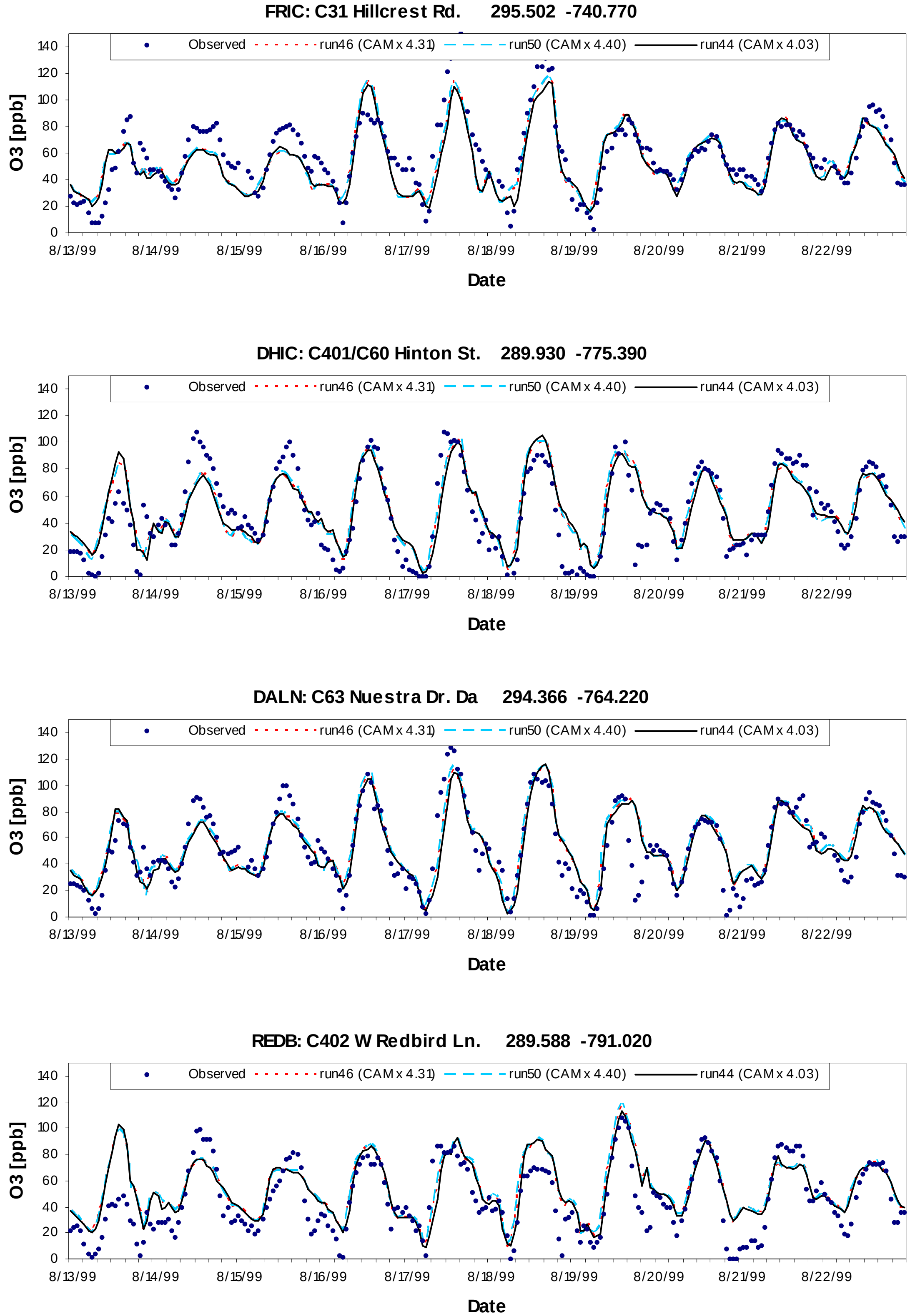
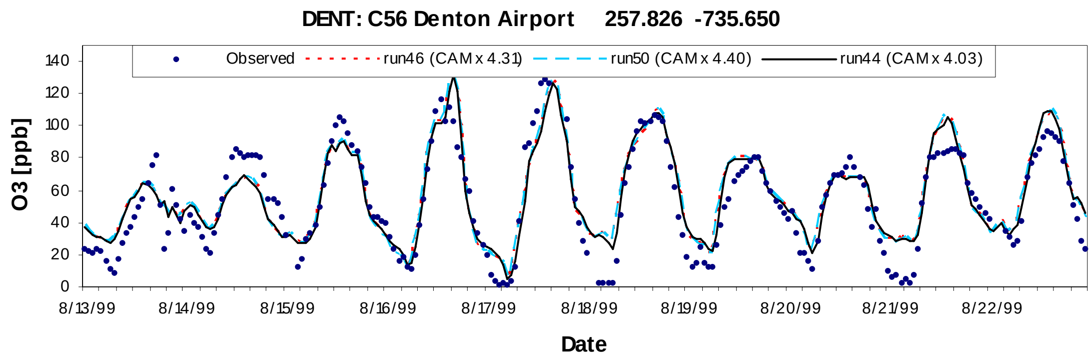
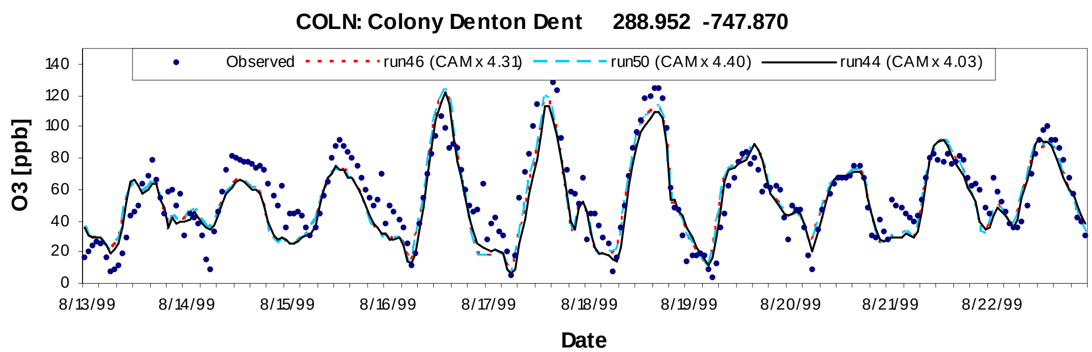
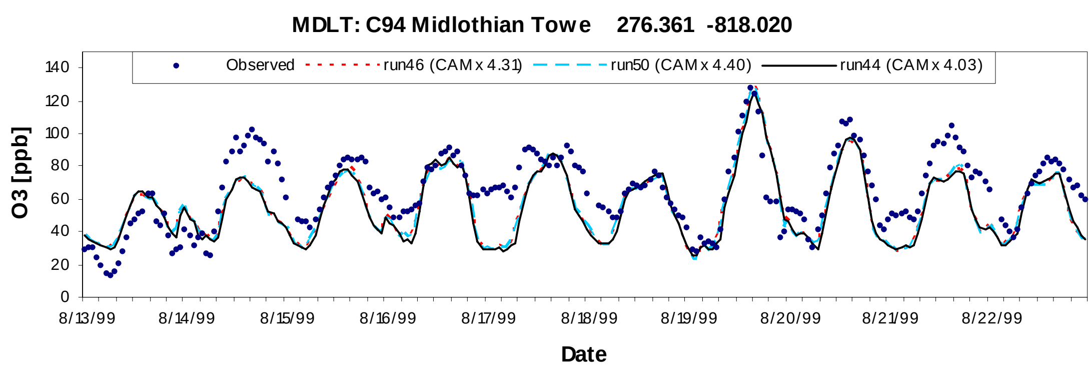



**Figure 2-15a: Hourly Time Series for the 1999 Baseline Comparing Three CAMx Versions**



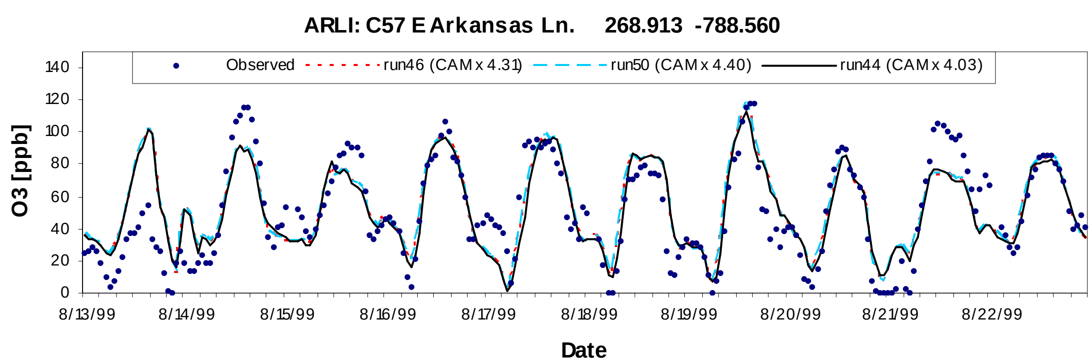
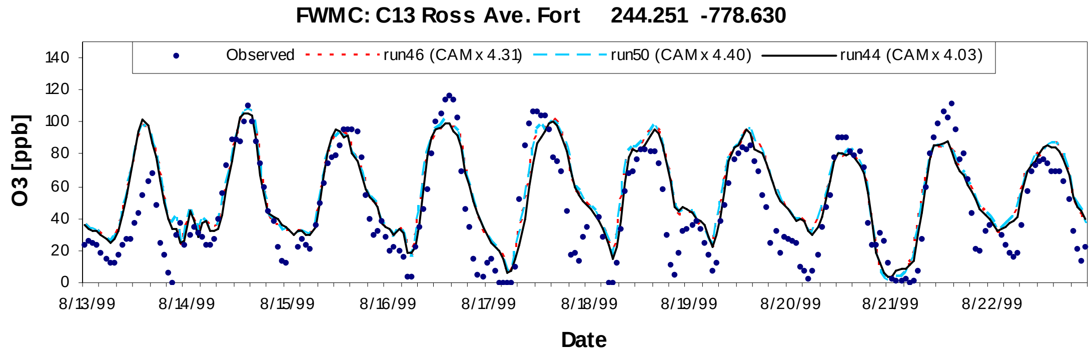




**Figure 2-15b: Hourly Time Series for the 1999 Baseline Comparing Three CAMx Versions**



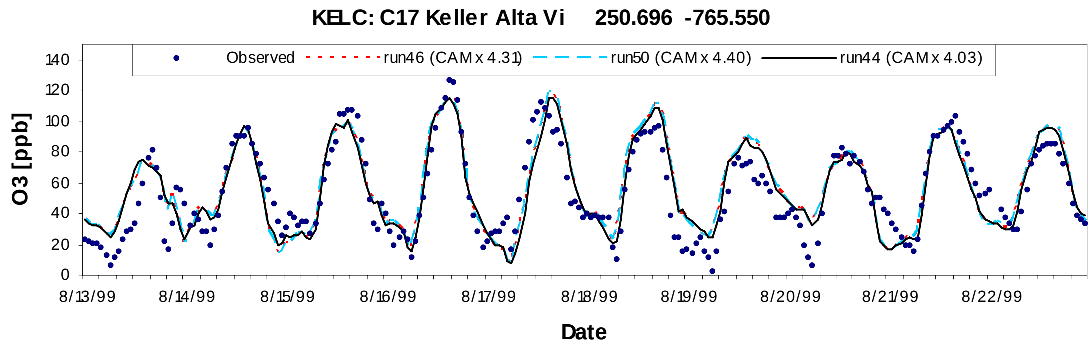




**Figure 2-15c: Hourly Time Series for the 1999 Baseline Comparing Three CAMx Versions**

## 2.7 DEVELOPMENT OF DFW 2009 FUTURE BASELINE AND SENSITIVITY TESTS

### Overview

The purpose of the future baseline case and sensitivity tests is to determine:

- whether the area will attain the ozone standard without any additional controls;
- the estimated amount of emissions reductions that may be required to meet the standard;
- whether the area is more responsive to VOC or $NO_x$ controls;
- which geographical areas are most difficult to bring into compliance; and
- the model response to different categories of controls.

Typically the first step is done with a future case baseline model run using the same meteorology that was validated in the base case, but using a future case inventory that accounts for growth and existing rules, without any additional controls. If the future case ozone design values are below 85 ppb at all monitors, attainment has been demonstrated. If not, modeling sensitivities are run to determine the type and amount of reductions that may be required to bring the area into attainment and then which types of controls would be the most effective.

### Background

As discussed previously, the DFW eight-hour ozone episode (August 13-22, 1999) has been under development for several years, and both the meteorology and the emissions have been continuously upgraded and improved over time. Initially, it was assumed that EPA would require an attainment demonstration for 2010, so emissions development was started with a goal of 2010 attainment. As a result, the TCEQ has developed modeling for both the 2009 and 2010 attainment years. The model has been producing consistent directional guidance and conclusions for both periods, even as modifications have been made to improve model performance.

The results of some of the early DFW sensitivity tests using 2010 modeling are included below. The remainder of this section addresses 2009 modeling and evaluates attainment during the 2009 ozone season.

**40 Ton Test Series**

In order to make a preliminary assessment of the effectiveness of $NO_x$ and VOC controls applied to different emissions source categories, a series of sensitivity runs imposing various emissions reductions on the 2010 inventory was completed. Each emissions category was reduced by the same amount, separately, to maintain comparability between categories. For example, 40 tons of $NO_x$ were removed from the point source emissions inside the DFW nine-county nonattainment area and tested in the model. Then 40 tons of $NO_x$ were removed from the on-road mobile, separately, and then from the area/non-road categories. Finally 40 tons of VOC were removed from the on-road mobile and area/non-road components separately, VOC from point sources was not tested since they do not emit enough VOC to be comparable. The graphical results of these runs are shown in Figure 2-16: *DFW 40 Ton Test Response Chart*.

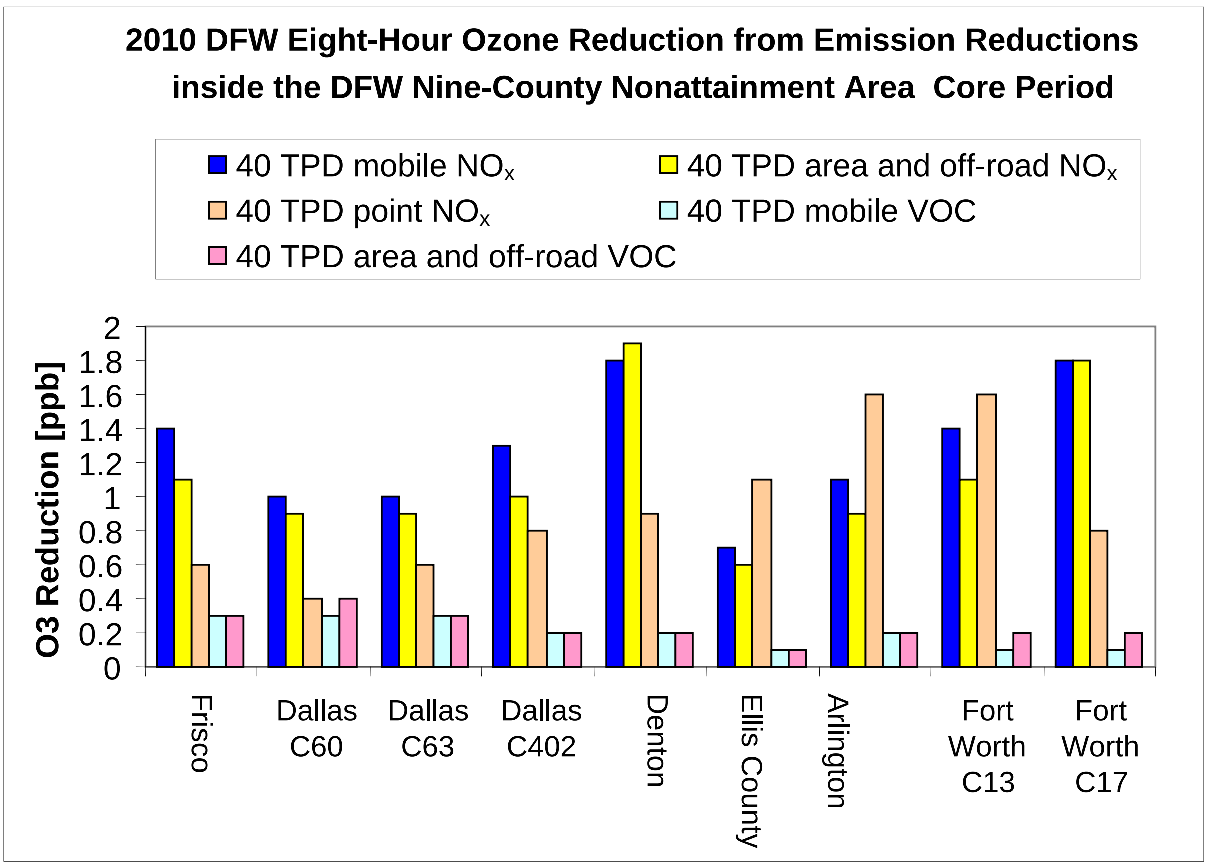



**Figure 2-16: DFW 40 Ton Test Response Chart**

The 40 ton test series shows that DFW ozone is more responsive to $NO_x$ reductions than to VOC reductions in all areas. For example, 40 tons of $NO_x$ controls inside the DFW nine-county area reduce ozone by as much 1.9 ppb at the Denton monitor, and 1.8 ppb at the Fort Worth-C17 monitor. In contrast, 40 tons of VOC reduction reduces ozone by 0.4 ppb at the Hinton Drive monitor and 0.1 ppb at the Ellis County monitor.

In terms of source categories, reducing on-road mobile and area/non-road $NO_x$ by 40 tons inside the nine-county area is more effective than equivalent $NO_x$ reductions applied to point sources at six out of the nine sites. On-road mobile source $NO_x$ reductions are more effective than area/non-road reductions at all sites except the Denton monitor. However, point source $NO_x$ reductions are more effective than on-road mobile or area/non-road reductions at the Ellis County, Arlington, and Fort Worth-C13 monitors.

While all areas are responsive to $NO_x$ reductions, the degree to which they respond varies. The 40 ton test series indicates that the DFW area is not homogeneous and that different areas respond differently to VOC and $NO_x$ controls. Some areas of the city respond better to mobile and area source controls, whereas other areas respond better to point source controls.

The monitors in the urban core (Dallas-C6- and Dallas-C63) tend to be more responsive to VOC controls than those in other areas. In contrast, monitors downwind of the city (where the highest concentrations of ozone are measured) are $NO_x$ limited and more responsive to $NO_x$ controls. Overall, the $NO_x$ controls are more effective than VOC controls.

**Control Strategy Sensitivity Tests**

The relative effectiveness of the different control strategies that were under consideration was evaluated. Each of the proposed control strategies was tested in the 2009 future case using the same CAMx version (4.03), meteorology (Run 44), and the same emissions inventory (.a1) so that all results would be comparable. Each strategy was initially tested separately to compare the relative effect and determine the most effective ones. Strategies were also tested to compare the relative effectiveness of controls applied inside the DFW nine-county area with controls applied in other areas of Texas.

For a list of all of the future case sensitivity tests to date, please refer to Appendix D: *DFW Future Case (2009) Sensitivity Tests.* This appendix describes the effect of those reductions on the Frisco and Denton monitors, as well as the average ozone reduction over the DFW area and the reduction in area of exceedance that resulted from the strategy. The results of all of these tests are discussed in detail in Tai, 2006b.

On a ton-for-ton basis, reductions made in the surface layers of the model are more effective than reductions made in elevated emissions. In addition, reductions made inside the DFW nine-county nonattainment area are more effective than similar reductions applied to distant sources. The response to $NO_x$ reductions is progressive: the larger the total reductions, the more effective they become.

Based on the results of these tests, combinations of the more effective control sensitivities were selected for testing. The results of these combination runs, the modeled design values, and the final package of control strategies proposed are discussed in Section 2.9.

## 2.8 DFW FUTURE BASELINE CASE (2009) MODELING RESULTS

**Overview**

This section explains how much ozone was generated in the DFW 2009 future baseline case and how the future ozone design values are calculated. The future baseline case includes only the controls that are already enacted in law and expected to be in effect by 2009. No additional controls or reductions are assumed. Additional controls adopted as part of this SIP revision and their effect upon future design values are not included in the future baseline case. The effects of the future control strategies are discussed in Section 2.9.

Two additional adjustments were made to the 2009 baseline modeling, including an upgrade to CAMx 4.31 and a future case emissions inventory adjustment. The 2009 emissions inventory incorporated an update based on the EPA's 2005 Acid Rain data.

## Projecting Future Design Values

In their most recent eight-hour ozone modeling guidance (EPA, 2005), the EPA describes a new procedure for estimating future case ozone expected to occur in the attainment year. This procedure is designed to eliminate some of the concerns of the previous one-hour procedure, which was based strictly on the modeled maximum future case ozone. In some of the one-hour cases the future modeled ozone was biased high, in other cases it was biased low. If the ozone in the future case ozone was too high, a significant level of controls would be required to reduce the value down to the standard. If the future case ozone was biased low, a smaller reduction (possibly even no additional controls) would be required to bring the area into compliance.

The new EPA procedure calculates a ratio between the base and future case ozone, which is then applied to the measured ozone values to estimate future ozone levels. The procedure is based upon two elements: the baseline design value and the relative reduction factor.

The baseline design value is an EPA term designed to represent the ozone that occurred in the past, as well as representing the value that must be reduced to meet the eight-hour ozone standard. The EPA recommends calculating the current design value by averaging the three, three-year design values that occurred in the area for the following specific periods: the year before the base year selected for modeling; the base year; and the year after the base year selected for modeling. Mathematically speaking, the new procedure recommends a five year center-weighted average of the fourth high eight-hour ozone concentrations measured at each monitor in the area. Since it is center-weighted, the calculation emphasizes the ozone that was measured during the base year. The baseline design value is the foundation for estimating the ozone that the model predicts will occur in the attainment year.

The relative reduction factor (RRF) is the second element used to estimate future ozone levels. The relative reduction factor is based on modeling and describes the amount of reduction expected to occur in the future year for a particular level of control. RRFs are calculated for each monitor individually by dividing the future year ozone modeled at a site by the base year ozone modeled at the site, expressed as a three digit decimal number. For example, a RRF of 0.900 indicates that future ozone is expected to be 90 percent of the base year ozone.

Once both elements are calculated for every monitor in the area, the baseline design value is multiplied by the RRF to determine the ozone predicted in the future at each monitor. For example, if the base year design value was 90 ppb, and the RRF was 0.900, the calculated future design value would be 81 ppb.

## DFW 1999 Baseline Design Value

The DFW modeling base year is 1999; therefore, the EPA baseline design value is determined by averaging the three annual design values from the year before (1998), the base year (1999), and the year after (2000). Table 2-3: *DFW 1999 Baseline Design Value Calculations* shows the values for each period for each of the monitors operating in the DFW area during the period. The last column shows the baseline design value, calculated as the average of the other three columns.

**Table 2-3: DFW 1999 Baseline Design Value Calculations**

| Site Name | 1999 97-99 | 2000 98-00 | 2001 99-01 | Baseline DV |
|---|---|---|---|---|
| | *ppb* | *ppb* | *ppb* | *ppb* |
| Frisco C31 | 101 | 101 | 99 | 100.3 |
| Anna C68 | | | | --- |
| Dallas Hinton C60 | 91 | 93 | 92 | 92.0 |
| Dallas North C63 | | | 93 | 93.0 |
| Dallas Exec (Redbird) C402 | 92 | 88 | 84 | 88.0 |
| Denton C56 | | 102 | 101 | 101.5 |
| Midlothian C94 | | 97 | 88 | 92.5 |
| Arlington Reg Office C57 | | 95 | 86 | 90.5 |
| FtW NW (Meacham) C13 | 99 | 99 | 97 | 98.3 |
| FtW Keller C17 | 95 | 97 | 97 | 96.3 |

**DFW Relative Reduction Factor (RRF) Calculations**

The EPA recommends a two-step procedure to calculate the relative reduction factors that averages the base case and future case ozone concentrations at a monitor before calculating the RRF. Since the essential element of the EPA attainment test is applying the relative reduction ratio to the baseline ozone, it is important to maintain the integrity of the individual day and monitor-specific RRFs. Since averages are distorted by extremely high and low values, the EPA averaging-first method may distort the relationship the RRF is attempting to calculate.

The EPA method for calculating future design values is straightforward, but it masks some of the information otherwise available. Since the EPA method averages the daily ozone over all the days of the episode, it substitutes a statistical assessment for a dynamic cause and effect analysis. Effectively, the method smooths over the model performance information that is contained in the daily response data.

As allowed in the EPA's modeling guidance (EPA 2005a) in the Foreword and on page 30, the TCEQ is using an alternative method to calculate future design values by calculating the ratios for each day and monitor first, and then averaging the ratios. This method preserves the relationship RRF between the base and future case at each monitor, and thereby the integrity of the RRF method. This daily method provides additional insight into daily model performance by showing which days and areas respond to precursor reductions. When combined with data on wind directions, internal and external sources, and source alignments, the daily response data permits analysis of $VOC/NO_X$ sensitivities in different portions of the urban area.

Comparisons of the two methods show that in most cases, the results are similar. Figure 2-17: *Comparison of EPA RRF Calculation Method with Daily Calculation Method* shows that the two methods give almost the same results except at monitors with extremely high or low calculated ozone values. The regression equation shows that TCEQ's daily method is strongly correlated with the EPA method ($R^2$=.9881), and the regression line for the daily RRF is only 1.9 percent different from the EPA calculations. Since the EPA recommends truncating (discarding) the last digit in the future design value calculations, in most cases the 1.9 percent difference between the two methods is relatively unimportant.

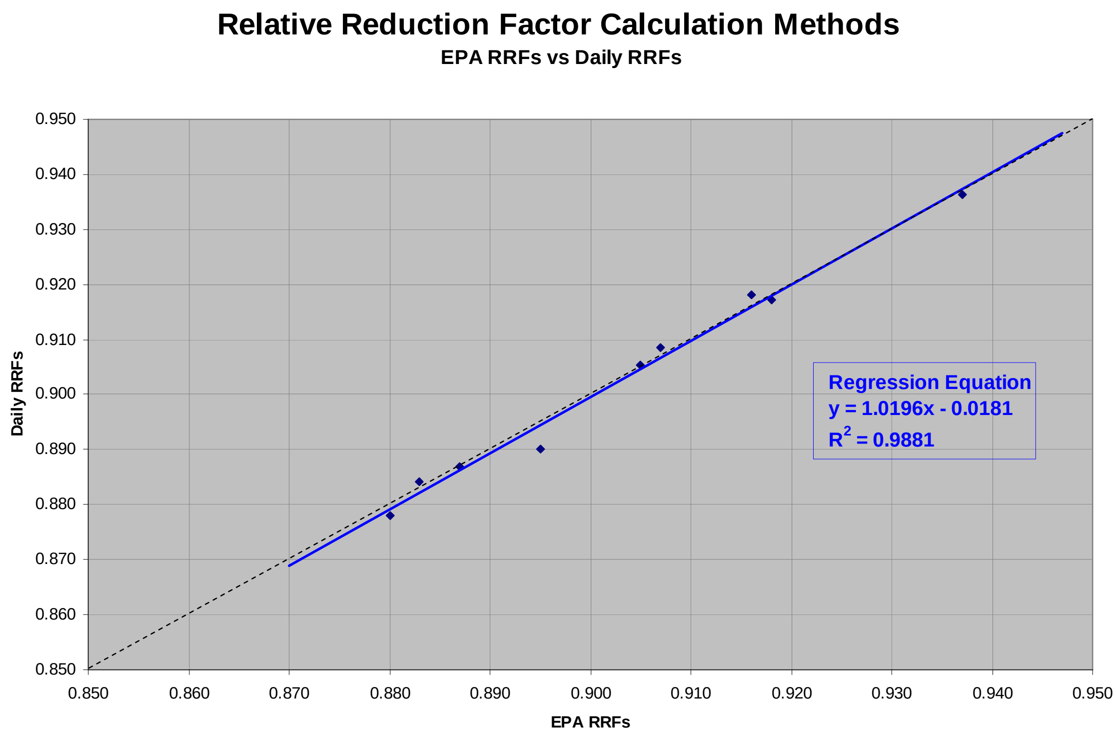



**Figure 2-17 Comparison of EPA RRF Calculation Method with Daily Calculation Method**

**Daily Relative Reduction Factor Calculations**
Table 2-4: *DFW 2009 Baseline RRF Calculations Using CAMx 4.31 and .a2 Emissions* shows the RRF calculations using the TCEQ's daily RRF method. The top two panels of Table 2-4 show the modeled ozone output at each monitor in the 1999 base and 2009 future case using the latest model configuration, Run 46 with CAMx 4.31 and the .a2 version of the inventory.

The EPA guidance recommends removing base case data points that are less than 85 ppb because those days do not respond well to controls. The data from the Frisco monitor from August 20 is colored orange in both the base and future cases to show that the data were not used in the daily RRF calculations, as recommended by the EPA. Although base case ozone was modeled below 85 ppb at several monitors, the TCEQ has taken a more conservative approach by only removing data less than 70 ppb. This removes only the very lowest values, while still leaving enough data to develop stable averages. However, leaving the other low values in the calculation makes the RRFs less responsive and ultimately results in higher (more conservative) future design values.

The third panel of Table 2-4, *DFW 2009 Baseline RRF Calculations Using CAMx 4.31 and .a2 Emissions* shows the daily RRFs calculated for each monitor, color coded to indicate the amount of response. Numbers labeled in blue represent RRFs less than 0.9, indicating that on that day ozone was reduced between 10-20 percent in the future case. Numbers in black indicate that the future modeled ozone was reduced from 0-10 percent compared to the base case. Numbers colored red indicate that the future case ozone increased at those monitors.

The color coding in the third panel illustrates the insight that can be gained by using daily RRF calculations. For example, when the RRFs are colored blue, it indicates that the model responds well on that day. The blue RRFs on August 15, 16, 18, 19, 21 and 22 indicate that the model is responding well to the future case ozone reductions on many days during the episode.

However, the daily RRF data also show RRFs greater than 1.0 at several sites on August 17 and 20, indicating that the ozone at these monitors increased in the future case (2009) compared to the baseline (1999). Since the biggest reductions between 1999 and 2009 were due to the $NO_x$ component of the inventory, the RRF results suggest that ozone in the city core is probably being scavenged by mobile $NO_x$ emissions, and as those $NO_x$ emissions are reduced in the future, less scavenging leads to increased ozone in those areas.

**Table 2-4: DFW 2009 Baseline RRF Calculations Using CAMx 4.31 and .a2 emissions**

| 1999 Base Case: run46 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Site** | **990815** | **990816** | **990817** | **990818** | **990819** | **990820** | **990821** | **990822** | **#Days>70** |
| Frisco C31 | 81.3 | 107.0 | 102.6 | 109.2 | 86.0 | 69.9 | 87.1 | 89.5 | 7 |
| Dallas Hiinton C60 | 83.1 | 99.8 | 103.4 | 103.8 | 99.2 | 78.0 | 85.5 | 85.3 | 8 |
| Dallas North C63 | 82.6 | 101.3 | 102.6 | 106.6 | 96.5 | 76.4 | 86.8 | 88.4 | 8 |
| Dallas Redbird C402 | 77.0 | 93.3 | 98.5 | 96.6 | 107.4 | 83.7 | 79.4 | 79.5 | 8 |
| Denton C56 | 102.6 | 113.1 | 110.0 | 112.5 | 84.7 | 73.1 | 101.6 | 99.6 | 8 |
| Midlothian C94 | 78.3 | 86.1 | 85.9 | 76.2 | 114.0 | 88.8 | 75.7 | 76.7 | 8 |
| Arlington C57 | 86.2 | 98.4 | 100.2 | 95.2 | 106.9 | 83.1 | 81.9 | 86.7 | 8 |
| FtW NW C13 | 93.8 | 105.5 | 104.3 | 106.0 | 96.0 | 80.1 | 89.8 | 92.0 | 8 |
| FtW Keller C17 | 101.1 | 111.1 | 110.4 | 108.3 | 92.4 | 78.6 | 95.9 | 94.9 | 8 |

| 2009 Future Base: run46.fy2009.a2 | | | (No Additional Controls) | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Site** | **990815** | **990816** | **990817** | **990818** | **990819** | **990820** | **990821** | **990822** |
| Frisco C31 | 67.7 | 100.9 | 101.9 | 100.5 | 73.2 | 63.9 | 74.8 | 74.4 |
| Dallas Hiinton C60 | 73.1 | 93.0 | 103.5 | 97.8 | 91.4 | 80.7 | 78.0 | 74.0 |
| Dallas North C63 | 71.0 | 95.6 | 101.9 | 99.7 | 84.4 | 77.4 | 76.2 | 74.1 |
| Dallas Redbird C402 | 66.7 | 82.4 | 89.5 | 85.1 | 97.0 | 85.2 | 70.3 | 71.3 |
| Denton C56 | 88.5 | 103.4 | 108.0 | 92.0 | 71.6 | 64.6 | 89.8 | 83.5 |
| Midlothian C94 | 72.6 | 77.3 | 78.8 | 70.3 | 99.0 | 85.7 | 69.9 | 70.7 |
| Arlington C57 | 75.0 | 89.2 | 90.6 | 81.8 | 95.5 | 85.2 | 73.1 | 79.6 |
| FtW NW C13 | 80.9 | 94.7 | 94.3 | 87.9 | 83.6 | 75.7 | 79.2 | 81.1 |
| FtW Keller C17 | 89.3 | 99.1 | 104.4 | 90.3 | 79.2 | 70.6 | 88.1 | 82.2 |

| Daily RRF Calculations | | | (With August 20th Removed) | | | | | | Average |
|---|---|---|---|---|---|---|---|---|---|
| **Site** | **990815** | **990816** | **990817** | **990818** | **990819** | **990820** | **990821** | **990822** | **RRF** |
| Frisco C31 | 0.833 | 0.942 | 0.993 | 0.921 | 0.851 | --- | 0.859 | 0.831 | 0.890 |
| Dallas Hinton C60 | 0.88 | 0.932 | 1.001 | 0.942 | 0.921 | 1.035 | 0.912 | 0.867 | 0.936 |
| Dallas North C63 | 0.86 | 0.944 | 0.993 | 0.935 | 0.875 | 1.014 | 0.878 | 0.838 | 0.917 |
| Dallas Exec C402 | 0.866 | 0.883 | 0.908 | 0.881 | 0.903 | 1.018 | 0.886 | 0.897 | 0.905 |
| Denton C56 | 0.863 | 0.914 | 0.982 | 0.817 | 0.845 | 0.883 | 0.883 | 0.838 | 0.878 |
| Midlothian C94 | 0.927 | 0.898 | 0.917 | 0.922 | 0.869 | 0.966 | 0.923 | 0.922 | 0.918 |
| Arlington C57 | 0.87 | 0.907 | 0.904 | 0.859 | 0.894 | 1.025 | 0.892 | 0.918 | 0.909 |
| FtW NW C13 | 0.863 | 0.897 | 0.904 | 0.83 | 0.871 | 0.945 | 0.882 | 0.881 | 0.884 |
| FtW Keller C17 | 0.883 | 0.893 | 0.946 | 0.834 | 0.857 | 0.898 | 0.919 | 0.866 | 0.887 |

**Future (2009) Design Values**

The future design values for the DFW area in 2009 are calculated in Table 2-5: *2009 Design Value Calculations*. The first column indicates the monitor site name; the second column shows the 1999 baseline design value taken from Table 2-3, *DFW 1999 Baseline Design Value Calculations*; and the third column shows the average RRF for that monitor. The future design values are shown in the last column, calculated by multiplying the average RRF by the 1999 baseline design value. The EPA recommends truncating the last digit of the calculation; however, the TCEQ shows the last decimal place in the calculation for clarity.

**Table 2-5: 2009 Design Value Calculations**

| | 2009 Baseline | | |
|---|---|---|---|
| Site Name | Baseline DV | Average RRF | Future DV |
| | *ppb* | | *ppb* |
| Frisco C31 | 100.3 | 0.890 | **89.3** |
| Dallas Hinton C60 | 92.0 | 0.936 | **86.1** |
| Dallas North C63 | 93.0 | 0.917 | **85.3** |
| Dallas Exec C402 | 88.0 | 0.905 | **79.7** |
| Denton C56 | 101.5 | 0.878 | **89.1** |
| Midlothian C94 | 92.5 | 0.918 | **84.9** |
| Arlington C57 | 90.5 | 0.909 | **82.2** |
| FtW NW C13 | 98.3 | 0.884 | **86.9** |
| FtW Keller C17 | 96.3 | 0.887 | **85.4** |

**Summary**

Of all the monitors, the Frisco monitor had the highest calculated future design value at 89.3 ppb. The second highest future design value was 89.1 ppb calculated at the Denton monitor. Although the Denton monitor started with the highest baseline design value, it also had the lowest (most effective) RRF. As a result, the Denton monitor shows the largest change between the base and future case, with a future design value below the Frisco monitor value.

The future (2009 Baseline) calculations show that the future case ozone is below 85 ppb at only three monitors, Dallas Executive, Midlothian, and Arlington. Thus additional controls are needed.

According to the 1999 baseline data, all of the sites in the DFW area were out of compliance in 1999. Therefore, according to the modeling, the controls that have already been adopted with compliance dates prior to 2009 are expected to bring three out of the nine monitors below 85 ppb.

Reversing the order of operations in the RRF calculations by determining the daily response at each monitor before averaging the RRFs to derive a monitor-specific RRF results in essentially the same number as the EPA calculation methodology but preserves the daily response information. The advantage of the daily RRF method is that it allows the TCEQ to analyze the daily response in each area of the city, to evaluate the responses with different wind directions, and to evaluate whether the model is performing as expected.

## 2.9 DFW FUTURE CASE (2009) WITH CONTROLS MODELING RESULTS

### Overview

This section evaluates and describes the effect of the VOC and $NO_X$ emissions controls included in this SIP revision. Section 2.7 described the results of the individual sensitivity tests performed to evaluate the effectiveness of various options for emissions reduction. Section 2.8 illustrates the controls already in place provide emissions reductions benefits toward attaining the eight-hour ozone standard, but that additional controls are required to bring to attain the ozone standard. This section describes the modeling results with the additional controls and uses the Daily RRF method to calculate the future design values and attainment status for the 2009 future case.

### 2009 SIP Control Package

The TCEQ evaluated various options for controlling DFW ozone and selected a package of controls to bring the area into attainment of the ozone standard. Several different packages were tested with CAMx 4.31, and the tenth combination represents the strategies being implemented through this SIP. Combination 10 includes reductions for the following: DFW major and minor sources, DFW electric generating facilities (EGFs), Ellis County cement kilns, NCTCOG on-road and off-road VMEP and TCM commitments and certain stationary engines located in 33 counties that are within 200 km of DFW. Table 2-6: *2009 Control Package Emission Reductions (Combination 10 compared to 2009 .a2 Baseline),* shows the list of controls included in Combination10 by emissions category.

**Table 2-6: 2009 Control Package Emission Reductions (Combination 10 compared to 2009.a2 Baseline)**

| 2009 Emissions Reductions in DFW SIP Revision | | |
|---|---|---|
| Control | NOx reduction | VOC reduction |
| | *tpd* | *tpd* |
| DFW Major Source, nine-county area | -9.0 | 0.0 |
| DFW Minor Source, nine-county area | -3.0 | 0.0 |
| DFW EGFs, nine-county area | -0.4 | 0.0 |
| Ellis County Cement Kilns | -10.4 | 0.0 |
| NCTCOG Off-Road Mobile[1] | -2.2 | +0.5 |
| NCTCOG On-Road Mobile[1] | -1.4 | -0.5 |
| Surface Coatings | 0.0 | -0.1 |
| On Road Mobile Outside DFW | +4.4 | +1.0 |
| Off Road Mobile Outside DFW | +1.7 | +1.9 |
| East Texas (33 counties)[2] | -22.4 | 0.0 |
| **TOTALS** | **-42.7** | **+2.9** |

1-The DFW mobile source emissions estimates used in the SIP proposal were based on NCTCOG's initial VMEP assumptions. NCTCOG's refined estimate is 2.63 tpd of $NO_X$ reductions. The Combination 10 control strategy also includes a 1.1 tpd NOx reduction for TxLED fuels in locomotives as well as some adjustments for Houston area mobile emissions. Combination 10 includes all of the corrections and final rule revisions incorporated in this SIP revision.

2-The proposed East Texas Combustion rule for gas-fired engines originally affected 39 counties within or traversed by the 200 km perimeter from DFW. The 2009 emissions reductions from the final East Texas Combustion rule in this SIP revision applies to 33 counties and rich-burn engines, and are estimated at approximately 22.4 tpd of NOx. The Combination 10 control strategy run incorporates these corrections.

**2009 Emissions with Combination 10 Controls**

Table 2-7: *Weekday $NO_X$ Emissions (tpd) for 2009 with DFW Combination 10 Controls* and Table 2-8: *Weekday VOC Emissions (tpd) for 2009 with DFW Combination 10 Controls* summarize the $NO_X$ and VOC reductions by county as tested in the 2009 future case with Combination 10 control package. Texas $NO_X$ and VOC emissions were reduced 42.6 and 2.8 tpd, respectively, from the 2009.a2 baseline.

**Table 2-7: Weekday $NO_X$ Emissions (tpd) for 2009 with DFW Combination 10 Controls.**

| | Bio | TX Mobile | Elev Points | TX Low Points | TX Area | TX Off-Road | Non-TX Low Anthro | All Anthro | Anthro Change from 2009.a2 Baseline |
|---|---|---|---|---|---|---|---|---|---|
| Collin Co | 10 | 14 | 1 | 0 | 2 | 8 | 0 | 25 | -0.3 |
| Dallas Co | 4 | 77 | 5 | 1 | 18 | 44 | 0 | 145 | -3.5 |
| Denton Co | 8 | 17 | 1 | 0 | 11 | 9 | 0 | 38 | -2.1 |
| Tarrant Co | 3 | 46 | 1 | 1 | 10 | 27 | 0 | 86 | -3.2 |
| Parker Co | 1 | 6 | 0 | 0 | 1 | 2 | 0 | 8 | -1.1 |
| Johnson Co | 5 | 5 | 3 | 0 | 0 | 5 | 0 | 13 | -2.2 |
| Ellis Co | 15 | 8 | 22 | 0 | 0 | 6 | 0 | 36 | -12.8 |
| Kaufman Co | 5 | 6 | 4 | 0 | 0 | 2 | 0 | 12 | -0.4 |
| Rockwall Co | 2 | 3 | 0 | 0 | 0 | 1 | 0 | 5 | -0.1 |
| **DFW 9-County** | **52** | **182** | **37** | **3** | **41** | **105** | **0** | **369** | **-25.7** |
| North Texas | 31 | 24 | 13 | 3 | 17 | 15 | 0 | 72 | -0.7 |
| NE Texas | 16 | 79 | 181 | 10 | 68 | 42 | 1 | 380 | -13.5 |
| Central TX | 114 | 92 | 143 | 2 | 58 | 70 | 0 | 366 | -7.6 |
| Houston | 21 | 179 | 226 | 11 | 53 | 63 | 0 | 532 | 4.4 |
| South TX | 229 | 189 | 261 | 21 | 75 | 100 | 0 | 647 | -1.2 |
| West TX | 524 | 160 | 140 | 21 | 212 | 106 | 1 | 641 | 1.6 |
| **Texas** | **986** | **907** | **1001** | **72** | **525** | **501** | **2** | **3008** | **-42.6** |
| Gulf + Mexico | 79 | 5 | 436 | 0 | 4 | 2 | 444 | 891 | 0.0 |
| Oklahoma | 227 | 1 | 256 | 0 | 2 | 3 | 661 | 924 | 0.0 |
| Louisiana | 106 | 1 | 715 | 1 | 2 | 1 | 1183 | 1903 | -0.1 |
| Arkansas | 125 | 2 | 220 | 0 | 0 | 2 | 468 | 692 | 0.0 |
| Mississippi | 121 | 0 | 353 | 0 | 0 | 0 | 455 | 808 | 0.0 |
| Alabama | 75 | 0 | 442 | 0 | 0 | 0 | 491 | 932 | 0.0 |
| Tennessee | 118 | 0 | 244 | 0 | 0 | 0 | 662 | 906 | 0.0 |
| Kentucky | 145 | 0 | 289 | 0 | 0 | 0 | 770 | 1060 | 0.0 |
| Georgia | 110 | 0 | 408 | 0 | 0 | 0 | 823 | 1230 | 0.0 |
| Florida | 56 | 0 | 367 | 0 | 0 | 0 | 1206 | 1573 | 0.0 |
| Mid Atlantic (SC, NC, VA, WV) | 293 | 0 | 977 | 0 | 0 | 0 | 2332 | 3310 | 0.0 |
| NE US | 314 | 0 | 1302 | 0 | 0 | 0 | 5748 | 7051 | 0.0 |
| Northern Plains | 5238 | 0 | 3269 | 0 | 0 | 0 | 8623 | 11892 | 0.0 |
| **Total** | **7992** | **916** | **10281** | **73** | **534** | **509** | **23869** | **36181** | **-42.7** |
| Change from 2009 baseline | 0.0 | 3.0 | -26.1 | -10.2 | -8.92 | -0.4 | -0.1 | -42.7 | |

**Table 2-8: Weekday VOC Emissions (tpd) for 2009 with DFW Combination 10 Controls.**

| | Bio | TX Mobile | Elev Points | TX Low Points | TX Area | TX Off-Road | Non-TX Low Anthro | All Anthro | Anthro Change from 2009.a2 baseline |
|---|---|---|---|---|---|---|---|---|---|
| Collin Co | 27 | 7 | 0 | 1 | 12 | 4 | 0 | 23 | 0.0 |
| Dallas Co | 50 | 42 | 4 | 8 | 72 | 17 | 0 | 144 | 0.0 |
| Denton Co | 65 | 8 | 1 | 1 | 15 | 4 | 0 | 29 | 0.0 |
| Tarrant Co | 64 | 25 | 2 | 7 | 54 | 9 | 0 | 96 | 0.0 |
| Parker Co | 121 | 2 | 0 | 0 | 5 | 1 | 0 | 8 | 0.0 |
| Johnson Co | 111 | 2 | 0 | 0 | 6 | 1 | 0 | 9 | 0.0 |
| Ellis Co | 89 | 2 | 3 | 2 | 6 | 2 | 0 | 15 | 0.0 |
| Kaufman Co | 112 | 2 | 0 | 0 | 7 | 1 | 0 | 11 | -0.1 |
| Rockwall Co | 3 | 1 | 0 | 0 | 2 | 1 | 0 | 4 | 0.0 |
| **DFW 9-County** | **642** | **91** | **10** | **20** | **180** | **38** | **0** | **340** | **-0.1** |
| North Texas | 601 | 8 | 24 | 2 | 29 | 5 | 1 | 69 | 0.0 |
| NE Texas | 4917 | 27 | 14 | 41 | 82 | 14 | 1 | 179 | 0.2 |
| Central TX | 6393 | 35 | 20 | 20 | 91 | 23 | 1 | 191 | 0.2 |
| Houston | 1683 | 81 | 91 | 215 | 247 | 42 | 0 | 676 | 1.7 |
| South TX | 2069 | 78 | 20 | 48 | 217 | 46 | 0 | 408 | 0.5 |
| West TX | 6198 | 59 | 10 | 28 | 215 | 52 | 3 | 367 | 0.3 |
| **Texas** | **22503** | **381** | **188** | **374** | **1060** | **221** | **6** | **2230** | **2.8** |
| Gulf + Mexico | 658 | 3 | 32 | 0 | 10 | 4 | 329 | 378 | 0.0 |
| Oklahoma | 7940 | 1 | 3 | 0 | 5 | 1 | 481 | 490 | 0.0 |
| Louisiana | 9941 | 0 | 47 | 3 | 4 | 1 | 546 | 601 | 0.0 |
| Arkansas | 13925 | 0 | 23 | 0 | 2 | 0 | 441 | 466 | 0.0 |
| Mississippi | 14818 | 0 | 35 | 0 | 0 | 0 | 548 | 583 | 0.0 |
| Alabama | 13954 | 0 | 39 | 0 | 0 | 0 | 655 | 695 | 0.0 |
| Tennessee | 8678 | 0 | 66 | 0 | 0 | 0 | 895 | 961 | 0.0 |
| Kentucky | 3753 | 0 | 34 | 0 | 0 | 0 | 622 | 656 | 0.0 |
| Georgia | 12198 | 0 | 53 | 0 | 0 | 0 | 869 | 922 | 0.0 |
| Florida | 9793 | 0 | 42 | 0 | 0 | 0 | 1594 | 1636 | 0.0 |
| Mid Atlantic (SC, NC, VA, WV) | 31294 | 0 | 67 | 0 | 0 | 0 | 2836 | 2903 | 0.0 |
| NE US | 20472 | 0 | 248 | 0 | 0 | 0 | 5407 | 5655 | 0.0 |
| Northern Plains | 40144 | 0 | 226 | 0 | 0 | 0 | 8224 | 8450 | 0.0 |
| **Total** | **210073** | **385** | **1104** | **377** | **1080** | **227** | **23453** | **26625** | **2.9** |
| change from baseline | 0.0 | 0.5 | 0.0 | -0.1 | 0.0 | 2.4 | 0.0 | 2.9 | |

**Future Case Model Response with Combination 10 Controls**

Spatial plots of the daily maximum eight-hour ozone in 2009 with Combination 10 analyses and the control differences from the 2009 baseline are shown in Figure 2-18: *Spatial Plots of the Daily Maximum Eight-Hour Ozone in 2009 with Combination 10 Controls* for each episode day in the DFW 4 km domain. On four days (August 15, 16, 21 and 22), the difference plots show that the largest ozone reductions occurred in plumes downwind of the Ellis County cement kilns and benefited Tarrant County. These plumes reflect the combined ozone benefit of all of the controls modeled in Combination 10.

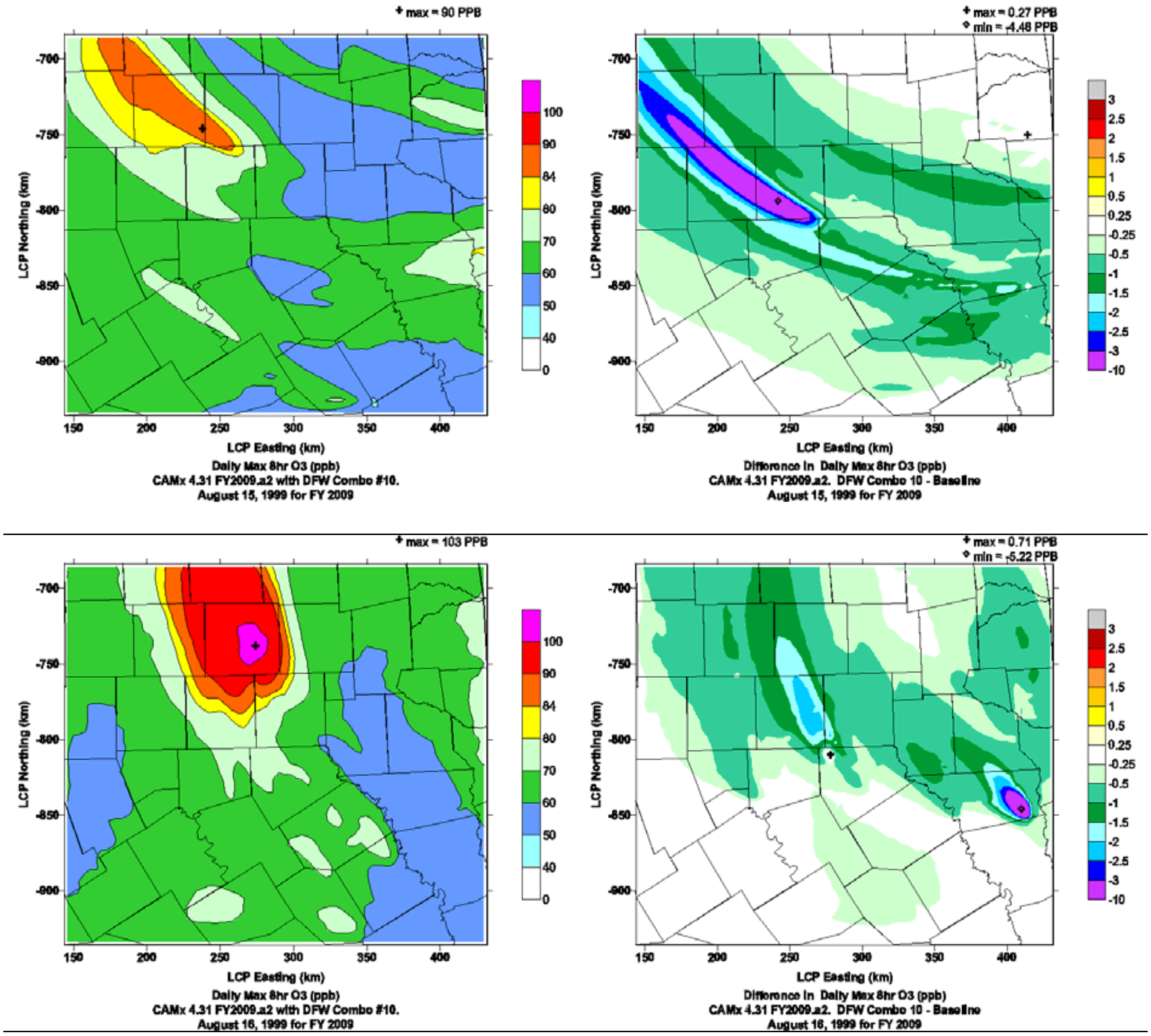



**Figure 2-18: Spatial Plots of the Daily Maximum Eight-Hour Ozone in 2009 with Combination 10 Controls, and Differences from the 2009 Baseline for Each Episode Day in the DFW 4 km Domain**

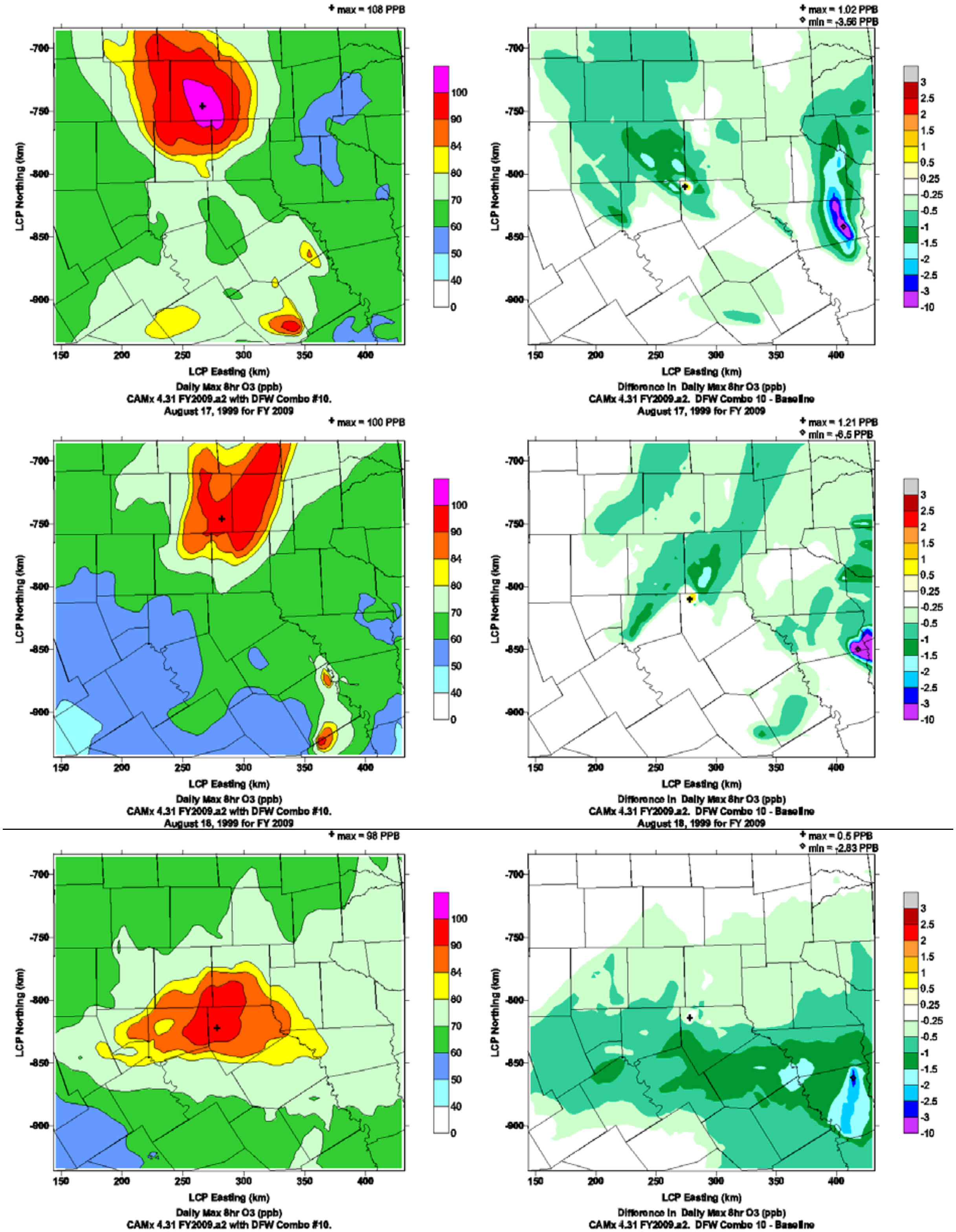



**Figure 2-18: (Continued) Spatial Plots of the Daily Maximum Eight-Hour Ozone in 2009 with Combination 10 Controls, and Differences from the 2009 Baseline for Each Episode Day in the DFW 4 km Domain**

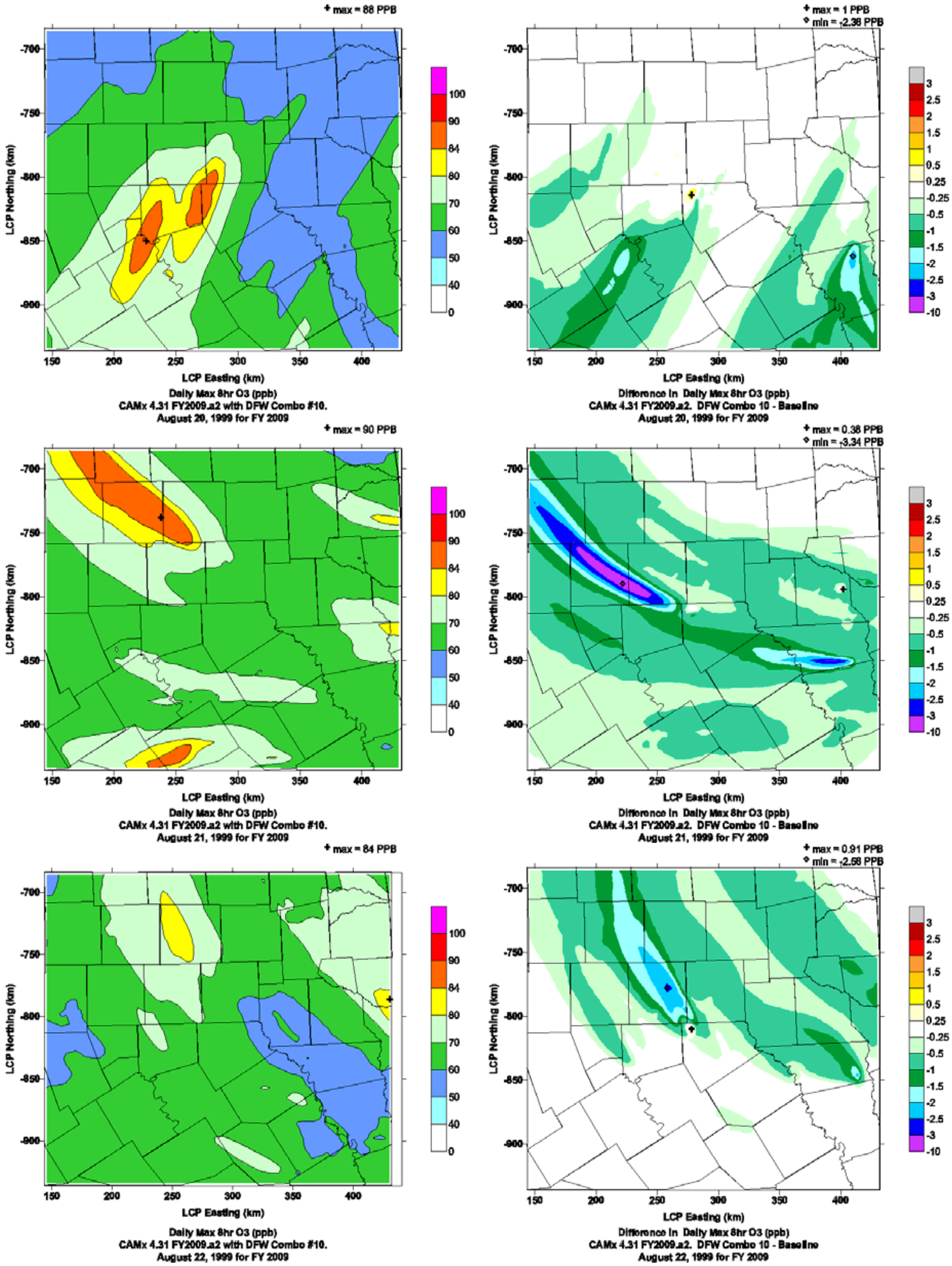



**Figure 2-18: (Continued) Spatial Plots of the Daily Maximum Eight-Hour Ozone in 2009 with Combination 10 Controls, and Differences from the 2009 Baseline for Each Episode Day in the DFW 4 km Domain**

**Relative Reduction Factor Calculations for Controlled Scenario**

The future case RRF calculations for 2009 with Combination 10 controls are shown below in Table 2-9: *DFW Future Case RRF Calculations with Combination 10 Controls*. All calculations are made using a daily RRF method. The RRF for each monitor and each day are individually calculated, with the average of the RRFs for that monitor shown in the last column on the right. Numbers labeled in blue represent RRFs less than 0.9, indicating that on that day ozone was reduced between 10-20 percent in the future case. Numbers in black indicate that the future modeled ozone was reduced from 0-10 percent compared to the base case. Numbers colored red indicate that the future case ozone increased at those monitors.

The EPA's guidance recommends removing data where the ozone modeled in the baseline case is below 85 ppb. The TCEQ is using a conservative approach, removing only one low value. Since the ozone at the Frisco monitor on August 20 is modeled at only 69.9 ppb in the baseline case, it was removed from the RRF calculations for the Frisco monitor. RRF calculations for all other monitors are based on a complete data set.

**Table 2-9: DFW Future Case RRF Calculations with Combination 10 Controls**

| Base Case: run46 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Site** | **990815** | **990816** | **990817** | **990818** | **990819** | **990820** | **990821** | **990822** | **#Days>70** |
| Frisco | 81.3 | 107 | 102.6 | 109.2 | 86 | 69.9 | 87.1 | 89.5 | 7 |
| Dallas HintonC60 | 83.1 | 99.8 | 103.4 | 103.8 | 99.2 | 78 | 85.5 | 85.3 | 8 |
| Dallas North C63 | 82.6 | 101.3 | 102.6 | 106.6 | 96.5 | 76.4 | 86.8 | 88.4 | 8 |
| Dallas Exec C402 | 77 | 93.3 | 98.5 | 96.6 | 107.4 | 83.7 | 79.4 | 79.5 | 8 |
| Denton | 102.6 | 113.1 | 110 | 112.5 | 84.7 | 73.1 | 101.6 | 99.6 | 8 |
| Midlothian | 78.3 | 86.1 | 85.9 | 76.2 | 114 | 88.8 | 75.7 | 76.7 | 8 |
| Arlington | 86.2 | 98.4 | 100.2 | 95.2 | 106.9 | 83.1 | 81.9 | 86.7 | 8 |
| Ft Worth C13 | 93.8 | 105.5 | 104.3 | 106 | 96 | 80.1 | 89.8 | 92 | 8 |
| Ft Worth C17 | 101.1 | 111.1 | 110.4 | 108.3 | 92.4 | 78.6 | 95.9 | 94.9 | 8 |
| **Future Year: run46.fy2009.a2.dfw_combo10** | | | | | | | | | |
| **Site** | **990815** | **990816** | **990817** | **990818** | **990819** | **990820** | **990821** | **990822** | |
| Frisco | 66.8 | 100.4 | 101.7 | 99.9 | 72.9 | 63.9 | 74.2 | 73.7 | |
| Dallas HintonC60 | 72.1 | 92.3 | 103.2 | 97.1 | 91.2 | 80.7 | 77.4 | 73.1 | |
| Dallas North C63 | 70.2 | 95.1 | 101.7 | 99.1 | 84.1 | 77.4 | 75.6 | 73.3 | |
| Dallas Exec C402 | 65.9 | 81.3 | 88.8 | 83.8 | 96.5 | 85.1 | 69.7 | 69.5 | |
| Denton | 87.7 | 102.7 | 107.6 | 91.5 | 71.2 | 64.4 | 89.4 | 82.6 | |
| Midlothian | 69.8 | 76.1 | 78.9 | 70.6 | 98.1 | 85.5 | 68.5 | 69.9 | |
| Arlington | 72.3 | 86.9 | 89.6 | 80.9 | 95.1 | 85.1 | 72.3 | 77 | |
| Ft Worth C13 | 77.8 | 92.5 | 93.3 | 87.4 | 83.1 | 75.6 | 78.5 | 78.7 | |
| Ft Worth C17 | 88.5 | 97.6 | 103.7 | 89.9 | 78.8 | 70.5 | 87.7 | 81.3 | |

| Daily RRFs w/o Aug 20th | | | | | | | | | Average |
|---|---|---|---|---|---|---|---|---|---|
| **Site** | **990815** | **990816** | **990817** | **990818** | **990819** | **990820** | **990821** | **990822** | **RRF** |
| Frisco | 0.821 | 0.938 | 0.991 | 0.916 | 0.848 | --- | 0.852 | 0.823 | 0.884 |
| Dallas HintonC60 | 0.868 | 0.924 | 0.998 | 0.936 | 0.919 | 1.036 | 0.905 | 0.857 | 0.930 |
| Dallas North C63 | 0.85 | 0.939 | 0.991 | 0.929 | 0.872 | 1.013 | 0.872 | 0.829 | 0.912 |
| Dallas Exec C402 | 0.856 | 0.871 | 0.901 | 0.868 | 0.898 | 1.017 | 0.879 | 0.874 | 0.896 |
| Denton | 0.855 | 0.908 | 0.978 | 0.813 | 0.841 | 0.881 | 0.879 | 0.829 | 0.873 |
| Midlothian | 0.891 | 0.884 | 0.918 | 0.926 | 0.861 | 0.962 | 0.905 | 0.912 | 0.907 |
| Arlington | 0.838 | 0.883 | 0.894 | 0.849 | 0.89 | 1.025 | 0.882 | 0.888 | 0.894 |
| Ft Worth C13 | 0.829 | 0.877 | 0.894 | 0.825 | 0.866 | 0.943 | 0.874 | 0.856 | 0.871 |
| Ft Worth C17 | 0.876 | 0.879 | 0.94 | 0.83 | 0.853 | 0.897 | 0.914 | 0.857 | 0.881 |

**Future Design Value Calculations for Controlled Scenario**

The future design value calculations for the 2009 baseline and with Combination 10 controls are shown in Table 2-10: *Future Design Value Calculations with Combination 10 Controls*. The baseline design value numbers were described in Section 2.8 and are identical for both calculations. The future design values for both cases are calculated by multiplying the site-specific RRF by the baseline design value.

Compared to the 2009 baseline, future design values with Combination 10 controls were reduced between 0.5 and 1.3 ppb. The design value at the Frisco monitor dropped 0.6 ppb to 88.7 ppb; the Denton monitor dropped 0.5 ppb to 88.6 ppb. Since the EPA design value calculation procedures truncate (delete) the decimal digit, the design values at the other seven DFW monitors models are at or below 85 ppb. The average of the truncated design values for all the DFW monitors is 83.9 ppb, which is below 85 ppb.

**Table 2-10: Future Design Value Calculations with Combination 10 Controls**

| Site Name | 2009 Baseline | | | 2009 Combo #10 | | | |
|---|---|---|---|---|---|---|---|
| | Baseline DV | Average RRF | Future DV | Baseline DV | Average RRF | Future DV | |
| | *ppb* | | *ppb* | *ppb* | | *ppb* | truncated |
| Frisco C31 | 100.3 | 0.890 | **89.3** | 100.3 | 0.884 | **88.7** | **88** |
| Dallas Hinton C60 | 92.0 | 0.936 | **86.1** | 92.0 | 0.930 | **85.6** | **85** |
| Dallas North C63 | 93.0 | 0.917 | **85.3** | 93.0 | 0.912 | **84.8** | **84** |
| Dallas Exec C402 | 88.0 | 0.905 | **79.7** | 88.0 | 0.896 | **78.8** | **78** |
| Denton C56 | 101.5 | 0.878 | **89.1** | 101.5 | 0.873 | **88.6** | **88** |
| Midlothian C94 | 92.5 | 0.918 | **84.9** | 92.5 | 0.907 | **83.9** | **83** |
| Arlington C57 | 90.5 | 0.909 | **82.2** | 90.5 | 0.894 | **80.9** | **80** |
| FtW NW C13 | 98.3 | 0.884 | **86.9** | 98.3 | 0.871 | **85.6** | **85** |
| FtW Keller C17 | 96.3 | 0.887 | **85.4** | 96.3 | 0.881 | **84.8** | **84** |
| Average | 94.7 | -- | **85.4** | -- | -- | **84.6** | **83.9** |

Examination of the RRFs in Table 2-10: *Future Design Value Calculations with Combination 10 Controls* indicates that the RRFs for the Frisco and Denton monitors are responsive, both in the 2009 baseline and the 2009 control case. As previously mentioned, RRFs less than 0.900 are considered relatively responsive and color coded in blue. The Frisco and Denton monitors are neither the least nor most responsive monitors. They are in the middle of the range of RRF values. The two least responsive monitors in the control case are Hinton and Dallas North, both urban core sites.

However, further examination of Table 2-10: *Future Design Value Calculations with Combination 10 Controls* suggests why the Frisco and Denton monitors are difficult to reduce. The 1999 baseline design values in the table are the starting point for the future design value calculations. The baseline values for both the Frisco and Denton monitors are unusually high, 100.3 ppb at the Frisco monitor and 101.5 ppb at the Denton monitor. In fact, the DFW modeling is based upon the August 13-22, 1999, episode that included days with the highest eight-hour average ozone ever measured at both the Frisco and Denton monitors.

The EPA calculation method for the baseline design value is effectively a five-year center weighted average of the fourth high ozone occurring each year. Since the EPA calculation procedure is center year weighted, the high 1999 ozone is weighted three times in the calculation of the baseline design value. Therefore, the Frisco and Denton baseline design values used in the EPA calculation are unusually high and thus it is more difficult to bring those two sites below 85 ppb in the future than the other sites in the area.

**Comparing Calculated Design Values**

Figure 2-19: *Change in DFW Eight-Hour Design Values* shows a graphical comparison of the design values calculated for the three stages of the modeling: the 1999 baseline case, the 2009 Future Base, and the 2009 Combination 10 control case. All of the DFW monitoring sites exceeded the 85 ppb ozone standard in the 1999 base year, and remarkable progress has been made since that time. The figure shows that the DFW modeling with the Combination 10 package of controls results in a significant reduction in ozone at all of the monitoring sites in 2009 and results in all but two monitors (Frisco and Denton) being at or below 85 ppb.

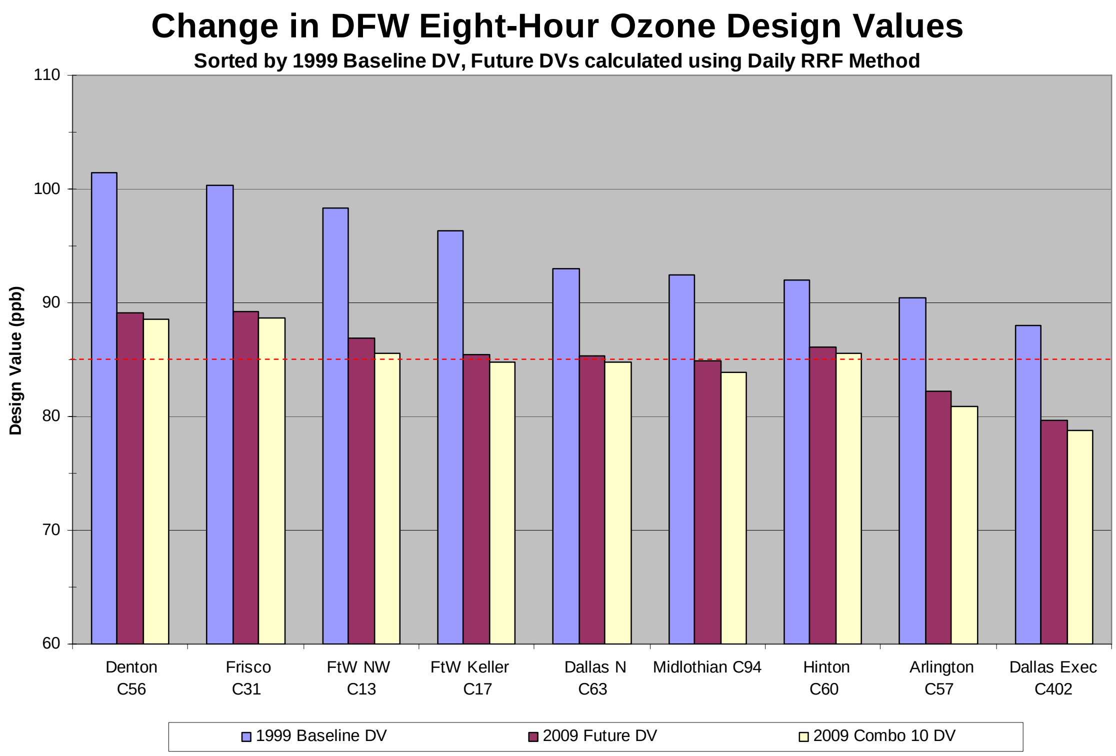



**Figure 2-19: Change in DFW Eight-Hour Ozone Design Values**

Because photochemical modeling is an evaluation tool and not an absolute prediction of future ozone concentrations, this SIP revision relies on weight-of-evidence (WoE) to demonstrate attainment. The WoE includes the corroborative analysis discussed in Chapter 3 and the additional measures outlined in section 4.2.6 of Chapter 4. The additional data in chapter 3 must be considered in order to draw conclusions about the validity of the final predicted design value and to determine that the attainment demonstration satisfies the requirements of the FCAA.

## 2.10 BIBLIOGRAPHY AND REFERENCES

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# CHAPTER 3: CORROBORATIVE ANALYSIS

## 3.1 OVERVIEW

The EPA's guidance acknowledges that many issues cannot be accurately quantified and therefore cannot be properly included in the photochemical modeling demonstration. Because photochemical modeling is an evaluation tool and not an absolute prediction of future ozone concentrations, additional data must be considered in order to draw conclusions about the validity of the final predicted design value and whether the attainment demonstration satisfies the requirements of the FCAA.

This chapter fulfills the EPA requirement for discussion of those additional factors. The TCEQ is following the EPA's Guidance on the Use of Models and Other Analyses in Attainment Demonstrations for the 8-hour Ozone NAAQS (EPA, 2005). In that guidance**,** the EPA recommends that additional studies, analyses, trends, and any other supplemental, but relevant, information be included as weight of evidence (WoE) in the SIP.

The WoE portion of this SIP consists of the corroborative analysis in this chapter; along with analysis of additional control strategies described in Chapter 4 that were not included in the modeling. The additional analyses in the WoE portions of this SIP support the conclusion that this DFW SIP demonstrates attainment of the eight-hour ozone NAAQS.

Key points of this chapter are:

- Ozone design values in the DFW area are decreasing as the result of historical emissions reductions. The downward trends are even stronger when adjusted for the number of monitors and meteorological variation.

- Analysis of VOC and $NO_X$ sensitivity indicate that the optimum path to attainment is through $NO_X$ reductions. The TCEQ has implemented controls on Texas $NO_X$ emissions, both inside and outside of the DFW nine-county nonattainment area, to develop the downward trends in ozone. Further, as shown in Chapter 2, the TCEQ is adding additional $NO_X$ controls in this SIP, which will perpetuate the downward trends in magnitude and frequency of measured high ozone concentrations.

- The state is federally preempted from regulating certain components of the emissions inventory, specifically emission standards for the on-road and non-road mobile categories. While these categories have been addressed through expeditiously implemented state programs, future reductions are dependent on the prompt implementation of new federal engine and fuel standards.

- Source apportionment and other data analyses show that background ozone contributes to the total ozone in the area. On average, initial conditions (IC) and boundary conditions (BC) make up 45 percent of ozone concentrations in the DFW area.

## 3.2 OZONE DESIGN VALUE TRENDS

The air quality in the DFW nine-county nonattainment area has been improving as a result of the control measures implemented by the TCEQ during the last several years. Despite a continuous increase in the population of the nine-county area and increases in other factors such as vehicle population and vehicle miles traveled, the DFW area is experiencing decreasing trends for ozone as well as precursor $NO_X$ and VOC emissions.

The one-hour and the eight-hour ozone design values for the DFW area from 1991 to 2006 are shown in Figure 3-1: *One-Hour and Eight-Hour Ozone Design Values in the DFW Area (1991-2006)*. The graphs shows that by 2006, the one-hour design value was reduced to 124 ppb, which indicates that the DFW area has attained the former one-hour ozone NAAQS. The eight-hour ozone design value for the DFW area in 2006 was 96 ppb and occurred at the Eagle Mountain Lake monitor. This monitor is located on the northwest side of the DFW metroplex. This location is consistent with the prevailing wind direction during DFW ozone episodes.

Figure 3-1 also shows that the one-hour ozone design value is decreasing at a faster rate than the eight-hour ozone design value. The trend line for the one-hour ozone design value for the DFW area shows a decrease of about 1.12 ppb per year, and the trend line for the eight-hour ozone design value shows a decrease of about 0.27 ppb per year. During the 1991 to 2006 period, the one-hour ozone design value decreased about 11.4 percent. During the same period, the eight-hour design value declined about 8.6 percent. Prior to this SIP, the TCEQ's efforts focused on addressing the one-hour ozone standard.

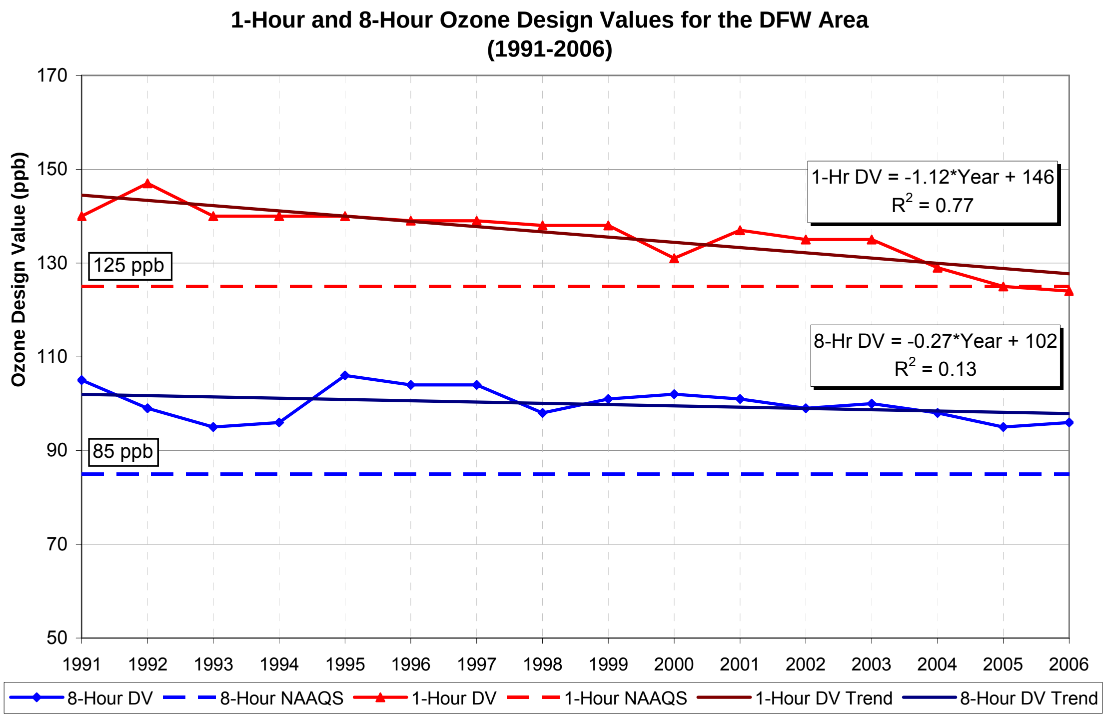


**Figure 3-1: One-Hour and Eight-Hour Ozone Design Values in the DFW Area (1991-2006)**

Population growth is also a consideration in development of air quality plans. Figures 3-2: *DFW One-Hour Ozone Design Values and Population* and 3-3: *DFW Eight-Hour Ozone Design Values and Population* show the relationship between population and ozone. For both one-hour and eight-hour standards, ozone design values have decreased despite the steady increase in the DFW area population.

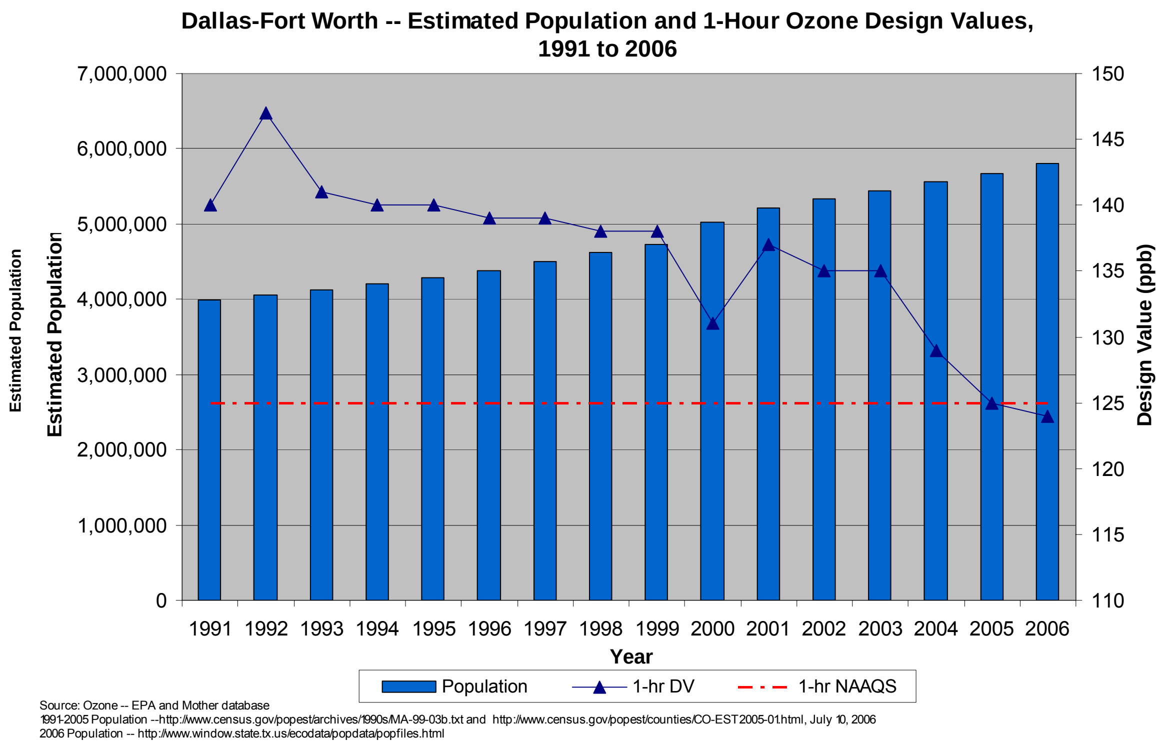


**Figure 3-2: DFW One-Hour Ozone Design Values and Population**

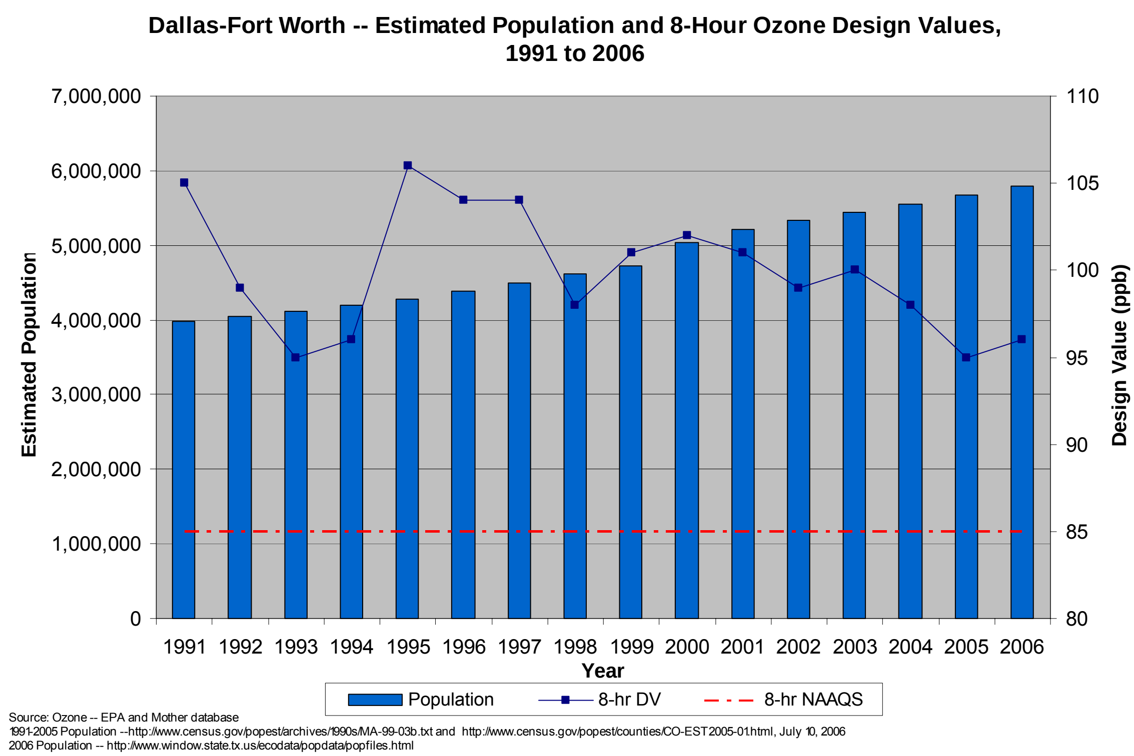


**Figure 3-3: DFW Eight-Hour Ozone Design Values and Population**

The eight-hour ozone standard is based upon the three-year average of the fourth highest ozone concentration at each monitor. Figures 3-4: *Frisco Eight-Hour Ozone Trends* and 3-5: *Denton Eight-Hour Ozone Trends* show the eight-hour trend lines at the Frisco and Denton monitors between 1997 and 2006. These two monitors have proven the most difficult to bring into modeled attainment, thus the trends at these monitors are important components of any analysis. The plots show the first, second, third, and fourth highest ozone measured at each monitor during the 10-year period. The dotted lines show the best-fit trend lines for the first and fourth highest ozone data.

Figure 3-4 shows that the measured values vary considerably each year due to differences in meteorology. The graph shows that the highest ozone measured at Frisco in 1999 was much higher than for any other year. The second, third, and fourth highest values were also anomalously high in that year.

However, since that time, the trend line for the fourth highest ozone at Frisco (the fourth high drives the design value calculation) shows a distinct downward trend. The equation for the fourth highest trend line indicates that the measured eight-hour ozone at Frisco is declining at approximately 1.4 ppb per year. The correlation coefficient for this equation is 0.4405, indicating that even though the ozone varies around the straight line because of annual variations in meteorology, the line accounts for 44 percent of the variance in the annual measurement at Frisco.

Similarly, Figure 3-5 shows the annual ozone and trend lines for the Denton monitor for the same period. The Denton graph also shows that extremely high ozone was measured during 1999, and again, those high values have not been repeated since that year. Both the first and fourth high trend lines show that ozone is also declining at this monitor. The equation for the fourth high ozone indicates that the ozone measured at the monitor is decreasing at about 1.01 ppb per year, despite the increase from 2005 to 2006. Finally, the correlation coefficient for the fourth high ozone at Denton indicates that approximately 44 percent of the annual variance is also captured at this monitor.

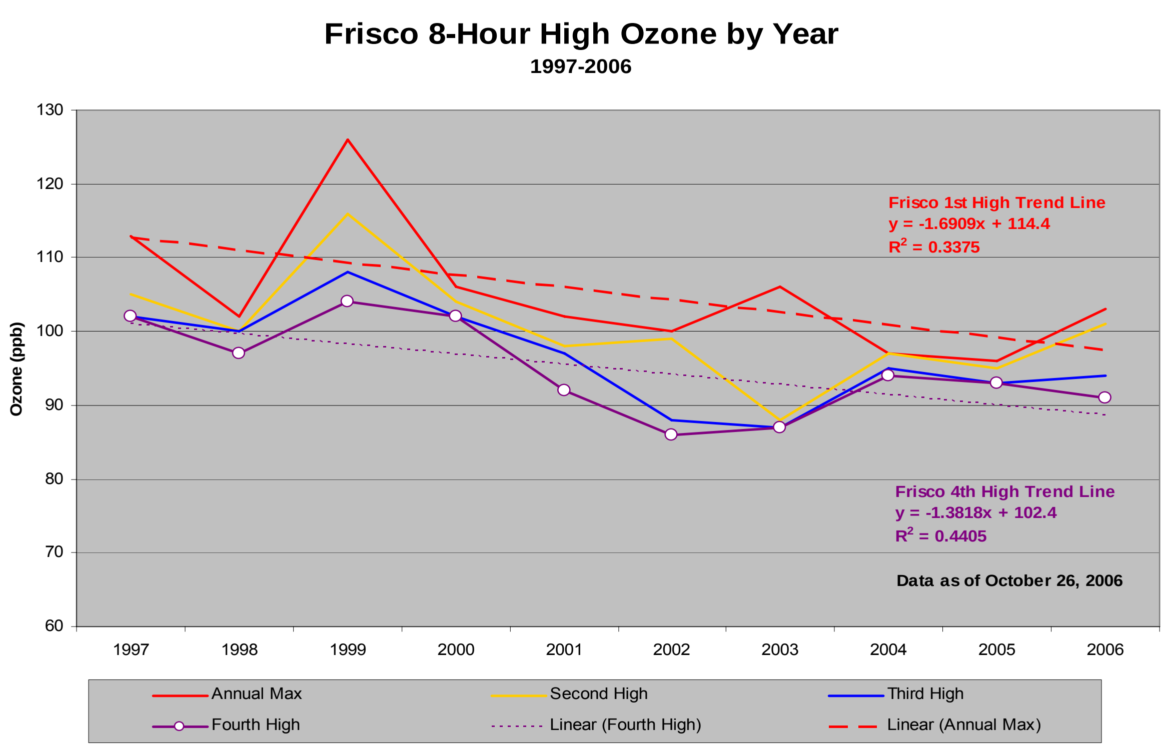


**Figure 3-4: Frisco Eight-Hour Ozone Trends**

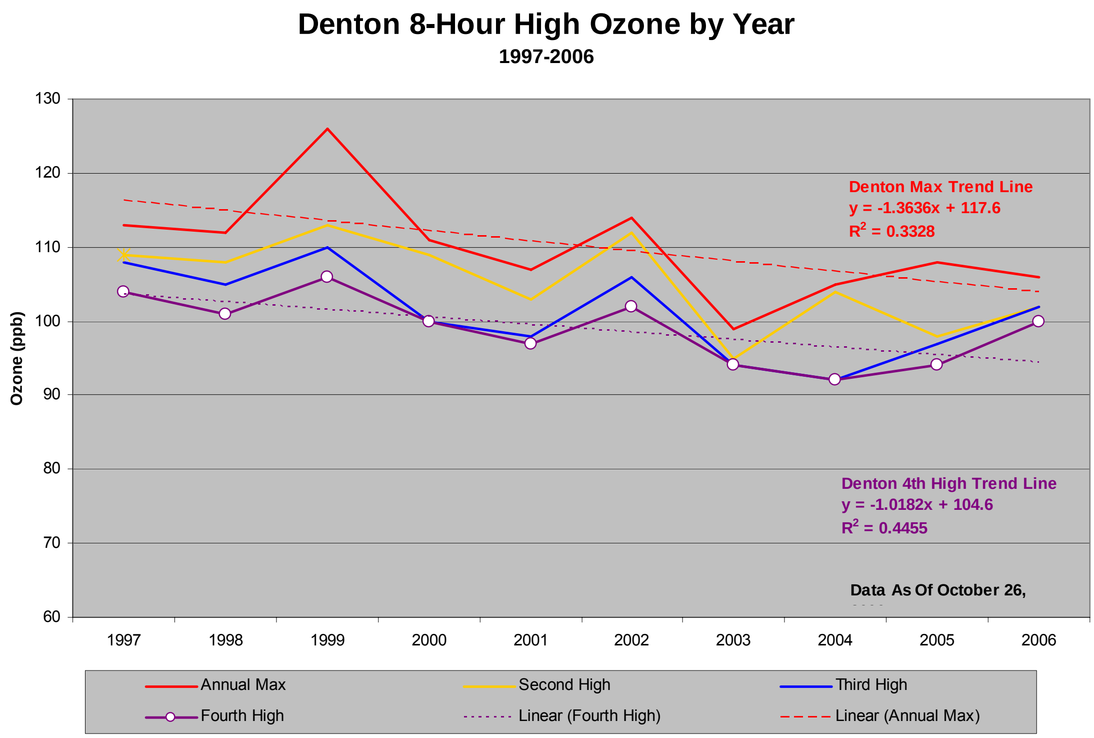


**Figure 3-5: Denton Eight-Hour Ozone Trends**

Table 3-1: *DFW Eight-Hour Ozone Trends* shows the period of record, the slope of the fourth highest ozone, and the correlation coefficient for several other monitors in the DFW area.

**Table 3-1: DFW Eight-Hour Ozone Trends**

| Ozone 4th High Trend Line Summary | | | |
|---|---|---|---|
| Site Name | Years | Slope (ppb/yr) | Correlation |
| Frisco | 1997-2006 | -1.3818 | 0.4405 |
| Denton | 1997-2006 | -1.0182 | 0.4455 |
| Grapevine | 2000-2006 | 0.8929 | 0.0481 |
| FtW NW | 1997-2006 | 0.2000 | 0.0117 |
| Keller | 1997-2006 | 0.7273 | 0.1092 |
| Eagle Mtn | 2000-2006 | 0.2143 | 0.0112 |

Table 3-1 shows that while trends at the Frisco and Denton monitors are decreasing, the slopes at Grapevine, Fort Worth NW, Keller, and Eagle Mountain Lake appear to be increasing slightly. However, the correlation coefficients for those monitors account for only one to five percent of the variance, so the trend lines are not statistically different from flat lines, and the upward trends are not conclusive.

In the eight-hour modeling guidance, EPA describes another necessary analysis called an unmonitored area analysis. The EPA requested this type of analysis be included in the DFW SIP. However, the EPA-defined procedures for that analysis and the software became available too late for them to be implemented in this SIP revision. Therefore, an EPA unmonitored area analysis cannot be accomplished at this time. However, the TCEQ submits the following assessment as a substitute for that request.

Although the current design values (2006) can be calculated for the Grapevine and Eagle Mountain Lake sites, baseline (1999) design values cannot be calculated because those monitors were not operating in 1997, 1998, and 1999. Therefore, the EPA procedures do not allow calculating future (2009) design values for those sites in this SIP revision. Nevertheless, the computer simulated ozone values at the Grapevine and Eagle Mountain Lake monitor sites for the base and future years are available, allowing the TCEQ to calculate the relative reduction factor (the average of the daily RRFs for each site).

Table 3-2: *Relative Reduction Factors (RRFs) for New Monitors* shows the average RRF for each new monitor in the DFW area between 1999 and 2009 (based upon the Combination 4 control package). The underlying data show that the modeled values at both the Eagle Mountain Lake and Grapevine locations decrease significantly over the period. The RRFs calculated for those sites are 0.858 and 0.895 respectively, indicating that in 2009 (with the addition of the adopted control strategies) the model predicts ozone reductions of 10-14 percent at those two sites. Thus, the control strategies included in this SIP revision are effective at these sites, and implementation of the control strategies should reduce the future ozone at those locations and help move the sites toward measured attainment.

**Table 3-2: Relative Reduction Factors (RRFs) for New Monitors**

| Site Name | Start Date | 2006 DV | Daily RRF |
|---|---|---|---|
| Anna C68* | 1-Nov-99 | --- | 0.865 |
| Sunnyvale C74** | 14-Nov-00 | 83** | 0.895 |
| Granbury C73 | 9-May-00 | 84.0 | 0.844 |
| Cleburne C77 | 10-May-00 | 87.0 | 0.880 |
| Kaufman C71 | 11-Sep-00 | 75.0 | 0.874 |
| Weatherford C76 | 26-Jul-00 | 88.0 | 0.858 |
| Rockwall C69 | 8-Aug-00 | 80.0 | 0.872 |
| **Eagle Mtn C75** | **6-Jun-00** | **96.0** | **0.858** |
| **Grapevine C70** | **4-Aug-00** | **93.0** | **0.895** |
| Waco C5010*** | --- | --- | 0.850 |
| Temple C651**** | 31-Jul-05 | --- | 0.890 |

Design Values Calculated as of 10/26/06
* Anna - Deactivated Sept 29, 2004, Only 1 year of recent data
** Sunnyvale - Deactivated March 30, 2006, only 2 years of recent data
*** Waco - Meteorology Only
**** Temple - Only one year of data

## 3.3 OZONE VARIABILITY ANALYSIS

The EPA has suggested that TCEQ broaden the ozone trend analysis to evaluate the effect of the increase in the number of monitors and the year-to-year variability in meteorology. The following analysis will show that when the number of monitors and meteorology are taken into account, the ozone decreases are greater.

Figure 3-6: *One-Hour and Eight-Hour Ozone Exceedances in the DFW Area from 1990 to 2006* counts the number of exceedances that occurred each year for both the one-hour and eight-hour ozone standard. As mentioned previously, there has been significant progress toward the one-hour ozone standard, but the eight-hour standard has proven more difficult to address. The graph confirms that there are more eight-hour ozone exceedances (blue bars) than one-hour exceedances (brown).

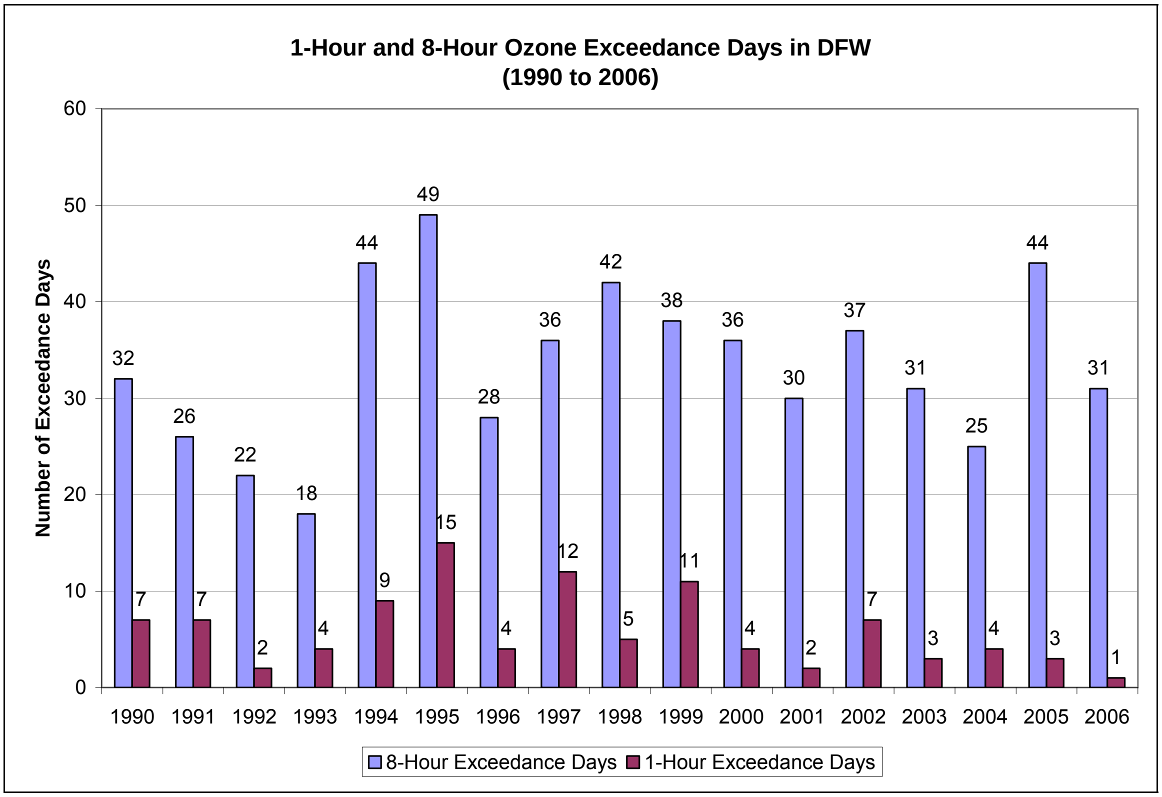


**Figure 3-6: One-Hour and Eight-Hour Ozone Exceedances in the DFW Area from 1990 to 2006**

Figure 3-6 also shows that the number of eight-hour ozone exceedances varies widely from year to year, depending upon the day-to-day meteorology and climatology each year. Despite the obvious year-to-year variation in number of exceedances, the eight-hour data suggest there has been a downward trend since 1998, the year that the TCEQ enacted rules limiting both DFW local $NO_X$ emissions and Texas power plant emissions.

However, simply counting the number of exceedance days is not the best indicator of the air quality trend in a particular area because of two factors: 1) the year-to-year variation in meteorology, and 2) changes in the number of monitors in an area. Rather, the number of counts can be adjusted for both the number of monitors and meteorological variation and as a result, derive relatively stable trend lines.

For example, Figure 3-7: *Average Eight-Hour Ozone Exceedance Days vs. Average Number of Monitors in the DFW Area from 1990 to 2006* shows that the number of exceedance days is highly correlated with the number of monitors in an area ($R^2$ = 0.986). The trend line shows that there is approximately one new exceedance for every new monitor operating in the DFW area. Similar results have been found in Houston and other areas. Therefore, as the number of monitors in an area increases, one would also expect the exceedance count to increase.

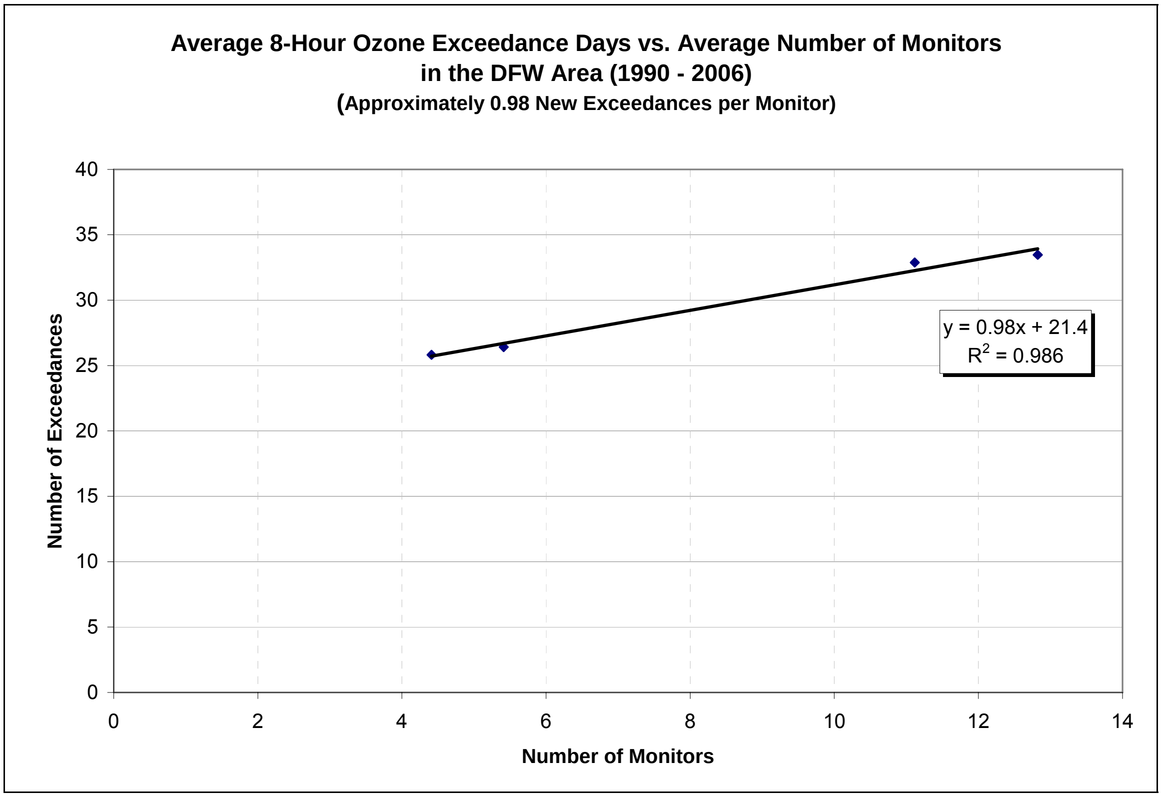


**Figure 3-7: Average Eight-Hour Ozone Exceedance Days vs. Average Number of Monitors in the DFW Area from 1990 to 2006**

This relationship can be used to adjust the exceedance count for the increase in the number of monitors. For example, since 1999, the number of monitors in the DFW area has increased from 10 to 21.

The regression equation found in Figure 3-7 and the number of monitors in the DFW area were used to calculate the number of expected eight-hour ozone exceedance days from 1990 to 2006 in Figure 3-8: *Number of Actual Eight-Hour Ozone Exceedance Days Compared to the Number of Expected Eight-Hour Ozone Exceedance Days in the DFW Area from 1990 to 2006*. The blue bars show the increase in the number of monitors in the area, and the red line shows the number of exceedances expected each year with that monitor count. The straight dashed red line shows the overall trend in expected exceedances. The dark blue line shows the actual number of exceedances measured in DFW each year.

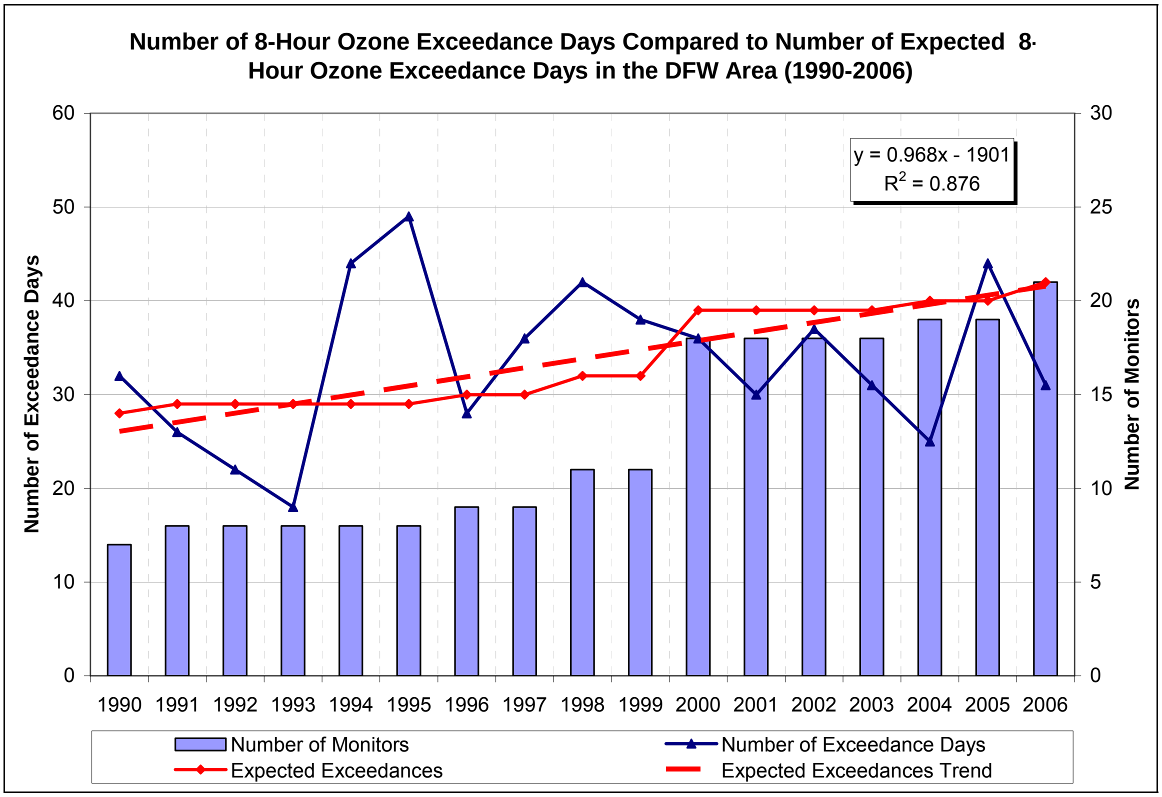


**Figure 3-8: Number of Actual Eight-Hour Ozone Exceedance Days Compared to the Number of Expected Eight-Hour Ozone Exceedance Days in the DFW Area from 1990 to 2006**

Figure 3-8 shows that the number of actual exceedances (blue line) varies considerably from year to year. However, in several of the early years, there are more exceedances than would be expected based upon the number of monitors. In the recent years, especially since 2000 when the number of monitors increased, the number of actual eight-hour ozone exceedances was less than the number of expected eight-hour ozone exceedances. Averaged over the recent period, the number of eight-hour ozone exceedance days appears to be holding steady despite a significant increase in the number of monitors operating in the DFW area.

Meteorological data can also be evaluated to adjust for the annual variation in weather. High ozone events in the DFW area are associated with light wind speeds. Therefore, a year with numerous days with light winds would be expected to have more ozone events. Figure 3-9: *DFW Ozone Trends Adjusted for Wind Speed* shows the results of a simple analysis that compares the ratio of the number of ozone events each year with number of days with low wind speeds. Effectively, the ratio shows the probability of ozone events each year, and the ratio would be expected to hold steady if there were no other factors involved and ozone was neither increasing nor decreasing.

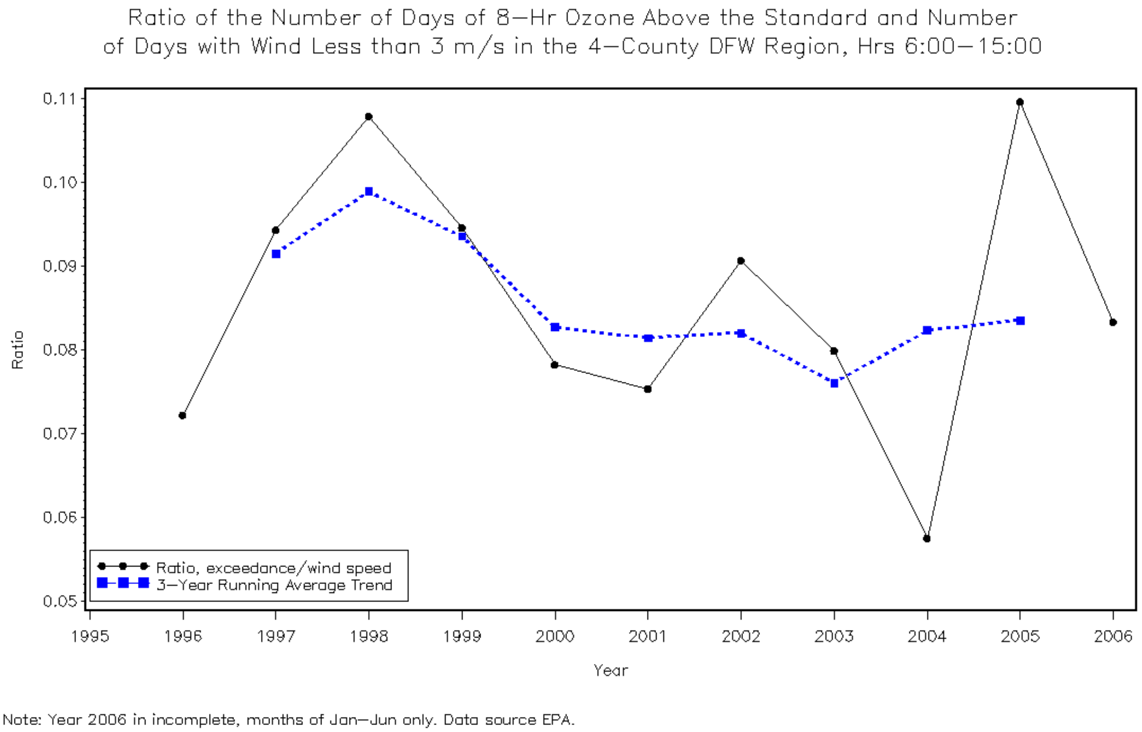


**Figure 3-9: DFW Ozone Trends Adjusted for Wind Speed**

Figure 3-9 shows the relative frequency of high ozone events (ozone greater than 85 ppb) compared to the number of days with wind speeds less than three meters per second (6.6 mph). The solid line shows the ratio calculated for each year. Following the EPA's three-year convention for evaluating exceedances, the blue dotted line shows the three-year center weighted average. The blue line smooths the annual variability in the data, and indicates that overall, the relative frequency of ozone exceedances is declining when adjusted for the number of days with low daytime wind speeds.

The number of eight-hour ozone exceedance days was also analyzed by separating the days into groups based on the maximum ozone concentration measured. This relationship is shown in Figure 3-10: *Percent of Total Eight-Hour Ozone Exceedance Days Above and Below 95 ppb in the DFW Area from 1990 to 2006*. The eight-hour ozone data for all exceedance days were divided into two roughly equal categories, ozone above 95 ppb and ozone below 95 ppb. If high and moderate ozone events were equally probable, then all the data would plot on the 50 percent line. Although there is some variation, particularly in early years the graph shows that the percent of high eight-hour ozone exceedance days above 95 ppb (red line) has decreased since 1999.

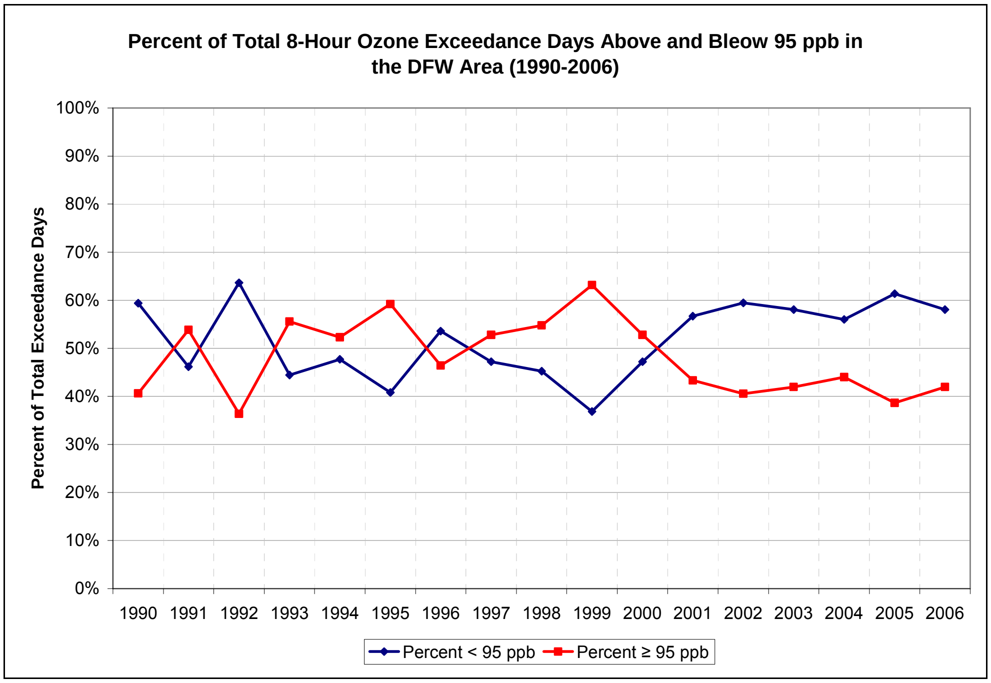


**Figure 3-10: Percent of Total Eight-Hour Ozone Exceedance Days Above and Below 95 ppb in the DFW Area from 1990 to 2006**

The long-term trend in the total number of events for exceedances above 95 ppb shows a similar declining trend line. Figure 3-11: *Long Term DFW Trend for Exceedances greater than 95 ppb* shows the DFW eight-hour ozone trend data since 1985, a longer period than plotted in Figure 3-15: *$NO_X$ Emission Inventory Trend in the DFW Area from 1990 to 2003*. The equation for the trend line indicates that the frequency of high eight-hour events decreases each year, and the trend line suggests that high events have decreased more than 20 percent over the 22-year period.

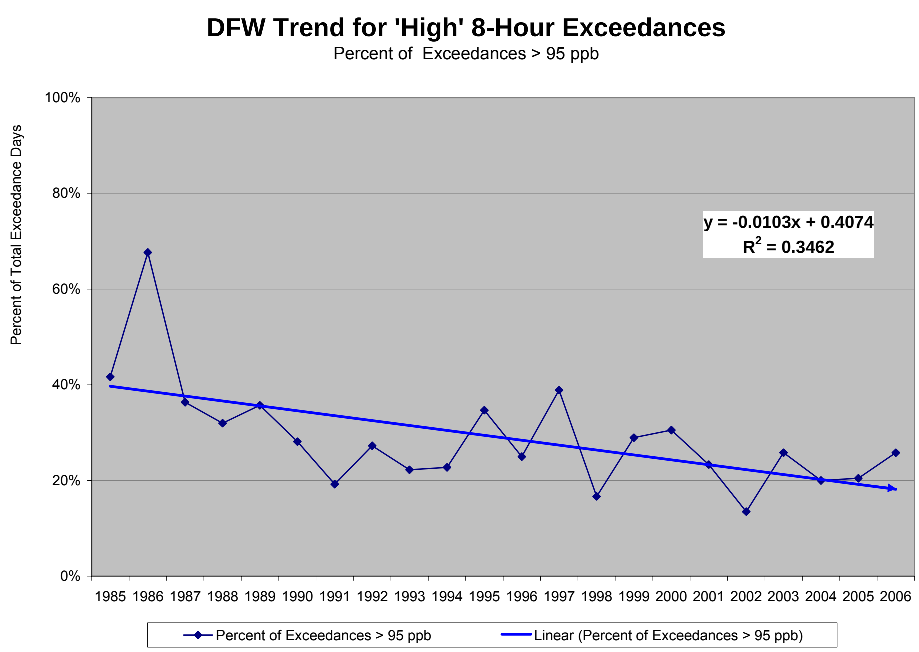


**Figure 3-11: Long Term DFW Trend for Exceedances Greater Than 95 ppb**

The EPA has also conducted studies that analyze the effect of meteorological fluctuations on ozone (Meteorologically Adjusted Ozone Trends in Urban Areas: A Probabilistic Approach, Cox and Chu, 1993). The study suggests that trends that ignore the influence of meteorology tend to underestimate the rate of improvement.

Recently, the EPA has done additional work (Camalier and Cox, personal communication) which includes more meteorological variables than the previous study. Figure 3-12: *DFW Seasonal Average Eight-Hour Daily Maximum Ozone Adjusted for Meteorological Factors (Camalier & Cox)* shows the results of a recent EPA analysis applied to ozone in the DFW area. The dotted line shows the maximum eight-hour ozone averaged over the ozone season (May –September) for each year. The solid line shows the average ozone when corrected to reflect annual meteorological variations.

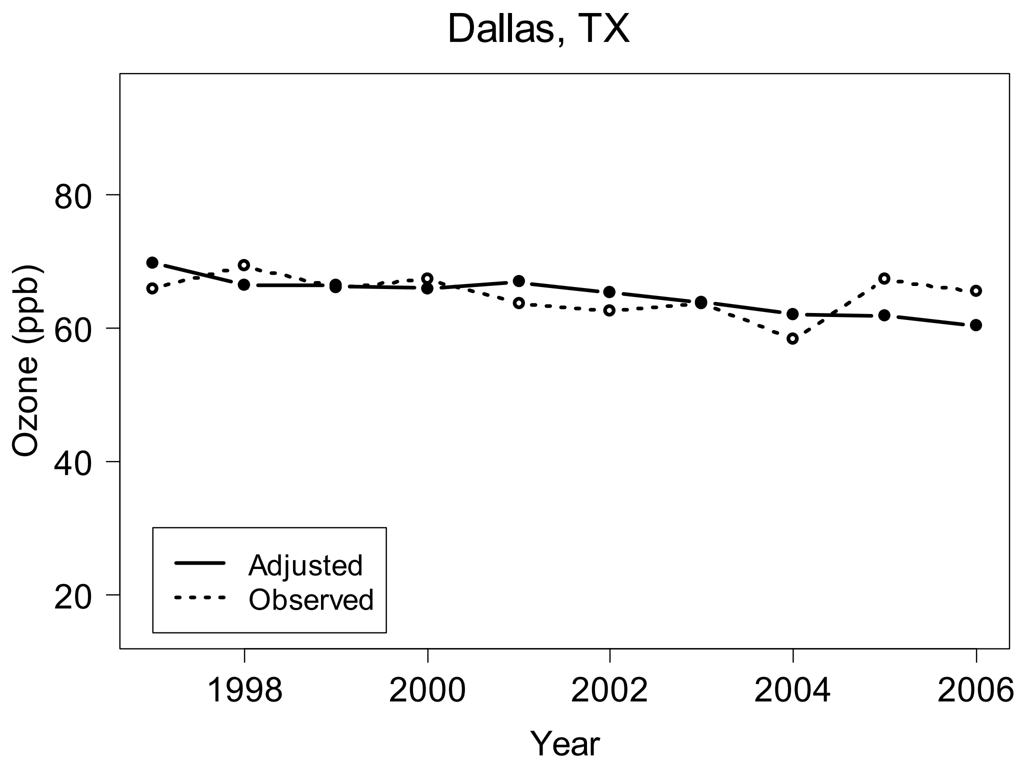


**Figure 3-12: DFW Seasonal Average Eight-Hour Daily Maximum Ozone Adjusted for Meteorological Factors**

The EPA trend line shows that the DFW summertime average ozone concentrations have been declining over the 1997-2006 period. Unfortunately, the graph (and the EPA method) shows the decline in average concentration rather than changes in the EPA design value. In addition, the graph does not include enough years to show how the decreases in Texas point source $NO_X$ emissions have accelerated the decline in high ozone frequency since 1998. However, the EPA graph does confirm the TCEQ trend analyses and the conclusion that DFW ozone has been decreasing despite annual variations in meteorology.

### 3.4 $NO_X$ AND VOC TRENDS

Analysis of $NO_X$ and VOC data show that emissions are decreasing in the DFW area and the downward trends are consistent with the changes in ozone frequency, magnitude, and design values discussed in the previous section.

Anthropogenic $NO_X$ and VOC emissions fall into the four following categories: point sources, on-road mobile sources, non-road mobile sources, and area sources. The $NO_X$ and VOC emissions data used for the trend analyses described in this section were from various data sources. The point source emission inventory (EI) data were collected from annual emission inventories provided by the companies located in the DFW area. The Texas Transportation Institute prepared the on-road mobile source data for the TCEQ. The TCEQ prepared the area and the non-road mobile source data for 2002 using the EPA-approved models and techniques. The Environ Corporation, under contract with the TCEQ, prepared all other EI data for non-point sources located outside of Texas.

The annual reported $NO_X$ emissions by source from 1999 in the DFW area are shown in Figure 3-13: *1999 Anthropogenic $NO_X$ Emissions by Source Category in the DFW Area* and the annual reported VOC emissions from 1999 in the DFW area are shown in Figure 3-14: *1999 Anthropogenic VOC Emissions by Source Category in the DFW Area*. These charts focus on the anthropogenic portion of the total DFW emissions because the biogenic component is not controllable. For example, the pie chart in Figure 3-13 shows that on-road mobile sources contributed over half of the controllable $NO_X$ emissions in the DFW area. The pie chart in Figure 3-14 shows that the largest contributors to VOC emissions in the DFW area also came from on-road mobile sources. However, for VOC, point sources contributed a much lower percentage than the other source types in the DFW area.

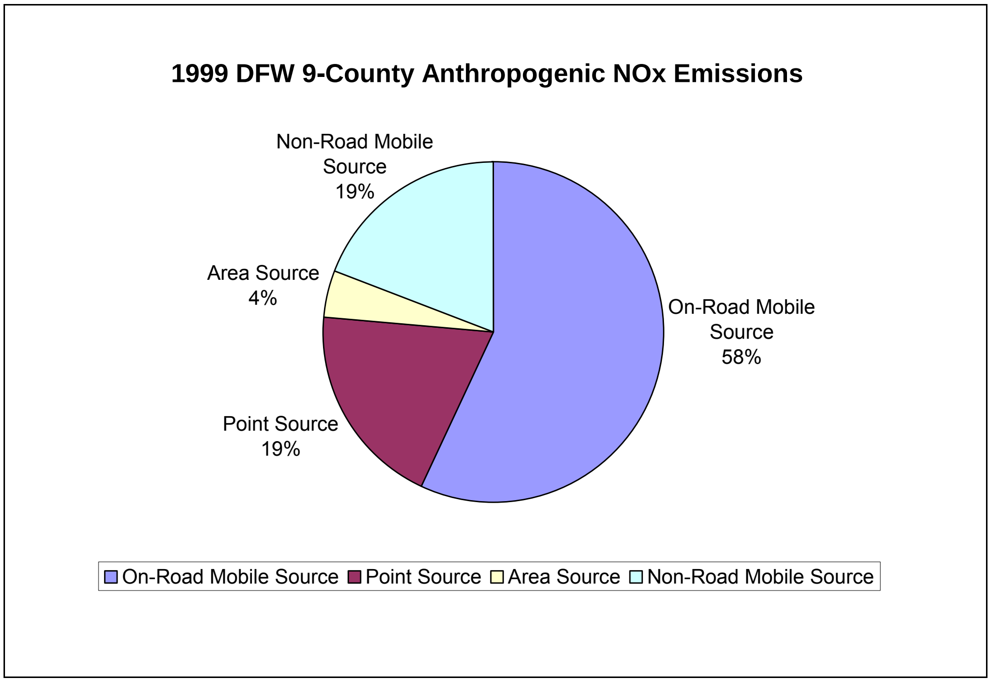


**Figure 3-13: 1999 Anthropogenic $NO_X$ Emissions by Source Category in the DFW Area**

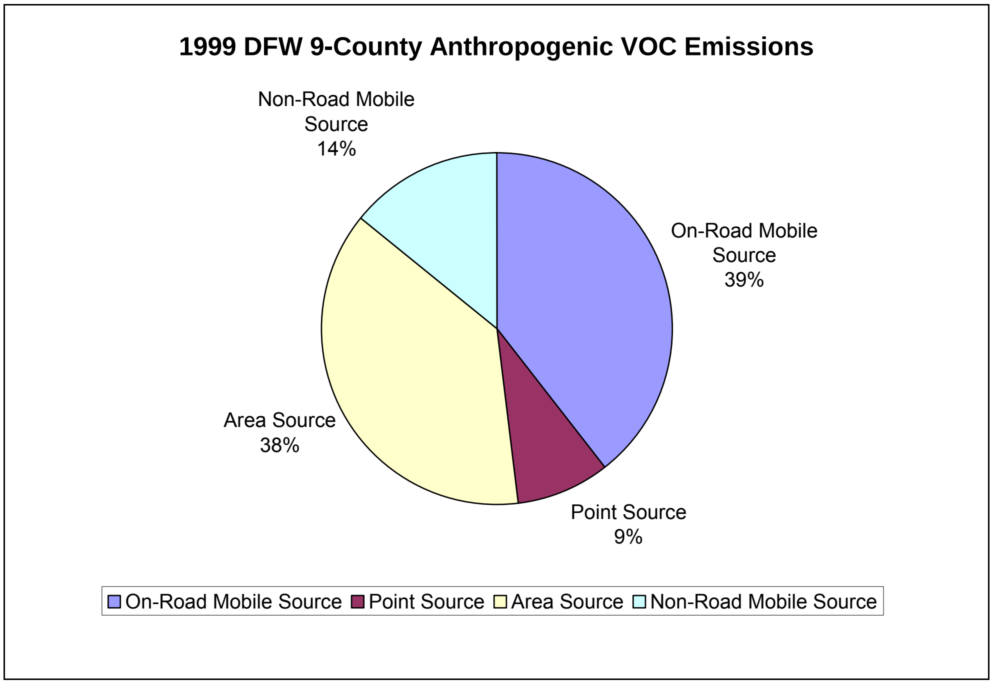


**Figure 3-14: 1999 Anthropogenic VOC Emissions by Source Category in the DFW Area**

Figure 3-15: *$NO_X$ Emission Inventory Trend in the DFW Area from 1990 to 2003* shows the trend in the DFW local $NO_X$ emission inventory as calculated for each source category from 1990 to 2003. The bar graph shows that the overall trends in the total DFW area $NO_X$ emissions are declining, but largely dependent upon the emissions from on-road mobile sources.

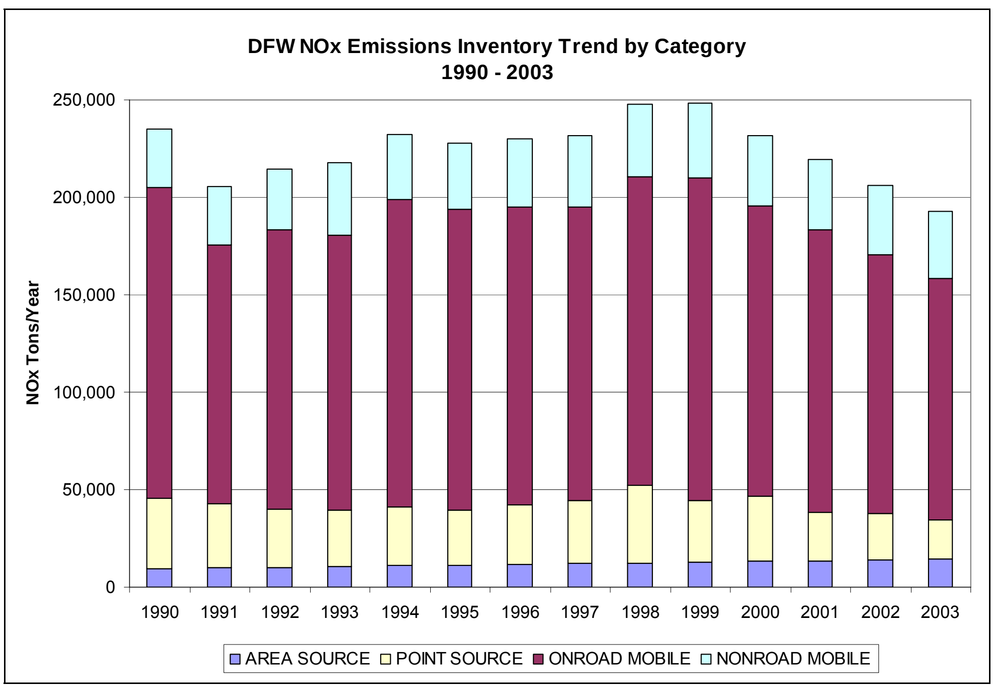


**Figure 3-15: $NO_X$ Emission Inventory Trend in the DFW Area from 1990 to 2003**

The TCEQ has limited authority to regulate mobile sources, so significant reductions in this major component of the inventory are dependent upon federal programs. Although the population and the vehicle miles traveled have increased in recent years (as illustrated in Figures 3-2 and 4-1), the $NO_X$ (and VOC) emissions from on-road mobile sources have been decreasing since 1999[1], due largely to fleet turnover. Where possible, the state has implemented supplemental local mobile source programs in the DFW area. The DFW one-hour ozone SIP $NO_X$ measures included a Vehicle Inspection and Maintenance (I/M) program, which came into effect after adoption in December 1999. The I/M program included counties that were not part of the DFW one-hour ozone nonattainment area.

In contrast, the TCEQ does have the authority to regulate $NO_X$ emissions from point sources. As a result, point source $NO_X$ showed a decrease of 44 percent from 1990 to 2003. However, over the same period, the non-road mobile source and the area source $NO_X$ emissions increased 16 percent and 51 percent, respectively.

Decreasing trends in the measured ambient data corroborate the trends in the $NO_X$ emissions reported above. The measured $NO_X$ concentrations in the DFW area also decreased during a similar analysis period (1995 to 2005). All of the monitors in the DFW area measured decreasing trends in the $NO_X$ median and the 95$^{th}$ percentile, except for Midlothian Tower and Denton Airport South monitors. Preliminary analysis from the TCEQ shows that the increased $NO_X$ measured at the Midlothian Tower site could be due to a change in quarry mining operations. In 2000, the quarry began mining closer to the monitor's location and switched to a process that uses heavy-duty diesel machinery instead of blasting. Because the Denton Airport South monitor is located north of the urban core, the increase in $NO_X$ concentration is probably due to increased population in the area and the transport of $NO_X$ from the DFW urban core under the influence of southerly winds.

Figure 3-16: *VOC Emission Inventory Trend in the DFW Area from 1990 to 2003* shows the VOC emission inventory trends by source category in the DFW local area from 1990 to 2003. The VOC emissions in the DFW area come primarily from area sources and on-road mobile sources. The reported VOC emissions inventory trends have shown statistically significant decreases of about 30 percent over the past 14 years. While the on-road mobile sources, point sources, and non-road mobile sources have decreased over the past 14 years by 52 percent, 37 percent, and 38 percent, respectively, the area sources have increased by 34 percent over the same period.

[1] Mobile source emissions in Figure 3-13 and Figure 3-14 were calculated using the Mobile5 model. Mobile Source emissions from the Mobile6 model, which is an updated version of the Mobile5 model, are available after 1999.

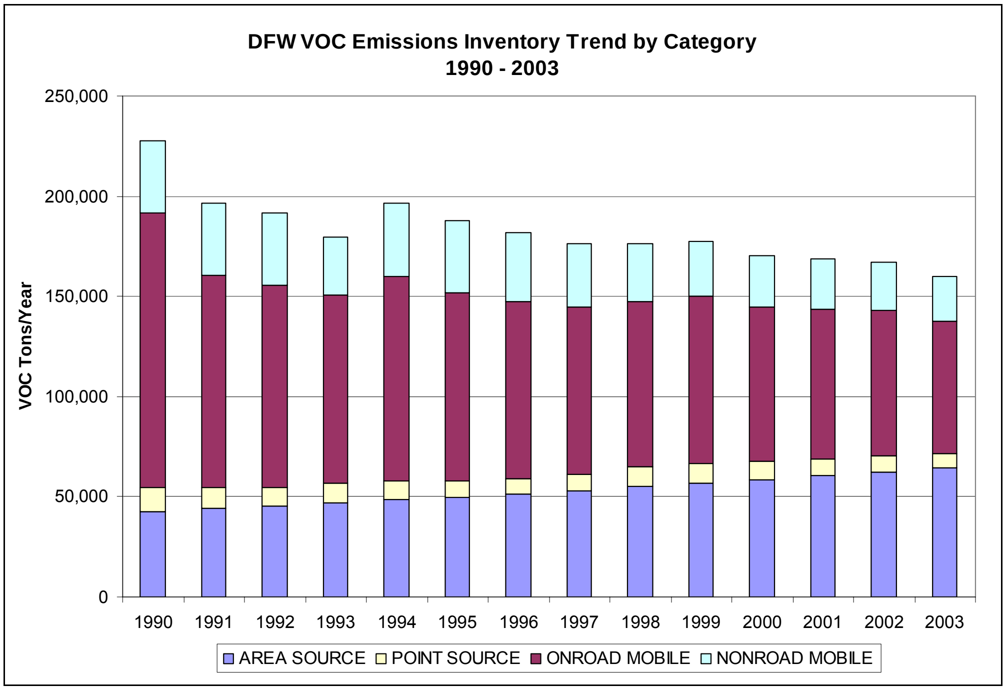


**Figure 3-16: VOC Emission Inventory Trend in the DFW Area from 1990 to 2003**

The measured ambient VOC concentrations in the DFW area have also decreased during the period. Two sites continuously measure VOC concentrations in the DFW area. These sites include automated gas chromatographs (auto-GCs) located at the Hinton monitor in Dallas and the Northwest monitor in Fort Worth. VOC data are available for the Hinton monitor from 1996 to 2005 and for the Fort Worth Northwest monitor from 2003 to 2005. Because the data at the Fort Worth Northwest monitor were available for only a short time, the trend analysis was limited to data from the Hinton monitor. Between 1996 and 2004, the average total VOC concentration at the Hinton monitor has significantly decreased.

Because background ozone is a large portion of the maximum ozone, the emission trends outside of the DFW area were also investigated. While emissions inside the DFW area are dominated by on-road mobile sources, point sources contribute the largest amount to emissions outside of the DFW area. Point source emissions from outside of the DFW area have also decreased by large amounts from 1990 to 2003.

The decrease in the eight-hour DFW ozone illustrated in Figures 3-1, 3-2, and 3-3 is also due in part to $NO_X$ reductions implemented in other areas of Texas. Figure 3-17: *NOX Emission Inventory Trends for the 110-County East Texas Area from 1990 to 2003* shows that the $NO_X$ emissions from both electric generating facilities (EGF) and non-electric generating facilities (NEGF) have been decreasing since 1990. Statewide, total $NO_X$ emissions have decreased by 57 percent from 1990 to 2003.

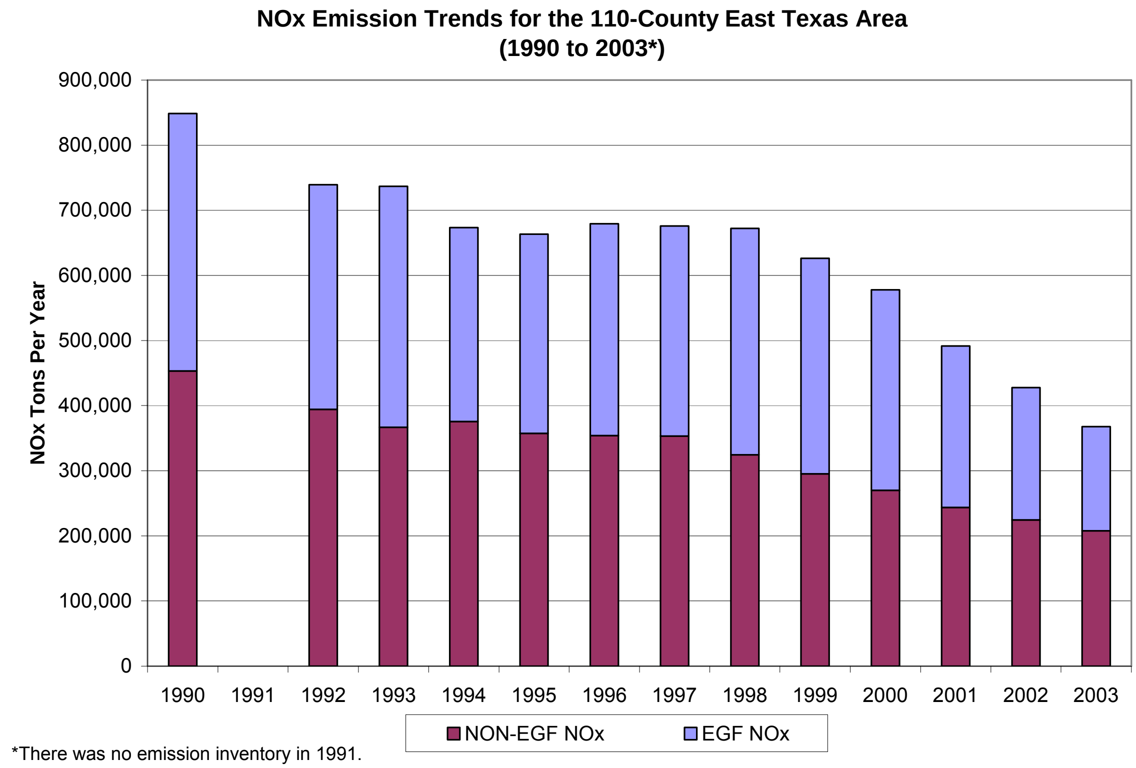


**Figure 3-17: $NO_X$ Emission Inventory Trends for the 110-County East Texas Area from 1990 to 2003**

Figure 3-17 also shows that although total $NO_X$ emissions were gradually decreased between 1990 and 1997, significant decreases began in 1998. The accelerated rate of decrease after 1998 is the result of Texas Senate Bill 7, which required EGFs in Texas to reduce their $NO_X$ emissions by 50 percent. This change in the $NO_X$ emissions after 1998 is also reflected in the changes in the ozone frequency and design values discussed in Section 3.2, *Ozone Design Value Trends*.

### 3.5 $NO_X$ AND VOC LIMITATIONS ANALYSIS

The VOC and $NO_X$ limitation of an air mass can help determine how immediate reductions in VOC and $NO_X$ concentrations might affect ozone concentrations and which controls (VOC or $NO_X$ ) are likely to be most effective in controlling ozone. A $NO_X$-limited region occurs where the radicals from VOC oxidation are abundant, and therefore the ozone formation is more sensitive to (and limited by) the amount of $NO_X$ present in the atmosphere. In these regions, controlling $NO_X$ is more effective in reducing the ozone concentrations. In VOC-limited regions, $NO_X$ is abundant, and therefore the ozone formation is more sensitive (and responsive) to changes in the radicals from VOC oxidation present in the atmosphere. In VOC-limited regions, controlling VOCs is more effective in reducing the ozone concentrations. Areas where ozone formation is not strongly limited by either VOC or $NO_X$ are considered transitional, and controlling either VOC or $NO_X$ emissions would reduce ozone concentrations in these regions.

The Measurement-based Analysis of Preferences in Planned Emission Reduction (MAPPER) program uses a smog production (SP) algorithm to estimate where and when the ozone formation is VOC or $NO_X$ limited. The advantage of using the MAPPER program is that is does not need measured VOC concentrations in order to calculate the VOC and $NO_X$ limitations. MAPPER calculates the extent of reaction (E), which describes how far the reactions proceed before running out of precursor chemicals, and E is what determines if the area is VOC or $NO_X$ limited. If E is less than 0.6, the air mass is described as VOC limited. If E falls between 0.6 and 0.9, the air mass is considered transitional.[2] If E is greater than 0.9, the air mass is considered $NO_X$ limited. (Chinkin, Main, and Roberts)

Figure 3-18: *Spatial Patterns of the Extent of Reaction in the DFW Area* shows the spatial distribution of the mean extent of reaction in the DFW area from 1998 to 2004 determined with the MAPPER program.

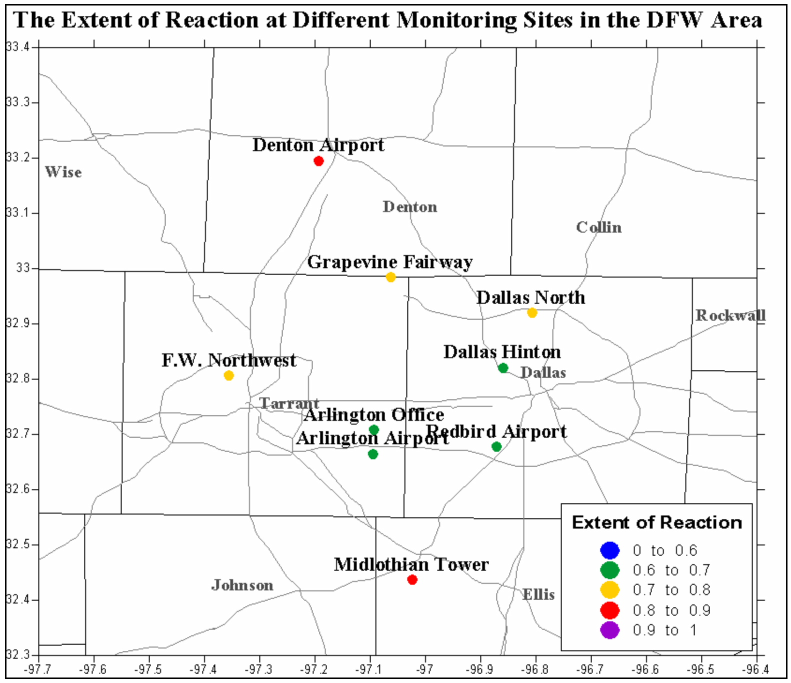


**Figure 3-18: Spatial Patterns of the Extent of Reaction in the DFW Area.**

The top five days with the highest ozone concentrations in DFW for each year from 1998 to 2004 were selected for MAPPER analysis. Then, the five hours surrounding the peak ozone were chosen for each site and each day. Next, the five hours from the five highest ozone days were used to calculate the median extent of reaction for each site for each year. Lastly, the median extent of reaction for each year were averaged together to obtain a mean limitation for each monitoring site.

The DFW urban core monitors are in the transitional range (green) but close to VOC-limited conditions while the more northern city monitors are transitional (yellow). The more rural monitors are still transitional, but closer to $NO_X$-limited conditions. The MAPPER analysis shows that on average, the DFW urban core is transitional and will respond to both $NO_X$ and VOC reductions. However, the wind direction and therefore source alignments change every day, so that on some days, the urban core may respond better to VOC reductions, and on other days, it will respond better to $NO_X$ reductions. The areas further from the urban core are also transitional (red), but relatively more responsive to $NO_X$ controls.

When evaluated by year, the MAPPER results show that, on high ozone days from 1998 to 2002, the area around the Denton Airport monitor was $NO_X$ limited, but in the past two years, the area has moved into the transitional range. The results also show that, on high ozone days from 2001 to 2002, the area around the Midlothian Tower monitor was strongly $NO_X$ limited, but in 2003

[2] The SP algorithm uses "true" $NO_X$ to calculate the extent of reaction. Most air quality monitors, however, measure $NO_X$ plus fractions of $NO_X$ reaction products (Blanchard, Ladner, Roberts, and Tanenbaum). These reaction products tend to overestimate the "true" concentration of $NO_X$, causing an underestimate of the "true" extent of reaction.

and 2004, it changed to transitional and is approaching VOC-limited conditions. All other sites showed consistently transitional conditions.

Therefore, although VOC reductions appear to be helpful in the urban core, biogenic VOC emissions are present in sufficient amounts to carry the ozone reaction forward in all areas. However, the areas downwind of the city (especially the Denton monitor) are $NO_X$ limited and therefore respond best to $NO_X$ reductions. Since these downwind areas have the highest measured ozone concentrations and are the most difficult to bring into attainment, a reduction strategy that emphasizes $NO_X$ reductions is appropriate for the DFW area.

The MAPPER technique provides useful analysis based on past $NO_X$ measurements. However, photochemical modeling is also useful to provide insight on future conditions. The DFW future baseline case (2009) was analyzed to determine the response to precursor reductions to determine whether VOC or $NO_X$ reductions would be most effective in reducing DFW ozone. In this test, future case CAMx runs were generated with emissions reductions applied to all sources inside the DFW nine-county nonattainment area. VOC was reduced in 25, 50, and 75 percent increments, and $NO_X$ was reduced by 20, 40, and 60 percent. The ozone at each monitor was plotted to develop response curves.

Figure 3-19: *Future Case CAMx Response to VOC Reductions* shows how the CAMx model responds to anthropogenic VOC reductions in the future case (2009). The graph indicates that although the model responds to anthropogenic VOC reductions inside the DFW nine-county area, the response is weak. In the 2009 baseline case, seven out of nine DFW monitors are predicted to be greater than 85 ppb. When anthropogenic VOCs are reduced, even by as much as 75 percent, five out of the nine monitors remain above the standard. This weak response to anthropogenic VOC reductions suggests that there are enough biogenic VOC emissions in the area to carry the ozone reaction forward even with less anthropogenic VOC.

In contrast, Figure 3-20: *Future Case CAMx Response to $NO_X$ Reductions* shows a stronger response to $NO_X$ reductions. Again, in the 2009 baseline case, seven of the nine monitors exceed the eight-hour ozone standard. However, when anthropogenic $NO_X$ is reduced inside the DFW nine-county area, the response is stronger. When $NO_X$ is reduced by approximately 28 percent, all of the monitors except Frisco are brought below the ozone standard. The model suggests that it will take about a 42 percent reduction in DFW $NO_X$ to bring the Frisco monitor below 85 ppb.

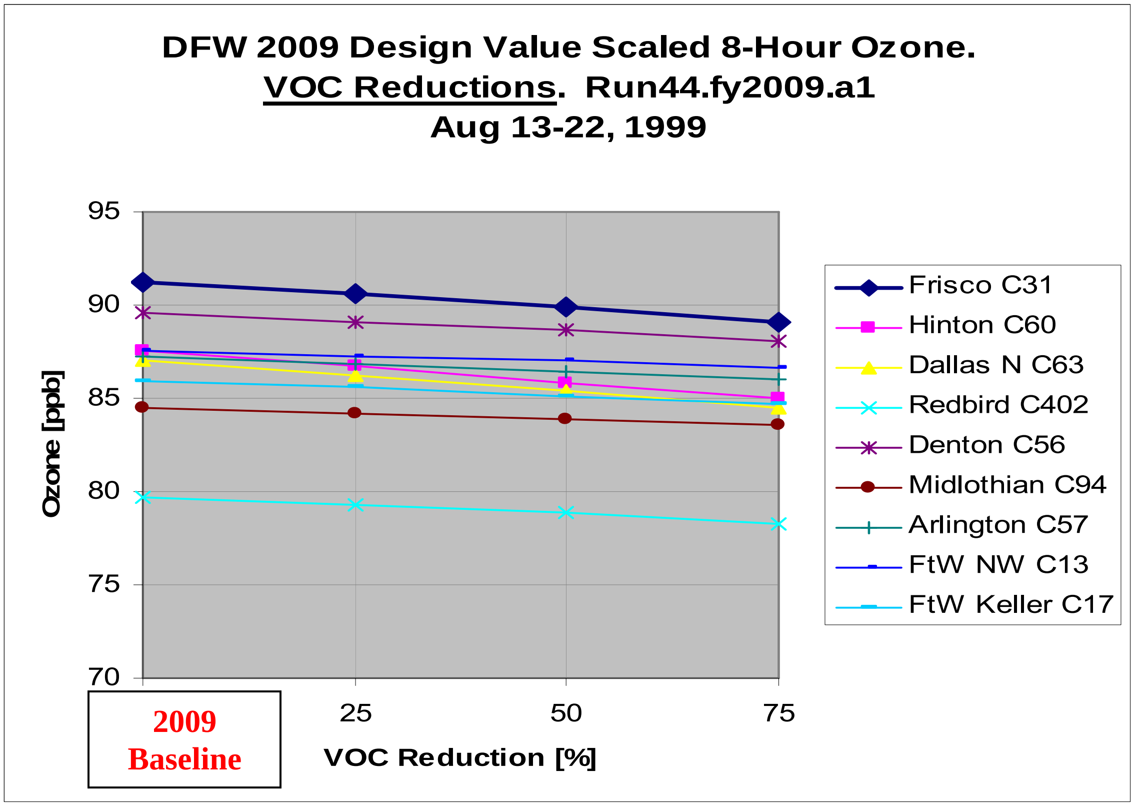


Figure 3-19: Future Case CAMx Response to VOC Reductions

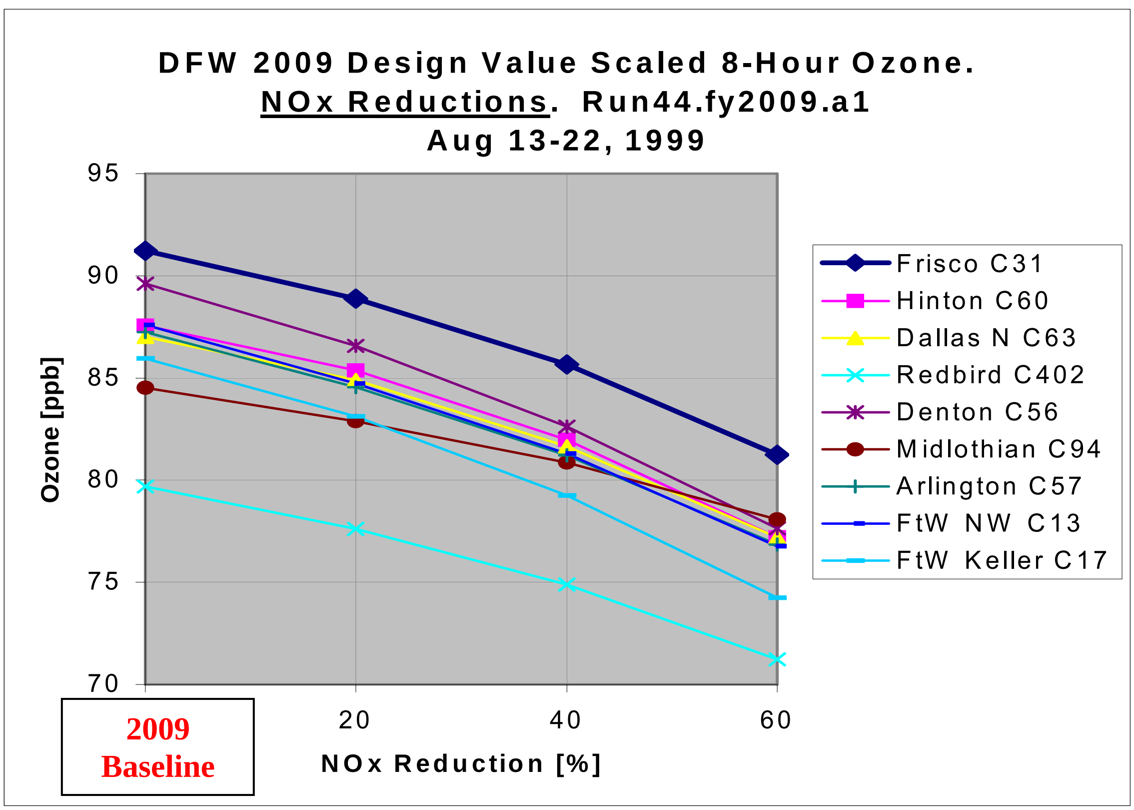


Figure 3-20: Future Case CAMX Response to $NO_X$ Reductions

### 3.6 LOCAL CONTRIBUTIONS AND FEDERAL PREEMPTION ISSUES

The TCEQ has limited authority to regulate certain components of the EI. For example, the federal government has jurisdiction over heavy-duty diesel trucks, trains, and planes since they are involved in interstate commerce. Similarly, the federal government sets emissions standards for cars. Since states cannot control sources that are under federal jurisdiction or in other states, there are limits on the ability of the state to impose controls on all of the sources that contribute to ozone formation in a nonattainment area.

Figure 3-21: *DFW Future Case (2009) $NO_X$ Emissions by Source Category* shows the DFW future case anthropogenic $NO_X$ emissions projected to 2009, for the emissions inside the DFW nine-county nonattainment area. The graph shows the source categories as well as the $NO_X$ emissions in tons per day (tpd) and in percent. The two largest future case contributions come from on-road and non-road mobile sources. Taken together, those two source categories contribute 291 tpd of $NO_X$, which is 74 percent of the $NO_X$ emitted inside of the DFW nine-county nonattainment area. The TCEQ cannot change the emissions standards for on-road mobile sources, nor can the state directly control emissions from on-road or non-road mobile sources involved in interstate commerce.

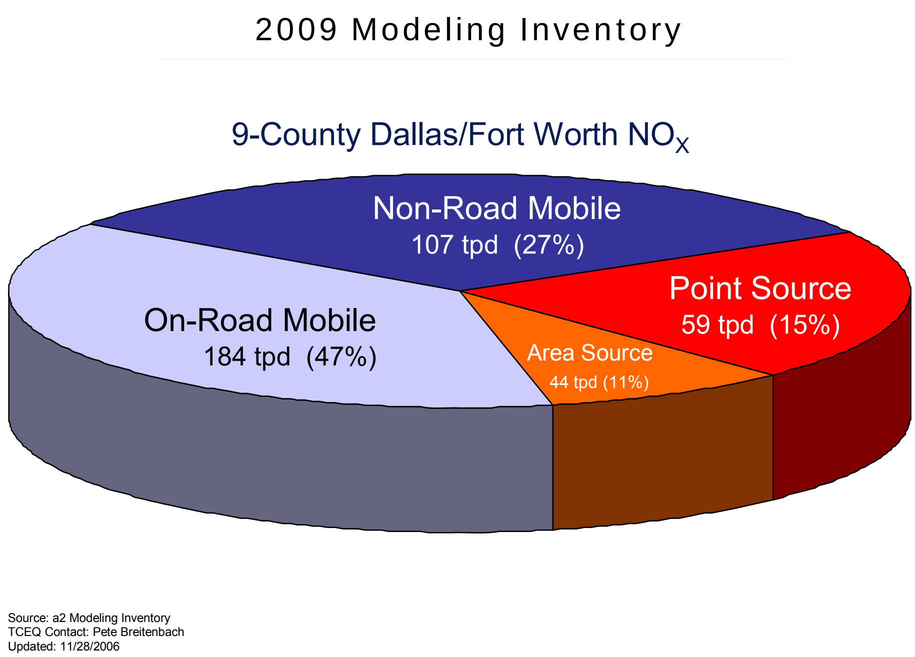


**Figure 3-21: DFW Future Case (2009) $NO_X$ Emissions by Source Category**

Figure 3-22: *$NO_X$ Sources Directly Regulated by TCEQ* shows the two source categories that the TCEQ can directly regulate. The TCEQ has jurisdiction over only 103 tpd or 26 percent of the emissions inside the DFW area. Since the majority of the $NO_X$ emissions come from sources that the TCEQ cannot directly regulate, making greater reductions in ozone is difficult without the prompt implementation of federal programs.

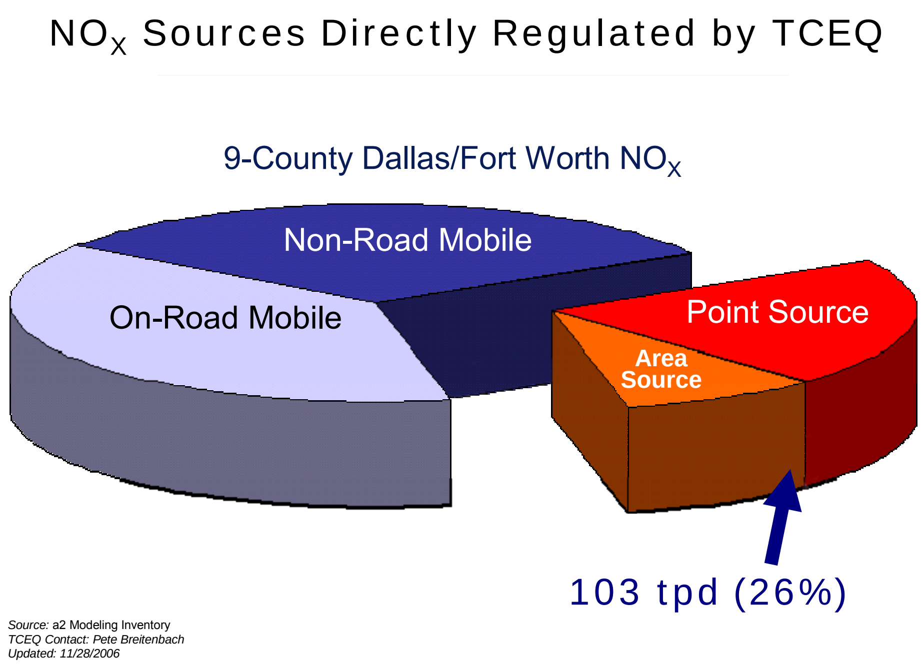


**Figure 3-22: NO$_X$ Sources Directly Regulated by TCEQ**

Figures 3-19 and 3-20 show that NO$_X$ reductions of approximately 28 percent will bring eight out of the nine DFW monitors below the 85 ppb standard. In order to bring all of the DFW monitors below 85 ppb, NO$_X$ reductions of more than 40 percent may be needed. The TCEQ's regulatory programs address non-road and on-road mobile reductions through programs such as TERP, fuel requirements, the I/M program, and local initiatives; however, prompt implementation of final federal engine standards will provide additional reductions.

### 3.7 BACKGROUND OZONE AND TRANSPORT CONTRIBUTIONS

Several different studies have shown that background ozone contributes to the total ozone in an area. Background ozone generally refers to ozone entering the nonattainment area from outside its boundaries and is usually measured on the upwind side of the city. Ozone concentrations in the urban area are the sum of two components, the background ozone and locally produced ozone.

Figure 3-23: *Eight-Hour Ozone in the DFW Area from 1998 to 2003* shows the average ozone in the DFW area (averaged over all days, high, medium and low) measured over a five-year period. The graph confirms that the average ozone concentrations in the DFW area are lower during the spring and fall months and peak during the summer. The DFW component (yellow) was determined by subtracting the measurements on the upwind side from the maximum ozone measured each day. The graph shows that the local contribution is a small portion of the total ozone, and that the background contribution is a large part of the total. The DFW contribution is relatively stable, and the summer peak is driven in part by seasonal variability. (Nielsen-Gammon, Tobin, McNeel, and Li).

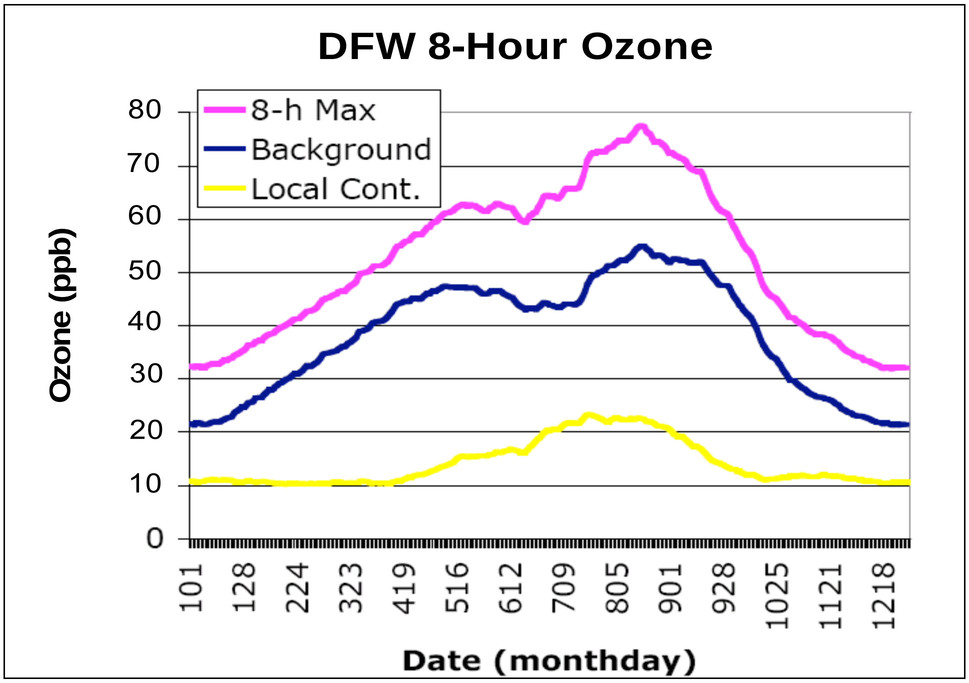


**Figure 3-23: Eight-Hour Ozone in the DFW Area from 1998 to 2003**

Recent Anthropogenic Precursor Culpability Assessment (APCA) modeling has shown similar results. Figure 3-24: *Site Specific APCA Contributions in DFW Future Case (2009)* shows the amount of ozone contributed by each source region to each of the monitors in the DFW area. The last bar shows the contribution averaged over the eight days of the episode and all of the monitors in the area.

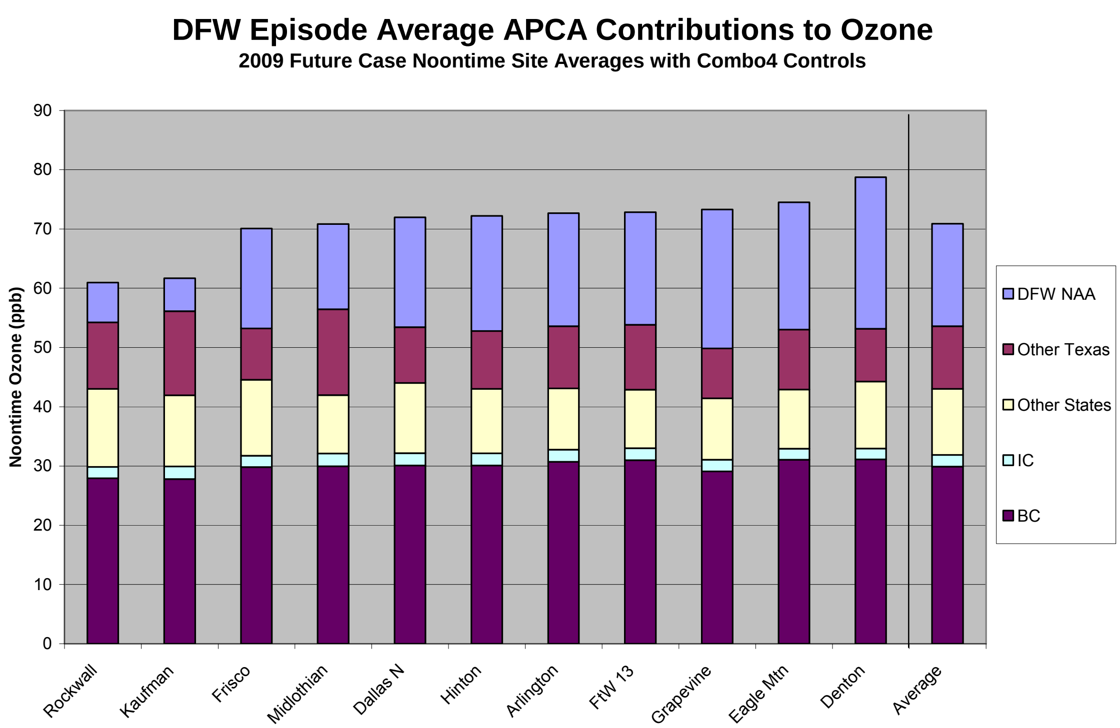


**Figure 3-24: Site Specific APCA Contributions in DFW Future Case (2009)**

Table 3-3: *Episode Average Ozone Contributions by APCA Source Region in DFW Future Case (2009)* shows the same APCA data as the last bar of Figure 3-24, but in tabular form. The APCA modeling results for the episode suggest that, averaged over the monitors and the eight days of the episode, approximately 24 percent of the total ozone is caused by local sources inside the DFW area, 15 percent by other sources in Texas, and 60 percent is caused by sources outside of Texas. Therefore, the majority of the ozone is not locally controllable.

**Table 3-3: Episode Average Ozone Contributions by APCA Source Region in DFW Future Case (2009)**

| Ozone (ppb) | Average | Percent |
|---|---|---|
| DFW NAA | 17.29 | 24.4 |
| Other Texas | 10.60 | 15.0 |
| Other States | 11.13 | 15.7 |
| Initial Conditions | 2.00 | 2.8 |
| Boundary Conditions | 29.87 | 42.1 |
| **TOTALS** | **70.89** | **100.0** |

### 3.8 2010 MOBILE EMISSIONS MODELING SENSITIVITY

In addition to the control measures modeled for the adoption package and described in Chapter 2 of this SIP revision, an additional modeling sensitivity including 2010 mobile emissions benefits was assessed to determine ozone concentrations on June 15, 2010, the ozone NAAQS attainment date. Since the on-road mobile emissions inventory is a snapshot of emissions on July 1 of the inventory year, it is reasonable to assume that the benefit estimated in the 2010 emissions would actually be in place by June 15, 2010. In addition to the 2010 mobile emissions benefit, this sensitivity analysis also assumes an additional six tpd of reductions expected from additional appropriations of TERP funds beyond 2007.

As shown in Table 3-4: *Future Case (2009) Ozone Design Values*, the results of this sensitivity analysis package are similar to the results from the Combination 4 package, which was included in the SIP proposal. The average ozone over the domain predicted in this sensitivity analysis is 83.70 ppb compared to the proposed 83.83. The average ozone was reduced by 1.7 ppb in this sensitivity analysis compared to the 2009 baseline while in Combination 4, ozone was reduced by 1.6 ppb. In this sensitivity analysis, only two sites exceed the 85 ppb ozone standard (Frisco and Denton). As described in Chapter 2, these exceedances are likely due to the unusually high design values measured in 1999, which continue to bias the future Design Value (DV) calculations. However, the future DVs at both monitors are less than 88 ppb.

**Table 3-4: Future Case (2009) Ozone Design Values**

| Site Name | 2009 Base | Combination Included in the December 2006 Proposal | 2010 Mobile Emissions Modeling Sensitivity |
|---|---|---|---|
| | *ppb* | *ppb* | *ppb* |
| Frisco C31 | **89.27** | **87.72** | **87.56** |
| Dallas Hinton C60 | **86.14** | 84.80 | 84.70 |
| Dallas North C63 | **85.29** | 83.97 | 83.89 |
| Dallas Exec C402 | 79.66 | 78.13 | 78.07 |
| Denton C56 | **89.13** | **87.71** | **87.43** |
| Midlothian C94 | 84.92 | 83.23 | 83.54 |
| Arlington C57 | 82.23 | 80.08 | 80.00 |
| FtW NW C13 | **86.91** | 84.75 | 84.43 |
| FtW Keller C17 | **85.42** | 84.05 | 83.73 |
| Average | **85.44** | 83.83 | 83.70 |
| Change from Baseline | -- | -1.614 | -1.735 |
| Exceedance Count | 6 | 2 | 2 |

## 3.9 CONCLUSIONS

### Weight of Evidence

Because photochemical modeling is an evaluation tool and not an absolute prediction of future ozone concentrations, the additional data in this chapter must be considered in order to draw conclusions about the validity of the final predicted design value and to determine that the attainment demonstration satisfies the requirements of the FCAA.

In addition to the photochemical modeling in Chapter 2 and additional unqualified measures discussed in Chapter 4, this chapter provides trends analyses and supplementary data to demonstrate attainment of the eight-hour ozone standard of 0.08 ppm in the DFW area by June 15, 2010.

### Ozone Trends

Despite a continuous increase in the population of the DFW nine-county area and other factors such as increases in the vehicle miles traveled, the DFW area is experiencing decreasing trends for ozone and for the ozone precursors, $NO_X$ and VOC. The one-hour and the eight-hour ozone design values both show decreasing trends over the past 15 years. The one-hour design value has decreased about 11.4 percent since 1991, and the eight-hour ozone design value has decreased by about 8.6 percent. In 2006, the one-hour ozone design value was measured at 124 ppb, which demonstrates attainment of the former one-hour ozone standard, which was recently rescinded. The design value for eight-hour ozone was reduced to 96 ppb in 2006.

The TCEQ's analysis shows that ozone is declining even faster when adjustments are made for the number of monitors and wind speed. Other data show that the probability of ozone events has decreased between 1998 and 1999 and that the frequency of high ozone events is decreasing in the DFW area. The EPA analysis of meteorologically adjusted trends confirms the TCEQ's assessment. Therefore, despite the slow decrease in eight-hour ozone shown in Figure 3-1, and despite increases in population and vehicle miles traveled, the design values, frequency, average concentration, and number of high ozone events are in fact decreasing in the DFW area.

### Emissions Trends

The DFW trends in total $NO_X$ emissions appear to be closely linked to the $NO_X$ emission standards for on-road mobile sources, which are specified by the federal government. The TCEQ is federally preempted from setting emission standards and therefore has limited ability to control these sources. Despite the increases in vehicle miles traveled, the fleet turnover from older to newer vehicles has helped reduce $NO_X$ emissions. The implementation of TERP, fuel requirements, the Vehicle I/M program, and local initiatives in the DFW and outlying areas has also proven beneficial.

Where the state has jurisdiction, rules and controls have been implemented to control emissions inside DFW and from other sources in Texas. For example, the $NO_X$ emissions from point sources, a source category that the TCEQ directly regulates, have decreased 44 percent over the past 14 years. The trends in reported emissions over the past 15 years are corroborated by actual decreasing measurements of ambient $NO_X$ over the same period.

The VOC emissions in the DFW nine-county area come primarily from on-road mobile sources and area sources. These emissions have decreased by about 30 percent during the past 14 years. The measured ambient VOC concentrations in the DFW area have also decreased in the last nine years. Examples of effective programs are the vehicle inspection and maintenance and cleaner gasoline requirements.

### Choice of Controls

The VOC or $NO_X$ limitation of an air mass is an important way to evaluate how immediate reductions in VOC and $NO_X$ concentrations affect the ozone concentrations. Applications of the smog production algorithm indicated that the urban core of the DFW area is transitional but close to VOC limited conditions, while the more rural parts of the DFW area are transitional but close to $NO_X$ limited conditions. Based on historical measurements, the DFW urban core is transitional and should respond to both $NO_X$ and VOC reductions.

However, the wind direction and, therefore, source alignments change every day, so that on some days, the urban core may respond better to VOC reductions and on other days, may respond better to $NO_X$ reductions. The areas further from the urban core are also transitional, but tend to be relatively more responsive to $NO_X$ controls.

Modeling has shown that in the future, the DFW area should respond better to $NO_X$ reductions than to VOC reductions. Since the monitors with the highest ozone are clearly $NO_X$ limited, $NO_X$ controls are the most effective path to attainment. As $NO_X$, VOC, and the trends discussed in this chapter indicate, existing and future controls will continue to further move the DFW area towards attainment of the eight-hour ozone standard.

**2010 Mobile Emissions Modeling Sensitivity**
In addition to the control measures modeled for the adoption package and described in Chapter 2 of this SIP revision, an additional modeling sensitivity including 2010 mobile emissions benefits was assessed to determine ozone concentrations in June 2010, the ozone NAAQS attainment date. In addition to the 2010 mobile emissions benefit, this sensitivity analysis also assumes an additional six tpd of reductions expected from additional appropriations of TERP funds beyond 2007.

The results of this sensitivity analysis package are similar to the results from the SIP proposal. The average ozone over the domain predicted in this sensitivity analysis is 83.70 ppb compared to the proposed 83.83. The average ozone was reduced by 1.7 ppb in this sensitivity analysis compared to the 2009 baseline while in the proposal, ozone was reduced by 1.6 ppb. In this sensitivity analysis, only two sites exceed the 85 ppb ozone standard (Frisco and Denton). As described in Chapter 2, these exceedances are likely due to the unusually high design values measured in 1999, which continue to bias the future Design Value (DV) calculations. However, even though high, the future DVs at both monitors are less than 88 ppb.

**Supplemental Information**
The commission will provide EPA updated information regarding TERP funding as discussed in Section 4.2.6.2 and other legislative information as appropriate, as well as information concerning additional measures adopted and implemented by local entities.

**Summary**
The corroborative analysis indicates that eight-hour ozone has decreased over the period and that the state-mandated local and regional $NO_X$ reductions have been effective. The data confirm the effectiveness of the Texas EGF/NEGF $NO_X$ reductions that began in 1998. The data also illustrate the importance of the new East Texas Combustion rule, which will further reduce $NO_X$ emissions from Texas sources outside the DFW area. Mobile emissions modeling sensitivity analysis shows emissions reductions from fleet turnover from ozone season 2009 through June 15, 2010 and additional appropriations of TERP funds beyond 2007 will assist the area in demonstrating attainment by June 15, 2010.

The corroborative analysis provided in this chapter supports the conclusion that this DFW SIP demonstrates attainment of the eight-hour ozone NAAQS.

## 3.9 REFERENCES

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2. Blanchard, Charles L., and Shelley Tanenbaum. "Weekday/Weekend Differences in Ambient Concentrations of Primary and Secondary Pollutants in Atlanta, Baltimore, Chicago, Dallas-Fort Worth, Denver, Houston, New York, Phoenix, Washington, and Surrounding Areas". Albany, CA: Envair, 2005, pp. 1-118.
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4. Balnchard, Charles L., Donna Ladner, Paul Roberts, and Shelley Tanenbaum. "Enhancement of Measurement-Based Analysis of Preferences in Planned Emission Reductions (Ozone MAPPER) and Application to Data From the Beaumont-Port Arthur, Dallas-Fort Worth, El Paso, and Houston Metropolitan Areas, 1994-1999." Envair and Sonoma Technology Inc., 1999, p. 7.
5. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Guidance on the Use of Models and Other Analyses in Attainment Demonstrations for the 8-hour Ozone, NAAQS, EPA-454/R-05-002, October 2005.

# CHAPTER 4: REQUIRED CONTROL STRATEGY ELEMENTS

## 4.1 OVERVIEW OF EXISTING CONTROL STRATEGIES

The TCEQ and DFW area local governments have implemented numerous control measures to improve DFW air quality. The area's air quality has also benefited from emissions reductions through federal measures. The control strategies implemented so far have significantly improved air quality in the DFW area.

Existing state, local, and federal $NO_X$ strategies currently in effect in the DFW area include reductions from industrial and utility boilers; emission limits for boilers and turbines in East and Central Texas; emission limits for cement kilns; vehicle inspection and maintenance; cleaner diesel fuel; TERP; reductions from airport ground support equipment; California standards for non-road large spark-ignition gasoline engines; emission limits for gas-fired water heaters, process heaters, and small boilers, as well as lean-burn and rich-burn engines; energy efficiency strategies; and a variety of voluntary mobile emission reduction measures (VMEP) and transportation control measures (TCM). These measures are detailed in previous SIP revisions.

Despite the significant decreases in one-hour ozone design values and $NO_X$ and VOC emissions in the DFW area, the increased stringency of the eight-hour ozone standard requires further reductions to bring the area into attainment of the eight-hour standard by June 15, 2010.

## 4.2 $NO_X$ AND VOC CONTROL MEASURES

Analysis of VOC and $NO_X$ sensitivity indicate that the optimum path to attainment is through $NO_X$ reductions. Accordingly, this SIP submittal contains estimated $NO_X$ reductions, which are summarized below in Table 4-1: *DFW Modeled $NO_X$ Emissions Estimates* and $NO_X$ control strategies in Table 4-2: *Summary of Control Strategy $NO_X$ Reduction Estimates for the DFW Eight-Hour Ozone Attainment Demonstration.*

**Table 4-1: DFW Modeled $NO_x$ Emissions Estimates**

| Weekday (August 17, 1999) Emissions Inventory | 1999 Baseline Emissions | 2009.a2 Future Year Baseline Inventory | 2009.a2 Future Year Combo 10 Inventory |
|---|---|---|---|
| | *tpd* | *tpd* | *tpd* |
| Area sources | 34 | 44 | 41 |
| Non-road sources | 148 | 107 | 105 |
| Point Sources | 134 | 59 | 40 |
| On-road mobile sources | 437 | 193 | 187 |
| Biogenic sources | 52 | 52 | 52 |
| **Total $NO_X$ Emissions** | **805** | **455** | **425** |

**Table 4-2: Summary of Control Strategies $NO_X$ Reduction Estimates for the DFW Eight-Hour Ozone Attainment Demonstration**

| TCEQ Rules | Estimated $NO_X$ Reductions by June 15, 2010 |
|---|---|
| | *tpd* |
| DFW Industrial, Commercial, and Institutional Sources Rule | 8.88 [1] |
| DFW Electric Generating Facilities (EGF) | 0.4 |
| DFW Minor Sources | 2.9 |
| Cement Kilns | 9.69 [2] |
| East Texas Combustion Sources | 22.4 |
| **Total** | **44.27** [3] |

[1] The final control strategy modeled assumed 9.0 tpd $NO_X$ reduction from DFW industrial, commercial, and institutional sources.
[2] The final control strategy modeled assumed 10.4 tpd $NO_X$ reduction from the cement kiln rule.
[3] Collectively, the final control strategy modeled assumed a 45.1 tpd $NO_X$ reduction from the Chapter 117 rules for major and minor sources (including EGFs, cement kilns and East Texas combustion sources). These rules, as adopted, are expected to reduce $NO_X$ by 44.27 tpd. The 0.83 tpd additional $NO_X$ from rule changes predicts modeled ozone to increase approximately 0.04 ppb at the monitor showing the greatest change, Fort Worth C13. Increases at other monitors will be less and this change does not affect the number of monitors predicted to be at or above 85 ppb.

| DFW Local Initiatives | Estimated $NO_X$ Reductions in 2009 |
|---|---|
| | *tpd* |
| Voluntary Mobile Emissions Reduction Program (VMEP) in nine counties | 2.63 |
| Transportation Control Measures (TCMs) in nine counties | 1.53 |
| **Total** | **4.16** |

| Federal Measures | Estimated $NO_X$ Reductions in 2009 |
|---|---|
| | *tpd* |
| On-Road | 217.52 |
| Non-Road | 21.49 |

### 4.2.1 VOC Control Measures

The VOC emissions in the DFW nine-county area come primarily from area sources and on-road mobile sources. The VOC emissions have decreased by about 62 percent in the past 14 years, mostly due to the continuing fleet turnover to cleaner vehicles. Point source VOC emissions have been reduced in the four-county area (Dallas, Tarrant, Collin, and Denton counties) due to rules in 30 TAC Chapter 115 implementing RACT (as detailed in Appendix J: *Reasonably Available Control Technology Analysis*). The ambient VOC concentrations in the DFW area have also decreased in the last nine years.

In April 2005, the commission adopted the DFW Five Percent Increment of Progress (IOP) SIP to demonstrate progress towards attainment and transition from the previous one-hour ozone standard to the eight-hour ozone standard. The VOC rules for Stage I vapor recovery and for surface coating processes were extended to Ellis, Johnson, Kaufman, Parker, and Rockwall Counties at that time.

The remaining applicable VOC rules were adopted on November 15, 2006, to meet the RACT requirements. The VOC RACT rules subject VOC-emitting sources located in Ellis, Johnson, Kaufman, Parker, and Rockwall Counties to the same control, monitoring, testing, recordkeeping, and reporting requirements that sources in the other four counties in the DFW nonattainment area are subject.

**4.2.2 $NO_X$ Control Measures**

The $NO_X$ emission control strategies described below are being adopted in conjunction with this SIP revision to reduce ozone formation to attainment levels in the DFW nine-county area. Ozone is a naturally occurring compound whose complex formation process is partially dependent upon factors outside of the State's control, particularly meteorology. For this and other reasons, the SIP is a prediction of attainment but not a guarantee. Individual control measures reduce the risk of exceeding the standard, but do not guarantee there will be no exceedances. Therefore, many of the following control strategies will be implemented by March 2009 and will reduce the risk of exceeding the standard during 2009. Other control strategies could not be implemented until March 2010, and will further reduce the risk of exceeding the standard by the June 15, 2010, attainment date.

Additional discussion on the basis for determining these $NO_X$ emission specifications for attainment demonstration can be found in the preamble to the 30 TAC Chapter 117 rulemaking (rule project number 2006-034-117-EN).

**4.2.2.1 Major Source $NO_X$ Reductions**

*Industrial, Commercial, and Institutional (ICI) Sources*

New division 30 TAC Chapter 117, Subchapter B: Combustion Control at Major Industrial, Commercial, and Institutional Sources in Ozone Nonattainment Areas; Division 4: Dallas-Fort Worth Eight-Hour Ozone Nonattainment Area Major Sources (§§117.400-117.456), requires owners or operators of major sources of $NO_X$ in the DFW area to reduce $NO_X$ emissions by March 1, 2009, or March 1, 2010, depending on the source type. New emission specifications for industrial, commercial, or institutional (ICI) boilers and gas turbines; duct burners used in turbine exhaust ducts; process heaters; stationary internal combustion engines; metallurgical heat treating furnaces; and incinerators are consistent with current emission specifications effective in the HGB ozone nonattainment area.

New emission specifications are adopted for certain source categories in the DFW eight-hour ozone nonattainment area that are not currently regulated by the state. The source categories to be newly regulated under 30 TAC Chapter 117 include brick and ceramic kilns; lime kilns; reheat furnaces used in steel production; lead smelting blast (cupola) and reverberatory furnaces; glass melting furnaces; fiberglass and mineral wool fiber melting furnaces; fiberglass and wool fiber curing ovens; and natural gas-fired heaters, ovens, and natural gas-fired dryers used in organic solvent, printing ink, ceramic tile, clay, and brick drying, and calcining and vitrifying processes.

New emission specifications vary by unit type and size. To comply with the new emission specifications, owners or operators of affected units may be required to maintain good engineering and combustion practices, install $NO_X$ controls, replace older units with those capable of complying with emission specifications, or use combinations of these compliance methods.

New $NO_X$ emission specifications for gas-fired boilers are 0.020 pounds per million British thermal units of heat input (lb/MMBtu) for units with a maximum rated capacity greater than or equal to 100 million British thermal units per hour (MMBtu/hr), 0.030 lb/MMBtu for units with a capacity greater than or equal to 40 MMBtu/hr but less than 100 MMBtu/hr, and 0.036

lb/MMBtu (or alternately, 30 parts per million by volume (ppmv) at 3.0 percent oxygen ($O_2$) dry basis) for units with a capacity less than 40 MMBtu/hr. New $NO_X$ emission specifications for liquid-fired boilers are 2.0 pounds per 1,000 gallons of liquid burned.

New $NO_X$ emission specifications for process heaters are 0.025 lb/MMBtu for units with a maximum rated capacity greater than or equal to 40 MMBtu/hr, and 0.036 lb/MMBtu (or alternately, 30 ppmv at 3.0 percent $O_2$ dry basis) for units with a capacity less than 40 MMBtu/hr. The new $NO_X$ emission specification for natural gas-fired ovens and heaters, and dryers used in organic solvent, printing ink, clay, brick, and ceramic tile, calcining, and vitrifying processes is 0.036 lb/MMBtu. Spray dryers used in ceramic tile processes are limited to 0.15 lb/MMBtu.

New $NO_X$ emission specifications for stationary gas turbines and duct burners used in turbine exhaust ducts are 0.032 lb/MMBtu for units rated at 10 megawatts (MW) or greater, 0.15 lb/MMBtu for units rated at greater than 1.0 MW but less than 10 MW, and 0.26 lb/MMBtu for units rated at less than 1.0 MW.

New $NO_X$ emission specifications for metallurgical furnaces are 0.087 lb/MMBtu for heat treating furnaces and 0.10 lb/MMBtu for reheat furnaces during ozone season, and 0.45 lb/ton of product for lead smelting blast (cupola) and reverberatory furnaces used in conjunction.

The new $NO_X$ emission specification for incinerators is 0.030 lb/MMBtu or 80 percent reduction from their reported calendar year 2000 emission inventory. The new emission specification for lime kilns is 3.7 lb/ton of calcium oxide produced on a unit-by-unit or plant-wide production weighted average basis. The new $NO_X$ emission specification for brick kilns is 0.175 lb/ton of product. Ceramic kilns have a new $NO_X$ emission specification of 0.27 lb/ton of product. Brick and ceramic kilns could also achieve compliance through a 40 percent reduction from their reported calendar year 2000 emission inventory.

New $NO_X$ emission specifications for glass and fiberglass melting furnaces are 4.0 lb/ton of product pulled for container glass melting furnaces and mineral wool-type cold-top electric fiberglass melting furnaces, 3.1 lb/ton product for mineral wool-type gas-fired non-regenerative fiberglass melting furnaces, and 1.45 lb/ton product for mineral wool-type regenerative fiberglass melting furnaces. The new $NO_X$ emission specification for gas-fired curing ovens used for the production of mineral wool-type or textile-type fiberglass is 0.036 lb/MMBtu.

In April 2005, the commission adopted the DFW Five Percent IOP SIP to demonstrate progress towards attainment and transition from the previous one-hour ozone standard to the eight-hour ozone standard. A portion of the Five Percent IOP was demonstrated through $NO_X$ reductions from stationary gas-fired reciprocating internal combustion engines. Emission specifications were adopted for stationary gas-fired engines rated 300 horsepower (hp) or greater at major sources of $NO_X$ in the DFW eight-hour ozone nonattainment area. Lean-burn engines are limited to 2.0 grams per horsepower-hour (g/hp-hr). Rich-burn engines installed, modified, reconstructed, or relocated before January 1, 2000, are limited to 2.0 g/hp-hr. Rich-burn engines installed, modified, reconstructed, or relocated on or after January 1, 2000, are limited to 0.50 g/hp-hr. Owners or operators are required to comply with IOP emission specifications and other associated requirements by June 15, 2007. These $NO_X$ emission standards are included in the new Subchapter B, Division 4 of §117.410(a).

The TCEQ has established new $NO_X$ emission specifications for stationary, gas-fired, reciprocating internal combustion engines. Rich-burn engines fired on landfill gas are limited to 0.60 g/hp-hr and all other gas-fired rich-burn engines are limited to 0.50 g/hp-hr. Lean-burn engines placed into service before June 1, 2007, that have not been modified, reconstructed, or relocated on or after June 1, 2007, are limited to 0.7 g/hp-hr. Lean-burn gas-fired engines installed, modified, reconstructed, or relocated on or after June 1, 2007, are limited to 0.60 g/hp-hr if fired on landfill gas and 0.50 g/hp-hr for all other lean-burn engines. In addition, the 300 hp exemption will no longer apply and engines less than 300 hp will be required to meet the same emission specifications.

Many existing diesel-fueled internal combustion engines may currently be operating within the new emission specification of 11.0 g/hp-hr or have the capacity to do so. New emission specifications for diesel engines placed into service on or after June 1, 2007, range from 2.8 to 5.0 g/hp-hr, depending on year of installation and engine rating. Because $NO_X$ emission specifications are derived from the EPA Tier standards for diesel engines, owners or operators are required either to purchase new manufactured units compliant with new emission specifications or to retrofit a relocated existing engine. Stationary diesel engines operated less than 100 hours per year, based on rolling 12-month average, are exempt if the engine was placed into service before June 1, 2007, and not modified, reconstructed, and relocated on or after June 1, 2007. New, modified, reconstructed, or relocated stationary diesel engines placed into service on or after June 1, 2007, that operates less than 100 hours per year, based on a rolling 12-month average, in other than emergency situations, would also be exempt provided the engines meet the corresponding emission standards in 40 CFR §89.112(a), Table 1 (October 23, 1998), in effect at the time of installation, modification, reconstruction, or relocation. These requirements ensure that as turnover of older, higher-emitting stationary diesel engines occurs, the replacements will be cleaner engines.

An additional control requirement for stationary diesel engines and stationary dual-fuel engines restricts the starting or operating of engines for testing or maintenance between 6:00 a.m. and noon. This requirement affects engines that are primarily used as back-up engines and will delay emissions of $NO_X$ from the testing of these engines until after noon in order to help limit ozone formation. The prohibition would not apply to manufacturer recommended engine testing that requires over 18 consecutive hours of running time, engine operation to verify the reliability of emergency equipment immediately after unforeseen repairs, and the operation of firewater pumps used for emergency response training from April 1 through October 31.

These emission specifications for attainment demonstration are equivalent to or more stringent than any RACT requirement that might be applied to applicable source categories in the five new counties of the DFW eight-hour ozone nonattainment area. Therefore, a separate rulemaking expanding the existing RACT emission specifications in existing §117.205 to the five new counties is not necessary.

Compliance with these emission standards is determined using monitoring, testing, reporting, and recordkeeping procedures consistent with current requirements for ICI sources in the HGB ozone nonattainment area. A continuous emissions monitoring system (CEMS) or predictive emissions monitoring system (PEMS) for $NO_X$ is required for units with a maximum rated capacity of 100 MMBtu/hr or greater, stationary gas turbines with a MW rating equal to or greater than 30 MW, units that use a chemical reagent to control $NO_X$, units that comply on a 30-day rolling average, and on any kiln subject to the rule. For units not required to have $NO_X$ CEMS or PEMS, initial compliance with new emission specifications is determined through stack testing using EPA test methods or EPA-approved test methods. Stationary engines subject to the emission specifications are required to perform biennial (or within 15,000 hours of operation) testing as well as quarterly testing to check fro proper operation.

*Electric Generating Facilities*
New 30 TAC Chapter 117 Subchapter C: Combustion Control at Major Utility Electric Generation Sources in Ozone Nonattainment Areas, Division 4: Dallas-Fort Worth Eight-Hour Ozone Nonattainment Area Utility Electric Generation Sources (§§117.1300-117.1356) applies to utility boilers, auxiliary steam boilers, stationary gas turbines, and duct burners used in

turbine exhaust ducts used in an electric power generating system that is owned or operated by a municipality or a PUCT-regulated utility, or any of their successors, regardless of whether the successor is a municipality or is regulated by the PUCT, or is owned or operated by an electric cooperative, municipality, river authority, or public utility operating in the Dallas-Fort Worth eight-hour ozone nonattainment area. The division establishes a unit-by-unit emission rate for compliance with existing emission specifications, established new output or efficiency-based $NO_X$ emission specifications, and establishes a system-wide heat input weighted average compliance option for utility boilers. Compliance with these new emission specifications is required by March 1, 2009.

New specifications for regulation of $NO_X$ emissions from electric generating facilities for the DFW eight-hour ozone attainment demonstration retain existing heat input based emission specifications, however, the new rules remove the system cap method of compliance. Under the new rules, affected units must comply with emission specifications on a unit-by-unit basis, however, utility boilers that are a part of large utility systems have the system-wide heat input weighted option for compliance. New specifications also include a new efficiency or output based (lb $NO_X$ per megawatt-hour (lb/MW-hr)) compliance option for utility boilers. The new emission specification for utility boilers that are part of a small utility system is 0.06 lb/MMBtu heat input on a 24-hour rolling average basis from March through October and on a 30-day rolling average basis from November through February. New emission specifications for utility boilers that are part of a large utility system are 0.033 lb/MMBtu heat input on a 24-hour rolling average basis from March through October, and on a 30-day rolling average basis from November through February; or 0.50 lb/MW-hr output on an annual average basis.

To satisfy RACT requirements for the five new counties, RACT emission specifications from existing §117.105 that apply in the DFW one-hour ozone nonattainment area will also apply as emission specifications for the DFW eight-hour ozone attainment demonstration. New $NO_X$ emission specifications for auxiliary steam boilers are 0.26 lb/MMBtu heat input on a 24-hour rolling average basis and 0.20 lb/MMBtu heat input on a 30-day rolling average basis while firing natural gas or a combination of natural gas and waste oil, 0.30 lb/MMBtu heat input on a 24-hour rolling average basis while firing fuel oil only, or the heat input weighted average of the applicable emission specifications on a 24-hour rolling average basis while firing a mixture of natural gas and fuel oil.

Two $NO_X$ emission specifications are established for stationary gas turbines with a MW rating greater than or equal to 30 MW and an annual electric output in megawatt-hr (MW-hr) of greater than or equal to the product of 2,500 hours and the MW rating of the unit. A $NO_X$ emission specification of 42 ppmv is established for stationary gas turbines while firing natural gas and a $NO_X$ emission specification of 65 ppmv is established for stationary gas turbines while firing fuel oil. Two $NO_X$ emission specifications are also established for stationary gas turbines used for peaking service with an annual electric output in MW-hr of less than the product of 2,500 hours and the MW rating of the unit. The $NO_X$ emission specification are 0.20 lb/MMBtu heat input, on a block one-hour average, while firing natural gas, and 0.30 lb/MMBtu heat input while firing fuel oil.

For utility boilers or auxiliary steam boilers, a carbon monoxide (CO) limit of 400 ppmv (or alternatively, 0.30 lb/MMBtu heat input for gas-fired units and 0.31 lb/MMBtu heat input for oil-fired units) is being adopted, based on a one-hour average for units not equipped with a CEMS or PEMS for CO or a 24-hour rolling average for units equipped with CEMS or PEMS for CO and for any stationary gas turbine with a MW rating greater than or equal to 10 MW, CO emissions in excess of a one-hour block average of 132 ppmv. New ammonia limits, for units that inject urea or ammonia for $NO_X$ control, are 10 ppmv for boilers and stationary gas turbines (including duct burners used in turbine exhaust ducts), based on a one-hour block average for units not equipped with a CEMS or PEMS for ammonia; or a 24-hour rolling average for units equipped with CEMS or PEMS for ammonia; and for all other units, 20 ppmv based on a one-hour block average.

Compliance with these emission standards is determined using monitoring, testing, reporting, and recordkeeping procedures consistent with current requirements for utility electric generation sources in the DFW ozone nonattainment area. In addition, for sources that an owner or operator elects to use the output based emission standard of 0.50 lb/MW-hr, parameter monitoring of the gross energy production of the unit in megawatt-hours is required. Carbon monoxide testing and monitoring procedures consistent with other ozone nonattainment areas are also required. Ammonia monitoring using the same procedures required in the HGB ozone nonattainment area is required for units that use ammonia or urea injection for $NO_X$ control.

*Cement Kilns*

On April 15, 2005, a settlement agreement was entered into by the TCEQ and Blue Skies Alliance, et al. to resolve a lawsuit brought by the Blue Skies Alliance, et al., against the EPA. The settlement agreement required the TCEQ to consult with parties to the settlement agreement regarding the scope of work and selection of a contractor for a study of technologies for controlling $NO_X$ emissions from cement kilns, already in progress by the TCEQ. The report, entitled "Assessment of $NO_X$ Emissions Reduction Strategies for Cement Kilns--Ellis County: Final Report," was submitted to the TCEQ on July 14, 2006, and is appended to this document as Appendix I. The final report is also available on the commission's web site at *www.tceq.state.tx.us/implementation/air/sip/BSA_settle.html*.

The study evaluated the applicability, availability, and cost effectiveness of potential $NO_X$ control technologies for the ten cement kilns located at three Ellis County sites in the DFW eight-hour ozone nonattainment area. The report primarily focused on three types of potential control technologies for cement kilns: selective catalytic reduction (SCR), selective non-catalytic reduction (SNCR), and low temperature oxidation (LoTOx). Based on results of this study, the TCEQ conducted modeling sensitivity analyses at two levels of control to evaluate potential ozone reduction benefits from possible cement kiln control strategies. One modeling sensitivity analysis assumed a range of 35 to 50 percent control on cement kilns, depending on kiln type. A second modeling sensitivity analysis assumed a range of 80 to 85 percent control on cement kilns.

After reviewing the final report of the cement kiln study, modeling sensitivity run results, and all other available information, the TCEQ has determined that the 35 to 50 percent control range is the most appropriate control level for this attainment demonstration.

The commission has developed a source cap approach that will require a reduction of approximately 9.69[4] tpd of $NO_X$ emissions from the cement kilns in Ellis County starting March 1, 2009. This source cap approach does not require a specific technology, but provides maximum flexibility for kiln operators to comply in the most effective, technically sound, and expeditious manner possible, while forcing sizeable $NO_X$ emission reductions from all cement kilns in the area. In most cases, the commission anticipates that the source cap limitations will be attainable with SNCR and will not require costly and time consuming research and development of other technologies. Pilot testing of SNCR on wet and dry kilns in Ellis County in 2006 demonstrated that 30 to 40 percent reductions were achievable without hazardous by-product formation, such as ammonia slip. Finally, before an increase in $NO_X$ emissions from a change in operation from one unit or the installation of new kiln could occur, a corresponding and equivalent decrease in $NO_X$ emissions would be required from another existing unit.

[4] The final control strategy modeled assumed 10.4 tpd $NO_X$ reduction from the cement kiln rule.

#### 4.2.2.2 Minor Source $NO_X$ Reductions

Amendments to 30 TAC Chapter 117, Subchapter D: Division 2--Combustion Control at Minor Sources in Ozone Nonattainment Areas, Dallas-Fort Worth Eight-Hour Ozone Nonattainment Area Minor Sources (§§117.2100-117.2145), require owners or operators of minor sources of $NO_X$ in the DFW eight-hour ozone nonattainment area to reduce $NO_X$ emissions from affected stationary internal combustion engines. These amendments regulate units at sites including small businesses and industries, hospitals, hotels, public and private office and administrative buildings, and school districts that were previously unregulated.

The TCEQ has identified 207 stationary engines in the DFW eight-hour ozone nonattainment area that are expected to be subject to the new emission specifications. Of these, 61 are estimated to be lean-burn engines and 146 are estimated to be rich-burn engines. The owners or operators of affected rich-burn engines are anticipated to comply with the rule using non-selective catalytic reduction (NSCR) and a secondary catalyst module. The owners or operators of affected lean-burn engines are likely to comply with the rule by using either exhaust gas recirculation (EGR) plus NSCR or selective catalytic reduction (SCR).

The TCEQ has established new $NO_X$ emission specifications for stationary, gas-fired, reciprocating internal combustion engines. Rich-burn engines fired on landfill gas are limited to 0.60 g/hp-hr and all other gas-fired rich-burn engines are limited to 0.50 g/hp-hr. Lean-burn engines placed into service before June 1, 2007, that have not been modified, reconstructed, or relocated on or after June 1, 2007, are limited to 0.7 g/hp-hr. Lean-burn gas-fired engines installed, modified, reconstructed, or relocated on or after June 1, 2007, are limited to 0.60 g/hp-hr if fired on landfill gas and 0.50 g/hp-hr for all other lean-burn engines.

The new $NO_X$ emission specification for stationary, dual-fuel, reciprocating internal combustion engines is 5.83 g/hp-hr. Owners or operators of affected stationary, dual-fuel, reciprocating internal combustion engines are anticipated to comply with the new emission specification by using combustion modifications.

New emission specifications for stationary, diesel, reciprocating internal combustion engines are the lower of 11.0 g/hp-hr or the emission rate established by testing, monitoring, manufacturer's guarantee, or manufacturer's other data for units placed into service before March 1, 2009, that have not been modified, reconstructed, or relocated on or after March 1, 2009. For engines not subject to the above, new emission specifications are 3.3 g/hp-hr for units with a hp rating of 50 – 99 hp, installed, modified, reconstructed, or relocated on or after March 1, 2009; 2.8 g/hp-hr for units with a hp rating of 100 – 749 hp, installed, modified, reconstructed, or relocated on or after March 1, 2009; and 4.5 g/hp-hr for units with a hp rating of 750 hp or greater installed, modified, reconstructed, or relocated on or after March 1, 2009. A stationary diesel engine operated less than 100 hours per year, based on a rolling 12-month average, would be exempt if the engine was placed into service before June 1, 2007, and not modified, reconstructed, or relocated on or after June 1, 2007. Any new, modified, reconstructed, or relocated stationary diesel engine placed into service on or after June 1, 2007, that operates less than 100 hours per year, based on a rolling 12-month average, in other than emergency situations would also be exempt provided the engine meets the corresponding emission standards in 40 CFR §89.112(a), Table 1 (October 23, 1998), in effect at the time of installation, modification, reconstruction, or relocation. This requirement ensures that as older diesel engines are replaced, the engine will be replaced with newer and cleaner engines.

An additional control requirement for stationary diesel engines and stationary dual-fuel engines restricts the starting or operating of engines for testing or maintenance between 6:00 a.m. and noon. This requirement affects engines that are primarily used as back-up engines and will delay emissions of $NO_X$ from the testing of these engines until after noon in order to help limit ozone formation. The prohibition would not apply to manufacturer recommended engine testing that requires over 18 consecutive hours of running time, engine operation to verify the reliability of emergency equipment immediately after unforeseen repairs, and the operation of firewater pumps used for emergency response training from April 1 through October 31.

Compliance with these emission standards is determined using monitoring, testing, reporting, and recordkeeping procedures similar to current requirements for minor sources in the HGB ozone nonattainment area. Initial compliance with these emission specifications is determined through stack testing using EPA test methods or EPA-approved test methods. In addition, similar to requirements for major sources in the HGB ozone nonattainment area, biennial (or within 15,000 hours of operation) testing and quarterly checks for $NO_X$ and CO are required for stationary engines.

#### 4.2.2.3 East Texas Combustion Source $NO_X$ Reductions

The amendments to 30 TAC Chapter 117, Subchapter E: Division 4--Multi-Region Combustion Control, East Texas Combustion (§§117.3300-3345), would require owners and operators of affected stationary, gas-fired, reciprocating internal combustion engines located in certain designated affected counties of the northeast Texas region to meet $NO_X$ emission specifications and other requirements to reduce $NO_X$ emissions and ozone air pollution transport into the DFW area. The counties included in this rule are: Anderson, Brazos, Burleson, Camp, Cass, Cherokee, Franklin, Freestone, Gregg, Grimes, Harrison, Henderson, Hill, Hopkins, Hunt, Lee, Leon, Limestone, Madison, Marion, Morris, Nacogdoches, Navarro, Panola, Rains, Robertson, Rusk, Shelby, Smith, Titus, Upshur, Van Zandt, and Wood Counties.

The TCEQ established an emission specification of 1.0 g/hp-hr for rich-burn gas-fired internal combustion engines with a maximum rated capacity less than 500 hp. While no rich-burn engines fired on landfill gas were specifically identified in the affected counties, landfill gas-fired engines, if any, must comply with a $NO_X$ emission specification of 0.60 g/hp-hr. The owners or operators of affected landfill-gas fired rich-burn engines are anticipated to use combustion modifications or engine replacement to comply with the new emission specification. All other rich-burn engines are required to comply with an emission specification of 0.5 g/hp-hr and the owner or operator is anticipated to comply with this emission specification by using NSCR.

According to the TCEQ's emissions inventory and studies conducted or funded by the TCEQ, $NO_X$ reductions from sources outside the DFW area can help the DFW area demonstrate attainment with the ozone NAAQS. Photochemical modeling performed by the TCEQ show that stationary gas-fired engines in attainment counties in east Texas contribute $NO_X$ emissions that impact the DFW area. While this rulemaking is part of the DFW attainment demonstration for the eight-hour ozone NAAQS, the Northeast Texas Early Action Compact area in east Texas will also benefit from $NO_X$ reductions resulting from this rule.

Compliance with these emission standards is determined using monitoring, testing, reporting, and recordkeeping procedures similar to current requirements for minor sources in the HGB ozone nonattainment area. Initial compliance with emission specifications is determined through stack testing using EPA test methods or EPA-approved test methods. In addition, similar to requirements for major sources in the HGB ozone nonattainment area, the rule requires biennial (or within 15,000 hours of operation) testing and quarterly checks for $NO_X$.

The commission conducted modeling sensitivity studies at control levels similar to this rule to all counties within or traversed by the 200 kilometer perimeter from the DFW eight-hour ozone nonattainment area, excluding the DFW nine-county area. Results of the initial sensitivity study, which estimated a $NO_X$ reduction of 40.9 tpd, based on 2009 future case modeling, indicated the reductions realized by this rule would benefit the DFW area by reducing ozone an average of 0.2 to 0.3 parts per billion. The adopted East Texas Combustion rule only applies to rich-burn engines 240 hp and larger.  Based on the revised list of 33 counties considered for this rule, the commission estimates that implementation of this rule will result in an overall reduction of approximately 22.4 tpd in $NO_X$ emissions in the northeast Texas area by March 1, 2010.  This rule applies to engines in the point source inventory, as well as engines that are categorized in the area source inventory.  Approximately 16.5 tpd of these reductions are from point source engines and approximately 5.9 tpd of these reductions are from area source engines.  The TCEQ estimates that the 22.4 tpd reductions in $NO_X$ emissions in the 33 counties subject to the adopted rule will still benefit the DFW area by reducing ozone an average of 0.1 to 0.2 parts per billion.

**4.2.2.4  Water Heater Rule Revision**

Amendments to 30 TAC Subchapter E: Division 3--Multi-Region Combustion Control, Water Heaters, Small Boilers, and Process Heaters (§§117.3200-3215), repeal the current statewide emission standard of 10 nanograms $NO_X$ per Joule heat input (ng/J) due to comments received and the inability of water heater manufacturers to produce units compliant with the current rule (rule project 2006-034-117-ED) by the rule deadline.  Under the new rules, manufacturers, distributors, retailers, and installers of natural gas-fired water heaters with a maximum rated capacity of no more than 75,000 British thermal units per hour (Btu/hr), designated as a "Type 0 unit" in the rules, manufactured, distributed, sold, or installed on or after July 1, 2002, but no later than December 31, 2004, are required to meet an emission limit of 40 ng/J.  Type 0 units manufactured, distributed, sold, or installed on or after January 1, 2007, were required to meet a 10 ng/J heat input limit.  The new rules repeal these standards and reinstate the 40 ng/J emission limit in force since July 1, 2002.

House Bill 965, from the $79^{th}$ Texas Legislative Session, authorized this amendment and required emission reductions to offset the loss of SIP credits due to the potential repeal of the proposed rule.  The TCEQ is using reductions included in the DFW Five Percent IOP SIP submittal dated April 27, 2005, that were in excess of five percent to offset the 0.5 tpd shortfall in the DFW four-county ozone nonattainment area.  The DFW Five Percent IOP SIP provided information and control measures to provide for a five percent increment of progress from the area's 2002 emissions baseline in addition to federal measures and state measures already approved by the EPA.  Table 4-3:  *DFW Five Percent Increment of Progress Reductions*, shows that the DFW Five Percent IOP SIP contained 4.23 tpd $NO_x$ reductions that exceeded the five percent requirement.  Because of this, the TCEQ will use 0.5 tpd of reductions in $NO_X$ emissions from the nine-county lean-burn and rich-burn engine rule to offset the shortfall.  According to the DFW Five Percent IOP SIP, the nine-county engine rule will reduce $NO_X$ emissions by 1.87 tpd by June 15, 2007, which is sufficient to offset the 0.5 tpd shortfall.  If 0.5 tpd of reductions from the engine rule were removed from the DFW Five Percent IOP SIP, the reduction requirement for that SIP would still be met.  The reduction requirement for the DFW Five Percent IOP SIP is based on total $NO_X$ and VOC emissions combined; therefore, adjustment to the DFW Five Percent IOP SIP is not necessary.

**Table 4-3: DFW Five Percent Increment of Progress Reductions**

| | | 5% IOP SIP April 27, 2005 | |
|---|---|---|---|
| | | $NO_X$ | VOC |
| Adjusted Baseline Inventory (2002) | (TPD) | 622.22 | 463.67 |
| Percent Target Reduction | (%) | 4.6 | 0.4 |
| Target Reduction | (TPD) | 28.62 | 1.88 |
| Source of reductions | | $NO_X$ | VOC |
| Eligible existing measures | | | |
| Alcoa (within 200 km radius) | (TPD) | 2.8 | |
| TERP | (TPD) | 22.2 | |
| Energy efficiency | (TPD) | 0.72 | |
| Portable fuel containers (nine-county area) | (TPD) | | 2.79 |
| Portable fuel containers (within 100 km radius) | (TPD) | | 0.63 |
| Subtotal | (TPD) | 25.72 | 3.42 |
| Control measures requiring rulemaking | | | |
| Nine-county lean-burn and rich-burn engine rule | (TPD) | 1.87 | |
| Expand surface coating rule to five counties | (TPD) | | 0.3 |
| Lower Stage I exemption throughput to 10,000 gallons per month in five counties (same as in four core counties) | (TPD) | | 2.09 |
| Subtotal | (TPD) | 1.87 | 2.39 |
| TOTAL IDENTIFIED REDUCTIONS | (TPD) | 27.59 | 5.81 |
| Reduction Percent of Baseline | (%) | 4.43% | 1.25% |
| Total Percent | (%) | 5.68% | |
| Surplus Percent | (%) | 0.68% | |
| SURPLUS REDUCTIONS as $NO_X$ | (TPD) | 4.23 | |

### 4.2.3 Transportation Control Measures

Transportation control measures (TCM) are transportation projects and related activities that are designed to reduce on-road mobile source emissions and are included as control measures in the SIP. Allowable types of TCM are listed in §7408 (Air Quality Criteria and Control Techniques) of the FCAA, 42 USC, 1970, as amended, and defined in the federal transportation conformity rule found in Title 40 CFR, Part 93 (Determining Conformity of Federal Actions to State or Federal Implementation Plans). In general, TCM are transportation-related projects that attempt to reduce vehicle use, change traffic flow, or reduce congestion conditions. Projects that add single-occupancy-vehicle roadway capacity or are based on improvements in vehicle technology or fuels are not eligible as TCM.

The NCTCOG has identified TCM that have been or will be implemented in the nine-county nonattainment area. By the start of the 2009 ozone season, these TCM will reduce $NO_X$ emissions in the DFW nonattainment area by 1.53 tpd and VOC emissions by 1.61 tpd. Table 4-4: *Total 2009 Estimated Emission Reductions by TCM Program* summarizes the 2009 emission reductions by type of TCM. The description in Table 4-2: *Summary of Control Strategies $NO_X$ Reduction Estimates for the DFW Attainment Demonstration* shows how each program improves air quality. The region's transportation policy body (the Regional Transportation Council) approved and identified funding for these local commitments. In addition to the information provided in the SIP about TCM commitments, the federal transportation conformity rule requires that timely implementation of TCM be demonstrated.

**Table 4-4: Total 2009 Estimated Emission Reductions by TCM Program**

| TCM Program | Commitments (Jan 2000–March 2009) | | March 2009 $NO_X$ Benefits | | March 2009 VOC Benefits | |
|---|---|---|---|---|---|---|
| | Modeled | Post-Processed | Modeled | Post-Processed | Modeled | Post-Processed |
| | | | *lbs/day* | *lbs/day* | *lbs/day* | *lbs/day* |
| Bicycle/Pedestrian Projects | 0.0 miles | 15.4 miles | 0.00 | 14.98 | 0.00 | 9.51 |
| Grade Separation Projects | 82 locations | 2 locations | 350.35 | 4.26 | 898.44 | 51.40 |
| HOV/Managed Lane Projects | 70.0 miles | 0.0 miles | 1,584.92 | 0.00 | 881.50 | 0.00 |
| Intersection Improvement Projects | 0 locations | 655 locations | 0.00 | 293.76 | 0.00 | 786.87 |
| Park and Ride Projects | 1,465 spaces | 820 spaces | 55.30 | 30.95 | 35.11 | 19.65 |
| Rail Transit Projects | 70.2 miles | 0.0 miles | 568.55 | 0.00 | 419.17 | 0.00 |
| Vanpool Projects | 0 vanpools | 216 vanpools | 0.00 | 168.99 | 0.00 | 113.11 |
| **Total Pounds/Day** | | | **2,559.12** | **512.94** | **2,234.22** | **980.54** |
| **Total Tons/Day** | | | **1.27** | **0.26** | **1.12** | **0.49** |

**All of the listed projects are commitments, have been approved by the transportation policy body (Regional Transportation Council), and are funded.*

***The project listing for each program area; with associated emission reductions and methodology will be accounted for in the subsequent Transportation Conformity Document(s).*

To avoid double counting emission reductions, the NCTCOG provided separately the reductions accounted for in the photochemical model and the reductions that are calculated after the photochemical modeling work is complete, i.e., post-processed. Reductions accounted for in photochemical modeling are reflected in the on-road emissions inventory. Post-processed reductions are not reflected in the emissions inventory but are subtracted from the inventory to establish the motor vehicle emissions budget. For more information about the calculation of motor vehicle emissions budget figures, see Table 4-27 in Appendix B: *Emissions Inventory (EI) Development*.

#### 4.2.3.1 TCM Project Descriptions

*Bicycle/Pedestrian Projects*

Projects that create and/or enhance bicycle/pedestrian pathways throughout the region serve to link individuals to alternative methods of transportation, other than driving a single occupancy vehicle. By doing so, the automobile emissions that would otherwise be released from the automobile are removed completely. In the North Central Texas region, a veloweb has been designed for use primarily by fast-moving bicyclists. The veloweb is also designed to encourage concurrent pedestrian transportation use. NCTCOG has identified 15.4 miles of veloweb projects that will be implemented in the DFW eight-hour ozone nonattainment area by the start of the 2009 ozone season.

*Grade Separation Projects*

By separating a road or railroad track from a crossroad, idling time that would otherwise be created by intersection blockage is eliminated. With this elimination of idling, grade separations increase the efficiency of traffic flow thereby improving travel time and minimizing delay. Thus, vehicle emissions and fuel consumption are reduced. NCTCOG has identified 84 project locations to be implemented in the DFW eight-hour ozone nonattainment area by the start of the 2009 ozone season.

*High Occupancy Vehicle (HOV) Projects*
High occupancy vehicle projects promote carpooling thereby removing single occupancy vehicles and the associated vehicle emissions released from the roadway. The increase in flow of HOV lanes offers incentive for drivers to carpool. NCTCOG has identified 70.0 lane miles of HOV projects that will be implemented in the DFW eight-hour ozone nonattainment area by the start of the 2009 ozone season.

*Intersection Improvement Projects*
Improvements to intersections including left and/or right hand turn lanes decrease the amount of time automobiles are left idling at intersections. This decrease in idling reduces fuel consumption and vehicle emissions. NCTCOG has identified 655 intersection improvement locations that will be implemented in the DFW eight-hour ozone nonattainment area by the start of the 2009 ozone season.

*Park and Ride Projects*
Park and ride facilities promote carpooling and vanpooling. With each occupied parking space at these locations, the emissions from the parked vehicle are reduced. Park and ride lots that also serve as transit stations are not accounted for in the analysis as it is assumed the majority of these park and ride lots contain transit riders that are then captured in Rail Transit Projects. NCTCOG has identified new locations to provide 2,285 additional new parking spaces in Park and Ride projects. These projects will be implemented by the start of the 2009 ozone season.

*Rail Transit Projects*
Rail projects involve implementation of new or expanded transit services or facilities. The improvements may be accomplished for all transit modes such as buses, rail, and paratransit. The three main components of improved transit are: system/service expansion projects, system/service operational improvements, and inducements. By improving regional transit systems, an increased opportunity to attract new passengers is created as well as an increase in air quality benefits. NCTCOG has identified 70.2 miles of rail projects that will be implemented in the DFW eight-hour ozone nonattainment area by the start of the 2009 ozone season.

*Vanpool Projects*
Vanpool projects include a group of six to fifteen commuters who travel to and from the same area, have similar work hours, share the costs of operating the van, and usually meet at a Park and Ride lot at a centralized location. These projects remove the extra vehicles that would otherwise be commuting by consolidating travelers into one automobile, thereby reducing air pollution, traffic congestion, and helping conserve fuel. NCTCOG has identified 216 vanpools that will be implemented in the DFW eight-hour ozone nonattainment area by the start of the 2009 ozone season.

Projects in this section are described and documented in Appendix F: *Transportation Control Measures for the DFW Eight-Hour Ozone SIP*. Appendix F, Table 1: *Completed Projects Without Applicable Benefits* covers projects that have been implemented but where the associated emission benefits are not applicable in this SIP revision. Appendix F, Table 2: *Completed Projects With Applicable Benefits* covers projects that have been implemented as well as their emission benefits. Appendix F, Table 3: *Projects with Applicable Benefits* is a summary table including the original commitments, completed commitments, and remaining commitments for each category with associated $NO_X$ and VOC emission benefits.

### 4.2.4 Voluntary Mobile Source Emission Reduction Programs (VMEP)

The 1990 FCAAA increased the states' responsibility to demonstrate progress toward attainment of the NAAQS. Voluntary mobile source measures have the potential to contribute, in a cost-effective manner, emission reductions needed for progress toward attainment and maintenance of the NAAQS.

Historically, federal mobile source control strategies have focused primarily on reducing emissions per mile through vehicle and fuel technology improvements. Tremendous strides have been made resulting in new light-duty vehicle emission rates that are 70 to 90 percent less than that for the 1970 model year. However, transportation emissions continue to be a significant cause of air pollution due to population and employment growth as well as an increase in daily vehicle miles traveled (VMT) per person. Therefore, mobile source strategies that attempt to complement existing regulatory programs through voluntary, nonregulatory changes in local transportation sector activity levels or changes in vehicle and engine fleet composition are being explored and developed.

A number of voluntary mobile source and transportation programs have already been initiated at the state and local level in response to increasing interest by the public and business sectors in creating alternatives to traditional emission reduction strategies. Some examples include economic and market-based incentive programs, trip reduction programs, growth management strategies, ozone action programs, and targeted public outreach. These programs attempt to gain additional emissions reductions beyond mandatory FCAA programs by engaging the public to make changes in activities that will result in reducing mobile source emissions.

Table 4-5: *NCTCOG Voluntary Mobile Emission Reductions* summarizes the new DFW voluntary commitments under this SIP revision. The estimated benefits listed are calculated for the year 2009 only and may not be forecasted to estimate emission reductions for any other year. VMEP strategies are limited to three percent or less of the total emissions reductions required.

NCTCOG identified seven voluntary programs that will aid in the improvement of the North Texas region's air quality. NCTCOG, as the regional metropolitan transportation planning agency for the DFW area, has committed to make a good faith effort to implement the projects and/or programs outlined in this document. NCTCOG will be responsible for monitoring and reporting the emission reductions to the TCEQ. Any VMEP shortfall (of the total 2.63 tpd $NO_X$ committed) will be covered by supplementing additional Transportation Emission Reduction Measures (TERMs). The program areas that may be used to remedy this shortfall are traffic signal improvements; intelligent transportation systems (ITS); and/or freeway and/or arterial bottleneck removal. These programs would be surplus to those already credited in the SIP.

More information on each of the VMEP commitments can be found in Appendix H: *NCTCOG Final Submittal of On-Road and Non-Road Mobile Emissions Benefit.*

NCTCOG's refined estimate for modeled and post-processed $NO_X$ reductions from VMEP is 2.63 tpd.

**Table 4-5: NCTCOG Voluntary Mobile Emission Reductions**

| Program Type | 2009 $NO_X$ Benefits | | 2009 VOC Benefits | |
|---|---|---|---|---|
| | Modeled | Post-Processed | Modeled | Post-Processed |
| | *tpd* | | *tpd* | |
| Clean Vehicle Program | 0.00 | 0.24 | 0.00 | 0.05 |
| Employee Trip Reduction | 0.43 | 0.00 | 0.28 | 0.00 |
| Locally Enforced Idling Restriction | 0.00 | 0.62 | 0.00 | 0.02 |
| Diesel Freight Idling Reduction Program | 0.00 | 0.33 | 0.00 | 0.01 |
| SmartWay Transport Demonstration Project | 0.00 | 0.00 | 0.00 | 0.00 |
| Public Agency Policy for Construction Equipment | 0.00 | 0.06 | 0.00 | 0.01 |
| Aviation Efficiencies | 0.00 | 0.95 | 0.00 | 0.24 |
| **TOTAL BENEFITS** | **0.43** | **2.20** | **0.28** | **0.33** |
| **COMBINED BENEFITS** | **2.63** | | **0.61** | |

### 4.2.5 Other Local Programs

The following list includes an assortment of locally implemented strategies in the DFW area including pilot programs, new programs, or programs with methodologies yet to be determined and accepted. These programs cannot be quantified at this point, but are expected to be implemented by March 2009. The exact form or extent to which they may be implemented is unknown. Due to the continued progress of these measures, additional air quality benefits will be gained or existing programs will be enhanced.

*Light-Emitting Diode (LED) Traffic Signal Replacement Program*

The replacement of traditional incandescent bulbs in traffic signals with LED lamps provides an energy savings opportunity to local governments. Local governments have confirmed positive experiences with conversions to this cost-effective alternative. In addition, LED technology has proven to be more reliable because of its increased life expectancy and reduced maintenance needs. The Regional Transportation Council (RTC) developed a goal-oriented regional plan for conversion of existing traffic signals and a policy for installation of LED in future traffic signal projects. The RTC program applies to traffic signal projects in the DFW nonattainment area that are implemented by both municipalities with more than 50,000 persons and the Texas Department of Transportation. A subcommittee of the Surface Transportation Technical Committee (STTC) was also established to develop a clearinghouse of information to describe benefits of available LED technologies and guidelines for implementation of these technologies.

*Blue Skyways Collaborative*

The Blue Skyways Collaborative was developed by the EPA and the Central States Air Resources Agencies (CenSARA) to significantly reduce air pollution in the central United States corridor. The collaborative emphasizes partnerships between non-profit environmental groups, private industries, and international, federal, state and local governments to meet air quality goals. Collaborative participants pledge active and meaningful participation in the planning or implementation of projects that use innovations in diesel engines, alternative fuels, and renewable energy technologies. Working together allows members to leverage funding, share technology, and professional expertise. The NCTCOG was designated a Blue Skyways Community in fall 2006 and is dedicated to promoting the mission of the collaborative. NCTCOG actively participates in collaborative meetings, subcommittee meetings, and funding opportunities offered by Blue Skyways.

*Air Quality Marketing and Outreach*
Transportation and air quality marketing and outreach program efforts promote general air quality awareness marketing and outreach throughout the North Texas region. The programs strive to encourage voluntary measures that help reduce emissions such as ridesharing, vehicle maintenance, and telecommuting, by offering incentives and promoting existing emission reduction programs, like AirCheck Texas. These programs also promote the use of clean vehicle technologies and fuels such as the Dallas-Fort Worth Clean Cities Technical Coalition. An Air Quality Public Relations Task Force was created to reach the general public by creating a unified message and brand related to air quality. Business outreach will be coordinated between this program and the North Texas Clean Air Coalition.

*Intelligent Transportation Systems (ITS)*
ITS attempts to improve traffic speeds and reduce idling time through advanced traffic control systems and more efficient incident and corridor management. ITS also combines the strengths of regional transportation planning models and traffic simulation models with overall transportation management strategies. Examples of ITS projects include transportation management centers and dynamic message signs. The DFW area is currently involved in the planning, programming, and implementation of ITS programs and projects. Using the National ITS Architecture as a model, the region is defining a Regional ITS Architecture to guide future deployment and to build consensus for multi-agency systems integration. Traffic monitoring and incident detection and response systems are operating on portions of the freeway system in Collin, Dallas, Denton, and Tarrant Counties.

*Parking Cash-Out Program*
Parking Cash-Out is an employee transportation benefit that offers workers the option of giving up their employer-subsidized parking space in exchange for its equivalent monetary value in cash or a transit subsidy. It gives non-motorists benefits comparable to those offered to motorists (cash equivalent of free parking) and effectively promotes the use of alternative transportation. NCTCOG has and continues to conduct a literature search to collect information on other parking cash-out pilot program experiences in order to quantify reductions in emissions and changes in employee behavior. A parking cash-out implementation policy will be developed based on knowledge gained from research and a pilot study conducted by NCTCOG.

*Truck Lane Restriction Program*
A pilot study was conducted to improve the operation efficiency and highway safety by restricting heavy-duty trucks from using the left lane. The truck restriction was imposed on the left lane of Interstate 30 (I-30) in the DFW area from August 2005 to January 2006. The volume and speed of trucks and cars were collected every hour for the off-peak period, and every 15 minutes for peak periods to analyze air quality benefits and Level of Service (LOS). Results showed that truck lane restriction effectively controlled trucks from using the left lane and slightly reduced truck speeds. Consequently, $NO_X$ and VOC emissions produced by trucks also decreased. Greater emissions benefits will be expected as the truck lane restriction is implemented region-wide.

*Roadway Peak Period Pricing*
Also known as value pricing or congestion pricing, peak period pricing is an incentive-based program to reduce congestion while improving air quality by charging increased rates on toll-roads during peak traffic periods. By introducing price to encourage changes in travel behavior, value pricing programs are a way to manage demand by encouraging travelers to use the facility in off-peak periods, to carpool, or use transit. Thus, a reduction in emissions can be claimed through a reduction in vehicle miles of travel and congestion. Interstate I-30 is under consideration for a value pricing pilot study, which may be implemented by the year 2008 or

earlier. Depending upon the results of the I-30 value pricing pilot study, value pricing may be implemented in other congested areas in North Central Texas.

*Control Strategy Catalog Review*
Cost benefit analysis was performed for 61 of 164 total short listed control strategies in the control strategy catalogue. NCTCOG will review the remaining 103 of the short listed strategies to analyze if they can be used as additional efforts for implementation consideration.

*Arterial/Freeway Bottlenecks*
The DFW Metropolitan Area has initiated a Freeway Interchange/Bottleneck Program and an Arterial Bottleneck Program in an effort to advance projects that increase mobility and safety, and improve air quality. The Freeway Interchange/Bottleneck Improvement Program is designed to fund interchange and bottleneck improvements on the highway system and interchange improvements at highway/arterial crossings. The Arterial Bottleneck Program is designed to fund arterial intersections and bottleneck improvements that reduce travel time, delay, and/or accidents due to implementation of low-cost projects that include multiple transportation modes. Implementation of these projects will reduce vehicular delays and travel time, which reduces transportation-related emissions due to inefficient traffic patterns.

*Traffic Signal Improvements*
The DFW Metropolitan Area is involved in the planning, programming, and implementation of traffic signal improvement programs and projects. Arterial congestion accounts for 35 percent of the total congestion in the region, in turn adding emissions due to inefficient traffic patterns and unnecessary idling. Traffic signal improvements such as signal retiming and signal coordination can enhance traffic flow and help decrease vehicular emissions. Much of the emphasis of the traffic signal improvement program in the North Central Texas region is placed upon major arterial corridors, where synchronizing a succession of traffic signals to operate as a continuous system has a great impact on a large volume of traffic. These improvements result in a more consistent travel speed and reduced delay, which reduces vehicular emissions due to frequent starts, stops, and unnecessary idling.

*Sustainable Development*
The promotion of sustainable development has become a specific objective of the North Central Texas region because of the direct link between land use, transportation, and air quality. Numerous studies have shown an inverse relationship between population density and vehicle miles traveled (VMT); as population density increases, VMT decreases, which also decreases transportation-related emissions. Therefore, the way in which transportation is planned, programmed, and constructed must be responsive to regional trends in economic expansion, population growth, development, quality of life, public health, and the environment in order to provide mobility and prevent the continued decline of the region's air quality status. A variety of strategies and policies have been adopted by the RTC to ensure the development of transportation plans, programs, and projects which promote air quality improvements through sustainable development. These strategies are designed to (1) respond to local initiatives for town centers, mixed use growth centers, transit oriented developments, Infill/Brownfield developments and pedestrian oriented projects; (2) complement rail investments with coordinated investments in park and ride, bicycle and pedestrian facilities; and (3) reduce the growth in VMT per person. The shift toward alternative modes of transportation and lower VMT will lead to reduced transportation-related emissions.

*SmartWay Transport Partnership*

The SmartWay Transport Partnership (SmartWay), established by the EPA in 2004, is a voluntary, public-private partnership with the ground freight industry. Truck and rail freight is integral to the nation's economy; however, heavy-duty diesel vehicles are major consumers of fossil fuels and major contributors to air pollution. SmartWay promotes a variety of strategies designed to reduce energy consumption and vehicle emissions that also lead to a reduction in costs for truck and rail freight operators. SmartWay carriers will typically commit to integrating fuel savings strategies and technologies into their fleet including: improved aerodynamics, single-wide tires, lighter wheels and rims, idle reduction, automatic tire inflation systems, driver training, and advanced powertrain technologies. NCTCOG has partnered with the EPA to support the SmartWay initiative in the DFW area through demonstration projects, outreach efforts, and development of a truck dealer network. Improvements in fuel efficiency will be directly proportional to reduced fuel use and emissions.

*AirCheck Texas Repair and Replacement Assistance Program*

The High-Emitting Vehicle Program (HEVP) supports high-emitting vehicle repair and replacement. Specifically, the HEVP Program will administer the State's AirCheck Texas Repair and Replacement Assistance Program (ACT), created to provide financial assistance for low-income vehicle owners that fail the regions new high-tech emissions test. Currently, the ACT Program is offered to residents in the nine-county area.

*High Emitting Vehicles*

Efforts will be made to develop a program with local governments and non-profit organizations to test for, then repair or retire, high-emitting auction vehicles in addition to supplementing the ACT Program to reach a larger audience that does not qualify to participate under ACT rules. Further components to be developed within the program include remote sensing activities, enhanced smoking vehicle detection, partnership with nonprofit organizations, public outreach and education, environmental enforcement training, and research and development projects.

*Dallas Emissions Enforcement Program*

The Dallas Emissions Enforcement Program coordinates with the Dallas County Judge's office, Justice Court, Precinct 4, participating county constables, the Department of Public Safety, and various local impound lots to administer the Dallas Emissions Enforcement Pilot Program to establish and verify the need for a region-wide program for identifying high emitting vehicles on the roadways due to fictitious or counterfeit state inspection and/or registration stickers. In 2005, the Texas Legislature passed HB 1611 that allowed for the development and implementation of projects that coordinate with local law enforcement officials to reduce the use of counterfeit state inspection stickers. The program aims to ensure impounded vehicles are either repaired or permanently removed from the roadways. Unclaimed impounded vehicles will be dismantled and/or scrapped and will not be resold or issued a new title unless the impound lot owner can provide evidence to the court that an unclaimed impounded vehicle is worthy of repairs and the impound lot owner assumes responsibility for those repairs. Data collected may also be used for future: legislative action, judicial action, rule implementation, and database development incorporating vehicle registration data with inspection and maintenance data, and serve as the foundation for future programs throughout the area.

*Regional Smoking Vehicle Program*

The North Central Texas Regional Smoking Vehicle Program (RSVP) is designed to encourage North Texans to voluntarily maintain and repair their vehicles and to promote public awareness regarding the harmful emissions and air pollution caused by smoking vehicles. By using the existing AirCheck Texas Repair and Replacement Assistance Program infrastructure, the incorporation of the RSVP will encourage greater participation by providing local solutions to vehicle owners.

*Pay-As-You-Drive Insurance Pilot Program*
Currently underway in North Central Texas, the Pay-As-You-Drive Insurance Pilot Program is a mileage-based vehicle insurance program. This program permits drivers to pay their automobile premiums on a variable scale, dependent upon how much they drive each vehicle. Since the cost of coverage is directly tied to use of the vehicles, Pay-as-You-Drive insurance is a strong incentive to drive less and; thereby, reduce emissions. This strategy compliments current RTC efforts not only to reduce VMT but also to promote the concept of sustainable development throughout the region.

*Sustainable Skylines*
Dallas was chosen as the first city in the country to test a new initiative aimed at bringing cleaner air to the DFW area. The city is teaming up with NCTCOG and the EPA in a joint venture called "Sustainable Skylines." The Sustainable Skylines venture will include projects such as: replacing taxis and rental cars with ultra-low or zero-emitting vehicles, encourage construction of energy-efficient affordable homes, helping to reduce air emissions from Dallas-area industries, and replacing lawn maintenance equipment and small utility vehicles with electric powered equipment. If the Dallas pilot is successful, the initiative could be used as a model for other cities.

### 4.2.6 Additional Measures
In addition to the control strategies discussed and quantified, several programs already in place in the DFW nine-county area will reduce $NO_X$ emissions and will help bring the area into attainment of the eight-hour ozone standard. Additional programs include additional energy efficiency measures, additional TERP and LIRAP commitments, the TCEQ's Clean School Bus program, and stationary diesel and dual-fuel engine control measures. Section 4.3 discusses fleet turnover beyond the 2009 ozone season. Although these programs were not accounted for in the photochemical modeling, they will benefit air quality and help bring the DFW area into attainment of the eight-hour ozone standard.

#### 4.2.6.1 Energy Efficiency Measures
Local governments may have enacted measures beyond what has been reported to the State Energy Conservation Office (SECO) and the Public Utility Commission of Texas (PUCT). The commission encourages local political subdivisions to promote energy efficiency/renewable energy (EE/RE) measures in their respective communities and to ensure these measures are fully reported to SECO and the PUCT via legislatively mandated mechanisms. The commission has attempted to include all known surplus, quantifiable, enforceable, and permanent $NO_X$ emissions reduction measures in the SIP.

In the 77$^{th}$ Texas Legislative Session in 2001, the Energy Systems Laboratory (ESL), part of the Texas Engineering Experiment Station, Texas A&M University System, was mandated as part of the TERP under Texas Health and Safety Code § 388.003(e) to provide an annual report on EE/RE efforts in the state. With the TCEQ's guidance, ESL produced an annual report detailing these efforts (*Energy Efficiency/Renewable Energy Impact in the Texas Emissions Reduction Plan (TERP))*. The report:

- provides quantification of energy savings and $NO_X$ reductions resulting from building energy code compliance in new residential and commercial construction in the 41 affected counties (as described by Senate Bill 5);
- describes methodologies developed to enable the commission to substantiate energy and emission reduction credits from energy efficiency and wind and other renewable energy initiatives to the EPA, including development of a web-based emissions calculator; and
- outlines progress by ESL in advancing EE/RE methodologies for documenting pollution reduction credit in the SIP.

The DFW Five Percent IOP SIP included emission reduction credits of 0.72 tpd for EE/RE programs in the DFW area. Energy efficiency reductions for 2007 were included in the DFW Five Percent IOP SIP, based on electricity and natural gas usage reductions expected to occur following implementation of Texas Building Energy Performance Standards for single and multi-family residences adopted in September 2001. These calculations also included reductions in energy use from energy efficiency measures implemented by local governments and utilities and reported to the SECO and the PUCT.

Legislation passed during the regular session of the 79th Texas Legislature directed the ESL to collaborate with the commission to develop a methodology for computing emission reductions attributable to use of renewable energy (primarily wind) and for the ESL to quantify annually such emission reductions for inclusion in the SIP. House Bill 2921 directed the Texas Environmental Research Consortium to use the Texas Engineering Experiment Station to develop this methodology.

The ESL documents methods used to develop current estimates of energy savings and $NO_X$ emissions reductions resulting from reductions in natural gas consumption and displaced power from conventional EGFs. The ESL used the EPA's Emissions and Generation Resource Integrated Database to spatially allocate energy use and emission reductions among EGFs. For natural gas reductions, the ESL used AP-42 emissions factors to calculate emissions reductions.

The Texas Health and Safety Code sections 389.002 and 389.003 contain requirements that the PUCT, the SECO, and the ESL report to the TCEQ all emission reductions resulting from EE/RE projects in Texas. Current estimates of EE/RE related $NO_X$ reductions in the DFW area are based on six types of EE/RE projects or programs:

*Residential Building Code*
The Texas Health and Safety Code, Chapter 388, Texas Building Energy Performance Standards, as adopted by the 77th Texas Legislature, states in Section 388.003(a) that single-family residential construction must meet the energy efficiency performance standards established in the energy efficiency chapter of the International Residential Code.

*Commercial Building Code*
The Texas Health and Safety Code, Chapter 388, Texas Building Energy Performance Standards, as adopted by the 77th Texas Legislature, states in Section 388.003(b) that all other residential, commercial, and industrial construction must meet the energy efficiency performance standards established in the energy efficiency chapter of the International Energy Conservation Code.

*Federal Facilities EE/RE Projects*
Federal facilities are required to reduce energy use by Presidential Executive Order 13123 and the Energy Policy Act of 2005 (Public Law 109-58 EPACT20065 most recent energy bill passed in August 2005). The ESL compiled energy reductions data for the federal EE/RE projects in Texas.

*Political Subdivisions Projects*
Political subdivisions in nonattainment and affected counties are required by SB 5 of the 77th Texas Legislature to report EE/RE projects to the SECO. See Texas Health and Safety Code Sections 388.005 and 388.006. These projects are typically building systems retrofits, non-building lighting projects, and other mechanical and electrical systems retrofits such as municipal water and waste water treatment systems.

*Electric Utility Sponsored Programs*
Utilities are required by SB 5 and SB 7 of the 77th Texas Legislature to report these projects to

the PUCT. See Texas Health and Safety Code Section 386.205 and Section 39.905 of the Texas Utilities Code. These projects are typically air conditioner replacements, ventilation duct tightening, and commercial and industrial equipment replacement.

*Renewable Energies*
The 79th Legislature through SB 20, HB 2481, and HB 2129 amended SB 5 added, among other initiatives, the following renewable energy initiatives; (1) requires 5,880 MW of generating capacity from renewable energy by 2015; (2) requires the TCEQ to develop methodology for calculating emission reductions from renewable energy initiatives and associated credits; (3) requires the Energy Systems Laboratory (ESL) to assist the TCEQ in quantifying emissions reduction credits from renewable energy and energy efficiency programs; (4) requires the Texas Environmental Research Consortium to contract with the ESL to develop and annually calculate creditable emissions reductions from renewable energy sources for the TCEQ's SIPs; and (4) requires the Public Utility Commission (PUCT) to establish a target of 10,000 megawatts of installed renewable technologies by 2025.

Due to uncertainties in the data and methods used for all of the above programs, emission reduction estimates have been reduced using a discounting formula. For example, the ESL estimates for building codes projects have been discounted 20 percent and the SECO reported projects have been discounted 60 percent. Original emissions reductions estimates were also reduced a further five percent per year to account for systems degradation.

According to projections by the ESL, the nine-county DFW area is estimated to reduce $NO_X$ in 2009 by 2.12 tpd from the six types of EE/RE measures and projects implemented from January 1, 2000, through December 31, 2009. Emissions reductions estimated as a result of the above programs were not explicitly included in the photochemical modeling because local efficiency efforts may not result in local emissions reductions.

#### 4.2.6.2 Texas Emission Reduction Plan (TERP) $NO_X$ Reductions
The 80th Texas Legislature is considering to the appropriation of additional funds, above and beyond those already appropriated through 2007, to TERP. The commission anticipates that additional funds may be appropriated to TERP in FY 2008-2009, resulting in continued reductions in the significant emission source categories of on-road and non-road engines. This funding increase will allow the commission to fund emission reduction projects that will help the DFW area in attaining the eight-hour ozone standard, above and beyond TERP reductions under the one-hour ozone standard.

#### 4.2.6.3 Low Income Repair Retrofit and Accelerated Vehicle Retirement Program (LIRAP)
The 80th Texas Legislature is considering legislation (Senate Bill 12) to revise the Texas Health and Safety Code to enhance LIRAP also known as the AirCheck Texas Repair and Replacement program. The bill would enhance the current program by increasing financial eligibility to 300 percent of the federal poverty level and providing increased financial assistance for eligible vehicle owners for replacement of vehicles.

#### 4.2.6.4 Clean School Bus Program
The 79th Texas Legislature passed House Bill 3469 which established the Clean School Bus Program as part of the TERP. The new program is codified in Chapter 390 of the Texas Health and Safety Code Chapter and implemented through 30 TAC §§114.640 – 114.648.

The program is based on the EPA guidance documents, *Improving Air Quality with Economic Incentive Programs* (EPA-452/R-01-001) and *Diesel Retrofits: Quantifying and Using Their Benefits in SIPs and Conformity* (EPA-420-B-06-005). Under the Economic Incentive Program guidance, the TCEQ is using the Financial Mechanism option, which is described as subsidies targeted at promoting pollution-reducing activities or products. The Clean School Bus Program will operate under the same general provisions as apply to other TERP incentive programs.

The Clean School Bus Program was established to provide monetary incentives for school districts in the state by reducing emissions of diesel exhaust in school buses. Eligible technologies include catalysts, particulate filters, qualifying fuels, and other emissions reducing add-on or retrofit equipment that will reduce emissions. Some of the technologies eligible for funding under the program will reduce $NO_X$ emissions. The 80th Texas Legislature is considering legislation to fund the Clean School Bus Program. The TCEQ included a recommendation for funding this program in its budget submission to the Legislature. The TCEQ will proceed as directed by the Legislature on this issue and is committed to implementing the program. If the program is implemented, $NO_X$ emission reductions from the eligible nonattainment areas will be available for SIP credit.

**4.2.6.5 Stationary Diesel and Dual-Fuel Engine Control Measures**
As discussed in Sections 4.2.2.1 and 4.2.2.2, the rules for ICI major and minor sources in the DFW area would establish new requirements on stationary diesel engines used less than 100 hours per year in other than emergency situations and that were placed into service, modified, relocated, or reconstructed after on or after March 1, 2009. These engines, which are primarily back-up engines, would be required to meet the emission standards in 40 CFR §89.112(a), Table 1 (October 23, 1998), in effect at the time of installation, modification, reconstruction, or relocation. This requirement ensures that as older diesel engines are replaced, the engines will be replaced with newer and cleaner model engines. An additional control requirement that applies to stationary diesel engines as well as stationary dual-fuel engines is the prohibition on starting or operating engines for testing or maintenance purposes between 6:00 a.m. and noon, except for certain situations. This measure delays $NO_X$ emissions from the engines primarily used as back-up engines until after noon to help limit ozone formation. Both of these measures are similar to control measures implemented for the HGB one-hour ozone attainment demonstration. These control measures are not accounted for in the modeling but are estimated to reduce $NO_X$ emissions by approximately 0.9 tpd in the DFW area.

The 0.9 tpd $NO_X$ reductions estimate is based on the 1.0 tpd $NO_X$ reductions estimated for all diesel engine control measures adopted for the Houston-Galveston-Brazoria one-hour ozone attainment demonstration. Because these measures predominately apply to back-up engines and emergency generators, the $NO_X$ reduction benefits from applying these measures to the DFW eight-hour ozone nonattainment area were assumed to be comparable to the Houston-Galveston-Brazoria ozone nonattainment area. The estimate for the DFW eight-hour ozone attainment demonstration was adjusted for 0.1 tpd $NO_X$ reductions accounted for in the Houston-Galveston-Brazoria $NO_X$ Mass Emission Cap and Trade Program.

**4.2.6.6 Locomotives and Marine Compression-Ignition Engines**
In the April 3, 2007, *Federal Register* notice (Volume 12, Number 63) the EPA proposed more stringent exhaust emission standards for locomotives and marine diesel engines. The proposal would significantly reduce harmful emissions of diesel PM and $NO_X$ emissions from these engines through a three-part program: (1) tightening emission standards for existing locomotives when they are remanufactured (as early as 2008, but no later than 2010 (2013 for Tier 2 locomotives)), (2) setting near-term engine-out emission standards, referred to as Tier 3 standards, for newly-built locomotives and marine diesel engines starting in 2009; and (3) setting longer-term standards, referred to as Tier 4 standards, for newly-built locomotives (beginning in 2015) and marine diesel engines (beginning in 2014) that reflect the application of high-efficiency aftertreatment technology. The EPA is also proposing provisions to eliminate emissions from unnecessary locomotive idling.

#### 4.2.6.7 VOC Emission Reductions for Architectural and Industrial Maintenance (AIM) Coatings and Consumer Products (CP)

The EPA is scheduled to adopt new rules with more stringent VOC content limits for AIM coatings and for CP. The current rules, found in 40 CFR Part 59, were adopted in 1998. The EPA is scheduled to propose new rules in June 2007 and promulgate them in December 2007. The EPA is also developing a reactivity-based rule to limit VOC emissions from aerosol paints, with proposal scheduled for June 2007 and promulgation by September 30, 2007. Compliance with all these rules would be required by January 1, 2009.

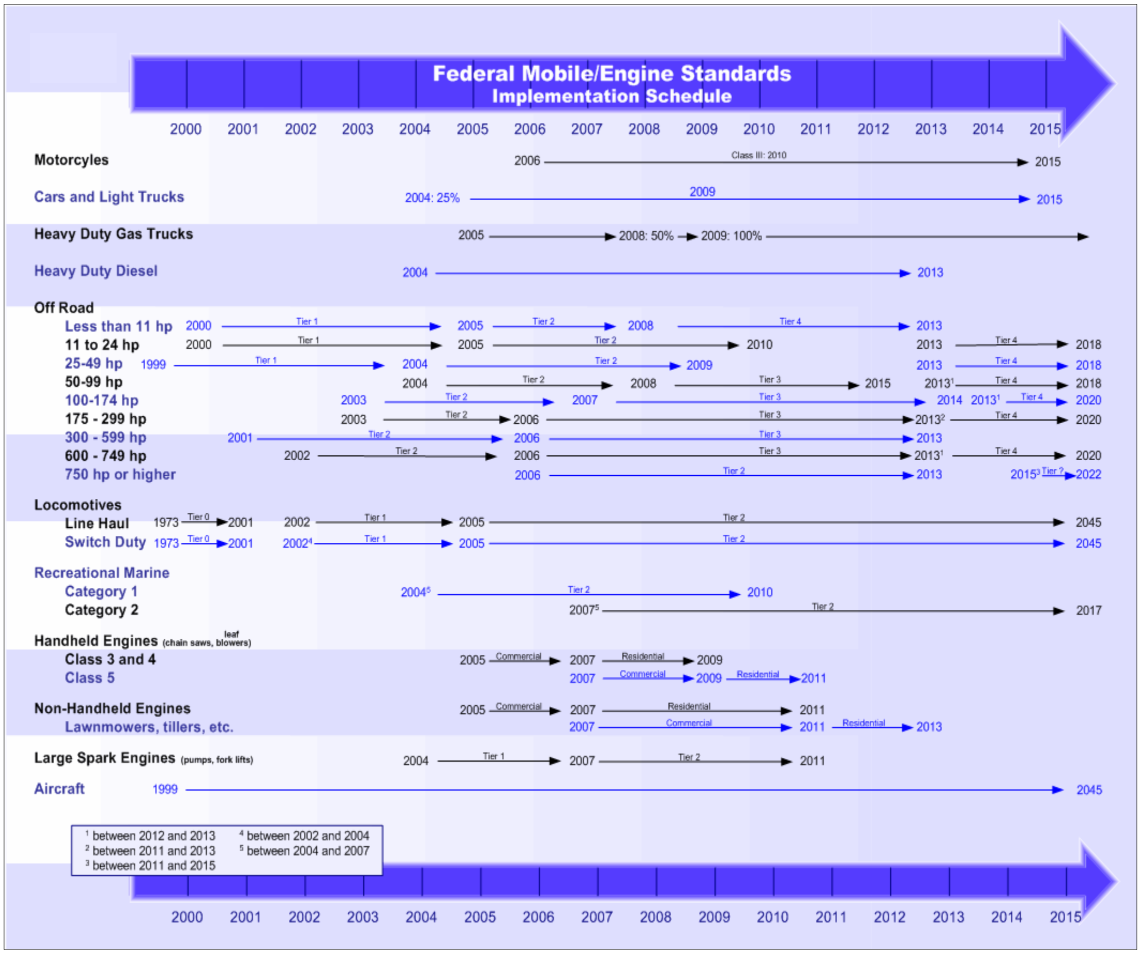
The EPA is preparing guidance to allow states to determine VOC emission reductions that will be achieved by these rules so states can use them in their SIP submittals. The EPA hopes to provide a memo giving credit information for the aerosol coatings and consumer products categories by April 30, 2007. Credit and baseline issues for the AIM rule will be discussed in the preamble of the AIM/CP amendments to be proposed in June.

Before the EPA announced plans to revise the national rules, the commission together with HARC sponsored project H-54 in late 2005 - early 2006 to estimate VOC emission reductions that might be achieved if Texas were to adopt more stringent rules in the AIM, CP, and aerosol coatings categories. Based on the study, the commission has estimated that the revised rules would yield reductions in the nine-county DFW area of 9.5 tpd for AIM and 4.8 tpd for CP from a 2002 baseline. Emission reductions from aerosol coatings were more difficult to quantify. These estimates are preliminary and subject to change when the EPA publishes guidance, but the EPA rules will be based on the same model rules that the H-54 study used to estimate possible reduction credits.

### 4.2.7 Post-2009

In addition to the control strategies and programs currently in place in the DFW nine-county area that will help bring the area into attainment of the eight-hour ozone standard, the continued timely implementation of federal engine standards for both on-road and non-road mobile measures will significantly reduce $NO_X$ emissions beyond 2009. Furthermore, $NO_X$ emissions from fleet turnover are expected to decrease by approximately 20 tpd from ozone season 2009 estimates, which are based on a starting date of July 1, 2009, to June 15, 2010 (see Chapter 3, Section 3.8 for further analysis). See Table 4-6: *Federal Mobile/Engine Standards Implementation Schedule* for more information.

**Table 4-6: Federal Mobile/Engine Standards Implementation Schedule**




#### 4.2.7.1 On-Road Emission Inventory Trends for the Nine-County DFW Area from 1999 to 2012

The purpose of this section is to show that though VMT in the DFW area are expected to increase in 2012, progress in emissions reductions will continue due to fleet turnover effects. During 2004 and 2005, NCTCOG submitted on-road emission inventories for the earlier referenced ozone episode to the TCEQ for the nine-county DFW area for 1999, 2007, and 2009. For each of these years, NCTCOG provided benefits of state-issued control strategies.

The results of these analyses for the representative Tuesday, August 17 episode day are summarized below in Table 4-7: *Tuesday, August 17 On-Road Emission Trends for Nine-County DFW From 1999-2012*.

A 2012 on-road emission inventory for this episode is under development by NCTCOG, but not yet complete. The TCEQ estimated approximate 2012 totals for on-road $NO_X$, VOC, and CO by modifying the 2009 MOBILE6.2 input files for 2012 application, along with increasing the 2009 VMT estimates at an annual rate of two percent. As in the 2007 and 2009 baseline inventories, the analysis includes the benefits from state-issued control strategies. The estimated changes that will occur in on-road emissions from 2009 to 2012 are summarized below in Table 4-8: *Change in On-Road Emissions for Tuesday, August 17 in Nine-County DFW From 1999-2012*.

**Table 4-7: Tuesday, August 17 On-Road Emission Trends for Nine-County DFW From 1999-2012**

| Calendar Year | Weekday VMT | Weekday Emissions | | |
|---|---|---|---|---|
| | | $NO_X$ | VOC | CO |
| | | *tpd* | *tpd* | *tpd* |
| 1999 | 138,299,779 | 438.86 | 183.58 | 2,271.67 |
| 2007 | 173,065,387 | 219.50 | 110.27 | 1,512.84 |
| 2009 | 187,988,303 | 193.42 | 99.68 | 1,157.68 |
| 2012 | 199,494,691 | 129.88 | 79.03 | 974.66 |

**Table 4-8: Change in On-Road Emissions for Tuesday, August 17 in Nine-County DFW From 2009-2012**

| On-Road Change From 2009 to 2012 | Weekday VMT | Weekday Emissions | | |
|---|---|---|---|---|
| | | $NO_X$ | VOC | CO |
| | | *tpd* | *tpd* | *tpd* |
| Difference | 11,506,388 | -63.54 | -20.65 | -183.02 |
| Relative Change | 6.12% | -32.85% | -20.71% | -15.81% |

As shown, even though VMT is expected to increase over six percent from 2009 to 2012, $NO_X$, VOC, and CO are expected to decrease by 33 percent, 21 percent, and 16 percent, respectively. Since State-issued control strategy benefits are included in both the 2009 and 2012 inventory totals, the expected drop in emissions is due solely to fleet turnover effects where the use of older high-emitting vehicles is discontinued, while only newer, low-emitting vehicles enter the fleet. These changes in the on-road fleet are shown graphically in Figure 4-1: *Weekday On-Road Emission Inventory Trends in Nine-County DFW from 1999-2012*.

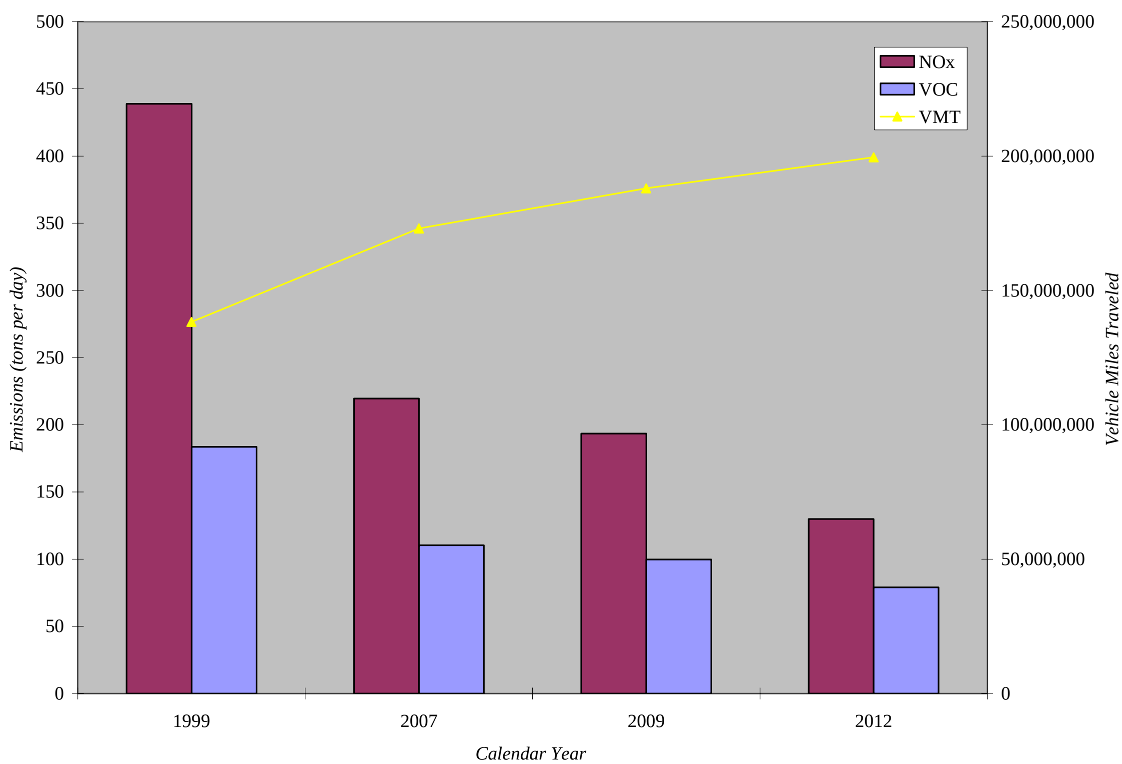



**Figure 4-1: Weekday On-Road Emission Inventory Trends in Nine-County DFW from 1999-2012**

### 4.3 REASONABLY AVAILABLE CONTROL TECHNOLOGY (RACT) ANALYSIS

Under the one-hour ozone NAAQS, the four-county DFW area, consisting of Collin, Dallas, Denton, and Tarrant Counties, was classified as a serious nonattainment area. Under the eight-hour ozone NAAQS the EPA classifies the nine-county DFW area, consisting of Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, and Tarrant Counties, as a moderate nonattainment area. Under the eight-hour ozone standard, the nine-county DFW area is required to meet the RACT mandates of the 1990 FCAAA under §172(c)(1), §182(b)(2) and §182(f). According to the EPA's Phase II Final Rule to Implement the Eight-Hour Ozone NAAQS (40 Code of Federal Regulations §51.912, November 29, 2005), areas classified as moderate nonattainment or higher must demonstrate that their current rules fulfill eight-hour ozone RACT for all Control Technique Guidelines (CTG) categories and all non-CTG major sources of $NO_X$ and VOC emissions.

The TCEQ demonstrates that the RACT requirements are being fulfilled in the DFW eight-hour ozone nonattainment area by (1) identifying all CTG source categories of VOC and $NO_X$ emissions and submitting negative declarations for categories where there are no major emission sources within the DFW area; (2) identifying all non-CTG major sources of VOC and $NO_X$ emissions; (3) identifying the state regulation that implements or exceeds RACT for each applicable CTG source category or non-CTG major emission source; and (4) describing the basis for concluding that these regulations fulfill RACT. Appendix J: *Reasonably Available Control Technology Analysis* provides the full RACT demonstration.

### 4.4 REASONABLY AVAILABLE CONTROL MEASURES (RACM) ANALYSIS

#### 4.4.1 General Information

Section 172(c)(1) of the FCAA requires states to "provide for implementation of all reasonably available control measures as expeditiously as practicable" and to include RACM analyses in the SIP. In the General Preamble for implementation of the FCAA Amendments (57 FR 13498), the EPA interprets Section 172(c)(1) as a requirement that states incorporate all reasonably available control measures that would advance a region's attainment date into their SIP. However, regions are obligated to adopt only those measures that are reasonably available for implementation in light of local circumstances. In the preamble, the EPA provided guidelines to help states determine which measures should be considered reasonably available:

> *If it can be shown that one or more measures are unreasonable because emissions from the sources affected are insignificant (i.e. de minimis), those measures may be excluded from further consideration...the resulting available control measures should then be evaluated for reasonableness, considering their technological feasibility and the cost of control in the area to which the SIP applies...In the case of public sector sources and control measures, this evaluation should consider the impact of the reasonableness of the measures on the municipal or other government entity that must bear the responsibility for their implementation.*

On July 2, 2002, the United States Court of Appeals upheld the EPA's definition of RACM, including the consideration of economic and technological feasibility, the ability to cause substantial widespread and long-term adverse impacts, the collective ability of the measures to advance a region's attainment date, and whether an intensive or costly effort will be required to implement the measures.

#### 4.4.2 Control Strategy Development to Determine Appropriate RACM

***Initial Identification Process and Development of Master List Emission Control Measures***

The TCEQ contracted with the NCTCOG to identify, evaluate, and quantify potential control measures for the DFW eight-hour ozone SIP. The NCTCOG subcontracted with two consultants, Environ International (Environ) and the Sierra Nevada Air Quality Group, to perform the strategy development work.

The initial identification process was an extensive effort designed to elicit and describe a wide range of appropriate and effective control measures. To identify potential emission control measures applicable to the DFW eight-hour ozone SIP, the NCTCOG, with assistance from Environ, prepared a master list of emission control measures based on reviews of numerous control measure development studies conducted for the DFW area as well as studies conducted for other ozone nonattainment areas in Texas and for other states. The NCTCOG also actively sought public comment, giving the public and directly affected stakeholders numerous opportunities to provide input during each phase of the control strategy development process. The EPA also provided a list of potential control strategies to assist states in ozone attainment. Appendix K: *Information Sources Used in the Emission Control Strategy Development Process* contains the sources reviewed by the NCTCOG, the opportunities for public involvement during the development process, and the control measures suggested by the EPA.

The master list contained 1,050 potential emission control strategies. Of these strategies, 176 affected area sources, 628 affected on-road mobile sources, 86 affected non-road mobile sources, and 106 affected point sources. An additional 54 policy and outreach measures reflecting various miscellaneous suggestions not targeted at any specific source categories or control technologies were also included in the master list and later incorporated into the other four source categories during the evaluation process. Appendix L: *Emission Reduction Control Strategies, Environ Final Report* contains the master list of emission control strategies.

The initial control measure identification process incorporated a wide variety of information sources and as a result many potential measures were included on the master list more than once. In addition, some measures that would alone have minimal effect on emissions were easily recognized as being part of larger measures. Prior to starting the evaluation process, duplicate control measures were combined and similar control measures were grouped into categories so the measures could be more easily compared with one another.

***Qualitative Analysis of Master List Emission Control Measures***

Environ performed a two-part qualitative evaluation to refine the master list into a short list of viable control measures selected for further quantitative analysis. The two-part qualitative evaluation was based on the technical opinion of Environ consultants who have experience in reviewing SIP control measures at both the federal and state level.

The master list was first evaluated against the EPA's criteria for SIP creditability and measures that did not meet all four of these criteria were omitted from further consideration. To meet the SIP credit criteria the emission control measure must be:

- **permanent** within the timeframe specified by the program;
- **surplus** to other reductions required by and credited to other applicable SIP provisions;
- **quantifiable** reduction in activity or emission rates; and
- **enforceable** under both state and federal law.

Master list emission control measures that did meet the SIP creditability criteria were then evaluated against a second set of four criteria. Environ assigned each control measure a score ranging from 1 to 4 (with 1 being the lowest score and 4 the highest score) and used those scores to rank the potential control measures. Since it was not feasible to model each individual control measure suggested, the goal of the qualitative ranking analysis was to identify the most feasible and effective measures for further quantitative review. Scoring for each of the four criteria was based on the following.

- **Practical to Implement** based on technical and/or implementation feasibility. The practicality score was a subjective judgment based on the reviewer's regulatory experience of the measure's technical or implementation feasibility.
- **Likely Acceptance** by public and regulated entities. The likely acceptance score was a subjective judgment based primarily on the reviewer's regulatory experience. Highest scores were assigned to measures to which the public or regulated entities are likely to react positively, lowest scores were assigned to measures unlikely to gain much public acceptance or likely to result in overwhelming opposition from potentially regulated entities.
- **Emissions Benefit.** The emissions benefit score was a relative ranking based on likely VOC or $NO_X$ reductions, with greater emphasis placed on $NO_X$ reduction measures. Rankings were based on results of evaluations of similar measures previously performed in the DFW area or other nonattainment areas. In some instances, especially for measures that had not been previously evaluated, professional judgment was relied upon to arrive at an appropriate ranking. More refined, quantitative analyses of emission reductions were subsequently performed for short list emission control measures.
- **Cost Effectiveness**. The cost effective score was a relative ranking based on the dollar per ton cost effectiveness estimates available from analyses of similar measures previously conducted in the DFW area or other nonattainment areas. In some instances, especially for measures that had not been previously evaluated, professional judgment was relied upon to arrive at an appropriate cost effectiveness score. More refined, quantitative analyses of cost effectiveness were subsequently performed for short list emission control measures.

Two combined scores were calculated for each control measure and those measures that received a high rank for either of the two combined scores were subsequently placed on a draft control measure short list. The first combined score was calculated by adding all four of the individual category scores (practicality, likely public acceptance, emissions benefit, and cost effectiveness) with equal weighting; high ranking measures scored at least 14 of the possible 16 total points. The second score was calculated by adding the individual category scores for acceptability and emissions benefit with equal weighting; high ranking measures scored at least seven of the possible eight total points.

***Quantitative Analysis of Short List Emission Control Measures***

The two-part qualitative evaluation described above was used to refine the master list into a draft short list of viable control measures selected for further quantitative analysis. The draft short list measures were then evaluated and selected for inclusion in the final short list based on several key considerations.

- The relative ranking assigned to the measure as a result of the qualitative evaluation.
- Availability of information to quantify the measures (e.g., measures based on rules already in place in other nonattainment areas were more readily quantifiable).
- Greater importance of $NO_X$ emission controls relative to VOC emission controls (but recognizing that measures offering significant VOC reductions in the urban core will also have value for reducing ozone and meeting the Clean Air Act five percent rate of progress requirements).
- Comments received from the stakeholder community.
- Studies being performed by other groups and local representatives that focus on emission controls for certain source categories (cement kilns, electric generating utilities, and energy conservation). To avoid duplication of effort, measures aimed at these source categories were not quantitatively evaluated although some were included in the final short list for sake of completeness.

Quantitative evaluations were performed for control strategies included on the short list. These evaluations included quantifications of emissions benefits and costs so that measures could be ranked according to their cost/benefit ratio. Evaluation results for each measure included on the final short list were summarized in a series of measure evaluations, each containing the following information:

- **Control Measure Title And Reference Number**: Summary title and control measure number.
- **Category/Type**: Emissions category affected and type of measure.
- **Author**: Name and affiliation of individual(s) responsible for the evaluation.
- **Description**: A concise narrative description of the control measure, including applicable technologies and legal/administrative procedures to be employed.
- **Analysis Methodology**: Description of analysis methods used to determine emissions benefit and cost effectiveness valuations.
- **Results**: Summary of results used to determine quantitative ranking.
- **Emissions Benefit**: Estimated tons per day reduction within the DFW eight-hour ozone nonattainment area of each affected pollutant.
- **Cost**: Estimated direct cost of implementation (cost accounting methods are described in the Analysis Methodology section).
- **Implementation Feasibility**: Results of a refined version of the technical and administrative feasibility review originally performed in the screening analysis.
- **Acceptability**: An expanded discussion and refined judgment of the political, social, and public acceptability of the measure.
- **References**: References used to develop the evaluation.

The final control strategy short list, including the quantified emission reductions and accompanying documentation, was submitted to the TCEQ in January 2006. For the results of the quantitative analysis of all short list control measures, please refer to Appendix L: *Emission Reduction Control Strategies, Environ Final Report*. The control strategy development and evaluation conducted by Environ was used to assist the TCEQ in gathering information on potential emission control measures to advance attainment of the eight-hour ozone standard. The final RACM determination however, was based on the technical judgment of the TCEQ and not bound by the information from Environ.

### 4.4.3 Point and Area Source RACM Analysis

All master list point and area source control measures were evaluated to determine if the RACM criteria were met and the TCEQ has determined that all reasonably available control measures are being implemented in the DFW eight-hour ozone nonattainment area. Appendix M: *RACM Analysis of Area and Point Source Emission Control Measures* contains the RACM analysis of these measures.

### 4.4.4 Mobile Source RACM Analysis

The NCTCOG and its subcontractors analyzed and quantified 11 short list non-road mobile strategies. The non-road strategies considered were: aircraft emission standards, California portable engine rule, emission reduction contract incentives with public funding, enhanced TERP, freight rail infrastructure improvements, hybrid-electric locomotives, a lawn mower replacement program, limitations on idling of heavy-duty construction equipment, locomotive idling restrictions, rail efficiency, and accelerated purchase of Tier 2 non-road equipment.

The NCTCOG and its subcontractors analyzed and quantified 32 short list on-road mobile strategies. The on-road strategies considered were: expansion of the I/M program to include 1974 and older model year vehicles, additional taxi fleet emissions testing, AirCheck Texas repair and replacement assistance program, bicycle and pedestrian programs, California low-emitting vehicle II standards, CARB 2007 on-highway diesel engine standards, carsharing, congestion (value) pricing, drive-thru service restrictions, enhanced AirCheck Texas repair and replacement assistance program, best workplaces program, carpooling, transit subsidy programs, vanpooling, expanded I/M to include diesel vehicles, expanded I/M to surrounding counties, fare-free transit system-wide on ozone action days, freeway and arterial bottleneck programs, heavy-duty idling restriction, higher vehicle occupancies, idle reduction infrastructure, intelligent transportation systems, light-duty vehicle idling restrictions, lower Reid vapor pressure, military ground equipment emissions testing, parking cash-out, pay-as-you-drive, speed limit decrease for heavy-duty diesel trucks, stricter I/M enforcement, traffic signal improvements, transit, and transit off-peak pass.

For an analysis of each short list mobile measure considered for analysis and quantification, please refer to Appendix L: *Emission Reduction Control Strategies, Environ Final Report*. The NCTCOG selected a list of mobile measures to implement. The measures committed to by NCTCOG are found in Chapter 4 of this SIP submittal under Transportation Control Measures and Voluntary Mobile Emission Reduction Measures. Appendix N: *NCTCOG Final Submittal of On-Road and Non-Road Emissions Benefits* contains the letter dated September 15, 2006, from NCTCOG, to the TCEQ detailing the commitment to these measures.

## 4.5 MOTOR VEHICLE EMISSIONS BUDGET (MVEB)

The MVEB refers to the maximum allowable emissions from on-road mobile sources for each applicable criteria pollutant or precursor as defined in the SIP. The budget must be used in transportation conformity analyses. Areas must demonstrate the estimated emissions from transportation plans, programs, and projects do not exceed the MVEB. The attainment budget represents the on-road mobile source emissions that have been modeled for the attainment demonstration. The budget reflects all of the on-road control measures reflected in that demonstration. The MVEB is shown in Table 4-9: *2009 Attainment Demonstration Motor Vehicle Emissions Budget for the Nine-County DFW Area*. For additional detail, see Table 4-27 of *Appendix B: Emissions Inventory Development.*

**Table 4-9: 2009 Attainment Demonstration Motor Vehicle Emissions Budget for the Nine-County DFW Area**

| Nine-County DFW Area | Total Emissions | |
|---|---|---|
| | $NO_x$ | VOC |
| | *tpd* | *tpd* |
| DFW motor vehicle emissions budget | 186.81 | 99.09 |

## 4.6 CONTINGENCY MEASURES

Contingency measures that were put in place for the one-hour ozone standard were never triggered, and as such, they will remain in place for the eight-hour ozone standard. See the TCEQ VOC rules on Offset Lithographic Printing §115.449(c), Degassing or Cleaning of Stationary, Marine, and Transport Vessels §115.549(b), and Petroleum Dry Cleaning §115.559(a).

Appendices are available upon request. Please contact:

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# Response to Comments Received Regarding the Dallas-Fort Worth (DFW) Eight-Hour Ozone Attainment Demonstration State Implementation Plan (SIP) Revision

The commission received comments from the following entities: American and Southwest Airlines (ASA), Association of Electric Companies of Texas, Inc.(AECT), Blue Skies Alliance (BSA), Burlington Northern Santa Fe Railway (BNSF), Mayor Miller and the City of Dallas (City of Dallas), Dallas City Council Representative Linda Koop, Dallas Sierra Club (Sierra-Dallas), Mayor Moncrief and City of Fort Worth (City of Fort Worth), Downwinders At Risk (Downwinders), Ellis County Judge Chad Adams representing himself (Judge Adams), North Texas Clean Air Steering Committee (NTCASC), Texas Clean Air Working Group, and Texas Environmental Research Consortium (TERC), Environmental Defense (ED), Environmental Systems Products (ESP), East Texas Environmental Concerns Organization (ETECO), FPL Energy (FPL), Greater Fort Worth Sierra Club (Sierra-Fort Worth), Green Party of Dallas County (GPDC), Interfaith Environmental Alliance (IEA), J-W Power Company (J-W Power), North Central Texas Council of Governments (NCTCOG), Northeast Texas Air Care (NETAC), Portland Cement Association (PCA), Public Citizen Texas Office (Public Citizen), District 90 State Representative Lon Burnam (Representative Burnam), District 95 State Representative Marc Veasey (Representative Veasey), District 93 State Representative Paula Pierson (Representative Pierson), Tarrant County Precinct 1 Commissioner Roy C. Brooks (Commissioner Brooks), Tarrant County Judge Glen Whitley (Judge Whitley), Texas Campaign for the Environment (TCE), the Texas Department of Transportation (TxDOT), Texas Pipeline Association (TPA), TXU Corporation (TXU), the United States Environmental Protection Agency (EPA), XTO Energy (XTO), and 82 individuals.

Comments regarding specific rules were responded to as part of the individual rule preambles and are included in the SIP through the adoption of those rules.

# Contents

# GENERAL COMMENTS

City of Fort Worth, Commissioner Brooks, Judge Whitley, and eight individuals commented that the DFW attainment demonstration should reduce more emissions to meet the standards. Downwinders, Sierra-Dallas, Public Citizen, and six individuals commentated that the DFW attainment demonstration should be expediting rules for cleaner engines. IEA asked the TCEQ to do what is right for the common good. Twenty-seven individuals commented that our quality of life depend on the strength of this plan. Two individuals commented that this plan should be done correctly. One individual requested a standard for the SIP that provides a margin of safety, and for Texas to be a model for progressive development. One individual requested attainment earlier than 2010. Two individuals commented that the commission should not allow additional emissions. BSA and many individuals insisted the TCEQ could produce a better plan and requested the TCEQ require all industry to reduce pollution in the DFW area. Two individuals commented that the TCEQ should not be influenced by concerns about costs. One individual requested improvement regarding instances where businesses that meet or exceed clean air standards are penalized because they gain no benefits by doing so, but they are then at a disadvantage when other businesses do not do their part. One individual noted that concerns for the economy should be secondary to the health of the community.

**The purpose of this plan is to demonstrate attainment of the eight-hour ozone NAAQS by June 15, 2010, in accordance with the EPA's guidance and Federal Clean Air Act (FCAA) requirements. The commission strives to protect our state's human and natural resources consistent with sustainable economic development. The commission's mission is clean air, clean water, and the safe management of waste. The commission is committed to attaining the standard as expeditiously as practicable and providing regulated entities a feasible compliance schedule. The 30 TAC Chapter 117 rules associated with this SIP revision include achievable and cost-effective $NO_X$ emissions standards for sources in and around the DFW eight-hour ozone nonattainment area. An achievable and cost-effective level of control for a particular source category depends on the current levels of emissions, available control technologies for the source category, and other technical and economic factors that may be specific to a source or to a region. The commission determined the appropriate**

**level of control for sources in DFW eight-hour ozone nonattainment area considering all appropriate factors, including information obtained during the public comment period. Discussion regarding the level of control required on specific source categories is provided in the adopted rules associated with this SIP revision. By improving air quality in the DFW area, this plan will improve the quality of life for many residents of the DFW area.**

Downwinders asserted that there has been no steady long-term trend toward a decrease in actual Clean Air Act violations in DFW for ozone pollution despite what the state points to as decreases in averages and inventories. Public Citizen stated that failure may result in federal takeover of the region's air plans and that past failures have already been affecting health, the economy, and transportation funding.

**The commission does not agree that this plan will result in failure, or will result in the implementation of a federal plan. Ambient ozone trends have shown significant improvement compared to the former one-hour NAAQS. Looking at the one-hour monitoring data, the DFW one-hour ozone design value is 124 ppb for 2006. If the area were still subject to the one-hour standard (125 ppb monitored), the area would be attaining the standard. Thus, the public has seen an improvement in air quality that positively affects public health. Lastly, the commission is unaware of (and the commenter did not provide information regarding) any specific transportation funding or economic growth problems resulting from SIP failures or transportation planning failures in the DFW area.**

Representatives Veasey and Burnam, BSA, and three individuals asked the TCEQ to not adopt the SIP as currently drafted and to prepare a more aggressive SIP in its place.

**The EPA requires submittal of this SIP by June 15, 2007. If the commission does not submit this plan, the EPA could make a failure to submit finding, which could begin a sanctions clock and result in the potential loss of federal highway funding and requirement for emission offsets. Further, if the commission did not adopt these measures now, any subsequent plan developed would have a later compliance date and thus be less aggressive. The commission has identified what reductions can be accomplished as expeditiously as possible and is pursuing those reductions in this plan.**

The EPA requested the commission show how the contingency measures that remain in place from the one-hour ozone standard in Collin, Dallas, Denton, and Tarrant Counties are surplus to the measures needed for attainment of the eight-hour ozone standard.

**The rules identified as contingency measures under the one-hour ozone standard will not advance the eight-hour ozone attainment date. Those measures would reduce VOC emissions. This plan targets $NO_X$ reductions because DFW ozone production is generally more responsive to $NO_X$ reductions overall than to VOC reductions. Therefore, the contingency measures are not needed to demonstrate attainment of the eight-hour ozone standard. However, if the measures are triggered in the future, those VOC reductions would still improve ozone concentrations in the DFW urban core (four original nonattainment counties), since that localized area tends to be more responsive to VOC reductions.**

Representative Burnam, Sierra-Dallas, Public Citizen, ED, Downwinders, and seven individuals requested that the commission adopt the more protective eight-hour standard of 60 to 70 ppb that was recently proposed by the EPA's Clean Air Act Advisory Committee (CAAAC).

**The current EPA rule and guidance requires states to submit plans to demonstrate attainment of the existing eight-hour ozone standard by June 15, 2007. The commission developed and adopted this SIP revision to meet those requirements. If the EPA lowers the current ozone standard and areas in Texas are designated nonattainment for a new standard, the commission will prepare SIP revisions to attain and maintain the new**

**standard for those areas.**

## Air Quality Concerns

City of Dallas, TCACC, and eight individuals commented that air quality is poor and that the air contains unacceptable levels of mercury, ozone, particulate matter, and other toxic contaminants. ETECO commented that additional air pollution is unacceptable. City of Dallas, City of Fort Worth, Sierra-Dallas, BSA, Downwinders, TCACC, and thirty individuals commented that the air quality in the DFW area has become worse over time and that the DFW area has had persistently poor air quality and failed to attain standards for more than 13 years. Sierra-Dallas, BSA, and Downwinders predicted that this plan will also fail to comply with the Clean Air Act. An individual commented that air in the DFW region has been unclean and dangerous for many years and continues to get worse. An individual stated that Texas needs stricter standards to protect it from toxic emissions and dirty industries.

**The commission disagrees with the comments. Air quality emissions trends for the former one-hour ozone NAAQS demonstrate significant improvement in air quality in the DFW area. The DFW area is currently monitoring attainment of the former one-hour ozone standard, which was established to protect public health, with a design value of 124 ppb for 2006. This, along with the declining emissions trends described in Chapter 3, shows that tremendous progress in air quality has been made in the DFW area. Additionally, since 1999 the number of exceedance days (with daily concentrations above 95 ppb) has decreased, reducing the severity of the exceedances of the standard.**

**All applicable sources in the state of Texas are required to meet the National Emissions Standards for Hazardous Air Pollutants, in addition to other federal and state requirements, such as site specific permit limits for all regulated emissions. Site specific permit limits are consistent with the EPA guidelines and similar regulations in other states. Further, any new or modified emissions increases that require permitting must be protective of public health. The commission monitors and evaluates levels of numerous hazardous air pollutants in the DFW area and has generally not found levels of concern. The most recent evaluations may be accessed at http://www.tceq.state.tx.us/implementation/tox/regmemo/AirMain.html.**

ETECO commented that emissions trading for toxic emissions, such as mercury, should not be allowed.

**The purpose of this plan is to demonstrate attainment of the eight-hour ozone NAAQS by June 15, 2010, in accordance with EPA's guidance and Federal Clean Air Act (FCAA) requirements. There are no emissions trading provisions proposed as a part of this plan. As required by the 79th Legislature, the commission adopted the Federal Clean Air Mercury Rule (CAMR), which does include a trading program and it intended to reduce mercury emissions nationwide by seventy percent. However, CAMR is a separate program and not a part of this SIP revision.**

An individual asked how many "orange alert" days have been issued for the area in the last five years, and how they have progressed, and commented that this information was hard to find on the Internet.

**The commission has issued high ozone watches and warnings in the DFW area for the past five years. In the last five years, there is no discernable trend in the number of days with an Orange AQI value in the DFW area. The exact number of Orange AQI days for each year is listed below. The webpage to request AQI values by year for Texas is located at http://www.epa.gov/air/data/monaqi.html?st~TX~Texas.**

| Year | Number of days with Orange Alerts |
|---|---|
| **2001** | **62** |
| **2002** | **87** |
| **2003** | **78** |
| **2004** | **53** |
| **2005** | **86** |
| **2006** | **75** |

## *Health Effects*

Commissioner Brooks, Judge Whitley, Representatives Burnam and Pierson, Public Citizen, Sierra-Dallas, ED, Downwinders, and forty individuals commented that the plan does not protect public health. Four individuals provided statistics related to public health problems in Texas and the DFW region. City of Dallas, TCACC, IEA, and forty-two individuals are concerned about the health impacts of the 17 proposed coal-fired power plants, and stated that in the DFW, Houston, Austin, and east Texas areas, there are days when children can not play outside, and asthma is on the rise. Representative Veasey and four individuals expressed concern for increased health care costs due to air pollution in the DFW area. One individual requested that an estimate of $15 billion per year for health costs be noted. City of Fort Worth expressed concern that hospitals and emergency rooms will become packed with those afflicted with air pollution related illnesses. ETECO stated that air pollution adversely affects the health and welfare of the people of east Texas. Representatives Burnam, Pierson, and Veasey, Commissioner Brooks, City of Fort Worth, IEA, TCACC, and ten individuals expressed concern about a link between asthma and air pollution. Representatives Burnam, Pierson, and Veasey are concerned with the impact of $NO_X$ emissions on emphysema and lung disease. Three individuals were specifically concerned about the impact of emissions from cement kilns on asthma. One individual expressed concern about a link between emphysema and air pollution. Two individuals expressed concern about a link between general lung disease and air pollution. Four individuals expressed concern about a link between incidents of various types of cancer and air pollution. Two of these individuals linked cancer to cement kilns. Three individuals expressed concern about a link between autism and air pollution. Two individuals specifically linked this concern to cement kilns. One individual commented that chemicals in air pollution contribute to mental illness. One individual expressed concern that air pollution affects the learning ability and mental processes of children. One individual asked the TCEQ to not allow pollution from the cement plants because of the extremely serious effects on people's health. Downwinders and one individual asserted that pollution from the cement plants has been killing people. IEA and six individuals expressed concern for toxics in air pollution. Downwinders and five of these individuals connected these toxics to air pollution from cement kilns. IEA specifically cited mercury as a problem. IEA and one individual both expressed concern about particulate matter. IEA stated that particulate matter is more serious than expected for women, and more than one thousand people die each year because of particulate matter and toxins released from power plants. Four individuals expressed concern for the effects of air pollution on heart health. One individual cited evidence from a newspaper article and two studies in the U.S. and Europe. Two individuals noted an article from the *New England Journal of Medicine* that correlated heart disease with air pollution. One individual further noted that the article identified coal-fired plants as a major source of pollution that contributes to heart attacks and strokes.

**The commission appreciates the comments related to health effects. This plan is designed to demonstrate attainment of the eight-hour ozone NAAQS, which is a heath standard, by June 15, 2010. By demonstrating attainment of the eight-hour ozone standard in the DFW area, in accordance with the EPA's Eight-Hour Implementation Rule, the EPA's guidance, and the CAA, the commission is ensuring that public health will be adequately protected.**

**$NO_X$ contributes to ozone formation and can react to form nitrate particles, both of which are known to aggravate existing respiratory diseases. Other air pollutants, including ozone,**

**can also aggravate existing respiratory diseases. The role that air pollution has in potentially causing respiratory disease is unclear. The primary health concerns for ozone are its effects to the lungs and respiratory system. Examples of effects include respiratory irritation and inflammation, impaired ability of the lungs to function normally, and aggravation of preexisting respiratory diseases such as asthma. These effects are generally associated with short-term exposure to high levels of ozone such as those that have been detected in the DFW area. Health effects from ozone generally diminish quickly once an individual is no longer exposed to high levels. However, in some sensitive individuals, effects may linger and take longer to resolve. For example, the commission agrees that the unique anatomy, physiology, and behavior of children may render them more sensitive to air pollutants such as ozone. Leading scientific researchers have noted an increased incidence of respiratory diseases such as asthma in the United States, particularly in select populations. The reasons for this increase are not entirely known and are likely due to many factors. Any role of air pollution in respiratory disease reinforces the need to minimize exposure to high ozone levels and to take steps to reduce the levels of chemicals that contribute to ozone formation. A relatively robust list of scientific literature exists on the health effects of ozone (for a recent review, please see the California Air Resources web site: *http://www.oehha.ca.gov/air/criteria_pollutants/pdf/ozonerec1.pdf* ). However, data gaps still exist in our understanding of the health effects of ozone, particularly in regards to sensitive populations, such as asthmatic children. The commission agrees that air pollution can also affect public welfare, including socioeconomic costs, reinforcing the need for emissions reductions that will continue progress toward attaining the eight-hour ozone standard, such as those identified in this adopted SIP. Furthermore, as discussed elsewhere in this response to comments, air pollution levels over the past decade have dropped substantially, while asthma rates have increased. Finally, there is no known scientific evidence at this time to support ozone causing cancer, autism, or affecting mental ability.**

**With respect to concerns relating to health impacts from the 17 proposed coal-fired power plants, in the announcement of the buy-out, TXU and the potential purchasers announced that it would withdraw applications for eight of the eleven proposed facilities and indicated those applications would be withdrawn upon completion of the buy-out. Regardless of the buy-out, part of the permit application process includes a commission review of the potential health impacts of the proposed unit to assure that public health and welfare concerns are addressed.**

**With respect to specific concerns about health effects in east Texas from air pollution, the commission adopted, on November 17, 2004, the NETX Early Action Compact SIP, which demonstrates attainment of the eight-hour ozone standard by December 31, 2007. The plan includes strategies such as: leak detection and repair programs to reduce highly reactive volatile organic compounds (HRVOC); the Department of Energy's (DOE) Clean Cities program to voluntarily reduce mobile source emissions; public awareness programs in the schools and communities; and energy efficiency programs to reduce electricity consumption.**

**With respect to concerns about mercury, the commission incorporated by reference the Clean Air Mercury Rule (CAMR), which is expected to reduce mercury emissions nationwide by 70 percent. Current mercury emissions from coal-fired power plants in the state of Texas are 5.0046 tons per year (tpy). Under the Federal CAMR rule, Texas has been given an annual mercury budget of 4.656 tpy for Phase I (2010-2017) and 1.838 tpy for Phase II (2018 and thereafter).**

**The New England Journal of Medicine article referenced by two comments referred to particulate matter. The DFW area is currently in attainment with the NAAQS for PM. However, many of the sources contributing to ozone formation are also sources of particulate matter, so further reduction of particulate matter can be expected because of controls in place for ozone precursors.**

## *Economic Effects*
An individual asserted that air pollution hurts the economy in increased health care, lost productivity, and lost education for children due to missed school days. Representatives Veasey, Burnam, and Pierson, Judge Whitley**,** City of Fort Worth and 29 individuals conveyed the possibility that nonattainment could cause loss to the area in terms of economic opportunities, lost productivity and sales worth several billion dollars annually, millions of dollars of important federal highway funding, and/or loss of local control of air quality regulations. ETECO stated that air pollution adversely affects important economic activities like agriculture and ranching and the livelihoods of the owners of such operations. ETECO also commented that air pollution adversely affects the overall economy of east Texas communities that rely primarily on the area's beautiful environment to attract businesses, retirement homes, and tourism.

**The commission is charged with developing plans that will help nonattainment areas meet federal air quality standards for ozone and other pollutants. This SIP revision is designed to demonstrate attainment of the eight-hour ozone NAAQS in the DFW area by June 2010, and thus, will prevent the possibility of a federal implementation plan being imposed on the area, the loss of highway funding and other economic repercussions. By demonstrating attainment of the eight-hour ozone standard in the DFW area, in accordance with the EPA's Eight-Hour Implementation Rule, the EPA's guidance, and the FCAA, the commission is balancing improved air quality with continued economic growth and development in the DFW area. In selecting control strategies for the DFW area, the commission worked with DFW local officials to ensure that emissions reduction requirements were both economically reasonable and technically feasible. In response to ETECO's comment, the commission has worked with the NETAC in aggressively implementing strategies to reduce ozone in the northeast Texas area, including participation in the development of the Early Action Compact SIP that demonstrates attainment of the eight-hour ozone NAAQS by December 2007.**

## *Impacts on Water Quality*
Downwinders and four individuals are concerned that air pollution is affecting water quality.

**While impacts to water quality are not a primary focus of plans to attain and maintain the NAAQS, the commission does seek to review impacts to water quality through other programs. The Total Maximum Daily Load (TMDL) Program works to improve water quality in impaired or threatened water bodies in Texas. The program is authorized by and created to fulfill the requirements of Section 303(d) of the Federal Clean Water Act. The goal of a TMDL is to restore the full use of a water body that has limited quality in relation to one or more of its uses. The TMDL defines an environmental target and based on that target, the state develops an implementation plan to mitigate anthropogenic (human-caused) sources of pollution within the watershed and restore full use of the water body. Concerns about water quality are beyond the scope of this SIP.**

One individual expressed concern that power plants waste excessive amounts of water to produce electricity.

**Water availability can be an issue for power plants, but the Texas SIP focuses on air quality, and concerns about water usage at power plants are beyond the scope of this SIP.**

# Evaluation of the SIP

## *General Support*
Judge Chad Adams, speaking for himself and his constituents and on behalf of NTCASC, NCTCOG, and TERC, thanked the TCEQ and its commissioners for a productive working

relationship and the work the commission has done to improve air quality. In addition, he stated that the TCEQ has done a good job on the process and data shows a constant and consistent improvement in air quality in north Texas. Three individuals endorsed Judge Adams' comments. American Airlines, Inc., Southwest Airlines Co., and one individual support the commission's effort to attain air quality standards.

**The commission appreciates this support and is committed to working with local entities and keeping interested parties updated on SIP developments and informed about technical issues related to air quality.**

AECT commented that it believes that the $NO_X$ emissions from point sources in the DFW area and in the subject attainment areas will be adequately controlled through the Chapter 117 rules adopted concurrent with this SIP revision.

**The commission agrees that emissions from point sources in the DFW area are adequately addressed in this SIP for the purposes of demonstrating attainment of the eight-hour ozone standard in the DFW area.**

City of Dallas supported the proposed SIP revision and associated rulemaking, but with some reservations, and stated that the commission should continue to evaluate and promulgate regulations during the SIP approval process with the EPA.

**The commission appreciates the support and is committed to working with the local entities and the EPA during the SIP approval process.**

## *Legal Validity*

Three individuals contended that the commission's plan does not protect health or the environment as the law requires. Eight individuals commented the plan achieves the minimum legal requirements for attainment; its acceptability is based on a technical clause that allows the plan to be close, but not effective. Downwinders commented that the use of WoE arguments was an excuse being used to keep the commission from implementing the full complement of ozone reduction measures necessary for attaining the eight-hour ozone standard.

**The commission has made no change in response to these comments. The adopted DFW SIP provides for emissions reductions necessary to attain and maintain the eight-hour ozone NAAQS, which is designed to protect health and the environment. As part of this demonstration, the commission uses photochemical modeling, which is a predictive tool that simulates the changes of pollutant concentrations in the atmosphere using a set of mathematical equations characterizing the chemical and physical processes in the atmosphere. In specifying requirements for photochemical modeling, the EPA allows for the use of corroboratory WoE by states to support demonstrations of attainment since there is always uncertainty in numerical forecasts of future events. The commission has analyzed the appropriate emissions reductions necessary for attainment of the eight-hour standard as described elsewhere in this response to comments and the DFW SIP.**

XTO stated that as it understands, the D.C. Circuit Court vacated the Phase 1 rules for the eight-hour standard, resulting in all eight-hour timelines being ineffective until the EPA re-issues the Phase I rules. Devon and an individual commented that uncertainty was added to the validity of the eight-hour standard by the recent D.C. Court decision and said that the state should request to go back to the one-hour standard timetable to allow reductions from federally controlled sources to occur rather than squeezing the remaining source types. NCTCOG commented that the recent court decision in South Coast AQMD v. EPA may impede the progress of some control strategies and suggested that the proposed controls be stringent enough to demonstrate attainment even if implementation of some strategies is precluded.

**The commission has made no change in response to these comments. The D.C. Circuit**

**Court issued an opinion on December 22, 2006, South Coast AQMD v. EPA, 472 F. 3d 882 (D.C. Cir. 2006). The court granted certain petitions in part, vacated the Phase I Eight-Hour Implementation Rule, and remanded the rule to the EPA for further proceedings. The Phase I rule specified requirements for the preparation, adoption and submittal of SIPs for the eight-hour ozone standard, in addition to revoking the one-hour ozone standard for an area one year after the effective date of the designation of an area for the eight-hour standard. The ruling did not question the validity of the standard, but rather how the standard is implemented through the EPA's rulemaking. While the D.C. Circuit Court decision does create some uncertainty for implementation planning, the full impact of this ruling will not be known until the ruling is final and if necessary, the EPA has promulgated new rules. The EPA, industry interveners, and plaintiffs have all filed petitions for rehearing of the decision with the D.C. Circuit Court. The EPA has indicated that states should continue efforts to develop and expeditiously submit their plans for meeting the eight-hour standard. While it is likely that SIP planning efforts will be impacted by continued litigation and the necessity of new rulemaking, the commission has no information regarding any change in timing requirements for attaining the eight-hour ozone standard resulting from this decision. Regardless of the outcome of the D.C. Court Ruling, the commission remains obligated to pursue reductions that would get the DFW area into attainment of the eight-hour standard.**

BSA, Public Citizen, and SEED Coalition strongly disagree with the commission's claim that it has adequate fiscal and manpower resources and will not be adversely affected through the implementation of this plan. This claim exposes the state to litigation. While our organizations understand that the law prohibits the TCEQ from lobbying for additional funding; this prohibition does not require the commission to claim it can accomplish everything with existing resources when it obviously cannot.

**In proposing and adopting SIPs, the commission is required to assess whether it continues to have adequate resources to implement the air quality plan. The commission has determined that is has adequate resources to implement the adopted plan and related rules. The commission acknowledges that individuals or groups have the ability to litigate and seek redress as allowed under law.**

BSA commented that the current proposal exposes the state to potential litigation since, for example, if a proper attainment demonstration for 2009 is submitted, the state will violate the Five Percent IOP SIP. Additionally, Blue Skies commented that the state will face potential litigation exposure when it fails to attain the eight-hour ozone standard by the 2010 deadline.

**As discussed elsewhere in this response to comment, the commission does not agree that the DFW SIP will result in the DFW area failing to attain the eight-hour ozone standard by the 2010 deadline. The commenter has not provided adequate information to evaluate whether a violation of the Five Percent IOP SIP will occur, so the commission can provide no response to this comment. The commission acknowledges that individuals or groups have the ability to litigate and seek redress as allowed under law.**

BSA commented that if the TCEQ has permitted more emissions from point sources than should have been allowed under past SIP demonstrations (especially considering significant increases of $NO_X$ emissions from Midlothian cement kilns), then the proposed attainment demonstration allows for backsliding, which is prohibited by law. BSA questioned permit activities within Ellis County, a designated nonattainment county. The SIP is required to set limits on permits in a nonattainment area through emissions inventory and growth projections.

**The commission does not believe that more emissions have been permitted than should have been allowed under past SIP demonstrations. Since Ellis County was previously classified as attainment under the one-hour standard, permitted emissions were not restricted to nonattainment levels. However, once it was designated nonattainment, Ellis County became**

**subject to the more stringent permitting rules in effect for nonattainment counties. The SIP does not explicitly limit permitting activity through emissions inventory or growth projections. The FCAA sets additional restrictions on permitting activity through its federal new source review permit requirements, which require a new major source or source making major modifications to obtain a nonattainment NSR permit. One of the additional requirements of this permit is to offset new or increased emissions with certified reductions from the same nonattainment area. In this manner, emissions growth is limited in the nonattainment area and not through SIP limitations. The TCEQ has projected emissions growth from permits issued for sources in Ellis County while the county was classified as attainment under the one-hour standard. Lastly, there is no possible anti-backsliding in this instance, because Ellis County was not part of the one-hour ozone nonattainment area.**

Downwinders stated that the commission's proposed SIP violates a binding legal agreement made by the TCEQ to make a good faith effort to submit a SIP in advance of the existing deadline of June 15, 2007, and to attain the eight-hour ozone standard as expeditiously as practicable. Additionally, the TCEQ agreed to consider rulemaking or other action for reasonably available and practically enforceable control measures in the eight-hour SIP planning process if such measures are needed to achieve expeditious attainment of the eight-hour ozone standard in accordance with FCAA §§ 172(c)(1), and 181(a)(1). Downwinders commented that instead of meeting these agreements, the SIP will not achieve attainment of the eight-hour ozone standard expeditiously, if ever, and that the proposed SIP did not consider all reasonable measures to get to attainment of the standard. Lastly, Downwinders commented that evidence demonstrates that there are other reasonably available and practically enforceable ozone reduction measures available that the TCEQ has chosen not to implement, including the lack of advanced controls on the Midlothian cement plants and the lack of stricter California-type vehicle emissions standards for the entire state.

**The commission does not agree with the comments. The commission made a good faith effort to propose the DFW SIP in a timeframe to allow submittal to the EPA in advance of the existing deadline of June 15, 2007. In response to letters received from environmental groups and county judges expressing concerns regarding expedited time lines for development of the DFW SIP, the Executive Director agreed to allow further time to provide for more robust stakeholder participation, as well as development of additional technical work. The commission does not agree that providing for this additional time, at the request of both environmental groups and local officials, in any way compromised performance of its obligation under the Settlement Agreement with Downwinders. The adopted DFW SIP provides for attainment of the eight-hour standard as expeditiously as practicable. The DFW SIP includes the commission's analysis regarding reasonably available control measures for the DFW area in Chapter 4 and Appendices K, L, M, an N of the DFW SIP. This analysis documents comprehensive work regarding all potentially available control measures that were assessed for the DFW area. In conducting rulemaking for cement kiln controls, the commission has addressed the potential availability of a variety of levels of controls for cement kilns applicable in Ellis County, where Midlothian is located. Lastly, with regard to the availability of California Low Emission Vehicle (LEV) II emissions standards for the state of Texas, the analysis documented in Appendix L of the DFW SIP indicates possible $NO_X$ and VOC reductions in a modeling demonstration of the lowered emissions. The 80th Texas Legislature is considering legislation to revise the Texas Health and Safety Code to provide the TCEQ with specific rulemaking authority to establish a low-emission vehicle program that is consistent with Phase II of the California Low-Emission Vehicle Program (Cal LEV II). This legislation would require the commission to adopt and revise rules as necessary to implement the revised statute and maintain consistency with the Cal LEV II program. The commission will proceed as directed by the legislature. See Appendix L, pages 108-115, for discussion of Cal LEV II.**

Representative Burnam stated that the TCEQ ignored Tarrant County with this plan. Downwinders commented that the proposed DFW SIP is discriminatory against Tarrant County because residents in the north and west parts of the nonattainment area would not be protected from cement kiln emissions, thereby denying them equal protection under the law.

**The commission disagrees with the comment that the DFW SIP ignores Tarrant County, and is discriminatory. All the rules and strategies adopted concurrent with this SIP revision apply to Tarrant County, since it is part of the eight-hour ozone nonattainment area. In order to demonstrate attainment of the eight-hour ozone standard, all monitors including the five in Tarrant County must demonstrate compliance. The commission uses photochemical modeling, as required by the EPA, as a tool to determine the effectiveness of particular emissions reduction strategies throughout the nonattainment area. The commission has previously required substantial emissions reductions from cement kilns in Ellis County, and is adopting additional emissions reduction requirements as part of this SIP.**

Devon commented that the eight-hour ozone standard made the attainment timetable unreasonable, especially since 70 percent of the emissions in the area come largely from federally controlled sources.

**The commission agrees that the time frame to meet the eight-hour standard is aggressive and that beyond 2009 additional reductions will be seen from sources that are largely federally controlled. This plan represents the best path forward for attainment of the eight-hour ozone standard in DFW, considering regulatory constraints on specific source categories.**

### Repeal of the Water Heater Rule

The EPA commented that the water heater rule revision repealing the standard of 10 nanograms per joule (ng/J) on residential water heaters can be approved as long as Texas submits an approvable eight-hour ozone attainment demonstration for DFW and the SIP demonstrates attainment as expeditiously as practicable. In addition, the EPA requested that the TCEQ use figures from the Five Percent Increment-of-Progress SIP published in the Federal Register at 71 FR 48870 (August 22, 2006) rather than the figures provided on page 4-13 (Table 4-5: DFW five percent Increment of Progress reductions) of the proposed SIP.

**The commission has made the suggested change to Table 4-3 (previously Table 4-5): DFW Five Percent Increment of Progress Reductions of the adopted SIP to reflect the reductions in the DFW Five Percent Increment of Progress SIP.**

## *Enforcement*

BSA commented that the SIP is not enforceable and that the lack of enforceability reduces the credibility of the assumptions used in the document. One individual asked that the TCEQ enforce the plan. Sierra Dallas commented that voluntary measures in the plan are not enforceable, and this would jeopardize the achievement of air quality goals. An individual commented that even though consumers are able to reduce energy consumption, voluntary measures aren't enough to get them to do so.

**The commission has made no change in response to these comments. The SIP is enforceable through rules established to meet and maintain air quality standards in Texas. The commission enforces these rules through various means, such as monitoring, recordkeeping, testing, and reporting requirements. In addition, the commission conducts investigations of companies in all areas of the state, including the DFW area, in order to determine compliance with the rules and regulations. The commission has the authority to and does take enforcement action against companies that fail to maintain compliance with both state and federal air quality rules. The commission acknowledges that voluntary measures,**

**unlike traditional control measures, are not enforceable; however, they are an important component in the SIP process. Voluntary measures provide opportunities for local areas and the state to raise awareness of and promote air quality issues and goals, although such measures may not be able to be quantified with the same level of certainty as traditional control measures. The commission acknowledges that voluntary measures may not always change consumer behavior. Since voluntary measures make up a small portion of the emissions reductions necessary for attainment, they are generally used to provide innovative approaches for emissions reductions. Ultimately, the commission is responsible for demonstrating attainment of the NAAQS, and if an area does not attain, additional emissions reductions may be necessary.**

An individual asked the TCEQ to enforce collection of fines. Texas has strict standards, yet the TXU and other industrial polluters can get away with breaking them. The TCEQ has traditionally shifted fine payment deadlines so that big industry never has to pay.

**The permit conditions and rules are enforced through report reviews and investigations conducted by the TCEQ's Office of Compliance and Enforcement. Any violations of those conditions or rules will be dealt with in accordance with the TCEQ's penalty policy. The policy defines how fines are calculated and provides companies with options for payment. Regardless of the option chosen for payment, total elimination of the penalty is not allowed. Collection of fines is a priority for the agency. Permits and other agency approvals can not be granted if a company has outstanding fines or fees. Information about the Enforcement Review Process and the commission's penalty policy is available on the commission's website at: http://www.tceq.state.tx.us/comm_exec/enf_rev/implement_recc.html.**

## *General Inadequacies of the SIP*

Sierra-Dallas asserted that this plan has no allowance for failure of any strategies and has overly optimistic expectations of compliance with voluntary measures. Sierra-Dallas and seven individuals commented that the DFW attainment demonstration does not include an adequate margin of safety. An individual stated that the plan does not anticipate that some strategies may not be implemented or may fail to achieve full reduction estimates.

**The SIP and associated adopted rules in 30 TAC Chapter 117 include specific mandatory and voluntary measures intended to reduce emissions in time to meet the eight-hour ozone NAAQS by the attainment date. The commission does not agree that the DFW SIP contains overly optimistic expectations of compliance for the voluntary measures. As discussed elsewhere in this response to comments, voluntary measures make up a small percentage of the emissions reduction necessary for attainment. While all are designed to raise awareness and promote air quality goals through strategies that obtain emissions reductions, some are not commitments in the SIP because they are difficult to quantify. Reductions from voluntary measures are estimated to be 1.63 – 1.93 tpd $NO_X$. Some measures included in the SIP have no reduction credit associated with them. This conservative approach assures that no credit is taken for measures where the likelihood of compliance is questionable or the reduction is not quantifiable.**

Eleven individuals commented that the plan does not effectively address important emissions sources, such as motor vehicles.

**The DFW SIP accounts for mobile source reductions attributed to fleet turnover and federal clean engine standards. Although the agency is federally preempted from regulating motor vehicle emissions standards, several agency sponsored programs and rules contribute to emissions reduction from these sources, including TERP, TxLED, reformulated gasoline, and vehicle inspection/maintenance programs.**

**The 80th Texas Legislature is considering the appropriation of additional funds, above and beyond those already appropriated through 2007, to TERP. The commission anticipates that additional funds may be appropriated to TERP in FY 2008-2009, resulting in continued reduction in the significant emissions from the on-road and non-road engines source categories. This funding increase will allow the commission to fund emissions reductions projects, above and beyond TERP reductions funded under the one-hour ozone standard that will help the DFW area in attaining the eight-hour ozone standard.**

Sierra-Dallas commented that the last DFW air plan did not implement some planned strategies after some industries, like the cement and power plant industries, told the state it would comply, but those planned reductions did not happen.

**In the past, the commission has required substantial emissions reductions from power plants and cement kilns in Ellis County. The commission is adopting new emissions reduction requirements for cement kilns as part of this SIP, which will assist the DFW area in attaining the eight-hour standard.**

## Climate Change

Sierra-Dallas and 12 individuals commented that the DFW attainment demonstration does not consider factors such as steady rises in temperature or global warming nor does it develop measures to address this in the plan and may therefore have underestimated the reductions needed. Seven individuals expressed concerns about the association of air pollution with global warming, the impact that $CO_2$ emissions in Texas could have on the entire planet, and the effects of global warming on our food supply. Sierra-Dallas and four individuals made the following statements:

- A study by the World Resource Institute for the World Wildlife Fund found that Texas leads the nation in job creation under global warming solution scenarios.
- Global warming solutions could create 8,400 new jobs in the state and save consumers an average of $207 annually.
- Our air needs to be cleaner to reduce contributions to global warming.
- Everyone has an obligation to do his part to curb global warming.

Sierra-Dallas and 13 individuals provided information asserting that Texas is already one of the leading producers of greenhouse gases in the nation and world and should therefore not allow new sources such as the coal-fired plants.

**The purpose of the SIP is to address attainment of the eight-hour ozone standard, in particular $NO_X$ and VOC emissions, which are the precursors to ozone formation. There are numerous studies of global climate change, none of which predicts ambient temperature increases perceptible on the same time scale for this SIP revision. Even if climate model forecasts of increasing temperatures are correct, because predicted temperature changes are so small, it is unlikely that increases in emissions from adaptive behavior such as greater use of air conditioning or increases in average ambient temperatures used in photochemical modeling would be large enough to make a measurable difference in photochemical model results. Certainly, Texas summers are hotter in some years than others, and future years could record higher temperatures than 2002. However, year to year fluctuations in regional average temperatures are common and are not necessarily attributable to global climate change. Global climate change models attempt to predict long-term changes in large-scale climatic conditions, rather than short-term fluctuations in regional weather patterns, such as slightly hotter (or cooler) summers from one year to the next.**

ETECO, IEA, and six individuals asked the state to prioritize measures to address global warming, and provided information supporting the relationship between $CO_2$ emissions and global warming. One individual stated that we shouldn't put one more molecule of carbon in the air.

**The purpose of the SIP is to address nonattainment of criteria pollutants. This plan addresses the eight-hour ozone standard, in particular $NO_X$ and VOC, the precursors to ozone formation.**

## Stakeholder Participation in SIP development

City of Dallas, NCTASC, and three individuals expressed appreciation of the partnership that has developed between the NCTASC and the commission. NCTASC and three individuals thanked the TCEQ of its efforts to provide frequent updates on the development of the SIP and to educate the members on technical issues related to air quality. AECT appreciates the public participation process that the TCEQ followed in its development of the proposed SIP and associated rules.

**The commission appreciates the support and will continue to encourage public participation in the SIP development process.**

TCE, Downwinders, NCTCOG, BSA, and one individual expressed the opinion that citizens' concerns were not given due consideration in development of the plan.

**As noted in Chapter 1 of the adopted DFW SIP, the commission provided significant opportunity for public review and comment during the SIP development process, including coordination efforts with the NCTCOG. Public meetings with interested parties, including local governments, industry, environmental groups, and members of the public were held in June 2005 and September 2005 to discuss development of the eight-hour ozone SIP. The meetings held in June 2005 focused on air quality control strategies and the eight-hour ozone attainment demonstration SIP, while the meetings held in September 2005 focused on emissions reduction control strategy catalog development. Stakeholder meetings were also held in Fort Worth and Richardson in September 2005 and in Arlington in December 2005. Two additional stakeholder meetings were held in June 2006 in Irving, and a third meeting was held in Longview in September 2006 to discuss potential rulemaking concepts.**

**In addition to these meetings, several other entities held meetings that were open to members of the public in 2005 and 2006, where topics relevant to the development of the eight-hour ozone SIP were discussed. These entities included: NTCASC, Clean Cities Technical Coalition, NCTCOG Surface Transportation Technical Committee, and NCTCOG Regional Transportation Committee.**

**Public review and comment was also accepted through seven public hearings on the proposed SIP in compliance with federal law. These hearings were held in January and February 2007 in Dallas, Arlington, Midlothian, Longview, Austin, and Houston prior to the close of the public review period on February 12, 2007. The commission reviewed and analyzed testimony, made changes in the SIP as appropriate, and responded to comments. The public review process and information about the SIP is further documented on the commission's web site at:www.tceq.state.tx.us/implementation/air/sip/dfw.html and at the NCTCOG web site at: www.nctcog.org/trans/air/sip/future/strategies.asp.**

**The commission acknowledges that there are a variety of stakeholder concerns and views that the commission must take into consideration. The commission appreciates and encourages continued participation in the SIP development process.**

## Public Hearings

BSA, Sierra-Dallas, and three individuals expressed support for the commission holding a number of public meetings around the DFW area, which allowed for increased public participation. Two individuals thanked the TCEQ for holding some of the meetings in the evenings.

**The commission will continue to encourage public participation in the development of SIP revisions and associated rules by holding public meetings at times most convenient to members of the public, including evening hours.**

Three individuals asked why no public hearing was scheduled in Fort Worth, and one individual commented that the easterly locations of all the hearings excluded or inconvenienced residents living in the western portions of the nine-county area. Three individuals asked the TCEQ to schedule more evening and/or weekend hearings.

**The commission makes every effort to schedule hearings for the convenience of the public and is committed to encouraging public participation. In general, the commission strives to find locations that are centralized to achieve the maximum amount of public participation. The commission also considers the size of potential venues for public participation. The commission will take these comments into consideration when scheduling future public hearings.**

One individual was disappointed that the commissioners did not attend the public hearings except the one in Austin.

**It is not the usual practice of the commissioners to attend public hearings. The commissioners consider and approve each SIP revision before it commences and receive copies of each SIP package, including the record of the public hearings, for review before they consider the matter at agenda. Members of the public are welcome to attend agenda and speak to the commission if they so desire.**

BSA, Public Citizen, and SEED Coalition asserted that the TCEQ'S public notice provided incorrect information about how the public may submit electronic comments; therefore, the commission should consider any comments filed late due to its error. Two individuals recommended more aggressive public notice, and more publicity for public hearings.

**The commission appreciates the comments and apologizes for the inadvertent error in the published notice of hearing and the proposed DFW eight-hour ozone attainment demonstrations SIP. The TCEQ staff did receive telephone calls during the comment period regarding the incorrect e-comment address and directed them to the correct address. Comments that were received after the close of the comment period were considered as part of the adoption package and are addressed in this response to comments. The commission advertises public hearings in newspaper notices, on the agency website, and in the Texas Register, and sends notices of hearings via an email listserv to interested parties. Furthermore, the commission allowed the comment period after proposal of the SIP to remain open for 45 days instead of the required 30, to allow extra time for members of the public to submit comments. The commission welcomes other ideas regarding how to expand and/or enhance public notices and meeting information.**

# CONTROL STRATEGY DISCUSSION

Seven individuals stated that the commission should require power plants and cement kilns to use newer technologies for controlling emissions. An individual recommended that the TCEQ adopt rules that require stringent, "technology-forcing, tough, and restrictive air pollution control technology on the major $NO_X$ and VOC point sources in the DFW ozone non-attainment area, even if those control measures require significant economic sacrifices. Two individuals asserted that industries could afford to reduce emissions and the TCEQ should force the businesses to shoulder the costs of their pollution. Two individuals also stated that the best pollution controls should be required in all sectors.

**While the commission strives to encourage the development of effective and innovative pollution control devices, prescribing technology-forcing emissions standards in regulations that are not economically or technologically feasible is contrary to the agency's mission and philosophy and the requirements of the Federal Clean Air Act. The commission issues permits to facilities that include requirements for the permit holder to comply with all applicable state and federal requirements, such as the requirement to install at a minimum the Best Available Control Technology (BACT) that is protective of human health and the environment.**

An individual recommended that the state lower the speed limit to 55 or 60 mph to reduce $CO_2$ emissions, and another individual stated that raising the prices for fuel and energy would motivate consumers to conserve energy.

**The commission and the TxDOT are prohibited by statute from making any changes to the speed limit as an emissions reduction strategy. In 2003, the 78th Texas Legislature removed authority for the TxDOT to prescribe speed limits for environmental purposes. In addition, the commission does not have authority to regulate or affect prices of fuel or energy. However, the commission does advocate pollution prevention and natural resource conservation through education and outreach initiatives. The commission made no changes to the SIP as a result of this comment.**

ETECO supported stronger emissions controls on all mobile sources throughout Texas.

**The commission will continue to work with local partners to evaluate initiatives that could reduce emissions from mobile sources and assist in reducing $NO_X$ and VOC emissions for the DFW area. Upcoming federal emissions standards for new vehicles and equipment will reduce emissions in the region. The commission made no changes to the SIP in response to this comment.**

An individual asserted that government should promote reductions using tax credits or other similar encouragements.

**The commission has made no change in response to this comment, but appreciates the suggestion. While it does not have authority for granting tax credits, the commission does provide financial assistance to repair or replace qualified high emitting vehicles through the Low Income Repair, Retrofit, and Accelerated Vehicle Retirement Program (LIRAP). This program is one method the State uses to encourage citizens to do their part to improve air quality.**

Sierra-Dallas and six individuals commented that the DFW attainment demonstration should establish appliance efficiency standards. An individual recommended expediting rules for cleaner engines, establishing appliance efficiency standards, and updating building efficiency codes.

**The adopted new 30 TAC Chapter 117 rules include more stringent emissions standards for stationary internal combustion engines in the Dallas-Fort Worth eight-hour ozone nonattainment area and establishes a new east Texas combustion rule that will require owners and operators of stationary, rich-burn gas-fired, reciprocating internal combustion engines located in thirty-three counties in the northeast Texas area to meet $NO_X$ emissions specifications and other requirements to reduce $NO_X$ emissions and ozone transport into the Dallas-Fort Worth eight-hour ozone nonattainment area.**

**The commission supports local energy efficiency measures and encourages local governments to comply with the provisions of Senate Bill 5 (77th Texas Legislature). Senate Bill 5 (SB 5) initially required significant changes in energy use to help the state comply with the ozone NAAQS. SB 5 applies to all political subdivisions within 38 designated counties and was later expanded to 41 counties, including the counties in the Dallas-Fort Worth area.**

**SB 5 requires new buildings to meet the state's new energy efficiency performance standards. These standards may be met through the use of items such as improved weather stripping, more efficient air conditioners, stricter insulation guidelines, switches to turn off water heaters, tighter sealing on buildings, and energy-efficient windows for new buildings. Under the new law, municipalities and counties are allowed to enact local amendments to the state energy codes as long as they are not less stringent than the statewide standard.**

**SB 5 amended the Health and Safety Code by requiring affected political subdivisions to implement cost-effective, energy-efficiency measures, meeting a goal to reduce electricity consumption by five percent each year for five years. The subdivisions are required to report their efforts and progress annually to the State Energy Conservation Office (SECO). The report details the efforts being undertaken by SECO to provide assistance and information to affected entities and the progress and efforts made by political subdivisions in meeting the energy efficiency mandates of SB 5. SECO provides the annual report to the commission.**

ETECO commented that all existing and proposed air pollution sources should be required to employ best available control technologies.

**The commission's existing permitting process requires a Best Available Control Technology (BACT) review for any new sources or modifications to existing sources that would increase emissions. Existing sources may be required to retrofit their facilities to meet with more stringent requirements than BACT if that reduction is technically and economically feasible and the reduction is necessary to get the area back into attainment with the standard. For example, many of the emissions standards in the DFW area are more stringent than would be required to meet BACT in a permit. The Federal Clean Air Act requires the TCEQ to issue permits upon a finding that the applicant has met BACT requirements at the time of the application.**

City of Dallas stated that Dallas is a demonstrated leader in addressing air quality issues. However, the City recognizes more can be done, and offers the following items as potential points of discussion with the TCEQ regarding local government initiatives, including the following: (1) Contractor language - significant reduction in the off-road inventory could be made with a progressive contractor incentive package. Dallas is willing to coordinate with the commission and other interested parties to develop a contractor program that could be adopted by public and private organizations across Texas; (2) Various municipal ordinances - the City is contemplating a variety of changes to ordinances, including a five-minute idle rule; (3) Building codes - the City recently started a workgroup to develop a combination of mandates and incentives to reduce energy use and environmental impacts from development; (4) Changes to City operations - the City is in the process of adopting an Environmental Management System based on ISO 14001. Many of its objectives and targets include consideration of clean air; and (5) Additional goals to reduce on-road and off-road emissions - reviewing police operations to reduce emissions and storm water impacts, and education of tenants and multi-family units related to multi-media environmental concerns.

**The commission acknowledges the City of Dallas' contributions to improved air quality in the DFW area. If the local government implements the identified local measures, the commission will include them as appropriate in future SIP planning.**

## North Texas Clean Air Steering Committee (NTCASC) Resolutions

Judge Whitley, Commissioner Brooks, City of Fort Worth, Judge Adams, BSA, Downwinders, SEED, Public Citizen, and 10 individuals commented that the DFW attainment demonstration does not include all the resolutions adopted by the NTCASC and supported by local citizens, government representatives, business representatives, and environmental representatives. TCE, Downwinders, NCTCOG, BSA, and one individual expressed concern about the proposed SIP not including local recommendations. Downwinders, BSA, City of Fort Worth, Judge Whitley, Commissioner Brooks, Judge Adams, Councilmember Koop, City of Dallas, NCTCOG, Public Citizen, SEED, the TERC, and 29 individuals requested that the SIP be modified to include rule promulgation for the 15 resolutions adopted by the NTCASC in 2006.

**The commission appreciates local efforts to improve air quality in the DFW area. However, the majority of the strategies suggested in the resolutions cannot be included in the DFW eight-hour attainment demonstration SIP at this time. Many of the resolutions require legislative authority or are not necessary for demonstrating attainment of the eight-hour ozone NAAQS. Other resolutions are local initiatives that require commitments from local governments to implement before they can be included in a SIP revision. A summary and response to each resolution are provided below.**

1) Resolution Supporting Adoption of California's Low Emission Vehicle (LEV) II Standards

   The resolution asks the Texas Legislature to adopt California LEV II standards and exempt people who purchase vehicles that meet Cal LEV II standards from paying sales tax.

   **The 80th Texas Legislature is considering legislation to revise the Texas Health and Safety Code to establish a low-emissions vehicle program that is consistent with Phase II of the California Low Emission Vehicle Program (Cal LEV II). This legislation would require the commission to adopt and revise rules as necessary to implement the revised statute and maintain consistency with the Cal LEV II program. The commission will proceed as directed by the Legislature.**

2) Resolution Supporting Allocation of Funds for the Texas Clean School Bus Program

   The resolution recommends allocating a portion of excess revenues collected from the Texas Emissions Reduction Plan (TERP) and the Low Income Repair Assistance Program (LIRAP) to the Texas Clean School Bus Program.

   **The commission included a recommendation for funding of this program in its budget submission to the Texas Legislature and the 80th Texas Legislature is considering legislation to fund the Clean School Bus Program. The commission will proceed as directed by the Legislature on this issue.**

3) Resolution Supporting Controls on East Texas Combustion Engines

   The resolution supports controls on east Texas combustion engines and combustion engines within 200 km of the DFW nonattainment area.

   **In the 30 TAC Chapter 117 rules associated with this SIP revision, the commission is addressing emissions from east Texas combustion sources in 33 counties outside of the DFW nonattainment area.**

4) Resolution on Existing Electric Generating Units

   The resolution recommends that the commission propose a requirement that all major electric generation units in east and central Texas must meet fuel-specific emissions requirements comparable to those in place in the DFW and Houston-Galveston-Brazoria (HGB) nonattainment areas.

**These sources have already been addressed as part of Senate Bill 7 (76th Legislature). The electric generating facilities in east and central Texas were required to reduce $NO_X$ emissions by 50 percent from their 1997 levels by 2003. Modeling conducted as a part of the development of this SIP revision indicates that $NO_X$ reductions made inside the DFW nine-county region are far more effective toward attaining the ozone standard. The commission therefore determined during proposal that further reduction in emissions from these sources would limit the availability of vendors and control technology for other necessary control measures within the DFW nonattainment area and the required controls could not be implemented by the attainment date. Therefore, additional controls on east and central Texas EGFs are not feasible. Furthermore, expanding the applicability of the rule to other counties would affect new parties, who would not have the opportunity to review and comment before the rule became effective.**

5) Resolution Supporting to Expedite the EPA's "Highway Diesel Rule", finalized January 2001

The resolution asks the Legislature to expedite the phase-in period of the EPA's Highway Diesel rule to 100 percent of the sales starting in 2007.

**The commission is limited by section 209 of the FCAA from regulating new motor vehicle emissions standards and, thus, could not take action on the resolution. Therefore, it is inappropriate for the commission to include the measure in this SIP revision.**

6) Resolution Supporting an Expanded Inspection and Maintenance Program to Include Diesel Vehicles

The resolution asks the commission to implement an inspection and maintenance program to test all on-road diesel vehicles in the DFW nonattainment area.

**Diesel vehicles make up a small percentage (approximately three percent) of the Texas vehicle population. As diesel emissions testing equipment technology continues to improve, the commission will evaluate the best possible testing methodologies and equipment for consideration in future program and SIP development. The DFW 2010 estimated reductions using OBD emissions testing for light-duty diesel vehicles (weighing less than 8,500 lbs) is: .0081 $NO_X$ reduction; .0203 HC reduction; and .0009 PM.**

7) Resolution Supporting Low Income Repair and Replacement Assistance Program (LIRAP) Improvements

The resolution supports legislative amendments that appropriate LIRAP funds for use in other programs that reduce emissions from mobile sources; require I/M testing for vehicles manufactured since 1981; enhance penalties for violations by vehicle inspectors and inspection stations; toughen penalties for violations of inspection requirement on salvaged vehicles; require removal of inspection and registration stickers at all impound and auction lots; modify the title assumption process for local government law enforcement programs; and allow Justices of the Peace to have jurisdiction over misdemeanor violations of mobile source emissions requirements.

The resolution also supports regulatory modifications that petition the commission to install cut-points and pass/fail points in an I/M program; expand the I/M program to include diesel vehicles; increase the replacement incentive and the income guidelines for LIRAP; allow 20 percent of LIRAP funds to be spent on administrative costs; and treat LIRAP advertising as a programmatic rather than administrative cost.

**The 80th Texas Legislature is considering legislation to revise the Texas Health and Safety Code to enhance the Low Income Repair, Retrofit, and Accelerated Vehicle Retirement Program (LIRAP), which provides financial assistance to eligible vehicle owners for repair or replacement of vehicles. The commission will proceed as directed by the Legislature on this issue.**

**Participating counties and program administrators continue to research and implement new methods for improving outreach and participation in the program. The commission and local program administrators have used a variety of outreach initiatives such as public service announcements, newspaper advertisements, radio advertisement, brochures, newspaper inserts, mail inserts, individual door hangers, and billboards on major thoroughfares to publicize that financial assistance is available to vehicle owners meeting eligibility requirements.**

**Because many of the recommendations in this resolution require authorization from the Texas Legislature, it is inappropriate for the commission to include these measures in this SIP revision.**

8) Resolution Supporting Low Temperature Oxidation (LoTOx) and/or Selective Catalytic Reduction (SCR) Technologies for Additional Cement Kiln Emissions Reductions (pilot testing)

The resolution asks the commission to require kiln owners to conduct pilot testing for LoTOx and/or SCR technologies if certain conditions are met; seek funding assistance from outside sources to offset the costs of the pilot tests to the cement industry; conduct the pilot tests no later than 2007 so the results may be incorporated into a SIP revision in the 2009-2010 timeframe. It also asks that the EPA, the TCEQ, the NCTCOG, cement plant owners, and local environmental groups all be involved in administering and monitoring the pilot testing.

**Regarding the resolution to require pilot testing of SCR or LoTOx, the commission staff contacted the Energy and Environmental Research Center (EERC) at the University of North Dakota regarding pilot testing of SCR and was provided a very preliminary estimate of $500,000 to $700,000 to conduct pilot testing of SCR on one cement kiln. Pilot testing on additional kilns would require additional funds. The EERC is the only entity known to the commission to conduct pilot testing of SCR using a mobile test bed. The commission staff also contacted a vendor of LoTOx and learned that pilot testing of LoTOx would cost about $250,000 for one kiln.**

**The commission acknowledges that pilot testing could be completed in approximately 18 months. However, the commission disagrees that the pilot testing of either of these technologies could be performed in time to help the DFW eight-hour ozone nonattainment area attain the NAAQS by the June 15, 2010, deadline. After completion of the pilot testing and evaluation of the results, even if the results indicated that SCR or LoTOx was appropriate for the cement kilns in Ellis County, there would not be sufficient time to require and implement controls prior to the attainment date in 2010.**

9) Resolution Supporting Preference in Purchasing Policies for Certain Cement

The resolution recommends that local governments and special districts be encouraged to include a criterion in their bidding policies that rewards or gives special consideration for using cement from the kilns that have the lowest $NO_X$ emissions.

**The commission considers this resolution a local government initiative.**

10) Resolution Supporting Rail Efficiency Through the Texas Rail Relocation and Improvement Fund

The resolution recommends that these revenues be appropriated to fund relocation, rehabilitation, and expansion of freight or passage rail facilities, including commuter rail, intercity rail, and high speed rail.

**This resolution requires authorization from the Texas Legislature; therefore, it is inappropriate for the commission to include this measure in this SIP revision.**

11) Resolution Supporting Selective Non-Catalytic Reduction (SNCR) Technology for Cement Kiln Emissions Reductions (requiring SNCR on all kilns in Ellis County)

The resolution recommends that the commission require kiln owners to install SNCR technology on all kilns in Ellis County.

**The commission's preferred approach, as adopted in the 30 TAC Chapter 117 rulemaking associated with the SIP revision, is to adopt a source cap that will allow the regulated entities the flexibility to choose the most appropriate control technology for their operations.**

12) Resolution Supporting Statewide Portable Equipment Registration Program
The resolution supports adoption of a statewide portable equipment registration program for portable engines and equipment units.

**The 30 TAC Chapter 117 DFW area minor source and east Texas combustion rules associated with this SIP revision are expected to address some of the emissions from these sources.**

13) Resolution Supporting Texas Emissions Reduction Program (TERP)
The resolution recommends legislative amendments that extend TERP beyond 2010, fully fund TERP, extend eligibility to heavy-duty vehicles operating primarily between Texas nonattainment areas, and extend the project activity life by allowing TERP to fund and use Geographic Positioning Systems (GPS). The resolution also recommended regulatory modifications that allow a project cost effectiveness of up to $13,000, activation and funding of the Texas Clean School Bus Program, and activate and fund the Light-Duty Motor Vehicle Purchase or Lease Incentive Program.

**In the last five years, the Texas Legislature has committed more than $413 million to TERP to encourage voluntary emissions reductions from on-road and non-road engines, which are significant emissions sources that cannot be directly regulated by the commission.**

**The 80th Texas Legislature is considering the appropriation of additional funds, above and beyond those already appropriated through 2007, to TERP. The commission anticipates that additional funds may be appropriated to TERP in FY 2008-2009, resulting in continued reduction in the significant emissions from the on-road and non-road engines source categories. This funding increase will allow the commission to fund emissions reductions projects above and beyond TERP reductions under the one-hour ozone standard that will help the DFW area in attaining the eight-hour ozone standard.**

**Regarding the recommendation to allow project cost effectiveness up to the $13,000 limit, the commission re-evaluates the cost effectiveness standards before each new grant application period. The commission expects that the cost effectiveness limits will be set closer to the statutory limit as the program matures and the most cost-effective projects are funded.**

**Regarding the recommendation to activate and fund the Light-Duty Motor Vehicle Purchase or Lease Incentive Program, the allocation of funds for this program was**

**removed from the statute in 2003 and has, to date, not been reinstated. Future consideration of this recommendation will depend upon any new legislative direction regarding allocation of funding and the priorities for reducing emissions in the nonattainment areas.**

**Regarding the recommendation to activate and fund the Clean School Bus Program, the 80th Texas Legislature is considering legislation to fund that program. The commission has included a recommendation for funding this program in its budget submission to the Legislature. The commission will proceed as directed by the Legislature on this issue and is ready to implement the program if approved.**

14) Resolution Supporting Adoption of Truck Lane Restriction

The resolution supports the use of truck lane restrictions on designated roadways and asked the NCTCOG and TxDOT to work to identify additional facilities that meet the truck-lane restriction requirements in the DFW nonattainment area.

**The commission considers this resolution a local initiative. The NCTCOG conducted a pilot study (see Section 4.2.5 of the adopted SIP), but no permanent program has been established. If the local governments decide to implement the restrictions, then the commission will include the emissions reductions in future SIP planning.**

15) Resolution Supporting Various Energy Efficiency Measures

The resolution supports legislation to establish appliance efficiency standards by rule; to modify the health and safety code to require all political subdivisions within an ozone nonattainment area to implement energy conservation measures, to require update and implementation of building efficiency codes, and create an energy-rating program for new and extensively remodeled homes. It also supports legislation to allow adoption by rule of a system for evaluating energy savings techniques and to certify home efficiency raters.

**Some bills to enact such requirements were introduced in the 80th Legislature and the commission will proceed as directed by the legislature. Any authority given to adopt regulations would most likely require action by the SECO, the state agency with primary jurisdiction for the energy efficiency sections of the health and safety code and local jurisdictions, who would need to adopt local ordinances.**

## Energy Efficiency, Conservation, and Renewable Energy

IEA and 12 individuals supported development, funding, and construction of alternatives to dirty coal technology for power generation. They asserted that some renewable energy generation technologies are affordable and readily available now, such as wind and power. One individual conveyed support of an outright ban on fossil fuels, especially coal, and demand side management.

**The commission supports efforts to improve energy efficiency. There are several bill proposals which have been passed by the Texas Legislature, such as SB 5 (77$^{th}$ Legislative session) and several bill proposals during the 80$^{th}$ Legislative session that support the generation of electricity from alternative sources. According to the American Wind Energy Association, the state of Texas is the leading state that produces electricity from wind. Texas had 2,768 megawatts capacity from wind energy while California had 2,361 megawatts.**

The EPA encourages the TCEQ to consider crediting energy efficiency measures in the attainment demonstration. IEA, Public Citizen and eight individuals commented that the DFW attainment demonstration does not address energy efficiency in a comprehensive manner. Two individuals requested that the TCEQ support stronger energy efficiency standards and codes. Two individuals said the state should consider conservation and demand-side management measures to meet the demands for power generation, and another individual asserted that citizens as well as industry must cut back on emissions. TXU commented that residents should also reduce electric consumption. IEA stated that we need to radically reduce energy inefficiency and stop wasting so much. One individual supported the use of state budget surplus to fund energy efficiency incentive programs.

**The commission fully supports energy efficiency, renewable energy, and energy conservation measures. In 2001, the 77th Texas Legislature passed Senate Bill 5 to amend the Texas Health and Safety Code and included requirements for local political subdivisions to implement all cost-effective energy-efficiency measures, establish a goal to reduce electricity consumption by 5 percent each year for five years, and report efforts and progress annually to the State Energy Conservation Office (SECO).**

**Some of the energy efficiency components of Senate Bill 5 required new buildings to meet energy performance standards which include provisions for better weather stripping, more efficient air conditioners, stricter insulation guidelines, switches to turn off water heaters, tighter sealing on buildings and energy-efficient windows for new buildings. Municipalities and counties can make local amendments to the state energy codes as long as they are not less stringent than the statewide standard. Additional energy related bills have been proposed by the legislature (80$^{th}$ Legislature).**

**The DFW 5% IOP SIP the commission submitted to EPA included emission reduction credits of 0.72 tpd for energy efficiency and renewable energy programs in the DFW eight hour ozone nonattainment area. The energy efficiency reductions included in the DFW 5% IOP SIP were based on electricity and natural gas usage reductions expected to occur following the implementation of measures reported to SECO. The commission anticipates additional reductions in the DFW area as a result of federal, state, and local energy efficiency measures; however, it is difficult to determine precisely where the actual reductions are occurring in the air shed. Therefore, the commission has chosen not to model the full potential benefit of these programs in the attainment demonstration.**

## Cement Kilns

BSA, Sierra-Dallas, Downwinders, ETECO, IEA, Public Citizen, SEED, Commissioner Brooks, Representative Burnam, City of Fort Worth, Judge Whitley, and 33 individuals expressed concerns about emissions from the cement kilns in Ellis County and stated that the plan is not sufficiently stringent on these kilns. Downwinders commented that the commission does not regulate kilns as strongly as other major DFW point sources and that in its 2000 SIP, the TCEQ demanded across-the-board cuts of 88 percent from all power plants in the four core counties, regardless of how old or new the plants were—all had to cut their emissions by the same factor, using SCR technology. Application of advanced controls would enable all of Midlothian’s kilns to meet the strict $NO_X$ emissions standard of one pound of $NO_X$ per ton of cement manufactured.

**The commission does not agree with these comments. The DFW eight-hour ozone attainment demonstration SIP and associated rulemaking impose extremely stringent emissions requirements on cement kilns and other sources of $NO_X$ in the DFW nonattainment area. This action is the latest in a series of regulatory actions by the commission that have substantially reduced $NO_X$ emissions from these cement kilns. In 2000, the commission adopted rules that required large reductions in $NO_X$ emissions from the kilns. Permitting of new kilns by the commission has also focused on controlling emissions of numerous pollutants, chief among them $NO_X$.**

**The rules adopted along with this attainment demonstration SIP revision require even further reductions in $NO_X$ emissions through some of the most stringent emissions standards for cement kilns in the nation and the world. Allowable emissions rates used to**

**compute the source cap, 1.7 pounds per ton (lb/ton) of clinker produced for dry preheater (PH) or precalciner (PC) kilns and 3.4 lb/ton for long wet kilns, impose some of the most stringent specifications on cement kilns anywhere in the world. In fact, the allowable emissions rate for dry kilns is even more stringent than recently proposed kilns in Florida and Arizona, 1.9 lb/ton, currently considered the industry standard.**

**The emissions factors used for the source cap calculation were determined based on actual emissions data from the sources located in Ellis County. The wet kiln $NO_X$ emissions factor, 3.4 lb/ton, is based on an approximate 35 percent reduction from Ash Grove's actual average pounds per ton of clinker emissions rate from 2003 to 2005. The $NO_X$ emissions factor for dry pre-heater-precalciner (PH/PC) or precalciner (PC) kilns, 1.7 lb/ton, is based on TXI's dry PH/PC kiln actual overall average pound per ton of clinker emissions rate since 2001. The 1.7 lb/ton emissions factor represents an approximate 45 to 50 percent reduction from Holcim's pound per ton of clinker emissions rate for 2001. The commission's rationale for the different approaches is to recognize the best performing kilns for each category while establishing a cap approach that requires feasible and equitable reductions from all three sites. The different approaches for the two types of kilns is also due to significant differences in the pound per ton of clinker $NO_X$ emissions from kilns of the same category located at different sites. While TXI's dry PH/PC kiln is currently meeting or below 1.7 lb/ton, the $NO_X$ emissions from TXI's wet kilns are substantially higher than Ash Grove's wet kilns. Therefore, under the source cap approach and because the TXI facility in Ellis County has both types of cement kilns, the emissions factor used for the dry kilns must be balanced against the more stringent emissions factor for wet kilns. Further, by moving from an output-based standard to a source cap, the commission is implementing a hard cap on emissions from these sources, which will prevent total emissions from rising as production increases, as can occur under current rules.**

Downwinders and four individuals stated that the commission selected Selective Non-Catalytic Reduction (SNCR) for the cement kilns, ignoring results of the 2006 cement kiln study (Assessment of $NO_X$ Emissions Reduction Strategies for Cement Kilns - Ellis County: Final Report, July 14, 2006), included as Appendix I if the SIP, and also available here: http://www.tceq.state.tx.us/implementation/air/sip/BSA_settle.html), that, it was claimed, recommended the commission require Selective Catalytic Reduction (SCR) on the Ellis County kilns. BSA, Sierra, Downwinders, IEA, Public Citizen, the SEED Coalition and thirteen individuals asserted that owners and operators of cement kilns should be required to install what they term "advanced" control technologies, namely SCR or Low Temperature Oxidation (LoTOx), that are believed to achieve 80 to 90 percent $NO_X$ reductions. Several of the comments expressed concern that the commission referred to SCR in the proposal preamble as "not as well established" for cement kilns. Finally, BSA and Downwinders stated that the commission has not provided adequate explanation or rationale for why some technologies are chosen and some are not.

**The commission disagrees with the comment that the cement kiln study recommended Selective Catalytic Reduction or LoTOx for the Ellis County cement kilns. The study did not recommend any particular technology. The study team evaluated potential technologies and assessed their applicability to the kilns in Ellis County using terms ("available," "transferable," and "innovative") modified from standard industry practice to suit the purposes of the study. The commission relied extensively on the conclusions of the study to determine the technical and economic feasibility of all technologies presented.**

**The commission disagrees that technology to eliminate 80 to 90 percent of $NO_X$ emissions from wet process kilns is available. The cement kiln study describes SCR and LoTOx technologies, which can reduce $NO_X$ emissions by roughly 80 to 85 percent; however, neither has been applied to wet kilns anywhere in the world. Furthermore, neither has been sufficiently tested on cement kilns similar in design and feed materials to Ellis County kilns to conclude with certainty that those levels of reductions are achievable, or that the**

**technologies are suitable for every dry kiln. An assessment including lengthy and costly research, development, and testing would be needed to determine if SCR and LoTOx technologies could be "transferable" to wet kilns from other similar processes before full deployment, if warranted.**

**Further, the assertion that SCR can achieve 80 to 90 percent reductions ignores at least three fundamental considerations. The first consideration is the cost of reducing $NO_X$ emissions by 90 percent. The commission addresses costs in more detail in the adoption preamble to the 30 TAC Chapter 117 rules. Second, because the incidence of ammonia "slip" (emissions of unreacted ammonia, a hazardous air pollutant (HAP)) increases as the target reduction rate increases, increasing levels of ancillary HAP emissions accompany $NO_X$ reductions from ammonia-based control technologies. Higher ammonia injection rates are necessary to achieve higher levels of control. Because ammonia is a precursor to fine particulate formation, additional ammonia emissions can also result in increased particulate matter. This constraint imposes an upper limit on the potential effectiveness, and thus the technical feasibility, of any ammonia-based control. Finally, computation of reductions is dependent on the baseline chosen. From 1996 to 2005, cement kilns in Ellis County have reduced $NO_X$ by 24 to 57 percent on a pound of $NO_X$ per ton clinker output basis. These rules require additional 35 to 50 percent reduction, leading to overall reductions of 54 to 85 percent, depending on the type of kiln, from 1996 levels. Pilot testing of SNCR at two kilns in Ellis County, one dry and one wet, have preliminarily demonstrated that SNCR can reduce $NO_X$ over 30 percent on both types of kilns.**

**Regarding the concern that the commission determined SCR to be "not as well established" as SNCR for cement kilns, the commission has determined, based on the cement kiln study and all available information, that SCR has not been demonstrated as an available control technology for the types of cement kilns in Ellis County. While further testing might support the application of SCR technology to cement kilns, the control level and source cap approach adopted with this rulemaking will obtain reductions starting March 1, 2009, in time to help the DFW eight-hour ozone nonattainment area attain the NAAQS by the June 15, 2010, deadline.**

Judge Adams, Commissioner Brooks, Judge Whitley, BSA, City of Fort Worth, NCTCOG, Sierra, Downwinders, Public Citizen, SEED, and seven individuals expressed support for a resolution adopted by the NTCASC recommending the commission require owners or operators of cement kilns to install SCR technology.

**As described elsewhere in this response to comments and in the adoption preamble to the 30 TAC Chapter 117 rules, the commission has instead chosen a source cap approach that does not require a specific technology, but provides maximum flexibility for kiln operators to comply in the most cost effective, technically sound, and expeditious manner possible, while forcing sizeable $NO_X$ emissions reductions from all cement kilns in the area. In most cases, the commission anticipates that the source cap limitations will be attainable with SNCR and will not require costly and time consuming research and development of other technologies. SNCR has been shown to be available for dry PH/PC or PC kilns and long wet kilns, whereas SCR has not. Of the ten kilns in Ellis County, seven are long wet kilns, and three are dry PH/PC kilns. Pilot testing of SNCR on wet and dry kilns in Ellis County in 2006 demonstrated 30 to 40 percent reductions were achievable without hazardous by-product formation, such as ammonia slip. Finally, before an increase in $NO_X$ emissions from a change in operation from one unit or the installation of a new kiln could occur, a corresponding and equivalent decrease in $NO_X$ emissions would be required from another existing unit. Depending on the control options selected by the owner or operator, the source cap would not necessarily impact production.**

Judge Adams, Commissioner Brooks, Judge Whitley, BSA, City of Fort Worth, NCTCOG, Public Citizen, Sierra-Dallas, Downwinders, Public Citizen, the SEED coalition, and seven individuals expressed support for a resolution adopted by the NTCASC requesting the commission require the Ellis County cement kilns to conduct pilot testing of SCR or LoTOx technologies by September 2007 so that reductions demonstrated from the pilot study can be incorporated into the DFW SIP, assuming that the technologies proved to be cost effective in achieving reductions at or below 1.9 lb/ton of clinker and that they do not materially affect plant operations or facilities. Downwinders also stated that pilot testing could be completed in 18 months.

**Regarding the resolution to require pilot testing of SCR or LoTOx, the commission staff contacted the Energy and Environmental Research Center (EERC) at the University of North Dakota regarding pilot testing of SCR and was provided a very preliminary estimate of $500,000 to $700,000 to conduct pilot testing of SCR on one cement kiln. Pilot testing on additional kilns would require more funds. The EERC is the only entity known to the commission to conduct pilot testing of SCR using a mobile test bed. This pilot testing is intended to determine certain operating parameters, such as catalyst configuration and ammonia injection rate, of a full-scale test, and not the long-term viability of SCR. TCEQ staff also contacted a vendor of LoTOx and learned that pilot testing of LoTOx would cost about $250,000 for one kiln.**

**The commission acknowledges that the duration of pilot testing could be completed in approximately 18 months. However, the commission disagrees that the pilot testing of either of these technologies could be performed in time to help the DFW eight-hour ozone nonattainment area attain the NAAQS by the June 15, 2010, attainment deadline. After completion of the pilot testing and evaluation of the results, even if the results indicated that SCR or LoTOx were appropriate for the cement kilns in Ellis County, there would not be sufficient time to require and implement controls prior to the attainment date in 2010, which necessitates controls be in place by March 1, 2009.**

BSA, Sierra, Downwinders, Public Citizen, and SEED stated that SCR has been used successfully on cement kilns in Germany and Italy.

**The commission disagrees with this assessment of the application of SCR to kilns in Germany and Italy. There is no consensus among plant owners, control technology vendors, or regulators that results of SCR at those plants has been "excellent" or "successful." Little information is available on any of these kilns to make a factual assessment. What is known is that the SCR system in Germany experienced substantial down-time due to technical problems, such as catalyst plugging, was costly to operate, and is currently not in service. Further, the European kilns in question are different in design and operation from kilns found in Ellis County, and both the limestone feed materials and fuel input differ from the kilns in Ellis County. The European kilns are modern dry PH/PC kilns, whereas seven of ten kilns in Ellis County use the wet slurry process to produce specialty cements. The wet process is inherently more energy and emissions intensive, as detailed in the cement kiln study. The commission has no information regarding any wet kiln in the world that has attempted either SCR or LoTOx technologies.**

**Under the rules adopted as part of this attainment demonstration SIP, the commission anticipates that the three dry kilns in Ellis County will, by using SNCR, reduce emissions that are comparable to emissions at the European kilns using SCR. BACT (Best Available Control Technology), termed BAT in Europe, is 2.5 lb/ton in Italy. One dry kiln in Ellis County that uses new process designs rather than end-of-pipe controls is achieving lower emissions than this already (1.36 lb/ton). These lower emissions, accomplished with SNCR, are even lower than new kilns in Florida and Arizona (1.95 lb/ton).**

Downwinders stated that the third largest cement manufacturer in the world, Cemex, admits that SCR technology has been proven effective in cement plants.

**The commission could find no evidence to support Downwinders claim that Cemex "admitted" that SCR has been proven effective in cement plants. This comment references a recent BACT analysis performed by Cemex for a proposed kiln in Florida. Commission staff contacted the Florida Department of Environmental Quality (FDEQ) and reviewed the Cemex Brooksville BACT application. The FDEQ required the applicant to analyze and compare SNCR and SCR for a proposed dry kiln. The FDEQ could not verify that Cemex stated SCR is BACT in the Florida BACT application. The commission also contacted the applicant directly and confirmed that the company made no such claim regarding SCR in its application or any of the supporting documents. The applicant did not admit SCR is effective, nor did they support the installation of SCR at the new kiln in Florida. In the BACT analysis, the applicant stated that before SCR could be considered, a pilot study lasting from one to three years would be necessary.**

An individual stated that area residents depend on jobs at the cement plants and points out the many uses of cement and concrete we rely on. The commenter asserted that closing the cement plants would make Midlothian a ghost town.

**The commission appreciates the comment. In developing plans to attain the ozone NAAQS, the commission must balance the health and safety of residents with the need to maintain a healthy and vibrant economy. The commission recognizes that concerns for employment and economic opportunity must be addressed in a way that protects the quality of life of all residents. The DFW attainment demonstration and associated rulemakings impose extremely stringent, though feasible, emissions control requirements on a multitude of emissions sources operating throughout the region.**

One individual expressed support for the source cap approach to cement kiln emissions control.

**The commission appreciates the comment. The commission has not mandated any particular technology for control of $NO_X$ at cement kilns. Instead, the commission has devised a source cap approach that provides flexibility to kiln owners and operators to comply with new emissions requirements using available technologies.**

BSA commented that 30-day averaging is too flexible to provide accurate assessment for ozone alerts and undermines enforceability of the reductions expected from cement kilns. BSA recommended a 24-hour limit for the source cap.

**The commission does not agree with the comment. $NO_X$ emissions from cement manufacturing are by nature highly variable. The suggested shorter averaging period would be an unreasonable burden and sources would not be able to comply with the source cap as adopted under a 24-hour averaging period.**

Two individuals opposed burning toxic waste as an alternative fuel in cement kilns without using the same emissions standards placed on toxic waste disposal plants.

**The commission appreciates these citizens' concern for toxic waste handling procedures and points out that burning hazardous waste in a cement kiln has been proven to be a safe and reliable way to dispose of these wastes. Cement kilns must meet the same destruction and removal efficiency standards as hazardous waste facilities, which are subject to extensive state and federal rules and permitting requirements.**

Downwinders also stated that the commission has imposed SNCR through a complicated cap system that it has not applied to power plants.

**The commission disagrees with this comment. The commission has not proposed to require a specific technology but instead has carefully evaluated the findings of the cement kiln study and other available information to develop a plan that provides flexibility for kiln operators to comply in the most cost effective, technically sound, and expeditious manner possible. The adopted source cap approach is a flexible and feasible plan to reduce $NO_X$ emissions by the greatest amount possible with available technologies that can be installed and operational by the attainment date.**

**The commission may provide system or source caps as an alternative means of compliance or require caps as a mandatory means of compliance to achieve reductions, such as in mandatory system caps for electric generating facilities in the Houston-Galveston-Brazoria ozone nonattainment area and the mandatory source cap for the cement kilns in Ellis County adopted with the Chapter 117 rulemaking under 30 TAC §117.3123 (Rule Project No. 2006-034-117-EN). Similarly, the commission can remove the system cap as an option in order to achieve reductions. The system cap option for electric generation utilities for the Dallas-Fort Worth eight-hour ozone nonattainment area was specifically removed to make $NO_X$ reductions from power plants without revising the current emissions specifications.**

Downwinders asserted that the commission has chosen the least reductive of three possible control technologies examined in the cement kiln study and chose SNCR, which is estimated to deliver approximately 40 percent reductions in cement kiln $NO_X$ emissions compared to 80 percent or more possible with SCR and LoTOx, according to the study.

**The commission has not chosen any particular technology for control of $NO_X$ at cement kilns. As discussed elsewhere in the SIP and this RTC, the source cap was designed to be achievable using SNCR, if kiln owners and operators find it to be the most cost effective and technologically sound approach.**

Downwinders asserted that the commission has attempted to dismiss or hide the results of the kiln study from public view or discussion. At a June 2006 stakeholders meeting to discuss the Ellis County cement plants, commission staff did not mention the study until late in the program, and did not present any conclusions of the study.

**The commission disagrees with this comment. A preliminary draft report was available on the commission Web site from January 2006. When the stakeholder meeting was held, the final version of the report was being reviewed for quality assurance and contractual compliance. Modeled reductions did not change from the draft to the final report. The final report was made available as soon as feasible on the commission Web site and has been used extensively by the commission in assessing the availability and technical feasibility of control options for the Ellis County cement kilns.**

BSA, Public Citizen, and SEED recommended the commission expand proposed control strategies for EGUs and cement kilns beyond DFW area.

The commission has chosen not to expand the proposed control strategies beyond the DFW area because it would affect new parties and would not provide adequate opportunity for public notice and comment. This process could not be completed within the available time.

## Electric Generating Facilities (EGFs)

TXU noted that under the new eight-hour designations, the DFW nonattainment area went from the five counties originally designated under the one-hour standard to the current nine-county area and ozone standards were modified from 125 ppb to 85 ppb. They asserted that power plants in the area have already reduced emissions and that the industry supports the planned recommendations for further reductions. TXU also requested a "level playing field" for the large and small utility systems in that all power plants should be subject to the same emissions standards. The EPA commented that previous commission photochemical modeling runs with emissions reductions and source apportionment analysis indicated that additional controls on even smaller power plants within the DFW nonattainment area (such as the City of Garland power plant) have some impact on reducing ozone in the DFW area. The proposal does not include controls on mid-size and smaller EGUs, which would further expedite the DFW area reaching attainment.

**The commission appreciates the support for this DFW SIP revision. As a result of Senate Bill 7, issued during the 76th legislative session, which took effect September 1, 1999, electric generating facilities in east and central Texas were required to reduce $NO_X$ emissions by 50 percent from their 1997 levels by 2003. The commission determined during proposal of this SIP that further reductions in emissions from these sources would limit the availability of vendors and control technology availability for other necessary control measures within the DFW nonattainment area and the required controls could not be implemented by the attainment date. Regarding the separate emissions standard for small utility systems, there is only one operational small utility system in the DFW eight-hour ozone nonattainment area. The commission has determined that subjecting this one small utility system to the same emissions control requirements of the large utility systems would not be economically reasonable.**

City of Fort Worth requested that existing and proposed power plants be allowed to operate only on the condition that they use technology that significantly reduces the total amount of pollution from their emissions. One individual requested that "clean-coal technology" be required for power plants.

**The commission issues permits to facilities that include requirements for the permit holder to comply with all applicable state and federal requirements, such as the requirement to install at least the best available control technology (BACT) and be protective of human health and the environment. The commission does not dictate the choice of production processes. As discussed elsewhere in this response to comments, the commission has determined that additional controls on existing EGFs in east and central Texas are not feasible at this time.**

JW-Power commented that although the air quality is important, keeping the lights turned on and paying the bills is important as well.

**The commission does not intend to adversely affect system reliability in the DFW area through implementation of any control measures. In order to address comments suggesting the rule may impact system reliability, the commission is adopting a system-wide heat-input weighted averaging option for compliance with the $NO_X$ emissions limits. This option will reduce $NO_X$ emissions from electric generating facilities in the area while maintaining the region's system reliability.**

An individual requested that the TCEQ encourage wind-driven power sources. Further, that the state should take strong action to force power companies to provide affordable power as deregulation has not accomplished that.

**This SIP and associated rulemakings were designed to demonstrate attainment of the eight-hour ozone NAAQS by June 15, 2010. Regulations beyond that goal are outside the scope of the rulemaking. However, as part of rules associated with this SIP revision, the commission has adopted an output-based $NO_X$ emissions specification as a compliance option for utility boilers at electric generating facilities in the DFW nine-county area. Output-based**

**emissions specifications have been generally recognized to encourage efficiency and allow for direct comparisons between different generation technologies and fuel types.**

One individual stated that the power plants already in operation produce visible smog and invisible deadly particulates.

**The TCEQ operates a network of ambient air monitors that continuously monitor for PM10 and PM2.5, which are invisible particulates that can cause adverse health effects. The EPA sets federal standards for PM10 and PM2.5 that are protective of human health. All of the PM10 and PM2.5 monitors in the DFW area are measuring compliance with the federal standards, therefore, no adverse health effects would be expected from these particulates.**

Public Citizen noted that the TCEQ's own report showed that reductions from east Texas power plants would get the DFW area a third of the way to attainment. City of Dallas, Sierra-Dallas, and one individual recommended that the plan include requirements for all power plants in the state to meet the same emissions standards as those in the DFW and HGB areas. BSA, City of Dallas, and ETECO suggested that the TCEQ extend the rules to the power plants that are outside the nine-county nonattainment area.

**Preliminary modeling indicated that HGB level $NO_X$ emissions specifications applied to electric generating facilities in east and central Texas may result in up to 1 ppb reduction at monitors within the DFW eight-hour nonattainment area. However, these sources were already addressed as part of Senate Bill 7 ($76^{th}$ Legislature), requiring electric generating facilities in east and central Texas to reduce $NO_X$ emissions by 50 percent from their 1997 levels by the year 2003. Modeling conducted as a part of the development of this SIP revision indicates that $NO_X$ reductions made inside the DFW nine-county region are far more effective toward attaining the ozone standard. The commission therefore determined during proposal that further reductions in emissions from these sources would limit the availability of vendors and control technology for other necessary control measures within the DFW nonattainment area and the required controls could not be implemented by the attainment date. Therefore, additional controls on east and central Texas EGFs are not feasible at this time.**

BSA questioned whether existing DFW area power plants will be contributing to reductions in this SIP revision.

**The 30 TAC Chapter 117 rules associated with this SIP revision require emissions specifications for existing electric generating facilities in the nine-county area. Facilities' efforts to meet the emissions specifications will assist in progress toward attainment of the eight-hour ozone standard in the DFW area.**

## Combustion Engines

NETAC opposes the proposed requirement that sets $NO_X$ emissions limits for stationary, gas-fired, reciprocating internal combustion engines located in 39 counties throughout northeast Texas. NETAC disagrees with the unqualified assertion that the proposed reductions would benefit the Tyler-Longview area (Northeast Texas Early Action Compact Area) because the proposed compliance deadline of 2009 rule comes too late to assist the NETAC area in monitoring attainment by December 31, 2007. Absent clarification, the proposed rule could present an obstacle to implementing voluntary emissions reduction programs, if the TCEQ asserts that TERP funding should not be available for early installation of catalyst technology to retrofit gas compressor engines. The TCEQ should clarify through the rule, the response to comments, or both, that it does not intend to impair NETAC's ability to obtain TERP funding for such retrofits.

**The purpose of the east Texas combustion rule is to reduce $NO_X$ emissions for previously unregulated sources in attainment counties that contribute to ozone in the DFW eight-hour**

**ozone nonattainment area. The commission is not relying on the potential benefits to the Tyler-Longview area as a justification for the east Texas combustion rulemaking. As adopted, the commission estimates that the rule will reduce approximately 4.8 tpd in $NO_X$ emissions in the five-county Tyler-Longview area. Additional benefit is also expected from reductions from neighboring Panola County. While the commission supports NETAC's efforts to demonstrate attainment by December 31, 2007, and to reduce emissions through voluntary measures, it is unlikely that NETAC could reduce an equivalent level of emissions by December 31, 2007, or even by the adopted compliance date, March 1, 2010, through voluntary implementation of controls on the same category of engines.**

**The commission has not allowed for the use of TERP for these engines because the technology has not gone through EPA certification or verification, which the commission requires for TERP funding. Legislation has been proposed, however, that would set up a funding mechanism for engine retrofit assistance unrelated to TERP. The commission will follow legislative direction regarding this program.**

J-W Power commented that many of the lean-burn engines in the area will not be able to meet the proposed criterion of 1.5 grams, which means companies will have to either retrofit them or move them out of the designated areas. J-W Power asked the commission to consider the cost/benefit ratio of reducing emissions from these engines. J-W Power also commented that at the current market cost, the price to retrofit lean-burn engines to meet the 1.5 gram criterion is prohibitive, about $17,000 to $20,000 per ton of reduction, and replacing lean-burn engines with rich-burn engines fitted with a three-way catalyst is estimated to cost about $7,000 per ton of reduction. J-W Power estimates that about 80 percent of emissions come from rich-burn engines that are less than 500 horsepower. J-W Power could reduce emissions from rich-burn at about $400 per ton of reduction and asked the TCEQ to give companies more time to work with the lean-burn engines until they can be replaced at a reasonable cost with newer technologies. J-W Power estimates that it would have to spend more than $2 million to retrofit all the rich-burn units for a pollution reduction of about five tons per year (tpy), and it would cost about $9 million to retrofit the lean-burn engines for a reduction of 12 tpy. J-W Powers commented that it has closely followed changes in the Federal New Source Performance Standards (NSPS) regulations over the last two years, which will address fuel volatility and contain grandfather clauses for current lean-burn technology that cannot be retrofitted. J-W Power estimates that it will spend more than $25 million in the next two years to meet the proposed NSPS standards, which is half of the company's budget for capital expenses in one year. J-W Power commented that it is already moving forward to retrofit its rich-burn engines with aftermarket catalysts and air filtration controllers. J-W Power is concerned about the size of the area proposed to fall under the rule, since it has 61,000 units in the DFW nonattainment area and 6,000 to 8,000 units in the HGB area. J-W Power commented that they would not be able to address the rental units that are in place as of June 1 for two years, and they will have to replace them and relocate them elsewhere, which it estimates will result in lost revenue of about $14.5 million per year. XTO surveyed nine companies in the affected counties and found more than 900 affected engines from that small group, and have estimated that it will cost these nine companies more than $100 million to comply with the proposed rule.

**For the East Texas region, the commission has exempted all lean-burn engines and those rich-burn engines that are less than 240 hp from the rule associated with this SIP revision. The commission also agrees that additional time will be necessary for sources to comply with the east Texas combustion rule. Therefore, the compliance schedule in §117.9340 has been revised to specify that owners or operators must comply with the requirement as soon as practicable, but no later than March 1, 2010. Because the adopted east Texas combustion rule only applies to rich-burn engines 240 hp and greater, the additional year is sufficient to allow owners and operators the time to install controls as necessary and to comply with all other requirements of the rule. Based on the numerous adverse comments received regarding gas-fired lean-burn engines, the commission decided not to include lean-burn engines in the adopted east Texas combustion rule. Other changes discussed in the**

**adoption rule preamble associated with this SIP revision regarding lean-burn engines, county applicability, and engine size for exemption will significantly decrease the number of engines impacted by the rulemaking associated with this SIP. The commission estimates that exemption of lean-burn engines will greatly reduce the cost of the east Texas combustion rule and address concerns regarding economic impact. The commission has decided to exempt rich-burn engines less than 240 hp from the east Texas combustion rule. As discussed elsewhere in the adoption rule preamble associated with this SIP revision, the commission is exempting these smaller rich-burn engines due to the large number of engines that fall under this size range. In addition, based on information provided by Houston Area Research Council (HARC) Project H68, the commission estimates that more reductions from rich-burn well-head compressor engines will be realized than originally estimated using HARC Project H40. Therefore, the adopted rule will still result in substantial emissions reductions from rich-burn engines 240 hp and larger.**

XTO disagrees with the TCEQ applying east Texas combustion rules for area sources in nonattainment areas. An individual commented that the plan proposed an east Texas engine rule that affects 39 counties outside the DFW nonattainment area and reduces ozone by an average of 0.2 to 0.3 ppb, rather than proposing more stringent control in the nine-county DFW area.

**The commission disagrees with these comments. Appendix G, DFW Conceptual Model, Chapter 3, Wind Meteorology and Ozone Levels, provides a thorough analysis of wind patterns that support the benefit of reductions from the east Texas combustion rule. The EPA's guidance acknowledges that reductions from areas up to 200 km outside the nonattainment area can provide air quality benefits for nonattainment areas. The 30 TAC Chapter 117 rules associated with this SIP revision address all major sources and minor sources in the DFW area. On-road sources and non-road sources in the DFW area are also addressed in this SIP. The commission's analysis of the availability of other control measures is documented in Chapter 4 of the adopted SIP.**

XTO stated that several of the counties listed in the proposed east Texas combustion rule are west and north of DFW; consequently, their emissions don't affect the nonattainment status of the DFW area during ozone season when winds are predominantly from the south and southeast.

**The commission performed additional modeling sensitivity analyses to evaluate the benefit of including Bosque, Cooke, Grayson, Hood, Somervell, and Wise Counties in the east Texas combustion rule. These sensitivity analyses indicate that ozone concentrations in the DFW area would be minimally reduced by approximately 0.05 ppb by including these six counties under the east Texas combustion rule. Based on this analysis, the commission agrees that these counties should not be included in the east Texas combustion rule and has revised the applicability of the rule accordingly.**

Speaking for the NTCASC, NCTCOG, and the TERC, Judge Adams, Ellis County, asked the TCEQ to reach outside the nonattainment area in requiring controls on all east Texas combustion engines to help the DFW area make the necessary $NO_X$ reductions. The rule could be applied to reduce more than twice the emissions currently proposed. ETECO expressed support for stronger rules to require significant emissions reductions from controls on compressor engines in the 39 east Texas combustion counties.

**The commission appreciates the support. Regarding the request to apply the east Texas combustion rule to all east Texas counties, the commission's initial sensitivity modeling indicated that applying controls to all gas-fired engines in east Texas would only slightly increase the benefit to the DFW area. This increased benefit was, on average, less than 0.02 ppb ozone reduction beyond that from the 39-county analysis, would not be cost-effective for improving air quality in the DFW area, and would unlikely be implemented prior to the attainment date. Furthermore, expanding the applicability of the rule to other counties would affect new parties, which would not have had the opportunity to review and comment**

**on the final rule.**

The EPA commented that they support the east Texas combustion rule but that the commission should consider a March 1, 2008, compliance deadline from the east Texas engine rule in order to assist the Northeast Texas Early Action Compact Area.

**The commission appreciates the support. The purpose of the east Texas combustion rule associated with this SIP revision is to reduce $NO_X$ emissions from previously unaddressed sources in attainment counties that contribute to ozone in the DFW area. The commission is not using the potential benefits to the Tyler-Longview area as a justification for the east Texas combustion rulemaking. The commission received many comments regarding the large number of rich-burn engines that may require replacement or retrofit, and has determined that it is unreasonable to expect all of the newly regulated sources to install and operate the control strategies by March 1, 2009. The commission has extended the east Texas combustion rule compliance deadline for rich-burn engines to March 1, 2010, in the rule associated with this SIP revision.**

The EPA, BSA, NCTCOG, and the TxDOT commented that the emissions reductions estimated for the east Texas combustion rule are overestimated. The EPA, BSA, NCTCOG, and the TxDOT commented that the initial strategy under consideration indicated a reduction of 40.7 tpd $NO_X$ if applied to 69 counties, while the final proposed rule applies to only 39 counties and achieves 37 tpd reductions. The EPA, BSA, NCTCOG, and the TxDOT stated that the 37 tpd appeared high considering the decreased number of counties and requested that the model be updated to reflect the adjusted reductions due to the proposed rule.

**Initial sensitivity analyses were performed to determine potentially effective control measures for the DFW area and provide direction for the commission. The initial sensitivity analysis for this strategy estimated 40.7 tpd reductions. The 33 counties selected represent a significant percentage of the original reductions from the initial sensitivity analysis since those counties have a high number of gas-fired engines known or expected to be located within them due to a higher concentration of oil and gas industry within those counties. Also, gas-fired engines are not equally distributed across east Texas. Counties with few gas-fired engines and counties where reductions from gas-fired engines would not be expected to benefit the DFW area were excluded from the adopted rule associated with this SIP revision. Section 2.9 of this SIP revision describes the final modeling for the DFW eight-hour ozone attainment demonstration and reflects the final reduction estimates from this control measure.**

## Major Sources and Minor Point Sources (Outside the Nonattainment Area)

NCTCOG asked the TCEQ to clarify the statement in the proposed SIP revision on page 4-21, Section 4.2.6.5, that the requirement for modification of engines be compliant with 40 CFR as an “additional” measure. NCTCOG noted that this is included under the major/minor stationary sources rule as a standard, and it appears this could create an issue of “double-counting.”

**As discussed in Chapter 4 of the SIP revision, reductions associated with the diesel engine emissions standards or the prohibition on diesel and dual-fuel engine operation for testing and maintenance between 6:00 a.m. and noon were not included in the modeling. The lower emissions standards for diesel engines ensure that replacement engines will be newer and cleaner model engines. Delaying operation of diesel and dual-fuel engines (regardless of model year) until after noon will help limit ozone formation in the nonattainment area. Potential reductions from these measures are difficult to quantify, but the commission estimated approximately 0.9 tpd and for WoE purposes. Even though these measures are discussed in Sections 4.2.2.1 and 4.2.2.2, there is no “double counting” of reductions. The**

**reductions associated with the lower emissions standards for dual-fuel engines at major sources are included in the point-source modeling but are not included in the 0.9 tpd estimate in Section 4.2.6.5.**

ETECO supports improved emissions controls on all major sources and minor sources in the DFW area.

**The commission appreciates the support.**

ED stated that the TCEQ continually acknowledges that $NO_X$ reductions outside the DFW area are instrumental for the DFW area to demonstrate attainment of the NAAQS for ozone.

**The commission recognizes that ozone concentrations in the nine-county DFW area can be impacted by emissions from outside the area. The 30 TAC Chapter 117 comprehensive $NO_X$ rulemaking associated with this SIP revision includes emissions controls for cement kilns in Ellis County, combustion sources in 33 east Texas counties, and water heaters, small boilers, and process heaters statewide.**

**Preliminary modeling indicated that HGB-level $NO_X$ emissions specifications applied to electric generating facilities in east and central Texas may result in up to 1 ppb reduction at monitors within the DFW eight-hour nonattainment area. However, these sources have already been addressed as part of Senate Bill 7 ($76^{th}$ Legislature), requiring electric generating facilities in east and central Texas to reduce $NO_X$ emissions by 50 percent from their 1997 levels by the year 2003. Modeling conducted as a part of the development of this SIP revision indicates that $NO_X$ reductions made inside the DFW nine-county region are far more effective toward attaining the ozone standard. The commission therefore determined during proposal that further reductions in emissions from these sources would limit the availability of vendors and control technology for other necessary control measures within the DFW nonattainment area and the required controls could not be implemented by the attainment date. Therefore, additional controls on east and central Texas EGFs are not feasible at this time. Furthermore, expanding the applicability of the rule to other counties would affect new parties, which would not have had the opportunity to review and comment on the final rule.**

XTO conveyed its concern with applying nonattainment rules to sources in attainment areas.

**The engine sources to be controlled beyond the nonattainment area have not been previously regulated for the purposes of attaining the ozone NAAQS. As discussed elsewhere in this preamble, the East Texas Combustion rule only applies to rich-burn engines 240 horsepower (hp) and larger. Based on the revised list of 33 counties considered for this rule, the commission estimates that implementation of this rule will result in an overall reduction of approximately 22.4 tpd in $NO_X$ emissions in the Northeast Texas area by March 1, 2010. The commission estimates that the 22.4 tpd reductions in $NO_X$ emissions in the 33 counties subject to the rule will benefit the Dallas-Fort Worth area by reducing ozone an average of approximately 0.2 parts per billion. This rulemaking applies to engines in the point source inventory, as well as engines that are categorized in the area source inventory.**

## Mobile Sources

### *Emissions from Motor Vehicles*

Judge Adams commented on the importance of TERP, noting that modeling indicates that 73 percent of the emissions in north Texas are from mobile sources and a viable portion come from heavy-duty diesel engines. Judge Whitley commented that he is gratified that Governor Perry proposes to add $183 million to TERP. One individual commented that since mobile source emissions contribute 70 percent of the $NO_X$ emissions and 50 percent VOC emissions in the DFW area, then significant reductions in mobile source emissions will be required to improve the DFW ozone situation. One individual commented that since on-road vehicles are responsible for more $NO_X$ than any other source, aggressive enforcement of the state inspection system, including emissions limits, would help keep high-polluting vehicles off the road. One individual commented that the plan does not effectively address important emissions sources, such as motor vehicles. One individual asked the commission to impose more stringent limits on domestic transportation emissions and commented that requiring sensible reductions from fixed sources such as kilns and generators may allow the DFW area to meet the EPA requirements without much demand on private transportation.

**The commission appreciates the perspectives and support of I/M and TERP programs, and adds the following information about the relative contributions of categories of emissions inventories in the DFW area:**

**Emissions Contributions by Source Category**

| **Source** | **$NO_X$** Tons/day | **VOC** | **$NO_X$** Percent | **VOC** |
|---|---|---|---|---|
| On-road | 184 | 92 | 46.7% | 27.1% |
| Non-road | 107 | 38 | 27.2% | 11.2% |
| Area | 44 | 180 | 11.2% | 52.9% |
| Point | 59 | 30 | 15.0% | 8.8% |
| **Total** | **394** | **340** | **100.0%** | **100.0%** |

**A summary of on-road vehicle types for 1999 is provided in the DFW SIP revision in Appendix B, Emissions Inventory Development, Table 4-5, heavy-duty diesel engines are found in 10 of these 28 vehicle types and accounted for 58.6 percent of the on-road $NO_X$ emissions and 2.6 percent of the on-road VOC emissions. A summary for 2009 can be found in Table 4-6; it shows that heavy-duty diesel vehicles will account for 48.2 percent of the on-road $NO_X$ emissions and 4.1 percent of the on-road VOC emissions.**

**Regarding enforcement of the I/M program, the current safety and emissions testing program has mechanisms in place to prevent fraud and ensure compliance, such as referee challenge facilities, citations, fines, re-registration denial, and covert and overt audits. Enforcement of the program is the responsibility of the Texas Department of Public Safety (DPS), the TxDOT, and the commission. Law enforcement officials are responsible for ensuring that vehicles operating on public roads have a valid registration and safety certificate. In addition, remote sensing is used to identify high-emitting vehicles operating and commuting into an area that have not complied with the program.**

**The analyzers used in the I/M program apply the emissions limits established by the EPA. These limits were uniquely designed and are based on the vehicle characteristics (i.e., model year, make, model name, engine size, number of cylinders, transmission type, and body style) at the time of the annual inspection. The I/M program reduces VOC, which reacts with $NO_X$ to form ground level ozone, CO emissions, which interfere with the oxygen-carrying capacity of the blood, and $NO_X$. The I/M program tests all two - 24 year old gasoline powered vehicles, including trucks and SUVs.**

**Other programs enacted in the SIP to reduce on-road mobile source pollution include fuel-related programs such as Stage II vapor recovery, low-emissions diesel, and low RVP; Transportation Control Measures (TCMs); and the Voluntary Mobile Source Emissions Reduction Program (VMEP). Individual TCMs and the VMEP measures are explained in detail in the appendices to the DFW SIP.**

**The 80th Texas Legislature is considering the appropriation of additional funds, above and beyond those already appropriated through 2007, to TERP. The commission anticipates that additional funds may be appropriated to TERP in FY 2008-2009, commission**

**anticipates that additional funds may be appropriated to TERP in FY 2008-2009, resulting in continued reduction in the significant emissions from the on-road and non-road engines source categories. This funding increase will allow the commission to fund emissions reductions projects above and beyond TERP reductions funded under the one-hour ozone standard that will help the DFW area in attaining the eight-hour ozone standard.**

One individual commented that the TCEQ needs to develop public education programs to encourage drivers to turn off the ignition rather than idling.

**The commission agrees that public education programs raise awareness of environmental issues such as excessive idling and has partnered with local organizations throughout the state to develop programs encouraging pollution prevention and conservation activities, including limiting vehicle idling. Local organizations are more effective in developing these messages because of their involvement in the communities they serve. The commission will continue to participate in public awareness partnerships and activities. The commission made no changes to the SIP in response to this comment.**

One individual commented that emissions limits on trucks based in this state should be imposed. The state should set up a fund to assist small trucking companies in meeting these requirements.

**Emissions standards for vehicle engines are set at the federal level by the EPA. The state has a voluntary incentive program, the Texas Emissions Reduction Plan (TERP), to assist truck and equipment owners to re-power, replace, or otherwise upgrade their vehicle and equipment fleets to help reduce motor vehicle emissions. The commission made no changes to the SIP and rules in response to these comments.**

AECT asked the TCEQ to continue encouraging the EPA to take all appropriate measures to speed up the reduction of $NO_X$ and VOC emissions from on-road and off-road mobile sources. AECT commented that it believes that the primary reason the DFW area does not attain the eight-hour standard is because of the significant amount of $NO_X$ and VOC emissions from on-road and off-road mobile sources in the area. The commission estimates that about 74 percent of $NO_X$ emissions in the 2009 inventory for the DFW area will be from on-road or off-road mobile sources (Executive Summary, proposed revisions to DFW SIP, p. ii). AECT asserted that since federal rules requiring reduced emissions from these sources are implemented, the area will see great reductions in their emissions, even with increases in population and vehicle miles traveled. AECT asked the commission to encourage and support programs and initiatives that will reduce emissions from on-road and off-road mobile sources in the DFW area, even if the resulting reductions cannot be considered in the DFW area SIP for various legal reasons (for example, because the measures are voluntary or the emissions reductions resulting from the measures will be difficult to quantify).

**The commission agrees that on-road and off-road mobile sources contribute $NO_X$ and VOC emissions in the DFW area and that federal emissions standards will reduce emissions in the area. As such, the commission will continue to work with local partners to develop and implement feasible initiatives to reduce $NO_X$ and VOC emissions from these sources. The commission made no changes to the SIP in response to this comment.**

Downwinders state that the TCEQ's argument that overall vehicle $NO_X$ is trending down despite more vehicle miles and population increases does not consider increased $NO_X$ emissions from vehicles using more biodiesel and ethanol-enhanced fuels in the coming years.

**As required in 30 TAC Chapter 114, Subchapter H, Division 2, biodiesel, when blended with diesel fuel, must meet all requirements of Texas low emissions diesel including $NO_X$ reductions. As for ethanol blended fuels, the EPA removed the RFG minimum oxygenate content requirement as required by the 2005 Energy Policy Act, thus allowing refiners to use ethanol or other products instead of Methyl tert-Butyl Ether (MTBE). Even though**

**refiners now have more flexibility in meeting RFG requirements, the RFG emissions performance standard that they must meet remains unchanged. As explained later in this response, the RFG performance standard is being met using ethanol without any increases in $NO_X$ and with slight decreases in both VOC and CO.**

**As required by the EPA, the latest version of the MOBILE6 model (dated September 24, 2003, and available at [http://www.epa.gov/otaq/m6.htm](http://www.epa.gov/otaq/m6.htm)) was used for SIP inventory development. A more complete discussion of the Reformulated Gasoline (RFG) properties included in MOBILE6 can be found in an April 2001 EPA report entitled "Estimating Emissions Effects of RFG Gasoline in MOBILE6", which is available at [http://www.epa.gov/otaq/models/mobile6/m6tech.htm](http://www.epa.gov/otaq/models/mobile6/m6tech.htm).**

**If the latest version of MOBILE6 is run using "default" inputs to compare MTBE versus Ethanol in RFG for 2009 (while holding all other inputs constant), the use of ethanol results in no change in $NO_X$, a 1.09 percent decrease in VOC, and a 4.66 percent decrease in CO. However, it is known that inclusion of ethanol tends to increase the Reid Vapor Pressure (RVP) of gasoline, so a more appropriate comparison would account for these RVP increases. RFG survey data, collected by the EPA in Houston during 2006, indicates an average summer RVP of 6.92 psi with ethanol-blended fuel, as compared with the 6.8-psi "default" RFG input assumed by MOBILE6 when ether, such as MTBE, is used. If the same analysis referenced above is rerun with an ethanol-blend RVP of 6.92, the results are no change in $NO_X$, a 0.16 percent decrease in VOC, and a 4.66 percent decrease in CO. These examples demonstrate that the inclusion of ethanol in RFG results in slight decreases in VOC and no change in $NO_X$.**

## *Local Perspectives*

Judge Whitley commented that progress is being made as new cars run cleaner because of the new technology and the older polluting cars are leaving the area, but the area is increasing its local and regionally-produced ozone.

**The commission agrees that mobile emissions are being reduced through new technology and fleet turnover. The commission also notes that even when the increased number of monitors and annual variations in meteorology are taken into account as shown in Chapter 3 of the SIP narrative, ozone is declining overall. While both local and regional emissions contribute to ozone, it is the local emissions in the nine-county area that have the greatest impact, and reductions of those emissions will have the greatest benefits for air quality in local areas and the region.**

City of Dallas commented that since 1993, Dallas has proactively reduced its on-road emissions through the purchase of over 1,200 natural gas vehicles and 175 hybrids.

**The commission appreciates local initiatives to improve air quality such as the conversion of fleet vehicles and the purchase of hybrid vehicles. The inclusion of an area's vehicle fleet is accounted for in the region's Travel Demand Modeling and associated emissions modeling using the EPA's MOBILE6. The appropriate reduction credits are included in the SIP emissions inventories and projections, as well as mobile source reduction strategies. Regional transportation planners at NCTCOG incorporate these measures in travel demand and emissions modeling.**

City of Dallas commented that Dallas would like to offer the following item as a potential point of discussion with the commission regarding local government initiatives. City of Dallas commented that significant reductions in the off-road inventory could be made with a progressive contractor incentive package to reduce emissions. City of Dallas commented that it recently passed an incentive program based on the TxDOT program, and they understand this program has had limited success in the organizations that have adopted this model. Lastly, the City of Dallas commented that they are willing to coordinate with other interested parties, with the TCEQ's assistance, in developing a contractor program that could be adopted by public and private organizations across Texas.

**The commission appreciates local initiatives and looks forward to incorporating enforceable local measures into future SIP revisions. In June 2006, the EPA issued guidance, "Diesel Retrofits: Quantifying and Using Their Benefits in SIPs and Conformity," which may provide a mechanism to incorporate non-road projects for on-road reductions into future SIP revisions.**

City of Dallas commented that Dallas would like to offer the following item as a potential point of discussion with the commission regarding local government initiatives. City of Dallas commented that they are currently contemplating a variety of changes to Dallas ordinances regarding air quality including a five minute idle rule but has concerns regarding the practicality of enforcement of such a measure.

**The commission has adopted a state rule for locally enforceable heavy-duty vehicle idling restrictions that may be implemented through adoption of local ordinances and a signed memorandum of agreement with the TCEQ. The TCEQ is willing to enter into MOAs with local jurisdictions, including those in the DFW nine-county area. Enforcement should be coordinated at the local level. The commission encourages the City of Dallas to contact other areas in the state that are implementing idling restriction ordinances, such as the City of Austin to learn more about potential enforcement mechanisms. The commission made no changes to the SIP and rules in response to this comment.**

Two individuals commented that the attainment demonstration does not provide sufficient basis for proving that the DFW area will comply with the ozone standard in 2009 because local and state officials are promoting initiatives like the Dallas Inland Port and the Trans-Texas Corridor (TTC) that will increase mobile source emissions in the DFW area. In addition, one of the individuals stated the majority of regional and state funds, in the near-term and long-term, are earmarked for freeway and toll-way projects, instead of rapid transit projects and likely that the TTC will concentrate much of the truck and rail traffic currently shipped by other means or through other points of entry right through the DFW area. A significant fraction of the cargo is likely to be carried by Mexican trucks, which are not subject to U.S. emissions standards. U.S. Courts have already ruled that due to provisions in the NAFTA treaty, environmental concerns cannot keep these trucks out of the U.S.

**Projects and the increased traffic associated with the Inland Port and the Trans-Texas Corridor will not be in place before 2010, and are outside the time period covered by this SIP revision. Therefore, emissions estimates from these activities are not accounted for in this SIP revision. As soon as these projects are funded and moving forward, activity levels and emissions can be estimated and incorporated into the SIP. At the time this SIP revision was proposed, Mexican-domiciled trucks were prohibited from traveling outside the economic zone. Therefore, emissions from potential NAFTA-related increased truck traffic were not included. A future SIP revision could account for these emissions as soon as activity levels can be established or estimated.**

## *Transit*

One individual recommended that the commission reallocate future transportation projects funds so that at least 50 percent of all state-controlled funds in nonattainment areas are spent on rapid transit projects. According to the NCTCOG's Mobility 2025 plan, the transportation spending planned between now and 2025 is $12.4 billion and prioritizes freeway and toll-way projects. It was asserted that any long-term solution must include a re-prioritization away from automobile friendly to transit friendly options. One individual stated that mass transit must be improved, and that Dallas is not friendly to people without cars.

**All of the area transit system improvements that can be in place and operational by the timeframe covered by this SIP are accounted for in this SIP revision. The emissions reductions associated with future transit improvements will be incorporated into future SIP revisions.**

**Congress provides funding to state departments of transportation for such programs through its Congestion Mitigation and Air Quality Improvement Program (CMAQ). CMAQ funds are allocated to states based on a formula that considers the severity of air quality problems and the size of affected populations. The TxDOT allocates CMAQ funds to the state's nonattainment and maintenance areas, including the DFW area, following this federal formula. The Metropolitan Planning Organizations (MPO) in these areas issue a "call for projects" to local areas in its jurisdiction. In the DFW area the MPO is at the NCTCOG. The MPO and the TxDOT district staff rank the projects based on criteria set by the area's transportation policy board. Scored projects are approved by technical and project selection subcommittees. The area's transportation policy board reviews and votes on the recommendations of the subcommittees.**

## *Vehicle Emissions Standards*

Three individuals stated that the SIP should require more stringent measures for reducing emissions from mobile sources, including statewide California Emissions Standards for mobile sources. One of the individuals quoted information from the NCTCOG, which noted that motor vehicles account for 51 percent of the nitrogen oxide; it was stated that Texas should adopt controls similar to those in California. Representative Burnam and two individuals noted that the plan does not include stricter auto emissions standards. One individual commented that more stringent limits on domestic transportation emissions should be imposed.

**The commission appreciates these perspectives and notes that the SIP emissions inventories for DFW indicate 48.8 percent of 2009 $NO_X$ emissions and 21.2 percent of 2009 VOC emissions are from on-road mobile sources of pollution. However, the state's vehicle inspection/maintenance (I/M) program applies and accounts for the federal motor vehicle emissions standards. The commission has implemented the I/M program, which requires vehicles to meet emissions standards prescribed for each model. To be issued a safety certificate, vehicles registered in the program area must comply with the safety and emissions testing program. The analyzers used for the emissions test are designed to apply the federal motor vehicle emissions limits uniquely designed for each vehicle. Those limits are selected based on vehicle characteristics (e.g., model year, make, model name, engine size, number of cylinders, transmission type, and body style). In fiscal years 2005-2006, close to 95 percent of the 13.1 million vehicles tested in Texas met or exceeded the federally mandated manufacturers' emissions standards and passed an emissions test. Of the 5 percent that failed, nearly three-quarters passed a subsequent retest after repairs were made. The remaining failing vehicles were denied renewal of their vehicle registration. As such, the current I/M program is meeting programmatic goals for effectiveness.**

**The 80th Texas Legislature is considering legislation to revise the Texas Health and Safety Code to establish a low-emissions vehicle program that is consistent with Phase II of the California Low-Emissions Vehicle Program (Cal LEV II). This legislation would require the commission to adopt and revise rules as necessary to implement the revised statute and maintain consistency with the Cal LEV II program. The commission will proceed as directed by the Legislature on this issue. The commission has analyzed the potential benefits of adopting Cal LEV II regulations. The commission estimates that adopting the Cal LEV II emissions standards would result in a reduction of 0.114 $NO_X$ tpd and 0.115 VOC tpd in the nine-county DFW area in 2010.**

## *Non-Road Sources*

The EPA commented that they support the Texas Low Emissions Diesel (TxLED) Program initiative in the SIP. Reductions of $NO_X$ emissions from locomotive switcher engines in the DFW nonattainment area using TxLED were not included in the modeling, but will assist in the area in reducing ground level ozone. The EPA requested that the TCEQ provide estimated emissions reductions for this measure.

**The commission appreciates the support for the TxLED control measures. Locomotive switcher emissions reductions from the use of TxLED were not modeled because estimates were not available prior to proposal. Based on recent data, $NO_X$ reductions from locomotive switcher emissions reductions are estimated to be somewhat less than 1 tpd. The adopted SIP modeling was revised to account for these non-road TxLED reductions.**

An individual commented that lawnmowers, leaf blowers, and off-road vehicles contribute to air pollution and should be controlled.

**The commission estimates emissions from non-road mobile sources, such as lawn and garden equipment and off-road recreational vehicles using the EPA's NONROAD model. The NONROAD model is the EPA-approved tool used to account for emissions reductions attributed to federal engine standards for non-road mobile sources. As older equipment is replaced by newer equipment with cleaner engines resulting from the new federal standards, the impact of these emissions reductions will be greater. Of course, emissions reductions from the increase of cleaner engines will be affected by the potential increase in the total number of equipment because of increases in the numbers people moving into areas. Most non-commercial lawn and garden equipment have equivalents that operate on electricity, both cord and cordless. The north Central Texas Council of Governments has considered implementing lawn and garden incentive programs in the past, and such programs may be implemented in the future on a voluntary basis. However, the commission notes that the DFW area is $NO_X$-limited and this SIP revision is a $NO_X$ reduction plan, and lawn and garden equipment emissions are VOC-heavy.**

BNSF Railway requested removal of a reference in Table 4-1 to the NCTCOG's VMEP program, or if it is not removed explain how it will be addressed administratively.

**No benefits have been taken for this measure. NCTCOG submitted revised VMEP commitments to the commission and the commission has adjusted the SIP accordingly (see Table 4-5).**

American Airlines, Incorporated, and Southwest Airlines Company request that the "Aviation Efficiencies" section, including the associated $NO_X$ and VOC emissions reduction estimates, be omitted from the SIP revision because it is unnecessary. Appendix H of the proposed SIP identifies American and Southwest as "Program Participants." However, neither American nor Southwest agreed to such participation, nor do they agree with the estimated emissions reductions calculated by the commission and represented in Appendix H and Table 4-7 (of the proposed SIP). It also envisions untenable Memorandums of Agreement that would impact the safety and efficiency of airline operations. The airlines commented they are working to further minimize emissions voluntarily.

**The commission appreciates these comments. In letters dated February 18, 2007, the NCTCOG committed to work with the airlines to reduce these emissions or provide equivalent emissions reductions through other measures. Attachments 1 and 2 of Appendix H of the adopted SIP revision include discussions of NCTCOG's commitments to address any shortfall from airlines estimated voluntary reductions.**

## *TERP*

The EPA fully supports continuing the TERP program, which has been cost effective in reducing $NO_X$ from mobile sources. The EPA remarks that full funding by the Texas Legislature would ensure that maximum benefits from the program are realized. Judge Whitley is gratified that Governor Perry proposes to add $183 million to TERP. AECT stated that the TERP program has resulted in significant emissions reductions from on-road and off-road sources. AECT supports additional legislative funding of the TERP and believes that the program will continue to significantly reduce emissions. The EPA also commented that if the TERP program is extended beyond 2008 and incorporated into the State plan, the program could reduce ozone-forming emissions from mobile sources in the DFW nonattainment area by as much as an additional 35 percent over what is expected from the current program.

**The commission appreciates the support for TERP and will continue to implement TERP at whatever level of funding is provided by the legislature. The 80th Texas Legislature is considering the appropriation of additional funds, above and beyond those already appropriated through 2007, to TERP. The commission anticipates that additional funds may be appropriated to TERP in FY 2008-2009, resulting in continued reduction in the significant emissions from the on-road and non-road engines source categories. The commission agrees that additional benefits can be derived from extension of the TERP program beyond 2007 commitments. The commission cannot say with certainty that additional TERP funding would result in an additional 35 percent emissions reduction. Additional analysis will need to be performed depending on legislative action. The commission will proceed as directed by the Legislature on this issue.**

NCTCOG requested that the TCEQ amend language in Chapter 4, Section 4.2.5.2, page 4-10 of the proposed DFW SIP in the sentence beginning “Future TERP Funds,” to clarify that any emissions reductions gained from future TERP activities will be used to bridge the gap between the 16.3 tpd reduction due to local strategies that the TCEQ used for modeling and the proposed NCTCOG local strategy reductions of 4.16 tpd.

**The 80th Texas Legislature is considering the appropriation of additional funds, above and beyond those already appropriated through 2007, to TERP. The commission anticipates that additional funds may be appropriated to TERP in FY 2008-2009, resulting in continued reduction in the significant emissions from the on-road and non-road engines source categories. The commission will proceed as directed by the Legislature on this issue. Because the appropriation of additional funds to TERP is not yet decided, and the amount is not known, the commission is not able to make definitive statements about the amount of emissions that will be reduced through use of any extra funds and where those reductions will occur.**

## *LIRAP and I/M*

The EPA commented that providing additional support for low-income vehicle owners to meet tail-pipe emissions and inspection standards will have a significant benefit for the area.

**The 80th Texas Legislature is considering legislation to revise the Texas Health and Safety Code to enhance the Low Income Repair, Retrofit, and Accelerated Vehicle Retirement Program (LIRAP) that provides financial assistance to eligible vehicle owners for repair or replacement of vehicles. This program provides assistance for citizens whose vehicle has failed the annual emissions test who may currently receive up to $1,000 towards the purchase of a replacement vehicle. The commission will proceed as directed by the Legislature on this issue.**

One individual commented that the commission should consider a vehicle buyback program to induce owners of old polluting vehicles to turn them in to the state.

**The DFW area, the Houston-Galveston-Brazoria (HGB) area, and the Austin area (Travis and Williamson Counties) implemented the Low Income Vehicle Repair Assistance, Retrofit and Accelerated Vehicle Retirement Program (LIRAP), commonly known as the AirCheck Texas Repair and Replacement Assistance Program. This program provides assistance for citizens whose vehicle has failed the annual emissions test who may currently receive up to $1,000 towards the purchase of a replacement vehicle. The 80th Texas Legislature is considering legislation to revise the Texas Health and Safety Code to enhance the Low Income Repair, Retrofit, and Accelerated Vehicle Retirement Program (LIRAP) that provides financial assistance to eligible vehicle owners for repair or replacement of vehicles. This program provides assistance for citizens whose vehicle has failed the annual emissions test who may receive up to $1,000 towards the purchase of a replacement vehicle. The commission will proceed as directed by the Legislature on this issue.**

An individual recommended that the LIRAP be publicized more aggressively than it has been in the past.

**The commission and local program administrators have used a variety of outreach initiatives such as public service announcements, newspaper advertisements, radio advertisements, brochures, newspaper inserts, mail inserts, individual door hangers, and billboards on major thoroughfares to publicize that financial assistance is available to vehicle owners meeting eligibility requirements. Participating counties and program administrators continue to research and implement new methods for improving outreach and participation in the program.**

One individual commented that school buses are not tested under the vehicle inspection and maintenance (I/M) program or required to have smog controls. One individual requested that the state implement a maintenance program to test all diesel vehicles in north central Texas.

**The 80th Texas Legislature is considering legislation to fund the Clean School Bus Program. The commission included a recommendation for funding this program in its FY08-09 budget submission to the legislature. The TCEQ is ready to implement this program at whatever level of funding the legislature may provide.**

**The I/M program tests all two - 24 year old gasoline powered vehicles, including school buses. Currently, diesel powered school buses are exempt from testing. As diesel emissions testing equipment technology continues to improve, the commission will evaluate the best possible testing methodologies and equipment for consideration in future program and SIP development. The SIP does include a low-emissions diesel fuel program (TxLED) to reduce emissions from diesel engines.**

Environmental System Products (ESP) commented that the TCEQ should consider the addition of low pressure evaporative testing for pre-1995 passenger vehicles as a control strategy in the DFW and HGB SIPs. ESP stated that the California Air Resource Board plans to claim a savings of 14 tpd of VOC. ESP commented that through extrapolating the real world experience of California to areas of Texas where vehicle testing is performed, more than 5 tpd of VOC would be saved.

The low-pressure evaporative tester is a stand-alone device made by ESP and Waekon, and costs around $3,000 to purchase and $100 annually to maintain. Estimated average repair costs will run about $161 per vehicle and result in the repaired vehicle saving 24 gallons of fuel per year. The repairs are durable and expected to last at least five years. ESP further stated that this would not materially increase the AirCheck Texas inspection costs.

**Preliminary MOBILE6.2 modeling indicates VOC reductions in 2009 using an evaporative tester to be an estimated .68 tpd in the HGB area and .41 tpd in 2012 with similar results in DFW. With each passing year, 1995 and older vehicles become a less significant portion of the overall vehicle miles traveled, and the VOC emissions reductions also diminish. The**

**California Air Resource Board's report dated November 29, 2005, on implementing a low-pressure evaporative test indicated it would increase the inspection cost by $7.50 to cover program costs. The increase in the cost per test with a diminishing fleet of 1995 and older vehicles does not make this a cost effective strategy. The commission made no changes in response to these comments.**

## *Motor Vehicle Emissions Budget (MVEB), Conformity, VMEP, and TCMs*

Representative Burnam expressed concern about the potential loss of federal highway funds if the SIP does not demonstrate attainment, as happened in Atlanta, Georgia. He indicated north Texas could be on the same path.

**The DFW SIP revision demonstrates attainment of the eight-hour ozone standard. The commission works closely with the region's transportation planners, the TxDOT, the Federal Highway Administration (FHWA), and the EPA to avoid federal highway sanctions and associated transportation conformity lapses in the DFW area. The agencies meet regarding technical and policy issues through regularly scheduled meetings and conference calls, and ad-hoc meetings and conference calls as needed. To date, the NCTCOG has achieved a near perfect record on conformity to the SIP.**

NCTCOG requested that the TCEQ place more attention on VOC emissions, since VOC MVEBs are included in the SIP proposal and will be used in the corresponding conformity analysis.

**The commission appreciates this comment, and will work with the NCTCOG and interagency consultation partners to discuss and identify on-road mobile strategies to appropriately address VOC emissions. Discussions can take place at the monthly SIP Workgroup, the quarterly Technical Work Group, and through ad hoc consultation.**

NCTCOG commented that the SIP proposal should document VOC reductions due to control strategies and add a discussion of how the MVEB for VOC of 91.33 tpd has been developed.

**The commission appreciates this comment. Development of both the $NO_X$ and VOC figures for the 2009 attainment demonstration MVEB is summarized in Table 4-26 of Appendix B: Emissions Inventory Development. A detailed narrative of all of the $NO_X$, VOC, and CO adjustments made to the 2009 on-road mobile source emissions inventory is contained in Section 4.0 of Appendix B.**

The EPA noted that numerals in Table 4-12 should be repositioned.

**The commission appreciates this comment and has repositioned numerals 3 and 4 under table 4-12 to align with the beginning of the third and fourth comments.**

The EPA commented that there are some discrepancies in dates cited within the SIP that require resolution. The proposed schedule in the "Memo to the TCEQ" indicates that controls must be in place by May 31, 2009, yet the TCMs discussed in this SIP are identified as being implemented by July 2009, and the $NO_X$ rules (Rule Project Number 2006-034-117-EN) have a compliance deadline of March 1, 2009. Per 40 CFR § 51.908(d), Texas must provide for implementation of all control measures needed for attainment no later than the beginning of the attainment-year ozone season. The DFW ozone season starts March 1$^{st}$, as defined in 40 CFR Par 58 Appendix D.

**The commission appreciates this comment. NCTCOG has committed to implementing all TCMs by the beginning of the 2009 ozone season; therefore, all references to "July 2009" in Section 4.2.3 of the SIP, including Table 4-4, were amended to read "March 2009."**

The EPA commented that they support the inclusion of TCMs in this SIP revision and appreciate the efforts of the TCEQ to organize the applicable TCMs into separate groups relating to implementation status and project life. This organizational concept came out of intensive efforts of the NCTCOG and stakeholders to identify a more "user-friendly" means of tracking the status of TCMs. The EPA commented that the tabular listing of TCMs provided will benefit the transportation conformity process by making it easy to identify the applicable TCMs and will increase the ability of interested citizens to track the implementation schedule of TCMs.

**The commission appreciates the support for the TCM project list that was provided by the NCTCOG and agrees that the format agreed to by the interagency partners will be beneficial in tracking implementation of TCMs.**

The EPA commented that they support the use of the VMEP in the SIP. The EPA requested the TCEQ to make available the methods used to calculate the projected emissions reductions from each of the measures listed in Table 4-7. The EPA requested that the TCEQ provide a detailed description of each of the VMEP measures, including how the TCEQ plans to monitor the actual emissions reductions.

**The commission has provided information in Attachment 3 of Appendix H of the adopted SIP explaining how the emissions reduction from each VMEP measure was calculated. In general, NCTCOG followed the methods provided for in the "Texas Guide to Accepted Mobile Source Emissions Reduction Strategies," a manual of reduction calculations that was agreed to by Texas interagency consultation partners. The commission will rely on the established interagency consultation process set forth in the state's transportation conformity rule, 30 TAC § 114.260 to monitor actual emissions reductions. This process includes monthly SIP workgroup meetings, quarterly technical work group meetings, and conformity consultation conference calls.**

The EPA, BSA, and the TxDOT commented that the model results for the future year attainment strategy with controls includes $NO_X$ emissions reductions from initial estimates from VMEP were 16.3 tpd from on-road and off-road sources. These values were included in the modeling, but more recent estimates are only 2.63 tpd of $NO_X$ reductions. This discrepancy results in an overestimation of emissions reductions of 17.57 tpd of $NO_X$ in the proposed control strategy modeling. Future attainment demonstration modeling in the final SIP will need to have parity between emissions reductions estimated by rules and the final control strategy modeling demonstration.

**The emissions reductions initially modeled for the SIP proposal were based on preliminary estimates by the NCTCOG as communicated to the commission. NCTCOG consulted with local project sponsors and identified funding for projects. For conformity purposes, the NCTCOG subsequently removed 5.42 tpd to be used to meet commitments for Texas Emissions Reduction Measures (TERMS) instead of for TCM or VMEP commitments. The commission updated the photochemical modeling as described in Section 2.9 to reflect the final commitment communicated by the NCTCOG, as described further in Appendix H, and in Attachment 3 of Appendix H of the adopted SIP.**

The EPA commented that the proposed SIP incorrectly states on pages 4-10 "VMEP strategies are limited to nine percent or less of the total emissions reductions required," since VMEP strategies are limited to three percent or less of the total emissions reductions required for each pollutant.

**The commission appreciates this comment and has corrected the SIP to state that VMEP strategies are limited to three percent or less of the total emissions reductions required for each pollutant.**

The EPA stated that the proposed SIP revision estimates that VMEP will reduce $NO_X$ emissions by 2.63 tpd and VOC emissions by .061 tpd. After the emissions reductions for all control measures for this attainment demonstration have been calculated, the EPA requested that the TCEQ show how the projected $NO_X$ and VOC emissions reductions from VMEP fit within the three percent cap on VMEP allowable credits.

**An October 24, 1997 EPA memorandum entitled Guidance on Incorporating Voluntary Mobile Source Emission Reduction Programs (VMEPs) in State Implementation Plans (SIPs) establishes a cap on the maximum amount of allowable credit. This memo states that the VMEP cap is 3% of the required reductions to reach attainment. The required reductions are the difference between the future year uncontrolled or "baseline" inventory and controlled or "attainment" inventory. The table below summarizes the differences by emission source categories between the baseline and attainment inventories.**

| ***9-County*** | ***2009 $NO_X$ Emissions (tpd)*** | | |
|---|---|---|---|
| ***Dallas/Fort Worth Area*** | ***Baseline*** | ***Attainment*** | ***Difference*** |
| ***Area*** | **49.52** | **41.00** | **8.52** |
| ***Non-Road*** | **127.91** | **105.00** | **22.91** |
| ***On-Road*** | **221.36** | **186.63** | **34.73** |
| ***Point*** | **91.20** | **40.00** | **51.20** |
| ***Total*** | **489.99** | **372.63** | **117.36** |

**The VMEP cap can be established as 3% of the 117.36 $NO_X$ tpd difference, or 3.52 $NO_X$ tpd. The adopted SIP revision VMEP commitment is 2.63 tpd, which is less than the 3.52 tpd $NO_X$.**

The TxDOT requested that the emissions reductions associated with VMEP and TCM commitments be consistent with the most recent data provided by the NCTCOG and that the related adjustments to the MVEB are closely coordinated with the NCTCOG. The TxDOT stated that 12.14 tpd of difference has not been coordinated with nor approved by local governments and if enacted could result in a transportation conformity lapse impacting about $640 million in transportation projects for fiscal year 2009. The TxDOT indicates data associated with the MVEB are not consistent throughout the SIP proposal, in particular the introduction and Chapter 4, and are not consistent with data provided by the NCTCOG.

NCTCOG commented that the TCEQ has incorrectly identified the tpd of $NO_X$ reductions credited to the NCTCOG local strategies and that the correct numbers should be 1.53 tpd for TCMs and 2.63 tpd for VMEP. NCTCOG states that because the commission included 1.27 tpd of TCM and 0.43 tpd of VMEP in the 2009 emissions inventory, the TCEQ should ensure that only 0.26 tpd of TCM and 2.2 tpd of VMEP reductions have been subtracted from the photochemical modeling results. NCTCOG commented that adjustment of these numbers will affect tables and/or references to NCTCOG local strategies throughout the introduction and Chapter 4 and on page 2-38. NCTCOG commented that the TCEQ should clarify information in Table 4-1 to explain how the 3.9 tpd were calculated; and if this number is the sum of one-hour and eight-hour ozone VMEP commitments, the table is incorrect, because calculations of reductions from VMEP have been updated. NCTCOG stated further that if the 3.9 tpd estimate in Table 4-1 has been used in photochemical modeling or in creation of the MVEB, the TCEQ should review and revise the model and the MVEB.

NCTCOG stated that it must be involved in any decisions or changes made to the MVEB because the changes will impact planning and implementation of local strategies and the outcome of future conformity decisions. NCTCOG is concerned about this issue because the commission mentions that the SIP proposal is based on early estimates of reductions from NCTCOG strategies, and it appears that these early estimates may have been used in the MVEB (Appendix B, Table 4-20, proposed SIP). NCTCOG requested that the TCEQ correct the repeated references to 16.3 tpd $NO_X$ reductions as NCTCOG's initial VMEP estimate, as that figure was never the NCTCOG's estimate of VMEP strategies but rather was the total of all potential controls listed in its Control Strategy Catalogue, which also included VMEP and other on-road controls. NCTCOG noted that the reference is included in footnotes throughout the document and in the discussion of MVEB on page 4-36 in section 4.7 of the proposed SIP.

NCTCOG requested that the commission update several references in the draft SIP proposal, primarily in Chapter 4 of the SIP, to the NCTCOG's one-hour attainment demonstration VMEP as the latter document was recently revised, and the SIP proposal should be updated to reflect those revisions. In particular, NTCCOG noted that the TCEQ should update Tables 4-1 and 4-3 in its document as they reference some existing voluntary programs that were planned but did not move forward locally.

**The commission appreciates the comments and has adjusted the SIP accordingly. The commission's adopted package was closely coordinated with the NCTCOG by way of conference calls, regularly scheduled technical and stakeholder meetings, and written communications with NCTCOG. The commission has corrected the TCM commitment and associated emissions reduction, replaced the VMEP with a revised version submitted to TCEQ by NCTCOG in March, 2007, revised the MVEB, and adjusted the modeling to account for all corrections made.**

The TxDOT noted that in several places throughout the SIP revision, the TCEQ acknowledges that the most accurate VMEP and TCM $NO_X$ reductions were not used in the modeled control strategy sensitivity run and that an additional 12.14 tpd of $NO_X$ were incorrectly modeled as local control measures.

**The commission appreciates the comment. Modeling was based upon the best available data at the time modeling was conducted. The discrepancies between the model and proposed controls were identified in the proposal and a commitment to revise the modeling was documented. Since that time, reanalysis of the commission rules and NCTCOG commitments have shown several other areas that needed to be changed, and revised modeling has been conducted as part of the adopted SIP revision. The new model runs made several corrections including changes in the NCTCOG local control measures. Revised VMEP and TCM commitments were modeled for the adopted SIP to more accurately represent estimated $NO_X$ reductions.**

An individual commented that while the SIP documentation shows that the commission expects on-road mobile source $NO_X$ emissions to decrease from 430 tpd in 1999 to 174 tpd in 2009 in the area is unlikely. Problems were citied with the MOBILE6 model that may contradict recent data about the mean age of vehicles.

**The commission appreciates the concern regarding the MOBILE6 model. The 2009 on-road inventory does not rely on MOBILE6.2 default assumptions for the age distribution inputs. Instead, at the time the 2009 on-road inventory was developed by NCTCOG, the latest available "snapshot" of the TxDOT vehicle registration database was from July 2005. Therefore, the assumption was made that the 2009 on-road DFW fleet will have the same age distribution as the 2005 fleet. This conforms to the EPA's guidance and is the optimal approach because it uses the latest available information for estimating future emissions levels.**

**The EPA's MOBILE 6.2 emissions model contains default age distribution profiles for a total of sixteen non-fuel specific vehicle types. These default data are based on a July 1996 "snapshot" of the nationwide fleet. In section 3.1 of the EPA's MOBILE 6.2 guidance document, the EPA recommends and encourages states to develop local age distributions. When developing the DFW on-road emissions inventories for both 1999 and 2009, NCTCOG and the TCEQ elected to use local age distributions through use of the REG**

**DIST command in MOBILE6.2.**

NCTCOG requested clarification on Tables ExSum-1 and ExSum-2, stating it is difficult to determine if the strategies shown in Table ExSum-1 are supposed to add up to equal the difference in the 1999 Baseline Emissions and the 2009 Future Year Control Inventory. The TxDOT and NCTCOG stated the title of table ExSum-2, "DFW Modeled $NO_X$ Reduction Estimates" suggests that the numbers are emissions reductions, but the column heading seem to identify the numbers as emissions inventory estimates. The on-road mobile sources future year base is different from the future year control inventory. The NCTCOG requested an explanation of what additional control measures account for the difference in the on-road mobile inventory, which is 184 tpd for a 2009 future base versus 174 tpd for a 2009 future control. The TxDOT also requests that the TCEQ explain which local control measures are included in the 2009 future year control inventory.

**The commission appreciates the comment. Table ExSum-1 is correctly labeled; it identifies the $NO_X$ reductions proposed in the SIP to bring the DFW area into attainment. Table ExSum-2 should be titled "DFW Baseline, Future Base and Control Case $NO_X$ Emissions," and it has been corrected in the SIP revision. The 10 tpd difference in mobile source emissions came from the original NCTCOG estimates to reduce on-road emissions versus its final commitment.**

**The data in Table ExSum-2 reflects the emissions used in the pre-proposal modeling for each of the emissions categories. The control measures proposed by NCTCOG had two components: reductions to non-road sources and reductions to on-road mobile sources. Only 10 tons of the proposed controls affected the mobile component.**

## MODELING

## General Technical Comments/Documentation

The EPA commented that state computer modeling analyses show uncertainty about attaining the air quality standard at two reference monitoring sites. However, other evidence presented by the State, which cannot be technically modeled, may support attainment of the eight-hour standard at these locations.

**As described in Section 2.9, the final photochemical modeling predicts ozone concentrations at four monitors that are 85 ppb or greater. Additional sensitivity analysis for June 15, 2010, predicts only two monitors exceeding the standard, at 87.56 ppb and 87.43 ppb. Photochemical modeling combined with the enhanced WoE, which includes corroborative analysis and additional control measure not in the photochemical modeling, demonstrates attainment of the eight-hour ozone NAAQS by June 15, 2010. The commission appreciates the EPA's acknowledgement that other corroborative evidence may be used for an area's attainment demonstration.**

The EPA commented that they worked with the TCEQ in the development of the DFW SIP modeling. They acknowledged meetings in 2005 between the EPA Region VI Office of Air Quality Planning and Standards (OAQPS), and the commission to discuss episode and initial base case model performance. They further acknowledged the letter submitted by the EPA Region VI to the TCEQ agreeing with the choice of episode selected as representative of the conditions most often associated with high eight-hour ozone concentrations in the DFW area. Finally, the EPA acknowledged the commission has shared evaluations of other episodes and could use the information to corroborate the episode chosen.

**The commission appreciates the EPA's cooperation and participation in the technical development and modeling decisions associated with the attainment demonstration. The**

**commission presented a comparison of the results of the DFW core modeling (August 13-22, 1999) with the results of an episode extension (August 23-September 1, 1999) and the TexAQS 2000 episode to both the EPA and NCTCOG. The comparison did not add any new information, but corroborated the directional guidance gained from the core modeling period. Since the model performance for these two episodes was erratic and did not add any new information, further work to develop the additional episodes to a SIP quality level was not warranted. Similarly, since the work at that time was based on older inventories and a 2010 attainment date, they were not discussed in the 2009 attainment demonstration.**

The EPA commented that it would have been helpful to include a discussion of the modeling conducted with the older DFW episodes (1995 and/or 1996), the TexAQS 2000 episode and the extended episode (August 23- September 1, 1999), the results of the modeling, and across-the-board $NO_X$ reductions in comparison to the DFW episode to support the appropriateness of the chosen episode and the estimated levels of reductions needed. The EPA commented that they would like to see further documentation on what emissions rates were modeled for each EGU in Texas (attainment and nonattainment areas). They recommended the inclusion of a spreadsheet in the appendices to include the emissions rates for each unit in the 2009 emissions inventory and also the emissions rate for each unit included in the base case/baseline inventory. The EPA also commented that in addition to the statistics and time series, a more detailed and comprehensive model performance evaluation analysis (similar to materials provided to the EPA in February-April 2005) should be included in the SIP.

**The commission carefully weighs both the added value of additional documentation with the added volume of additional documentation, as it develops the modeling procedures and results. The 1995-1996 episode modeling was designed to demonstrate attainment of the one-hour standard. Although the emissions reductions implemented in the previous DFW SIP revisions have assisted in reducing eight-hour ozone concentrations, the previous SIP revision is not relevant to the eight-hour ozone attainment demonstration. The EPA's suggested increase in documentation would be enormous, given the number of EGUs in the state, the number of days in the episode, and the amount of hourly Acid Rain data that was used for the EGUs in Texas. The data is summarized in tables of Appendix B: Emissions Inventory (EI) Development separated by areas of the state, by EGUs and non-EGUs, by hourly emissions and daily emissions. Quality baseline modeling instills confidence in the validity of the future case and conclusions. As the EPA observes, the statistics, time series and results of these improvements have been briefed to both the EPA and NCTCOG, and the work for previous SIP revisions has since been superseded. Including this extensive body of data would not change the final results; it would simply lengthen the modeling chapter. The commission always makes actual data files available to the public and will make them available to the EPA.**

The EPA commented that it is unclear from the modeling chapter if Plume-In-Grid (PiG) was used for sources outside the 4 km domain. The EPA asked for clarification if PiG was used in the 12 km domain.

**The commission inadvertently omitted data in Appendix B on the location and number of sources treated as plumes in the modeling work. The commission has added this information to the Appendix to clarify that point sources inside of Texas were treated as separate plumes if they emitted at least 2 tons per day (tpd) of $NO_X$. Outside of Texas, a point source was treated as a plume if it emitted more than 25 tpd of $NO_X$. Co-located points (i.e., same facility, different stacks) were treated as separate points. A total of 96 points were treated this way, of which 70 were in Texas.**

The EPA commented on Section 2.7 of the SIP regarding Relative Reduction Factor (RRF) calculations and future Design Values (DVs). The EPA commented that while an alternate technique is acceptable as a calculation method, the EPA method for calculating RRFs should also be used and included in the SIP. The EPA also noted that both the base case and future level ozone values should be reported in the SIP.

**The commission followed the EPA's guidance in doing the calculations and has shown that the EPA method and the Texas method are essentially equivalent in Figure 2-17 of the SIP. The EPA's guidance (EPA-454/R-05-002) states on page 29-30, "there are various other ways to use modeling results. . ." and on the next page "use of the same modeling attainment demonstration but with future design values that are calculated in an alternative manner…" Since alternative techniques are acceptable, the commission does not agree that the EPA's method should be included. Further, calculations of the baseline design values were done using the EPA's guidance and are included in Table 2-3. Table 2-5 also includes baseline design values along with future case design values.**

The EPA commented that an explanation that the banked emissions credits and discrete emissions credits in the DFW area have been accounted for in the photochemical modeling is needed.

**All of the details for the emissions inventory development are provided in Appendix B: Emissions Inventory (EI) Development. The "bank" refers to all of the certified and creditable ERCs (Emissions Reduction Credits) and DERCs (Discrete Emissions Reduction Credits) available in the bank. These "credits" are applied to the non-electric generating units (NEGUs) in the nonattainment areas of the state in which they were generated as future growth for 2009. More details on this procedure are provided in Appendix B: Emissions Inventory (EI) Development. Please also see Section 2.3, with the emissions summaries (amount of banked credits added) provided in Tables 2-6 and 2-7 of Appendix B.**

BSA commented that in its review of the SIP proposal the TCEQ states that background ozone is a huge problem and that the major source of the background ozone is point sources.

**The commission disagrees with the commenter. Background concentrations are the sum of all emissions coming into an area. Since much of the background is carried in from sources outside of Texas, background is largely uncontrollable. Point sources inside of Texas also contribute to ozone, but so do cars, trucks, tractors, and emissions from the other urban areas in Texas. Finally, modeling studies consistently indicate that the largest and most controllable portion of the ozone (especially for the monitors with the highest readings) comes from local sources.**

BSA commented that the average background ozone contribution is a large part of the maximum eight-hour ozone, while the local ozone contribution is much less of the total. And, while emissions in the DFW area are dominated by on-road mobile sources, other sources contribute to the largest amount outside the DFW area.

**Background ozone is the sum of emissions from all sources outside of the area. Since much of the background is transported from outside of Texas, background is largely uncontrollable. Recent APCA modeling indicates that on average, 35.3 percent of the ozone in the DFW area is the direct result of DFW local sources, and the largest single component comes from mobile sources. Modeling also indicates that (depending on the distances involved) local controls are as much as four times as effective as controls on distant sources.**

BSA commented that it did not understand Table 4-1 in the SIP and that it does not give a snapshot of when the control measures were originally proposed and adopted.

**The commission appreciates this comment. Table 4-1 of the proposed SIP has been removed to avoid confusion. The most significant existing DFW SIP $NO_X$ control strategies are listed in Chapter 4, which directs the reader to previous SIP revisions for additional detailed information.**

Downwinders and one individual questioned the modeling procedures and data used in the modeling. The individual specifically commented that the commission failed to model a number of different ozone episodes or an entire ozone episode. Another individual commented that the TCEQ should develop meteorological and photochemical models based on the entire ozone season.

**The commission followed the EPA's modeling guidance and has documentation from the EPA acknowledging acceptability of the episode. The commission prefers to select representative episodes with complete synoptic cycles and to validate the detailed fine grid performance against local data to ensure city specific results. For Texas, developing focused local episodes provides more representative data than would be available from a large statistical sample of various episodes or an entire ozone season. Numerous DFW ozone episodes have been modeled (1995, 1996, 1999, 2000, and 2002). Since they have all given consistent results and directional guidance, they corroborate each other. However, only the most recent episode can reflect the current emissions and control requirements. The 1999 ozone episode (August 13-22, 1999) represents typical ozone-conducive conditions and a complete synoptic cycle. It includes nine consecutive days with ozone over the 85 ppb standard, each with slightly different meteorology, wind speed and direction. The period starts with low ozone, includes several days with increasing ozone followed by a peak, and then ends when the ozone returns to normal levels. The EPA Region VI reviewed the episode and submitted a letter to the commission (dated June 2, 2005) indicating that they agreed with the episode selection as representative of the conditions most often associated with high eight-hour ozone in the DFW area. The EPA concurs with the approach that the commission has taken.**

An individual commented that the attainment demonstration does not provide sufficient basis for believing the DFW area will attain by 2009 for the following reasons: the model has a negative bias and will likely underestimate future ozone concentrations; the modeling lost much of its utility outside the August 13-22, 1999, modeling episode by the repeated cycles of performance evaluations and model adjustments; and the model failed when its performance was evaluated during two periods outside August 13-22, 1999.

**The commission agrees that the model has a small residual negative bias. However, the commission disagrees that the model underestimates future ozone concentrations in a manner that significantly impacts the model result, since improved model performance results in improving confidence in the model predictions. The EPA's recommended 'Relative Reduction Factor' procedure is specifically designed to eliminate 'bias' as a factor in predicting future case design values. Section 15.0 of the EPA's *Guidance on the Use of Models and Other Analyses in Attainment Demonstrations for the 8-hour Ozone NAAQS,* concerning procedures for evaluating model performance and the role of operational and diagnostic analyses, encourages a robust operational evaluation of the model to increase confidence. The guidance does not place limits on the frequency of the evaluations or adjustments, nor has the EPA provided negative comments in its review of model performance documentation. Two additional episodes were evaluated (1999 Extension and 2000 TexAQS) and were not appropriate for use in modeling because of poor performance. However, the episodes (not the photochemical model) were rejected because daily performance was unstable due to coarse grid meteorology optimized for other areas and generic rather than episode specific emissions inputs. Performance for these two episodes was not as good as the August 13-22, 1999, episode and did not meet the EPA statistical performance criteria. The EPA concurs with the approach that the commission has taken.**

BSA commented that the plan does not look beyond controls in the nine nonattainment counties.

**The commission disagrees with this comment. The plan includes rules for engines outside the nonattainment area and also takes into account reductions realized through Senate Bill**

**7, which mandated reductions from power plants in east Texas.**

## General: Emissions Inventory

BSA, Public Citizen, and SEED commented that the TCEQ's assumptions in future case emissions inventories are faulty, and the commission has not answered questions from NTCASC and others about those assumptions.

**The commission's assumptions in future case emissions development were briefed and offered for peer review through the DFW Photochemical Modeling Technical Committee, and were based on the best information available. The commission used EPA-approved growth methodologies and models for future case emissions inventory development and provides extensive details regarding their development in Appendix B. The commission has responded to all direct queries regarding the growth assumptions and is unaware of any unanswered queries from NTCASC or others.**

Downwinders commented that the DFW attainment demonstration does not anticipate the rapid growth of Barnett shale deposit gas drilling and ancillary operations as sources of $NO_X$ emissions.

**The commission uses the most currently available emissions inventory information and EPA-approved models and growth factors to estimate growth of emissions. In addition, the commission conducts special emissions inventory studies when information is provided on anticipated growth of a specific inventory source. No information was provided by the commenter on specific operations, so the commission is unable to address this issue further.**

An individual commented that since mobile source emissions contribute 70 percent of the $NO_X$ emissions and 50 percent VOC emissions in the DFW area, significant reductions in mobile source emissions will be required to improve the DFW ozone situation.

**The commission appreciates the comment. On-road and non-road mobile sources are expected to contribute 291 tons per day of $NO_X$ in 2009, which is 71% of the total anthropogenic $NO_X$ in the area. The commission agrees that reductions from mobile sources are a necessary component of this attainment demonstration SIP. This SIP revision documents emissions reductions from fleet turnover, as well as emissions reductions necessary from other source categories.**

Sierra commented that the TCEQ emissions inventory in the DFW area has errors due to estimates being used instead of "real counting." These errors are causing underestimations of the total $NO_X$ and VOC. BSA commented that the commission should have a requirement to adhere to assumed emissions inventories for specific sources that are within the TCEQ's control.

**While the commission agrees that emissions inventories are not exact quantitative replications of all emissions, this SIP goes well beyond the requirements of the Federal Clean Air Act and the EPA rules and guidance to ensure that periodic emissions are adequately represented in this SIP revision. The modeling used in the attainment demonstration relies on annual, ozone season, hourly acid rain continuous emissions monitoring, and emissions events data reported by industry for the modeling inventories. These inventories represent the best information that is available. While portions of the inventory rely on estimated data, many large industrial $NO_X$ producers in the DFW area do report $NO_X$ emissions measured by continuous emissions monitors. These include the cement and power plant industries.**

**The emissions inventories developed by the TCEQ for modeling undergo quality assurance reviews and are some of the most detailed inventories used for SIP preparation in the United States. The inventories follow all of the prescribed emissions inventory development methodologies and are more robust than the EPA's guidance requirements. Furthermore,**

**the modeling performance in the base and future case meets the EPA performance criteria.**

BSA commented that the TCEQ removes EGUs with the official status of "mothballed" from the 2009 future case EI; however, the commission does not require that the permits of these plants be revoked. Further, the TCEQ removed emissions from EGUs with Reliability Must Run (RMR) status because these EGUs have applied to curtail emissions and the TCEQ expects that these EGUs will receive approval for shutdown, but the commission includes no enforcement mechanism.

**The photochemical modeling in this SIP revision includes a realistic view of the future attainment year. An Electric Generating Facility (EGF) owner is not required to notify the commission of its intentions to mothball or put other units on RMR status, so the commission researches these proposed activities through the Public Utility Commission of Texas (PUC) and Electric Reliability Council of Texas (ERCOT) web pages. An EGF owner is not required to void a TCEQ permit upon shutdown, mothball, or curtailment of a unit. Authorization is required from the PUCT prior to permanent shutdown of a facility and there are specific requirements that allow for "mothballing" in order to ensure stability of the electric power grid. However, the actual emissions decreases (and any increases) are accounted for in the annual emissions inventory annual reporting cycle. Future projections (including growth) have been accounted for in the modeling. See Appendix B, specifically Section 2.3, for additional information on point source EI development.**

Downwinders commented that DFW eight-hour ozone trends are increasing by 2009, yet the decreasing point source inventories are not anticipating new and increased sources of unaccounted pollution.

**The reported point source inventories show a decrease in emissions for many years, despite the industrial growth in Texas. This is a result of required and voluntary emissions reduction programs and regulations. The commission is required to address emissions growth as part of the attainment demonstration, and new sources of pollution have been accounted for in the modeling. See Appendix B, Section 2.3 for additional information.**

## Point Source Impacts (Electric Generating Facilities)

Judge Whitley, Representatives Burnam, Pierson, and Veasey, City of Dallas, Sierra-Dallas, Sierra-Fort Worth, IEA, ED, Downwinders, PCOT, BSA, and 25 individuals commented that the commission has failed to consider the effect of emissions from 19 proposed coal/lignite/petcoke power plants. ED noted that the only mention of the proposed plants in the SIP proposal is in Appendix B, which indicates that only Sandow 5 was included in the modeling analysis and that as a result the ozone air quality impacts of the proposed power plants are not being considered in the SIP review process.

Judge Whitley, City of Dallas, City of Fort Worth, TCACC, IEA, ETECO, Downwinders, NCTCOG, Ms. Harrison, former Mayor of Dallas and former EPA Regional Administrator, and twenty-four individuals expressed concern that increased pollution from new sources such as coal-fired power plants would cause a decline in air quality, including possible increases in mercury, particulate matter, and ozone, both in the nonattainment areas and in the near nonattainment areas.

TCACC noted that a report from Austin—the Environ report—states that during one episode, when all 17 proposed EGUs were modeled, they added 0.2 to 0.6 part ppb to the DFW 2009 baseline design values. City of Dallas, TCACC, and ED commented that available evidence from a report, *The TERC*, TCEQ by TCACC reported that:

- Concentrations of ozone and fine particulate matter would increase in each of the four urban areas examined; ozone levels may increase as much as 2.96 ppb in the DFW area.

- Although TXU proposes to offset the impact of the power plants with twenty percent emissions reductions, the potential impact to DFW is as much as 2.42 ppb.
- Fourth-highest day ozone levels may increase in 2009, by 0.349 ppb at the Frisco monitor and 0.276 ppb at the Dallas North No. 2 monitor.
- Ozone levels in east Texas, already a near nonattainment area, could increase more than 2 ppb.
- The seasonal model predicts that if the current fourth-highest ozone concentration in Waco is near 80 ppb and if the construction of new plants increases that value by 6 to 7 ppb, then the effect of the new plants may be to put Waco air above 85 ppb.

Judge Whitley, City of Dallas, NCTCOG, Downwinders, and one individual stated that the new emissions could cancel a significant portion of the ozone reductions claimed in the NCTCOG's plan and reverse the work of more than ten years by DFW-area governmental and non-governmental organizations, industries, and individuals.

TXU commented that power plants being proposed in the area would be required to reduce $NO_X$ emissions even more than the plants they are replacing. TXU further commented that the Environ report only models one scenario that might be built and that the report is outdated and should be redone.

**The commission made no changes as a result of these comments. The DFW SIP revision includes emissions and controls that will affect the 2009 ozone season. Although the commission has received many permit applications for new electric generating facilities, only Sandow 5 and JK Spruce 2 expect to be constructed and operating by the end of ozone season 2009. Further, the amount of electric generation capacity associated with the permit appliances for new EGFs is more than will be needed to meet the electrical demand in 2009. Based on this, it is anticipated that existing facilities will either shut down or curtail operations. The commission can not anticipate what facilities will be constructed, when they will come on line, and what their emissions will be in 2009. Therefore, the commission did not include potential emissions in its SIP modeling from facilities not expected to be operating in 2009, especially if no NSR permit has been granted.**

**The commission is required to address emissions growth as part of the attainment demonstration, and new sources of pollution have been accounted for in the modeling. Appendix B: Emissions Inventory (EI) Development, of this DFW SIP revision provides details of growth projections. All of the power plants that are permitted and expected to be operating in 2009 are included in the modeling, as described in Appendix B.**

**In response to the comment about potential increases in other pollutants, the commission adopted the Clean Air Interstate Rule (CAIR) and the Clean Air Mercury Rule (CAMR), which is intended to reduce mercury emissions nationwide by seventy percent. Current mercury emissions from coal-fired power plants in the state of Texas are 5.0046 tpy. Under the Federal CAMR rule, Texas has been given an annual mercury budget of 4.656 tpy for Phase I (2010-2017) and 1.838 tpy for Phase II (2018 and thereafter).**

City of Dallas and TCACC also made the following comments:

- Controls for the 20 percent offset reductions proposed by TXU are not achievable in time for the attainment deadline. Mr. McCall (TXU) stated that they may not be installed until 2010 to 2011, which is after the DFW attainment date.
- TXU agrees that location of the new plants and the offsetting reductions can affect modeling results depending on their location, but so far, TXU has been unwilling to release location information. Reductions might be made in locations that would not reduce air pollution for the DFW area.
- The 20 percent reduction isn't voluntary; as TXU will already be required to make these reductions under the Clean Air Interstate Rule, which comes into affect in 2009 and 2015.

- Even with the 20 percent reduction, according to the Environ report, impacts to DFW on several days modeled may be as high as 0.8 ppb at the Frisco monitor. This is the monitor of great concern to the region.
- In Mr. McCall's deposition, he wouldn't give a time frame to the 20 percent reduction nor state whether TXU would be willing to enter into an agreement before the permits are issued.
- The TXU has admitted that they intend to bank emissions for the 20 percent reduction. Credits can be used by the TXU to emit more or can be sold to another company so they don't have to reduce emissions.
- The reduction commitment would be voluntary and unenforceable. In the past, the TXU has reneged on verbal commitments to add improved technologies at its plants.
- Seven months ago, TXU sent a letter to the commission offering to put the voluntary reduction commitment in writing, yet that has not been done.

City of Dallas and TCACC stated that local elected officials of this region have requested rules for the SIP regarding the proposed power plants that are legally enforceable and can be relied on by citizens and commented that this would have positive impact not only on DFW but on Austin, Waco, and east Texas as well. Two individuals expressed opposition to more coal burning plants in the north Texas region unless proven equipment that would prevent further deterioration of air quality was included in their construction.

**The commission has made no change in response to these comments. Discussion concerning a potential 20 percent emissions reduction commitment from TXU was not proposed as part of this DFW SIP revision. Recent announcements by TXU state that they will seek to suspend the permit application process for several units. Given the uncertainty of the permit applications and the 20% offset proposal, the commission maintains that potential emissions increases or decreases should not be included in the SIP or modeling efforts until and unless the emission rates are authorized and enforceable.**

City of Dallas and the TCACC states that it is unclear how a SIP can take credit for an emissions reduction plan required by law (CAIR), when the locations of the reductions are unknown, and credits will be banked for future use.

**This SIP revision does not take credit for CAIR. The commission has implemented a preliminary CAIR allowance system to address the federal rule. The commission adopted the CAIR by reference, except for a $NO_X$ calculation methodology specified by state statute. Emissions reductions are only creditable/bankable if they are in excess of what a federal or state rule requires. CAIR allowances are only tradable and usable within the CAIR program and may not be used to satisfy any other requirements.**

ED commented that the TCEQ's reliance on ERCOT's reserve margin forecast showing that Texas had adequate power through 2009 is no longer valid. ERCOT's 2006 forecast suggested that more power would be needed by 2008 if supply or demand side options were not implemented. ED commented that they are uncertain about the basis of removing 50 tons of emissions from the EGU inventory in 2009 given the fact that some mothballed plants like Valley have been reactivated in the past year. ED commented that the TCEQ should review the 2006 ERCOT forecast as well as any recent changes in the operating status of existing plants and revise its future EGU emissions accordingly.

**The revised ERCOT forecast was released after June 2006 and, therefore, was not included in the modeling. The commission notes that no point source model inputs were modified after June 2006, as implied in Appendix B. Any future modeling may include adjustments for these changes in projected demand, including another review of mothballed/RMR units.**

**Opposition to Fast Tracking Permits**

City of Dallas, IEA, and thirty individuals were opposed to the governor's executive order to fast-track the permit process for the TXU's planned coal-fired electric generating plants. Three individuals are concerned that the TCEQ is a rubber stamping organization for approval of coal-fired power plant applications. Four individuals asked the TCEQ to impose or support a 180-day moratorium on permitting the proposed power plants, per House Concurrent Resolution 43, to allow time to look at alternatives to dirty coal energy. One individual requested that the plan first consider financial liability to the state due to the proposed coal-fired power plants.

**The DFW eight-hour ozone nonattainment SIP revision, including the rules adopted as part of this SIP revision in 30 TAC Chapter 117, do not make any changes and are not applicable to the permitting process for coal-fired electric generating plants, including applications filed by TXU. Further, Executive Order RP-49, issued by Governor Perry does not apply to this SIP revision or the applicable rules. It is not clear what would be the cause of any potential financial liability to the state based on applications for coal-fired power plants. No changes were made in response to these comments.**

## Point Source Impacts - Trains

Judge Whitley, City of Dallas, City of Fort Worth, TCACC, ETECO, Downwinders, NCTCOG, Sierra-Dallas, Sierra-Fort Worth, IEA, ED, PCOT, BSA, Ms. Harrison, former Mayor of Dallas and former EPA Regional Administrator, and twenty-four individuals expressed concern that increased pollution from new sources such as trains that would transport coal to the proposed coal-fired power would cause a decline in air quality, including possible increases in mercury, particulate matter, and ozone, both in the nonattainment areas and in the near nonattainment areas. Judge Whitley commented that studies show pollution from locomotives carrying coal for the newly proposed power plants could use up to 28 percent of the gains made in reducing local pollution. The City of Dallas commented that the impact of the trains transporting coal for the newly proposed power plants may obliterate the hard work in reaching attainment. Downwinders commented and referenced a statement from Mike Eastland, as reported in the February 1, 2007, Fort Worth Star- Telegram. The article referenced a recent analysis by the TCEQ that concluded that the emissions from the trains going through Johnson and Tarrant Counties would cancel a significant portion of the ozone reductions measures claimed in the plan by the North Texas Council of Governments. The City of Dallas, the TCACC, and the ED commented that available evidence from the TERC H60 report reported that on average, the additional emissions resulting from increased train traffic would virtually neutralize all the benefits to the DFW area from the TXU's proposed twenty percent offset. Two individuals commented that the locomotives that carry coal through Tarrant County would make pollution worse.

Representatives Burnam, Pierson, and Veasey, and 24 individuals stated that the proposed SIP does not consider emissions from the trains that would carry coal to the proposed new coal-fired plants. Five individuals commented that the plan needs to address the impacts of the increased locomotive emissions as a result of the new power plants. An individual commented that there will be tremendous train traffic carrying coal from Powder River Basin in Wyoming to the power plants south and will go through Dallas. She read from a letter written to Representative Burnam stating that NCTCOG had worked with the train companies to determine increases. Representative Burnam commented that the trains coming through Tarrant County would add 28 percent of proposed plan reductions.

**The commission acknowledges that increased emissions would result by adding additional sources, including locomotive engines in trains carrying coal or any other product through the DFW metroplex, or other areas of the State. The commission has reviewed the analysis that NCTCOG performed in conjunction with BNSF to project potential emissions from anticipated locomotive engine traffic expected to supply coal to future power plant electric**

**generation units. These emissions estimates are based on the amount of coal feed required for such units and the minimum number of locomotives needed to pull coal rail cars loaded and unloaded through the nonattainment area. NTCOG estimates include projected emissions from both the line haul activity and idling from increased waiting at Tower 55. The commission reviewed the assumptions from this work and the resulting emissions estimates. The commission, using similar assumptions, estimated that the addition of 16 extra engines running through the DFW area could increase $NO_X$ by an additional 2.58 tpd. However, since permits have not been issued for the additional facilities, the commission did not include potential increased locomotive emissions in its 2009 future case modeling. Also, recently TXU has indicated that it will seek to suspend the permit application process for several of the proposed new units and does not intend to apply for or reapply for permits. So, at this time it is very difficult to accurately estimate the impact of potential increases of locomotives hauling coal for the newly proposed power plants.**

Two individuals commented that there is inadequate rail capacity for the trains needed to carry coal to the new power plants.

**The commission has no regulatory authority over railroads and has no information on the potential need for additional rail capacity to carry coal for newly proposed power plants. When reviewing a permit, the commission considers the issuance of the permit based on the proposed stationary facility's compliance with statutory and regulatory requirements and protectiveness of public health and the environment. Potential infrastructure needs associated with a proposed stationary facility are not required to be considered by the applicant or commission in reviewing the issuance of a permit.**

## Monitored Attainment

Representatives Burnam, Pierson and Veasey, City of Dallas, and three individuals commented that while the commission projects that almost all of the monitors will be below the EPA ozone standard by the end of the ozone season in 2009, two of the monitors will still be above the standard. Any additional sources of emissions to the DFW region further threaten the ability to achieve this standard. Judge Whitley and Commissioner Brooks also commented that the ozone levels at two of the monitors – Frisco and Denton, are expected to miss the mark. Rita Beving, Sierra-Dallas, commented the TCEQ plan falls short because two ozone monitors – Frisco and Denton – are predicted to still register at levels over the limit.

**The adoption package photochemical modeling of the control strategies shows that four monitors in the DFW area will be at or above 85 ppb. However, the EPA recognizes that modeling is just one of the tools that can be used to project compliance of the standard. The EPA's guidance allows for supplemental analyses to support the modeled attainment test, as well as allowing for alternate methodologies for determining the future ozone design values at the monitors. Certain strategies, like energy efficiency, are difficult to quantify and are expected to influence the monitored values of ozone but are not accounted for in the modeling. The commission believes that taking into account these difficult to quantify strategies reinforces that the area will attain the standard.**

**The EPA method for calculating future design values uses two factors, one of which may bias the results. The EPA method multiplies the 1999 baseline ozone design value by a model-based reduction factor to determine the future design value. The actual ozone measured in the 1999 baseline year at both Frisco and Denton was higher than any year before or since. However, the DFW 2009 modeling also shows that with the adopted control package, ozone at Frisco should be decreased by 11.6 percent, and ozone at Denton should be decreased by 12.7 percent, consistent with reductions at other sites. When the commission discounts the bias caused by the high initial values and evaluates only the reduction factors, the modeling results show that the controls in the DFW SIP are also effective at Frisco and Denton. Finally, modeling is just a predictive tool. The EPA will**

**ultimately decide whether those monitors are in attainment based on actual monitoring data.**

An individual commented that we should not be relying on the Frisco monitor when it isn't even in the path of prevailing winds most of the time.

**The commission is not relying solely on the Frisco monitor. All monitors must get into attainment in order for the area to be reclassified as attaining the standard. Monitors in the DFW area are predicting attainment in this demonstration. Much discussion has centered around Frisco since the Frisco monitor measured the highest ozone in the nonattainment area for the 1999 base year and has proven one of the most difficult to bring into modeled attainment.**

## Meteorology

Public Citizen commented that a TCEQ study presented by a commission scientist shows that in the DFW area when the winds are out of the south and southeast, there are often excessive ozone amounts. Public Citizen also commented that this study showed that if the existing power plants in east Texas reduced $NO_X$ emissions by 70 percent, the DFW area would be a third of the way to modeling attainment.

**The modeling study referred to by Public Citizen estimated the change that would occur in DFW 2010 ozone if east Texas EGFs were controlled as stringently as those in Houston. However, electric generating units in east and central Texas have already been adequately addressed as a result of the requirements of Senate Bill 7 (76th Legislative Session). These sources made a 50 percent reduction in $NO_X$ emissions from their 1997 levels. Modeling conducted as a part of the development of this SIP revision indicates that $NO_X$ reductions made inside the DFW nine-county region are far more effective than reductions outside the area in efforts to attain the ozone standard. The commission therefore determined during proposal that further reductions in emissions from these sources are not warranted for the nine-county DFW ozone nonattainment area to demonstrate attainment with the ozone NAAQS.**

An individual commented that the use of a 1999 episode does not account for changes in ambient air temperature and solar radiation occurring in the DFW area. The commenter provided a table with temperature trend data. He stated that in order for the 1999 base case to apply in 2009, the temperature used in the photochemical modeling needs to be increased to account for climate change and increasing temperature. Sierra Club-Dallas commented that the plan does not take into account warmer temperatures that will affect pollution in the area.

**The commission does not change the temperature in photochemical modeling for several reasons. First, although the model is sensitive to temperature, it is more sensitive to wind speed, mixing height, and changes in emissions. Next, the mean daily average temperature in August is highly variable, so the amount of temperature change that must be applied to any future year is highly uncertain. Ozone modeling avoids confusion by freezing the meteorology, and changing only the future emissions. Using the same meteorology (temperature, wind speed, and direction), the commission can more accurately predict the effects of various control strategies on expected future ozone concentrations.**

Judge Whitley commented that the area is impacted not only by what happens in the region, but also by what happens in the state, the country, and throughout the continent. He commented that air pollution is driven into north Texas by weather and winds from the Ohio River Valley, from Houston, and from east Texas.

**The commission agrees that emissions from outside the region may impact the DFW area. The EPA's website states that because of CAIR, Texas' ground-level ozone air quality will**

**improve because of reductions of $NO_X$ in Alabama, Arkansas, Louisiana, and Mississippi. The EPA recognizes a certain percentage of ozone occurring in an area is natural background. Thus, the modeling defines background boundaries. However, the greatest benefit for reducing ozone pollution can be realized from reducing emissions in the nonattainment area.**

Downwinders commented that the winds blow from the southeast and northwest during the ozone season. If the winds are superimposed to where the cement plants are located, there is greater impact from the plants. Downwinders commented that the SIP is built around one particular monitor, Frisco, but the wind was not blowing typically on a day Downwinders identified; instead it was blowing in the opposite direction, so the cement plants emissions did not reach Frisco that day, but farther west into Tarrant, Denton, and Parker Counties.

**The wind patterns associated with ozone formation in the DFW area come from several directions, northeast, east, and southeast, on different days. Winds must come from the south and southwest to transport cement kiln emissions toward the Frisco monitor. Winds from this direction are usually strong and therefore not generally associated with ozone formation because pollution is quickly dispersed. The winds from the southeast do carry Ellis County emissions into Tarrant County. The modeling supported by WoE demonstrates that the entire nine-county area, including Tarrant County, will attain the eight-hour ozone NAAQS with this SIP control package.**

## Data Analysis

An individual commented that the TCEQ should not rely on recent ozone trends to support its attainment demonstration for the DFW area since the most recent 4-year trends demonstrate that throughout the nonattainment area ozone concentrations are increasing.

**The commission does not rely on short term ozone trends to support its attainment demonstration. Various factors including meteorology, ozone precursor concentrations, and the number of monitors can affect ozone trends in an area. As the design value calculation removes some of these variables, it becomes appropriate to include long-term trends. Analyzing design values over a longer period also provides statistical confidence that the trends are real and not due to chance.**

An individual commented that the TCEQ should not be depending on monitors that do not represent the wind flow.

**To demonstrate attainment, ozone concentrations at all monitors are examined. The commission does not depend on any particular monitors that do not represent the wind flow. A suite of wind directions is included in the modeling to represent all the conditions that lead to ozone formation. Since the winds may change daily, and, even hourly, some of the monitors are upwind of the DFW area and measure relatively low ozone, and some others are downwind and reflect the area's high ozone.**

## Modeling and Evaluating the Effects from Kilns

Downwinders commented that modeling sensitivities applying advanced controls on the Midlothian kilns showed that these controls had the highest impact on ozone of almost any other single reduction modeled by the TCEQ. Downwinders also commented that a modeling test run by the state shows that a nine to 12 ppb reduction could be realized if 50 percent of the cement kiln emissions were eliminated. BSA commented that the TCEQ's own report demonstrates the benefit of imposing the "high-combination" control scenario upon the cement kilns**.** One individual commented that the TCEQ's modeling showed that reducing cement kiln $NO_X$ would not have a measurable impact on Frisco and Denton, the worst performing monitors in the DFW area. The individual added that modeling performed also demonstrated that reductions in $NO_X$ emissions from the Midlothian plants would not bring the DFW area into compliance with the ozone standard. The individual commented that the TCEQ has not performed any analysis that indicates that a high level of reductions of $NO_X$ emissions for the Midlothian cement kilns would result in the DFW area coming into compliance. The PCA contended that the commission's photochemical modeling shows $NO_X$ reductions from Ellis County cement plants will not have measurable impact on critical monitors in DFW and that neither "high control" nor "low control" scenarios show DFW attaining the eight-hour ozone standards. PCA submitted a memo from Trinity Consultants that it claims confirms that reductions offered by cement manufacturers in other comments to the rule proposal will not result in measurable impacts on Frisco or Denton monitors, the critical monitors in the DFW area. Downwinders commented that the greatest beneficiaries of the sensitivity of the cement plant advanced controls were residents of Tarrant, Wise, and Parker Counties.

**The commission disagrees with the comments. The cement kiln controls do not have the highest impact on ozone in the DFW area. Although it is true that cement kiln emissions are carried into Tarrant, Wise, and Parker counties, the ozone in those counties is caused by the aggregate of contributions from all the on-road, point, area, and non-road sources. Of these, the largest $NO_X$ contributions are from on-road and off-road mobile sources.**

**The commission also conducted two modeling sensitivity analyses based on the results of the cement kiln study, included as Appendix I of the DFW eight-hour ozone attainment demonstration SIP. These modeling sensitivity analyses reflected a low level of control (assuming SNCR control and approximately 10 tpd of $NO_X$ reduction) and a high level of control (assuming SCR control and approximately 20 tpd of $NO_X$ reduction), respectively. With 10 tpd of $NO_X$ reduction, the DFW nine-county average response was -0.08 ppb. With 20 tpd of $NO_X$ reduction, the average response was -0.31 ppb.**

**As discussed in the adoption preamble of the 30 TAC Chapter 117 rules (Rule Project No. 2006-034-117-EN), the technical feasibility of the advanced controls necessary to reduce $NO_X$ emissions from cement kilns by 20 tpd to the level modeled is questionable. In addition, the commission has determined that, even if advanced controls such as SCR or LoTOx could be determined to be feasible through pilot testing, such controls could not be implemented in time to make reductions prior to the attainment date. Therefore, the ozone reductions modeled from advanced controls in the sensitivity run are not realistic.**

**However, $NO_X$ reductions from the cement kilns in Ellis County are necessary for the DFW eight-hour ozone nonattainment area to attain the NAAQS. The DFW eight-hour ozone nonattainment area must demonstrate attainment of the NAAQS at all monitor locations, not just the Frisco and Denton monitors. Initial sensitivity modeling analyses indicated that $NO_X$ reductions from the cement kilns would provide significant benefit to the western portion of the nonattainment area, especially the Fort Worth Northwest (C13) monitoring location. The initial "low control" kiln modeling run indicated a 0.50 ppb reduction in ozone at the C13 monitoring location. The 9.69 tpd reductions anticipated from cement kilns under the adopted rule associated with this SIP revision represent approximately half of the total point source $NO_X$ reductions contained in this attainment demonstration. These reductions are essential to the area demonstrating attainment with the NAAQS.**

Commissioner Brooks, BSA, SEED, Public Citizen and two individuals commented that the DFW attainment demonstration does not adequately address emissions from existing power plants and cement kilns. Commissioner Brooks, Downwinders and six individuals commented that the DFW attainment demonstration does not address the cement plants in Midlothian. They commented that these facilities produce 50 percent of all the industrial pollution, half of nitrogen oxide smog-forming pollution, and 80 percent of sulfur dioxide for the nine counties. The commenter states that this is as much ozone pollution as five thousand cars parked in northwest Ellis County and running 24/7. Another individual commented that there are 233 industrial polluters in the DFW nonattainment area. The cement plants represent about two percent of the industrial polluters but count for 15 percent of industrial air pollution including the 27 percent of all industrial particulate matter; 49 percent of industrial nitrogen oxide, and 79 percent of the sulfur dioxide.

Representative Burnam, BSA, Downwinders and three individuals stated that the cement kilns produce half of all industrial air pollution in north Texas, including half of all $NO_X$, 30 percent of particulate matter, and 80 percent of $SO_2$. Three individuals also remarked that the kilns have raised DFW smog levels three times as much as would all proposed new coal plants.

**The three Ellis County Portland cement kiln sites are relatively large facilities and therefore emit more than small sources. However, to put the industrial emissions into proper perspective, recent anthropogenic precursor culpability analysis (APCA) modeling indicates that DFW local on-road mobile, non-road engines and area sources each contribute more to DFW ozone than all the industrial point sources combined. The ten cement kilns are estimated to contribute approximately half the $NO_X$ reported by point sources in the DFW area. However, point sources are not exhaustive of all industrial sources, nor are these sources the greatest contributors to $NO_X$ emissions in the DFW area. The subset of industrial sources referred to as point sources are estimated to contribute about 8 percent of $NO_X$ emissions in the DFW area. Other source categories contribute considerably more $NO_X$ than industrial sources, notably on-road mobile sources (47 percent) and non-road mobile sources (26 percent). Area sources, which include some industrial sources not classified as point sources, contribute an additional 10 percent. Compliance with provisions of this SIP and associated rules will reduce the cement kiln emissions to about 27 tons of $NO_X$ per day out of the DFW area total of 395 tons per day.**

**Based on the reported 2002 industrial point source inventory, as required by 30 TAC Section 101.10, for the nine-county DFW nonattainment area: 232 sites submitted annual emissions inventories; the three cement plants in Ellis County accounted for 1.3 percent of the number of reporting sites; the cement plants in Ellis County accounted for 45 percent of criteria pollutant emissions; the cement plants in Ellis County accounted for 32 percent of $PM_{2.5}$ emissions; the cement plants in Ellis County accounted for 46 percent of $NO_X$ emissions; and the cement plants in Ellis County accounted for 83 percent of $SO_2$ emissions.**

**While automobile pollution can be compared to point source pollution, the effect of $NO_X$ or VOC emissions varies significantly depending on various factors including the location of the source and stack height release and temperature. Thus, mobile reductions that occur at ground level may be more effective than the same quantity of emissions from a point source.**

**The commission has previously required substantial emissions reductions from power plants and cement kilns in Ellis County and is adopting new emissions reduction requirements for cement kilns as part of this SIP, which will assist the DFW area in making progress toward attainment of the eight-hour ozone standard.**

BSA and Downwinders commented that the only way to get similar impacts to what could be obtained from cement kiln emissions reductions would be to take all the cars off the road in Dallas. An individual commented that if the three cement kilns would install SCR it would be like taking a half million cars off the road in north Texas.

**As discussed elsewhere in this SIP and in the adoption preamble to 30 TAC Chapter 117, the rules associated with this attainment demonstration (2006-034-117-EN), the commission has determined that SCR is not a reasonably available control technology for cement kilns. This SIP revision includes new rules to reduce emissions from a variety of sources. Mobile sources, such as cars and trucks, and industrial point sources, such as cement kilns, emit $NO_X$ which contributes to the formation of ground level ozone. The revised rules for cement kilns in the DFW eight-hour ozone nonattainment area will contribute to the overall reduction of $NO_X$ emissions in the airshed. The commission supports and encourages local**

**transportation initiatives that would decrease the number of cars on the roads in order to help bring the area into attainment of the eight-hour ozone standard.**

**The comments are technically correct in that the three cement kilns contribute about half of the industrial $NO_X$ in the DFW area. However, other source categories in the DFW area contribute much more than major industrial sources. Recent APCA modeling indicates that on-road and non-road engines inside the DFW nine-county area contribute 46.9 percent and 26.2 percent of the locally generated ozone. Area sources contribute another 10.1 percent. For comparison, the contribution of all the industrial point sources in the DFW area (taken together) is only 8.4 percent.**

## WEIGHT OF EVIDENCE (WOE)

Representatives Veasey, Pierson, and Burnam, Judge Whitley, City of Dallas, Downwinders, Sierra-Dallas, and four individuals commented that the DFW attainment demonstration does not achieve attainment because two monitors will still be above the standard by 2009. Judge Whitley and five individuals commented that the DFW attainment demonstration does not sufficiently reduce $NO_X$ and VOC in the DFW area to meet clean air goals. Sierra-Dallas and one individual commented that the plan does not meet the modest federal target of 80 ppb; it reaches only 87 ppb. One individual commented that the modeling appears to indicate that the plan will not achieve attainment by 2010. Sierra-Dallas asserted that this plan does not achieve the goal of 80 parts per billion. City of Dallas and the TCACC noted that the TCEQ projects that two DFW area monitors will still be above the standard at the end of ozone season in 2009. The Frisco and Denton monitors are projected to be at 87.7 ppb in 2009, which is 2.7 ppb over the standard; therefore, additional sources to DFW region further threaten our ability to meet the standard. Downwinders asserted that the proposed SIP uses only the Frisco and Denton monitors, which will not adequately measure impacts from the cement kilns because of prevailing wind directions during ozone season. An individual commented that the state should not be using the Frisco monitor for the projections. An individual commented that this monitor does not reveal how much the cement and coal plants will affect pollution in the future, and because of the way the winds blow, monitoring in northwest Tarrant County would have shown that stricter emissions controls on the Ellis County plants would reduce air pollution over Tarrant County.

**The commission disagrees that this SIP revision focuses inappropriately on the Frisco and Denton monitors. This SIP revision demonstrates attainment of the eight-hour ozone standard for the entire DFW nine-county area. Attainment of the eight-hour ozone standard is demonstrated in accordance with 40 CFR Part 50, Appendix I, which provides that the eight-hour ozone standard is met when the three-year average of the annual fourth highest daily maximum eight-hour average concentration is less than or equal to 0.08 ppm. The number of significant figures in the level of the standard dictates the rounding convention for comparing the computed three-year average annual fourth-highest daily maximum eight-hour average ozone concentration with the level of the standard. The third decimal place of the computed value is rounded, with values equal to or greater than five rounding up. Thus, a computed three-year average ozone concentration of 0.085 ppm is the smallest value that is greater than 0.08 ppm. The Frisco monitor must be addressed because that site shows less modeled response to controls than other nonattainment area monitors. The wind patterns associated with ozone formation in the DFW area come from several directions, northeast, east, and southeast. Winds must come from the south and southwest to transport cement kiln emissions toward the Frisco monitor. Winds from the south are usually strong and therefore not generally associated with ozone formation. The winds from the southeast do carry Ellis county emissions into Tarrant County. The modeling, which predicts future ozone concentrations, supported by WoE, demonstrates that the entire nine-county area, including Tarrant County, will attain the eight-hour ozone NAAQS with this SIP control package.**

BSA, Public Citizen, and SEED, ED, the TxDOT, Downwinders and seven individuals assert that the TCEQ has not satisfied WoE requirements in the proposed SIP revision. They stated that the EPA's ozone implementation guidance allows corroborative analysis to construct WoE, but the analysis in this DFW SIP revision fails to overcome the inadequacy of the TCEQ's proposed control strategy to bring the DFW area into attainment. Accounting for the error in emissions would put the DFW area's predicted ozone levels outside of the range allowed by the EPA's guidance for use of WoE. ED also commented that the arguments presented in the proposed SIP revision are not convincing given the high hurdle that must be overcome.

**The EPA recommends WoE analyses for a broad range of future design values, but has not established rigid boundaries where WoE analysis is not accepted. The commission incorporated several suggestions to enhance the Corroborative Analysis and Additional Control Measures sections and strengthen the WoE analysis. Design value and zone trends both support a finding that the DFW area is continuing to make progress toward attainment of the ozone NAAQS. The actual ozone measured in the 1999 baseline year at both Frisco and Denton was higher than any other year. Additionally, although the number of eight-hour ozone exceedance days varies widely from year to year, depending on the day-to-day meteorology and climatology each year, the eight-hour ozone exceedance data suggest a downward trend in the number of exceedance days and number of exceedance days above 95 ppb since 1998, the year that the commission enacted rules limiting both local $NO_X$ and Texas EGF $NO_X$ emissions. Evidence also indicates that ozone design values are declining at the Frisco and Denton monitors. The photochemical modeling demonstrates that the Frisco and Denton monitors are responsive to the adopted control strategies. Additionally, emissions reductions from fleet turnover from ozone season 2009 to June 15, 2010, are estimated to be 20 tpd, which is anticipated to provide significant benefits toward attainment of the eight-hour ozone attainment, as described in Chapter 4 of the adopted SIP.**

The EPA congratulated the TCEQ on being one of the first agencies in the country to propose an eight-hour ozone attainment demonstration. However, the EPA went on to recommend some additional WoE/Corroborative Analysis they would like to see, to include:

- A quantification of the amount of emissions reductions within the DFW nonattainment area (and potentially Texas overall) that the area might expect to occur in a period such as 1999/2000 to 2009, compared with DV trends during this period;
- A meteorologically adjusted trend analysis. The analysis could include federal measures, proposed state reductions, and reductions from previous that could be compared to both the area's design value and other metrics;
- Additional ozone/emissions trend analysis for 1999-2005 and 2005-2009; and consideration of the growth of the monitoring network, which results in more exceedance days than would be expected if no progress toward attainment was being made;
- An analysis of ozone excesses and the distribution of the excess to show potential movement toward attainment;
- Further discussion of other modeling episodes;
- An unmonitored area analysis, using the recently released the EPA draft version of the tool to perform the analysis;
- Additional ozone precursors trend analysis such as using San Antonio, as an example, to do a comparison to recent DFW data to support the trends towards attaining the standard. They also suggest differences in model trends and monitored trends and an evaluation of $NO_X$/VOC emissions trends; and
- An evaluation of sub-sets of days that were near the ozone design value.

**The commission appreciates suggestions from the EPA that will strengthen the Corroborative Analysis in the DFW SIP. The commission revised the Corroborative Analysis to include documentation on six of the eight items recommended by the EPA. A substitute for the EPA unmonitored area analysis is included since the EPA method was not**

**released in time for this SIP revision. Chapter 2 already includes spatial plots showing the peak modeled ozone each day of the episode. However, two of the items are not included. Other episodes are not included in this SIP revision because they did not perform as well as the 1999 episode. Additionally, the commission believes that trends in other cities are not relevant to this DFW SIP revision.**

BSA commented that the TCEQ's corroborative analysis discusses ozone design value trends, but does not provide evidence to suggest which of the past control strategies actually contributed to these trends. They also commented that the commission has not conducted a review of past SIPs' future emissions assumptions in comparison with the current existing emissions inventories.

**The commenter is correct that the corroborative analysis does not specify which control measures actually contributed to the downward ozone design value trends. It is generally assumed that every existing control measure contributes to lower ozone at the monitors, and, thus, lower design values. The list of existing control measures may be found in Chapter 4.**

BSA commented that the WoE should take into account what happens in the future to include the 17 coal-fired power plants.

**The commission is not including this discussion in the WoE since locations and emissions from the new facilities are not yet defined and are uncertain as discussed elsewhere in this response to comments. The DFW SIP addresses the facilities, emissions and controls that will be operating in 2009 and are expected to affect the 2009 ozone season and attainment statistics.**

NCTCOG commented that the TCEQ should initiate analysis of additional out years, such as 2012, in order to be better prepared in the event future planning is necessary.

**The purpose of this revision is to demonstrate attainment of the ozone NAAQS by June 15, 2010, and therefore the information is unnecessary.**

NCTCOG commented that they did not understand the corroborative analysis in Chapter 3 and WoE. They recommended that the section be clearly identified by re-naming it and strengthening the verbiage.

**The commission appreciates the suggestion. Chapter 3 of the adopted SIP revision has been revised to explain that the WoE included consists of Chapter 3, Corroborative Analysis and Section 4.2.6, Additional Control Measures. Additional discussion has been added to support the conclusion of attainment.**

## REASONABLY AVAILABLE CONTROL TECHNOLOGY (RACT) DEMONSTRATION

BSA, Sierra-Dallas, Downwinders, and five individuals claimed that SCR and LoTOx are cost effective and available, thereby satisfying requirements for RACT, or "reasonably available control technology," and thus should be required by the commission.

Downwinders asserted that the proposed rules arbitrarily select SNCR for $NO_X$ controls on cement kilns, allowing wet kilns to operate at higher emissions rates than dry kilns, whereas SNCR pilot testing at Holcim shows $NO_X$ reductions between 40 and 50 percent. Downwinders disagreed that SCR is not as well established as SNCR for cement kilns. Downwinders commented that the TCEQ's use of "not as well established" is not a sufficient criterion for selecting control technologies in the SIP.

**The term "reasonably available" has a specific meaning when used in the field of air pollution control. The EPA defines "reasonably available control technology," or RACT, as "the lowest emissions limitation that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility." (44 FedReg 53762). This standard considers both technological and economic factors in RACT determinations.**

**The commission disagrees with the claim that SCR and LoTOx are reasonably available control technologies (RACT). No RACT determination has been made for these technologies for cement kilns. No regulatory agency in the U.S., including the EPA, requires SCR on cement kilns. No SCR or LoTOx units are operating on cement kilns anywhere in the U.S. The commission does not consider either SCR or LoTOx to be demonstrated technologies for the cement kilns in Ellis County. While further testing and development might support application of SCR technology to cement kilns in the future, the control level and source cap approach adopted in this SIP and associated rulemaking mandate substantial reductions from cement kilns, achieve them cost effectively, and achieve them expeditiously so that they may be in place by March 1, 2009, in time to help the DFW eight-hour ozone nonattainment area attain the ozone NAAQS by the June 15, 2010, deadline.**

**While the cement kiln study concluded that SCR and LoTOx were "available" for the three dry kilns, the study authors admitted that the definition of "available" in the study does not correspond to the legal definition of "available" as used by the EPA. Instead, while using industry standard terminology in their assessments, the study authors were clear to state that the definition of "available" for purposes of the study was different from the industry standard. The study states that, for purposes of the study, "available" means a technology that is "commercially available and in use on similar types of cement kilns." This interpretation is a much less strict interpretation of "available" than required for RACT determinations cited previously (44 FedReg 53762). Clearly, SCR and LoTOx are commercially available--they are in use on numerous types of industrial equipment. However, neither SCR nor LoTOx has been applied to wet process cement kilns, and only SCR has even been attempted on dry process cement kilns, with ambiguous results. Little technical information is available on these SCR applications. The few cement kilns known to be using SCR, all located in Europe, are known to have different process designs, different feed materials, and different fuels.**

**The commission has also determined that costs for SCR and LoTOx are unreasonably high for the cement kilns in Ellis County, exhibiting unfavorable cost effectiveness compared to readily available alternatives and imposing substantial burden costs on owners and operators of those kilns. LoTOx is even less established than SCR, as it has never been applied to any cement kiln of any kind anywhere. Clearly, LoTOx cannot be considered "available" for cement kilns, and was deemed "transferable" in the cement kiln study. The commission evaluates the availability of measures based on all available information.**

**Regarding SNCR pilot testing at Holcim, reductions of 45-50 percent were achieved on one kiln, but 35 percent on the other, whereas the proposed rules would require roughly 45-50 percent reductions for the Holcim site overall. The adopted rules do not require any particular control technology; however, SNCR has proven to be a cost effective method of reducing substantial $NO_X$ emissions at the Ellis County kilns, whereas SCR has not.**

**As discussed in the fiscal analysis of the proposal preamble published in the December 29, 2006, issue of the Texas Register (31 TexReg 10601), total capital costs for installation of SNCR for all ten cement kilns in Ellis County are estimated to be approximately $15.3 million to $17.7 million. Annual costs for operation of SNCR are estimated to be between $300,000 and $1 million per kiln. Setting aside consideration of costs for pilot testing, development, and optimization of SCR customized for the kilns in Ellis County, SCR is**

**more costly to install and operate than SNCR. Using cost estimates presented in the cement kiln study, capital costs for installation of SCR was estimated to be $60.9 million for all ten kilns, compared to $16.4 million for SNCR. Capital costs for installation of LoTOx were estimated to be $49.5 million. Annual costs to operate and maintain SCR systems on all ten kilns, including capital servicing costs were estimated to be $20.5 million, compared to $5.9 million for SNCR. Annual costs for LoTOx were estimated to be $15.4 million. Even requiring these units to operate only during ozone season does not change the relative costs, though it would be expected to reduce the operation and maintenance portion of annual costs by about one third. In terms of cost per ton of $NO_X$ emissions reduced, SNCR is more cost effective than SCR and LoTOx. Cost effectiveness estimates for SNCR presented in the cement kiln study range from $1,400 to $2,300 per ton of $NO_X$. Cost effectiveness for SCR, on the other hand, was estimated to be considerably higher: $1,600 to $5,500 per ton of $NO_X$. LoTOx cost effectiveness estimates ranged from $2,100 to $3,000 per ton. The commission considers the costs for SCR and LoTOx to be unacceptably high compared to the readily available alternative.**

**The estimated cost per unit of output, termed "burden cost" in the cement kiln study, of SCR is also considerably higher than SNCR. Even excluding two wet kilns (TXI #2 and #3) that operate only sporadically and thus have unrepresentative burden costs, SCR was estimated to impose burden costs ranging from $1.10 per ton of clinker produced from one dry kiln, to as high as $14.00 per ton clinker from wet kilns. Singling out wet kilns, of which there are seven in Ellis County, burden cost estimates ranged from $12.00 to $14.00 per ton of clinker. By comparison, estimated burden costs for SNCR ranged from $0.60 to only $2.30 per ton of clinker. SNCR burden costs for wet kilns ranged from $2.10 to $2.30 per ton of clinker. The commission considers the costs for SCR and LoTOx to be unacceptably high compared to the readily available alternative.**

Devon commented that the agency needs to allow for the use of infrared (IR) imaging within any fugitive inspection and maintenance requirements.

**The commission is aware of and is following the development of infrared imaging cameras and other technologies as alternative leak detection procedures to identify and measure VOCs. However, this plan targets $NO_X$ reductions because DFW ozone production is generally more responsive to $NO_X$ reductions overall than to VOC reductions.**

The EPA suggested the commission certify that the emissions specifications and associated control technologies in rule project number 2006-013-SIP-NR represent RACT or above for ozone pollution control. The EPA requested verification that VOC RACT requirements are still being met for the following specific source categories in which the RACT determination was made many years ago: §§115.352 – 359, Fugitive Emissions Control in Petroleum Refining and Petrochemical Processes; §§115.552 - 553, §§115.555 - 557, and §115.559, Petroleum Dry Cleaning Systems; §§115.112 – 119, Storage of Volatile Organic Compounds; §§115.311 – 319, Process Unit Turnaround and Vacuum-producing Systems in Petroleum Refineries; §§115.131 – 139, Water Separation; and §§115.531 – 539, Pharmaceutical Manufacturing.

**The commission appreciates the comment. In the Phase II Implementation Rule published in the *Federal Register* on November 29, 2005, the EPA noted in the preamble on page 71655 that its current $NO_X$ and VOC RACT guidance could continue to be used by states in making RACT determinations for the eight-hour ozone standard. Additionally, the EPA stated that for areas where major sources or source categories were previously reviewed, states should review, and if appropriate, accept the initial RACT analysis as meeting RACT for the eight-hour standard. Absent data indicating that the previous RACT determination was no longer appropriate, states would not need to submit a new RACT determination for those sources. In such cases, the EPA indicated states should submit a certification as part of its SIP revision, with appropriate information, that these sources are already subject to SIP-approved requirements that still meet the RACT obligation. The commission has**

**completed a new analysis for RACT as part of the Dallas-Fort Worth eight-hour ozone attainment demonstration SIP that documents that the emissions specifications and associated control technologies proposed in this rulemaking represent RACT or above, in conjunction with information presented elsewhere in this preamble. The source categories in the Dallas-Fort Worth eight-hour ozone nonattainment area have been reviewed and evaluated to determine appropriate emissions specifications, control requirements, and associated control technologies for those source categories. The commission determined that the controls adopted with this rulemaking are available, reasonable, and necessary to help the Dallas-Fort Worth eight-hour ozone nonattainment area make progress toward attaining the eight-hour ozone NAAQS. Moreover, the requirements in §§115.352 – 359, Fugitive Emissions Control in Petroleum Refining and Petrochemical Processes, were beyond RACT when they were adopted in 1994 with a leak definition for valves of 500 ppm instead of 10,000 ppm. The current rules still represent RACT. The commission regulates dry cleaning facilities under 30 TAC Chapter 337; increasing the stringency of §§115.552 - 553, §§115.555 - 557, and §115.559 for Petroleum Dry Cleaning Systems would not result in meaningful reductions in VOC emissions. The rules in §§115.112 – 119 for Storage of Volatile Organic Compounds, §§115.311 – 319 for Process Unit Turnaround and Vacuum-producing Systems in Petroleum Refineries, §§115.131 – 139 for Water Separation, and §§115.531 – 539 for Pharmaceutical Manufacturing remain RACT for the DFW area because of the small number of sources of VOC emissions in the source categories affected by these rules.**

The EPA requested the TCEQ identify and provide analysis of VOC emissions from all major sources in both the four-county DFW one-hour ozone nonattainment area and the nine-county DFW eight-hour ozone nonattainment area.

**The commission has provided the requested information in Appendix J of the DFW attainment demonstration SIP.**

The EPA requested the TCEQ confirm that the RACT submittal accounts for all major VOC and $NO_X$ sources of affected sectors within the relevant counties.

**The commission confirms that, according to available information, the revised RACT submittal accounts for all major VOC and $NO_X$ sources of affected sectors within the relevant counties.**

The EPA stated that the DFW VOC RACT Analysis Table 2 uses the phrase “economically reasonable” instead of the phrase “economically feasible.” The EPA requested additional economic analysis or other documentation showing whether additional control for RACT is economically “feasible” for each major source of VOC and $NO_X$ emissions in the nine-county DFW eight-hour ozone nonattainment area.

**The commission has revised the incorrect reference to read economically feasible (see Appendix J). Control of VOC emissions resulting from incomplete fuel combustion is not economically feasible due to the high volume and low VOC concentration of the exhaust gas streams.**

The EPA commented that the term “RACT” meaning Reasonably Available Control Technology is used or referred to numerous times throughout Chapter 115; however, RACT is not defined in §115.10. The EPA recommended that the commission adopt the EPA’s long standing definition of RACT from 44 FedReg 53761, September 17, 1979, as “the lowest emissions limitation that a particular source can meet by applying a control technique that is reasonably available considering technological and economic feasibility.”

**While the commission agrees with the EPA’s definition of RACT, it disagrees with the EPA’s suggested change. The term RACT is only used in Chapter 115 as a descriptor to**

**distinguish those standards and requirements the commission has adopted for RACT purposes from those adopted for other purposes. The commission decides what is considered to be RACT for a particular source category during the evaluation phase of rulemaking. Including a definition of RACT in §115.10 would neither clarify the rule nor improve enforcement of the RACT requirements of any particular rule requirement. Therefore, the commission declines to make the suggested change.**

the EPA commented that the "RACT" meaning Reasonably Available Control Technology is used or referred to more than 240 times throughout Chapter 117; however, RACT is not defined in §117.10. The EPA recommended that the commission adopt the EPA's long-standing definition of RACT from 44 FedReg 53761, September 17, 1979, "the lowest emissions limitation that a particular source can meet by applying a control technique that is reasonably available considering technological and economic feasibility."

**While the commission agrees with the EPA's definition of RACT, it disagrees with EPA's suggested change. The term RACT is only used in Chapter 117 as a descriptor to distinguish those standards and requirements the commission has adopted for RACT purposes from those adopted for other purposes. The commission decides what is considered to be RACT for a particular source category during the evaluation phase of rulemaking. Including a definition of RACT in §117.10 would neither clarify the rule nor improve enforcement of the RACT requirements of any particular rule requirement. Therefore, the commission declines to make the suggested change.**

The EPA commented that on October 5, 2006, The EPA published notice of final determination and availability of control technique guidelines covering lithographic printing materials, flexible packaging printing materials, flat wood paneling coatings, and industrial cleaning solvents. The EPA stated that although the current RACT SIP analysis does not need to address these new control technique guidelines the state should consider these new documents in future VOC SIP rule revisions.

**The commission appreciates the comment and will consider the appropriate applicability of the control technique guidelines published for these source categories in future VOC rulemakings.**

One individual agreed the source cap approach for cement kilns is fair and flexible, though he strongly encourages requiring 80 percent reductions and modification of the cap to reduce an additional 10 tons of $NO_X$ emissions. However, the commenter disagreed that SCR is not as well established for control of cement kilns as SNCR, and asserted that RACT should govern control selection. The commenter noted that the EPA's guidance states RACT need not be available "off-the-shelf," but should be stringent, even technology forcing, considering technological and economic feasibility, and that the TCEQ should adopt stringent, technology forcing, tough and restrictive standards, even if this requires significant economic sacrifices. The commenter included a report on SCR performance at a dry kiln in Italy, a copy of an electronic mail mentioning two vendor quotes for 90-95 percent $NO_X$ reductions with SCR for a California facility, and a letter from a LoTOx vendor proposing 90 percent $NO_X$ reduction. The commenter also recommended establishing a single description for applicability of the cement kiln source cap, rather than multiple terms "installed," "in operation," and "operational." Finally, the commenter recommended applying a single emissions level (K factor) for both wet and dry kilns in the computation of the source cap for each site, corresponding to an overall 80 percent reduction in $NO_X$ emissions at each account, as an incentive to retire older, higher emitting kilns.

**The commission appreciates the detailed and informed comments, but disagrees that SCR is well established and is RACT for the cement kilns located in Ellis County. The commission has no information indicating that SCR has been proposed or tested on any wet process cement kiln. Seven of ten kilns in Ellis County are wet kilns. Very few SCR systems have been tested on dry process kilns, none of which has been attempted in the United States.**

**The commission is familiar with the report on the Italian kiln, which is a dry process kiln. The information regarding the kiln in California mentions vendor quotes, but not amounts, target emissions rates, nor type of kiln. This information notes that neither vendor has retrofitted SCR to a cement kiln. The commission has contacted the LoTOx vendor, and while the vendor asserts the LoTOx system could be applied to cement kilns, LoTOx has never been installed on cement kilns. The vendor also stated that the system would likely cost more than other options and would require more time to construct and optimize. Regarding establishing a single term to refer to an operational kiln, applying a single emissions factor for all types of kilns in the source cap equation would not be appropriate. As discussed elsewhere in this preamble, there are significant differences between the two types of cement kilns in Ellis County. Prescribing a single emissions factor, either on a tpd or pound per ton (ppt) of clinker basis would not be equitable and could make compliance with the rule unfeasible for owners or operators of certain kilns. The commission does not intend to force owners or operators to shut down kilns to comply with the rule. Additional information regarding the commission's analysis of control technologies for cement kilns is available elsewhere in this response to comments and in the adoption preamble for 30 TAC Chapter 117.**

## REASONABLY AVAILABLE CONTROL MEASURES (RACM) DEMONSTRATION

The EPA recommended using a consistent implementation date of March 1, 2009, for new rules associated with the DFW attainment demonstration SIP.

**The commission understands that controls must be implemented prior to the attainment date to benefit the area in reaching the NAAQS and has provided a RACM assessment on this basis. However, in reviewing comments submitted for the 30 TAC Chapter 117 rules and the DFW attainment demonstration SIP, the commission determined that additional time may be necessary for some sources to comply with the requirements of certain control measures because of the large number of affected sources and/or time needed to obtain equipment, etc. As discussed in the adoption preamble for the 30 TAC Chapter 117 rules, the compliance schedule for major sources in §117.9030 has been revised to provide some sources additional time by extending the compliance date to March 1, 2010. Brick and ceramic kilns are included in those source categories that will have until March 1, 2010. Additionally, the commission provided that emissions reductions from East Texas combustion sources will be required by March 1, 2010. The commission also provided the ability for cement kilns to obtain an extension for compliance until March 1, 2010, if specified criteria are met regarding potential contested case hearings. While a contested case hearing is unlikely in the case of the cement kilns subject to this rulemaking due to the nature of the controls likely to be used, the commission agrees that the possibility of a contested case hearing exists. The commission expects that some sources will comply before the March 1, 2010, deadline. The commission has determined that although there may not be emissions reductions from a full ozone season prior to the attainment date, these extensions are for a limited subset of sources that will result in small emissions reductions, however, these control measures are still necessary for attainment.**

**Ozone is a naturally occurring compound whose complex formation process is partially dependent upon factors outside of the State's control, particularly meteorology. For this and other reasons, the SIP is a prediction of attainment but not a guarantee. Individual control measures reduce the risk of exceeding the standard, but do not guarantee that no exceedances will occur. Therefore, while many of the control strategies will be implemented by March 2009 and will reduce the risk of exceeding the standard during 2009, other control strategies that could not be implemented until March 2010 will further reduce the risk of exceeding the standard by the June 15, 2010, attainment date.**

REVISIONS TO THE STATE IMPLEMENTATION PLAN (SIP)
FOR THE CONTROL OF OZONE AIR POLLUTION

# 5 PERCENT INCREMENT OF PROGRESS DEMONSTRATION
# DALLAS-FORT WORTH OZONE NONATTAINMENT AREA
# 8-HOUR OZONE STANDARD

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
P.O. BOX 13087
AUSTIN, TEXAS 78711-3087

PROJECT NO. 2004-096-SIP-AI

Adopted
April 27, 2005

## EXECUTIVE SUMMARY

On April 15, 2004, EPA designated several counties in the North Texas area as nonattainment for the 8-hour ozone standard. Those counties are: Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall and Tarrant. The 9-county DFW area was classified as moderate for the 8-hour ozone standard and must attain the 8-hour NAAQS by June 15, 2010. In accordance with the EPA's 8-hour ozone rule, the area should monitor attainment in the ozone season of the year prior to 2010.

On April 30, 2004, EPA promulgated its Phase I 8-Hour Implementation Rule. In 40 CFR § 51.905(a)(ii) and subsequent guidance, EPA provided three options for areas without an approved 1-hour ozone attainment plan:

A) Submit a 1-hour ozone attainment demonstration no later than one year after designation (by June 15, 2005);
B) Submit an 8-hour ozone plan no later than one year after designation (by June 15, 2005) that provides a 5 percent increment of progress from the area's 2002 emissions baseline that are in addition to federal measures and state measures already approved by EPA, and to achieve these reductions by June 15, 2007; or
C) Submit an 8-hour ozone attainment demonstration by June 15, 2005.

This SIP revision contains information and control measures to meet option B, which represents the best path forward for the DFW area at the present time. In light of EPA's pending revocation of the 1-hour ozone standard in June 2005, the agency's resources should be focused on the more protective 8-hour ozone standard. The TCEQ is evaluating the performance of the DFW photochemical model to determine the viability of the 1999 episode for the development of local control strategies. Furthermore, a 2007 projected Ozone Season Day inventory demonstrates a downward trend of emissions. For these reasons, the commission, in coordination with EPA,selected option B, the 5 Percent Increment of Progress (IOP) plan, as a technically sound and expeditious approach to starting to achieve the reductions ultimately needed for attainment of the 8-hour ozone standard.

This revision contains several elements:

- 2002 Periodic Emissions Inventory (PEI) for the 9-county DFW ozone nonattainment area;
- An IOP plan that achieves a 5 percent reduction in emissions from the 2002 emissions inventory baseline;
- Control measures that achieve the necessary $NO_x$ and VOC emission reductions;
- Rules and programs necessary to implement the 5 percent IOP control measures; and
- Motor vehicle emissions budgets (MVEBs) for use in transportation conformity demonstrations.

### EMISSIONS INVENTORY

The 1990 Amendments to the FCAA require that emissions inventories (EIs) be prepared for ozone nonattainment areas. Because ozone is photochemically produced in the atmosphere when VOCs are mixed with $NO_X$ in the presence of sunlight, the commission must compile information on the important sources of these precursor pollutants. The EI identifies the source types present in an area, the amount of each pollutant emitted, and the types of processes and control devices employed at each plant or source category. The EI provides data for a variety of air quality planning tasks, including establishing baseline emission levels, calculating reduction targets, control strategy development for achieving the required emission reductions, emission inputs into air quality simulation models, and tracking actual emission reductions against the established emissions growth and control budgets. The total inventory of emissions of VOC, $NO_x$, and other pollutants for an area is summarized from the estimates developed for five general categories of emissions sources: point, area, onroad mobile, nonroad mobile, and biogenic.

In accordance with the EPA's Consolidated Emissions Reporting Rule (CERR), the Texas 2002 Periodic Emissions Inventory (PEI) has been developed for VOC, $NO_x$, and other pollutants from point, area, onroad mobile, nonroad mobile, and biogenic sources. As directed by the CERR, the PEI includes statewide coverage, thus reporting emissions for the 1-hour ozone nonattainment areas as well as the 8-hour ozone nonattainment areas in Texas. Emissions are reported on a daily basis averaged over the peak ozone season.

In addition, the EPA requires that the 5 Percent IOP SIP establish MVEBs for transportation conformity purposes. A MVEB is the onroad mobile source allocation of the total allowable emissions for each applicable criteria pollutant or precursor, as defined in the SIP. Transportation conformity determinations must be performed using the budget test, once EPA determines the budget(s) adequate for transportation conformity purposes. To pass the budget test, areas must demonstrate that the estimated emissions from transportation plans, programs and projects do not cause the MVEB to be exceeded. This SIP revision establishes a 2007 MVEB for the DFW area, which is necessary to prevent a transportation conformity lapse after June 15, 2005.

**2007 DFW Motor Vehicle Emissions Budgets**

| | VOC (tpd) | $NO_x$ (tpd) |
|---|---|---|
| 2007 onroad mobile source inventory, unadjusted | 104.14 | 206.72 |
| TERP credits | 0 | –5.4 |
| **2007 MVEB** | **104.14** | **201.32** |

EPA requires that the 2002 PEI for the nine county DFW area and the MVEB be available for public comment and be submitted as part of this five percent IOP SIP. In March 2005, it was discovered that incorrect diesel fraction inputs were used in the development of both the 2002 and 2007 onroad mobile inventories that were included in the 5 Percent IOP SIP proposal. The TCEQ and NCTCOG worked together to correct the problem and the updated onroad mobile figures are included below in the $NO_x$ and VOC emission summaries for each source category for both the 2002 base year and the 2007 future year. See Tables 2-4 and 2-5.

According to the guidance, states should ensure that the projected future inventory is at least 5 percent less than the 2002 inventory or the appropriate percentage of NOx and VOC if a combination of pollutants is used. That is, the 2007 projected inventory must be no greater than 95 percent of the 2002 inventory.

This SIP revision demonstrates that Texas has met this requirement. The percentage reductions in the VOC and NOx inventory from 2002 (adjusted to include VOC emissions from portable fuel containers and NOx emissions from Alcoa outside the 9-county DFW nonattainment area) to 2007 (adjusted for 5 percent control strategies) are summarized below:

**DFW Reductions from 2002 to 2007**

| Pollutant | Adjusted 2002 inventory (tpd) | Adjusted 2007 inventory (tpd) | Percentage reduction from 2002 to 2007 |
|---|---|---|---|
| VOC | 465.75 | 403.19 | 13.4% |
| $NO_x$ | 622.22 | 422.02 | 32.2% |

This tables shows that the 2007 inventories for both VOC and $NO_x$ in comparison to the 2002 inventories have each decreased by much more than 5 percent.

**DATA ANALYSIS**

In its guidance for the 5 Percent IOP plan, EPA states that reductions from outside the nonattainment area that are not already in the approved SIP are creditable if consistent with previous EPA guidance, provided they occur within 100 km of the nonattainment area for VOCs or within 200 kilometers for $NO_x$. A demonstration must be made that, in addition to the 100km/200km criteria, the reductions have been shown to impact the nonattainment area. The guidance states that this demonstration may be met by analyzing wind rose data, available modeling, or similar technical documentation. As provided for by this guidance, wind rose data and other analysis are used to calculate the reductions from the new portable fuel container rule and the shut-down of the existing boilers at the Alcoa facility in Milam County.

The guidance also states that the emissions from the source or sources where the reductions are occurring must be added to the baseline inventory. Furthermore, all measures for inclusion should meet the general criteria for SIP approval of being permanent, quantifiable and enforceable.

**REQUIRED CONTROL STRATEGY ELEMENTS**
**Existing Creditable Measures**

**$NO_x$ Control Measures**

Texas Emission Reduction Plan (TERP)

The 5 Percent IOP plan relies upon $NO_x$ reductions from the TERP. During the first part of FY 2004, a total of 43 projects in the eligible 41 counties were awarded funding for $15.3 million. The projected $NO_x$ reductions are 3,047 tons, at an average cost per ton of $5,008. In March 2004, 479 applications requesting over $350 million were received and reviewed. The 171 projects funded are anticipated to result in over 10,000 tons of $NO_x$ reductions, at an average cost per ton of $5,980. Overall, as of mid-January, there were contracts in place for 282 projects, totaling over $120 million for projected reductions in $NO_x$ emissions of over 21,100 tons, at an average cost per ton of $NO_x$ reduced of $5,714. For the DFW area, this means approximately 5.2 tpd of $NO_x$ are projected to be reduced in 2007 from the over 100 TERP projects in place in the DFW area. Accounting for these projects already funded and, based on the approach established for allocating future TERP funds, TERP funding will be sufficient to achieve over 22.2 tpd of reductions in the DFW area by 2007.

Energy Efficiency

Energy efficiency measures are a critical part of the commission's plan for clean air. Not only do they decrease $NO_x$ emissions, they also produce reductions in other criteria pollutants such as PM, $SO_2$, VOC, and CO. The primary benefit of energy efficiency is its ability to decrease the demand for electrical generation, which provides for greater reliability, with the secondary benefit being emission reductions. When combined, various efficiency measures have the potential to add up to significant energy savings as well as emission reductions, thereby contributing to the overall goal of clean air in Texas.

The database and applications developed and used by the E-calc system were used to calculate $NO_x$ reductions in the DFW nonattainment area. These reductions are enforceable and permanent because SB 5 mandates the statewide adoption of the International Residential Code (IRC) and the International Energy Conservation Code (IECC) for residential, commercial, and industrial buildings. The $NO_x$ reductions were calculated based on electricity and natural gas savings from implementation of the 2000 construction code to single and multi-family residences in 2003. The resulting annual $NO_x$ reductions for 2007 was calculated to be 0.72 tpd.

**VOC Control Measures**

Statewide Portable Fuel Container Rule

The portable fuel container rule establishes new requirements relating to the design criteria for portable fuel containers and portable fuel container spouts. The new rules will establish design criteria for "no-spill" portable fuel containers based in large part on the CARB standards. By December 31, 2005, these new rules will limit the type of portable fuel containers and portable fuel container spouts sold, offered for sale, manufactured, and/or distributed in the State of Texas. Fuel released into the environment leads to the contamination of both the state's air and water. These rules will ensure that portable fuel containers manufactured under these standards will release fewer amounts of fuel as the result of spillage and evaporation.

**Measures Requiring Rulemaking**

**$NO_x$ Control Measures**

Lean-Burn and Rich-Burn Engines

The reductions relied upon in the 5 percent IOP plan include the implementation of new $NO_x$ emission specifications and other compliance demonstration requirements for certain industrial, commercial, and institutional gas-fired stationary, reciprocating internal combustion engines. The rule associated with the adopted requirements are in Chapter 117, Subchapter B, Division 3 and apply to sites located in Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, and Tarrant Counties. The adopted rule requires each gas-fired rich-burn engine placed into service before January 1, 2000 and gas-fired lean-burn engine to achieve a 2.0 grams $NO_x$ per horsepower hour (g/hp-hr) emission limit. The adopted rule also requires gas-fired rich-burn engines placed into service on or after January 1, 2000 to achieve 0.5 g/hp-hr. A CO limit of 3.0 g/hp-hr limit applies to all gas-fired lean-burn and rich-burn engines as well as certain demonstration of compliance requirements. The $NO_x$ emission reductions resulting from the implementation of this rule are 1.87 tpd.

Alcoa, Milam County

EPA's guidance for the 5 Percent IOP plan allows credit to be taken for $NO_x$ reductions occurring within 200 km of the ozone nonattainment area. The Alcoa plant in Rockdale, Milam County is within 200 km of the boundary of the DFW ozone nonattainment area. As the result of enforcement actions, Alcoa is required to make reductions from its three lignite-fired boilers (Sandow Units 1, 2, and 3).

EPA's 5 Percent IOP guidance also requires that emissions from the source contributing the emissions credits be added to the 2002 baseline inventory. The 2002 $NO_x$ and VOC emissions inventories for Alcoa, 23.17 tpd and 2.13 tpd, respectively, have been added to the 2002 CERR inventory. All control measures that are a part of the 5 Percent IOP plan must be implemented by June 15, 2007. Alcoa has chosen to replace the existing boilers. Only one boiler will be replaced by June 15, 2007, and therefore only reductions for one boiler will be claimed for credit in this SIP.

**VOC Control Measures**

Surface Coating

Various rules for surface coating operations have been in effect for the four core DFW counties in order to meet RACT and Control Technique Guideline (CTG) requirements. In rulemaking concurrent to this SIP, the commission is adopting a rule to extend the requirements for surface coating to the five newly designated DFW nonattainment counties. This control measure will result in 0.3 tpd VOC reductions.

Stage I Gasoline Unloading

Rules have already been in effect for Stage I gasoline unloading operations in the four core DFW counties, with an exemption for operations with a throughput equal to or less than 10,000 gallons per month. In rulemaking concurrent to this SIP, the commission is adopting a rule revision to extend these Stage I requirements, with the 10,000 gallons per month exemption, to the five newly designated DFW nonattainment counties. This control measure will result in 1.49 tpd VOC reductions.

**SUMMARY**

The control measures developed as part of this SIP and summarized in the following table will achieve the required 5 percent reductions from the 2002 baseline, and therefore satisfy the conditions of the 5 Percent IOP plan.

| **Source of reductions** | **TPD $NO_x$** | **TPD VOC** |
|---|---|---|
| **Eligible existing measures** | | |
| Alcoa (within 200 km radius) | 3.9 | |
| TERP | 22.2 | |
| Energy efficiency | 0.72 | |
| Portable fuel containers (9-county area) | | 2.79 |
| Portable fuel containers (within 100 km radius) | | 0.63 |
| **Subtotal** | 26.82 | 3.42 |
| **Control measures requiring rulemaking** | | |
| Nine county lean-burn and rich-burn engine rule | 1.87 | |
| Expand surface coating rule to 5 counties | | 0.3 |
| Lower Stage I exemption throughput to 10,000 gal/mo. in 5 counties (same as in 4 core counties) | | 1.49 |
| **Subtotal** | 1.87 | 1.79 |

| | | |
|---|---|---|
| **TOTAL IDENTIFIED REDUCTIONS** | **28.69** | **5.21** |
| Minimum reductions required to meet 5% | 28.69 | 1.86 |
| **SURPLUS REDUCTIONS** | **0** | **3.35** |

## FUTURE ATTAINMENT PLANS

### Path Forward For The 8-Hour Attainment Demonstration

This 5 Percent Increment of Progress SIP revision is a first step in addressing the 8-hour ozone standard. The 8-hour ozone attainment demonstration SIP revision will be submitted to EPA by the required date of June 15, 2007. The TCEQ continues to evaluate existing modeling episodes for application in developing an 8-hour ozone attainment demonstration. The TCEQ will be working towards an 8-hour ozone attainment demonstration which may include an evaluation of potential control measures, an assessment of the need for additional regional control strategies, and an analysis of the contribution to ozone formation from areas other than Texas.

## FUTURE INITIATIVES

The TCEQ is committed to researching emerging technologies, building the science for ozone modeling and analysis, and addressing industrial, onroad and nonroad mobile, and area sources of emissions, all in an effort to improve air quality in Texas. The New Technology Research and Development (NTRD) program promotes commercialization technologies that will support projects that are eligible for funding under the TERP Emissions Reduction Incentive Grants Program and works to streamline and expedite the process through which the TCEQ and the EPA provide recognition and SIP credit for new, innovative and creative technological advancement.

The Texas 2000 Air Quality Study, the most comprehensive and successful air quality study conducted to date in the U.S., with over 40 research organizations and over 250 scientists, has provided and will continue to provide a large part of the scientific basis for reassessing the ozone problem in eastern Texas. The second phase of this study, Texas Air Quality Study II (TexAQS II), is scheduled for 2005 and 2006 and will cover the area of Texas east of, and including the, I-35/37 corridor. The TCEQ will be involved in this research in order to improve regulatory analysis and prediction tools used for developing SIPs.

The commission is committed to working in cooperation with the regulated community, academia, research consortiums, and others to ensure that the modeling used to develop effective control strategies will use the most current scientific methodologies and information to replicate high ozone episodes in a given area.

## SECTION V: LEGAL AUTHORITY

A. General

The TCEQ has the legal authority to implement, maintain and enforce the national ambient air quality standards.

The first air pollution control act, known as the Clean Air Act of Texas, was passed by the Texas Legislature in 1965. In 1967, the Clean Air Act of Texas was superseded by a more comprehensive statute, the Texas Clean Air Act (TCAA), found in Article 4477-5, Vernon's Texas Civil Statutes. The Legislature amended the TCAA in 1969, 1971, 1973, 1979, 1985, 1987, 1989, 1991, 1993, 1995, 1997 and 1999. In 1989, the TCAA was codified as Chapter 382 of the Texas Health & Safety Code.

Originally, the TCAA stated that the Texas Air Control Board (TACB) is the state air pollution control agency and is principal authority in the state on matters relating to the quality of air resources. In 1991, the Legislature abolished the TACB effective September 1, 1993 and its powers, duties, responsibilities and functions were transferred to the Texas Natural Resource Conservation Commission (TNRCC). With the creation of the TNRCC, the authority over air quality is found in both the Texas Water Code and the TCAA. Specifically, the authority of the TNRCC is found in Chapters 5 and 7. Chapter 5, Subchapters A - F, and H - J and L, include the general provisions, organization and general powers and duties of the TNRCC, and the responsibilities and authority of the Executive Director. This Chapter also authorizes the TNRCC to implement action when emergency conditions arise, and to conduct hearings. Chapter 7 gives the TNRCC enforcement authority. In 2001, the 77$^{th}$ Texas Legislature continued the existence of the TNRCC until September 1, 2013, and changed the name of the TNRCC to the Texas Commission on Environmental Quality (TCEQ).

The TCAA specifically authorizes the TCEQ to establish the level of quality to be maintained in the state's air and to control the quality of the state's air by preparing and developing a general, comprehensive plan. The TCAA, Subchapters A - D, also authorize the TCEQ to collect information to enable the commission to develop an inventory of emissions; conduct research and investigations; enter property and examine records; to prescribe monitoring requirements; to institute enforcement proceedings; to enter into contracts and execute instruments; to formulate rules; to issue orders taking into consideration factors bearing upon health, welfare, social and economic factors, and practicability and reasonableness; to conduct hearings; to establish air quality control regions; to encourage cooperation with citizens' groups and other agencies and political subdivisions of the state as well as with industries and the Federal Government; to establish and operate a system of permits for construction or modification of facilities.

Local government authority is found in Subchapter E of the TCAA. Local governments have the same power as the TCEQ to enter property and make inspections. They also may make recommendations to the Commission concerning any action of the TCEQ that affects their territorial jurisdiction, may bring enforcement actions, and may execute cooperative agreements with the TCEQ or other local governments. In addition, a city or town may enact and enforce ordinances for the control and abatement of air pollution not inconsistent with the provisions of the TCAA, the rules or orders of the Commission.

B. Applicable Law

The following statutes and rules provide necessary authority to adopt and implement the SIP. The rules listed below have previously been submitted as part of the SIP.

Statutes

| | |
|---|---|
| TEXAS HEALTH & SAFETY CODE, Chapter 382 | September 1, 2001 |
| TEXAS WATER CODE | September 1, 2001 |

All sections of each subchapter are included, unless otherwise noted.

Chapter 5: Texas Natural Resource Conservation Commission
Subchapter A: General Provisions
Subchapter B: Organization of the Texas Natural Resource Conservation Commission
Subchapter C: Texas Natural Resource Conservation Commission
Subchapter D: General Powers and Duties of the Commission
Subchapter E: Administrative Provisions for Commission
Subchapter F: Executive Director (except §§ 5.225, 5.226, 5.227, 5.2275, 5.232, and 5.236)
Subchapter H: Delegation of Hearings
Subchapter I: Judicial Review
Subchapter J: Consolidated Permit Processing
Subchapter L: Emergency and Temporary Orders (§§ 5.514, 5.5145 and 5.515 only)

Chapter 7: Enforcement
Subchapter A: General Provisions (§§ 7.001, 7.002, 7.0025, 7.004, 7.005 only)
Subchapter B: Corrective Action and Injunctive Relief (§ 7.032 only)
Subchapter C: Administrative Penalties, §§ 7.051- 7.075
Subchapter E Criminal Offenses and Penalties: §§ 7.177, 7.179-7.181

Rules

All of the following rules are found in Title 30, Texas Administrative Code, as of the following effective dates:

| | |
|---|---|
| Chapter 7, Memoranda of Understanding, §§ 7.110 and 7.119 | May 2, 2002 |
| Chapter 35, Subchapters A-C, K: Emergency and Temporary Orders and Permits; Temporary Suspension or Amendment of Permit Conditions | December 10, 1998 |
| Chapter 39, Public Notice, §§ 39.201; 39.401; 39.403(a) and (b)(8)-(10); 39.405(f)(1) and (g);39.409; 39.411 (a), (b)(1)-(6) and (8)-(10) and ©)(1)-(6) and (d); 39.413(9), (11), (12) and (14); 39.418(a) and (b)(3) and (4); 39.419(a), (b),(d) and (e); 39.420(a), (b) and ©)(3) and (4); 39.423 (a) and (b); 39.601; 39.602; 39.603; 39.604; and 39.605 | September 23, 1999 |
| Chapter 55, Request for Contested Case Hearings; Public Comment, §§ 55.1; 55.21(a) - (d), (e)(2), (3) and (12), (f) and (g); 55.101(a), (b), ©)(6) - (8); 55.103; 55.150; 55.152(a)(1), (2) and (6) and (b); 55.154; 55.156; 55.200; 55.201(a) - (h); 55.203; 55.205; 55.206; 55.209 and 55.211 | October 20, 1999 |

| | |
|---|---|
| Chapter 101: General Air Quality Rules | October 20, 2002 |
| Chapter 106: Permits by Rule, Subchapters A and B | October 20, 2002 |
| Chapter 111: Control of Air Pollution from Visible Emissions and Particulate Matter (formerly known as Regulation I), except amendments effective September 16, 1996 and June 11, 2000 | June 11,2000 |
| Chapter 112: Control of Air Pollution from Sulfur Compounds (formerly known as Regulation II) | July 16, 1997 |
| Chapter 113, §113.120, Subchapter A: Control of Air Pollution from Toxic Materials (formerly known as Regulation III) | July 9, 2000 |
| Chapter 114: Control of Air Pollution from Motor Vehicles (formerly known as Regulation IV) | May 28, 2002 |
| Chapter 115: Control of Air Pollution from Volatile Organic Compounds (formerly known as Regulation V) | May 16, 2002 |
| Chapter 116: Permits for New Construction or Modification (formerly known as Regulation VI) | October 20, 2002 |
| Chapter 117: Control of Air Pollution from Nitrogen Compounds (formerly known as Regulation VII) | April 4, 2002 |
| Chapter 118: Control of Air Pollution Episodes (formerly known as Regulation VIII) | March 5, 2000 |
| Chapter 122, § 122.122: Potential to Emit | September 20, 1993 |

## LIST OF ACRONYMS

ACT - Alternative Control Techniques
AFV - Alternative Fuel Vehicle
AIRS - Aerometric Information Retrieval System
APA - Administrative Procedure Act
ARACT - Alternate Reasonably Available Control Technology
ARPDB - Acid Rain Program Data Base
ASC - Area Source Categories
ASE - Alliance to Save Energy
ASM - Acceleration Simulation Mode (I/M Test)
ATC - Air Traffic Control
BACT - Best Available Control Technology
BEIS-2 - Biogenic Emissions Inventory System, version2
BELD - Biogenic Emissions Land Cover Database
BIOME - Biogenic Model for Emissions
BPA - Beaumont-Port Arthur
Cal LEV - California Low Emission Vehicle
CAM - Compliance Assurance Monitoring
CAMS - Continuous Air Monitoring Station
CAMx - Comprehensive Air Model with Extensions
CARB - California Air Resources Board
CARE - Clean Air Responsibility Enterprise
CB-IV HC - Carbon Bond IV Hydrocarbon
CFR - Code of Federal Regulations
CEMS - Continuous Emissions Monitoring System
CERR - Consolidated Emissions Reporting Rule
CMAQ - Congestion Mitigation and Air Quality
CMSA - Consolidated Metropolitan Statistical Area
CNG - Compressed Natural Gas
CO - Carbon Monoxide
COAST - Coastal Oxidant Assessment for Southeast Texas
CTG - Control Technique Guidelines
DART - Dallas Area Rapid Transit
DERC - Discreet Emission Reduction Credit
DFW - Dallas-Fort Worth
DFWN - Dallas-Fort Worth North
DFWRTM - Dallas-Fort Worth Regional Travel Model
DOW - Day of Week
DRI - Desert Research Institute
DV - Design Value
EBT - Emissions Banking and Trading
Ecalc - Texas Energy and Emissions Reduction Calculator
EDMS - Emissions and Dispersion Modeling System
EF - Emission Factor
EGAS - Economic Growth Analysis System
EGF - Electric Generating Facilities

EGU - Electric Generating Units
EI - Emissions Inventory
EIQ - Emissions Inventory Questionnaire
ELP - El Paso
EPA - U.S. Environmental Protection Agency
EPN - Emission Point Number
ERC - Emission Reduction Credit
ERCOT - Electric Reliability Council of Texas
ESL - Energy Systems Laboratory
ETR - Employer Trip Reduction
FAA - Federal Aviation Administration
FCAA - Federal Clean Air Act
FMVCP - Federal Motor Vehicle Control Program
FR - Federal Register
FTP - File Transfer Protocol
GIS - Geographic Information System
g/hp-hr - Grams Per Horsepower-Hour
GloBEIS - Global Biosphere Emissions and Interactions System
GSE - Ground Support Equipment
HAP - Hazardous Air Pollutant
HAXL - Houston Air Excellence in Leadership
HB - House Bill
HC - Hydrocarbon
HDD - Heavy-duty Diesel
HDDV - Heavy-duty Diesel Vehicle
HDEWG - Heavy Duty Engine Working Group
HDV - Heavy-duty Vehicle
HGB - Houston-Galveston-Brazoria
H-GAC - Houston-Galveston Area Council
HON - Hazardous Organic NESHAPS
HOV - High Occupancy Vehicle
HP - Horsepower
HPMS - Highway Performance Monitoring System
HRM - Houston Regional Monitoring
IIG - Interim Implementation Guidance
IIP - Interim Implementation Plan
I/M - Inspection and Maintenance
INIT - Initial Condition Tracer
IOP - Increment of Progress
ITWS - Integrated Terminal Weather System
IWW - Industrial Wastewater
KG/HA - Kilograms/hectare
KM - Kilometer
LDT - Light-duty Truck
LED - Low Emission Diesel
LEV - Low Emission Vehicle
LNG - Liquefied Natural Gas
LTO - Landing/Takeoff

m - Meter
MACT - Maximum Achievable Control Technology
MAPPER - Measurement-based Analysis of Preferences in Planned Emissions Reductions
MERC - Mobile Emission Reduction Credit
MIR - Maximum Incremental Reactivity
MMBtu - Million British Thermal Unit
MPA - Metropolitan Planning Area
MY - Model Year
NAAQS - National Ambient Air Quality Standard
NCDC - National Climatic Data Center
NCTCOG - North Central Texas Council of Governments
NEGU - Non-electric Generating Units
NEI - National Emissions Inventory
NESHAPS - National Emission Standards for Hazardous Air Pollutants
NEVES - Nonroad Engine and Vehicle Emission Study
NLEV - National Low Emission Vehicle
NSR - New Source Review
$NO_x$ - Nitrogen Oxides or Oxides of Nitrogen
$NO_y$ - Nitrogen Species
NSR - New Source Review
NTCASC - North Texas Clean Air Steering Committee
NWS - National Weather Service
$O_3$ - Ozone
OAQPS - Office of Air Quality Planning and Standards
OBD - On-Board Diagnostics
OSAT - Ozone Source Apportionment Technology
OTAG - Ozone Transport Assessment Group
PAMs - Photochemical Assessment Monitoring Sites
PEI - Periodic Emissions Inventory
$PM_{10}$ - Particulate Matter less than 10 microns
$PM_{2.5}$ - Particulate Matter less than 2.5 microns
ppb - Parts Per Billion
ppm - Parts Per Million
ppmv - Parts Per Million by Volume
PSDB - Point Source Database
PSIA - Pounds per Square Inch Absolute
QA/QC - Quality Assurance/Quality Control
RACT - Reasonably Available Control Technology
RAQPC - Regional Air Quality Planning Committee
RCTSS - Regional Computerized Traffic Signal System
RFG - Reformulated Gasoline
REMI - Regional Economic Modeling, Inc.
ROP - Rate-of-Progress
RSD - Remote Sensing Device
RVP - Reid Vapor Pressure
SB - Senate Bill
SCAQMD - South Coast Air Quality Management District [Los Angeles area]
SCC - Source Classification Code

SCRAM - Support Center for Regulatory Air Models
SETRPC - Southeast Texas Regional Planning Commission
SIC - Standard Industrial Classification
SIP - State Implementation Plan
$SO_2$ - Sulfur Dioxide
$SO_x$ - Sulfur Compounds
SOCMI - Synthetic Organic Chemical Manufacturing Industry
SP - Smog Production algorithm
STARS - State of Texas Air Reporting System
SULEV - Super-Ultra-Low Emission Vehicle
TAC - Texas Administrative Code
TACB - Texas Air Control Board
TAFF - Texas Alternative Fuel Fleet
TCAA - Texas Clean Air Act
TCEQ - Texas Commission on Environmental Quality (commission)
TCF - Texas Clean Fleet
TCM - Transportation Control Measure
TERP - Texas Emissions Reduction Plan
TIP - Transportation Improvement Program
TIPI - Texas Industrial Production Index
TMC - Texas Motorist’s Choice
TNMOC - Total nonmethane organic compounds
TNRCC - Texas Natural Resource Conservation Commission
TPOD - Tons Per Ozone Day
TPY - Tons Per Year
TSP - Total Suspended Particulate
TTI - Texas Transportation Institute
UAM - Urban Airshed Model
USDA - United States Department of Agriculture
USGS - United States Geological Survey
UTM - Universal Transverse Mercator
VAVR - Voluntary Accelerated Vehicle Retirement
VERP - Voluntary Emission Reduction Permit
VMAS - Vehicle Mass Analysis System
VMEP - Voluntary Mobile Source Emissions Reduction Program
VMT - Vehicle Miles Traveled
VNR or VNRAT- VOC-$NO_x$ ratios
VOC - Volatile Organic Compound
WOE - Weight of Evidence

**5 PERCENT INCREMENT OF PROGRESS DEMONSTRATION**
**DALLAS-FORT WORTH OZONE NONATTAINMENT AREA**

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## CHAPTER 1: GENERAL

### 1.1 BACKGROUND

**"The History of the Texas State Implementation Plan (SIP), " a comprehensive overview of the SIP revisions submitted to EPA by the State of Texas, is available at the following web site:**
http://www.tnrcc.state.tx.us/oprd/sips/sipintro.html#History

The Dallas-Fort Worth (DFW) area (consisting of Collin, Dallas, Denton, and Tarrant Counties) was classified as a moderate ozone nonattainment area in accordance with the Federal Clean Air Act (FCAA) Amendments of 1990. As a moderate area, DFW was required to demonstrate attainment of the 1-hour ozone standard by November 15, 1996. Ambient air monitoring data for the years 1994-96 showed that the 1-hour ozone standard was exceeded more than one day per year over this three-year period. As a result, the EPA reclassified the DFW area from moderate to serious, effective March 20, 1998, for failure to attain the 1-hour ozone standard by the November 1996 deadline. The EPA required that a SIP revision be submitted within one year, showing attainment of the National Ambient Air Quality Standard (NAAQS) and addressing requirements for serious areas. TCEQ submitted a SIP revision containing a Post-1996 Rate-of-Progress (ROP) SIP demonstration to the EPA on March 18, 1999. This SIP revision contained photochemical modeling. The modeling indicated that additional nitrogen oxides ($NO_x$) reductions would be needed to attain the standard by November 1999. The following rules were developed and included in the SIP:

- Reasonably Available Control Technology (RACT) for $NO_x$ point sources
- Nonattainment New Source Review (NSR) for $NO_x$ point sources
- Revisions resulting from the change in the major source threshold for RACT for Volatile Organic Compounds (VOCs)

The commission indicated that due to time constraints, the Post-1996 ROP SIP would not have all rules necessary to bring the DFW area into attainment by the November 1999 deadline and that a complete attainment demonstration would be submitted in the spring of 2000. The EPA determined that the Post-1996 ROP SIP was incomplete and began an 18-month sanctions clock effective May 13, 1999.

The attainment deadline for serious areas under the 1-hour ozone standard was November 15, 1999. The November 15, 1999, deadline passed, and EPA has not made a determination regarding the DFW area attainment status. Technical data became available suggesting that DFW is significantly impacted by transport and regional background levels of ozone. Therefore, the reductions from the strategies needed for the HGB area and the regional rules were seen as a necessary and integral component in the strategy for DFW's attainment of the 1-hour ozone standard.

In order to develop local control strategy options to augment federal and state programs, the DFW area established the North Texas Clean Air Steering Committee (NTCASC) made up of local elected officials, business leaders, and other community stakeholders. Specific control strategies were identified for review by technical subcommittee members. In addition, the North Central Texas Council of Governments (NCTCOG) hired an environmental consultant to assist with the analysis and evaluation of control strategy options.

The Post-1996 ROP SIP was not approved by EPA prior to the next commission action. On April 19, 2000, the commission adopted a SIP revision and associated rules for the DFW ozone attainment demonstration. The April 2000 Attainment Demonstration SIP contained the following control strategy elements:

- **Federal measures**
  - Onroad mobile:
    Phase II RFG
    Tier II vehicle emission standards and federal low-sulfur gasoline NLEV standards
    Heavy-duty diesel standards
  - Nonroad mobile:
    Lawn and garden equipment standards
    Tier 3 heavy-duty diesel equipment standards
    Locomotives standards
    Recreational marine standards
    Standards for compression ignition vehicles and equipment
    Standards for spark ignition vehicles and equipment

- **State measures**
  - Point sources:
    Electric generating facilities requirements
    Cement kiln requirements
  - Onroad mobile:
    Texas low emission diesel
    Expanded vehicle inspection and maintenance (I/M) testing in 9 DFW counties
    Reduced speed limits
    Transportation control measures
    Voluntary mobile source emission reduction program (VMEP) measures such as telecommuting, vanpooling
  - Nonroad mobile:
    Texas low emission diesel
    Airport ground support equipment agreed orders
    California rule for gasoline-fueled, large spark ignition engines
    Operating restrictions for certain heavy-duty diesel equipment
    Accelerated purchase of certain Tier 2/Tier 3 diesel equipment
  - Area:
    Energy conservation efforts for buildings, including 2000 International Energy Conservation Code (IECC), and low-$NO_x$ water heaters

The April 2000 Attainment Demonstration SIP contained the following elements:

- Photochemical modeling of specific control measures and future state and national rules for attainment of the 1-hour ozone standard in the DFW area by the attainment deadline of November 15, 2007.

- A modeling demonstration that showed that air quality in the DFW area was influenced at times by transport from the HGB area. Under EPA's July 16, 1998, transport policy, if photochemical modeling demonstrated that emissions from an upwind area located in the same state and with a later attainment date interfered with the downwind area's ability to attain, the downwind area's attainment date could be extended to no later than that of the upwind area. For the DFW area, this extended the attainment date to November 15, 2007, the same attainment date as the HGB area.
- Identification of the level of reductions of VOC and $NO_x$ emissions necessary to attain the 1-hour ozone standard by 2007. The reductions of 141 tpd $NO_x$ from federal measures and 225 tpd $NO_x$ from state measures resulted in a total of 366 tpd $NO_x$ reductions for the attainment demonstration.

- A 2007 motor vehicle emission budget for transportation conformity.

- A commitment to perform and submit a mid-course review by May 1, 2004.

At the time it was submitted, the April 2000 Attainment Demonstration SIP would have allowed EPA to determine that the DFW area should not have been bumped up from serious to severe under the conditions of EPA's July 16, 1998, transport policy. The new attainment date for the DFW area would have been no later than November 15, 2007, the attainment date for HGB area.

In this same SIP revision, the commission repealed the airport ground support equipment (GSE) rule for the DFW area because agreed orders were signed with the area's major airlines, airports, and governmental entities to achieve the same $NO_x$ reductions that would have been required by the rule.

The April 2000 Attainment Demonstration SIP was not approved by EPA prior to the next commission action. In August 2001, the commission adopted revisions to the DFW SIP which repealed two of the rules adopted as part of the April 2000, SIP revision. The first rule restricted the use of construction and industrial equipment (nonroad, heavy-duty diesel equipment rated at 50 hp and greater). The second rule required the replacement of diesel-powered construction, industrial, commercial, and lawn and garden equipment rated at 50 hp and greater with newer Tier 2 and Tier 3 equipment, with the amount and timing of reductions depending on the horsepower rating of the engine fleet. These repeals were required by Senate Bill 5 (SB5), passed by the 77th Legislature of the State of Texas in May 2001. This legislative requirement was implemented by submitting the rule repeals to EPA as part of the August 2001, SIP revision. The Texas Emissions Reduction Plan (TERP) grant incentive program established by SB 5 replaced the above-referenced rules. Therefore, the $NO_x$ reductions previously claimed from the repealed rules are being achieved through an alternate but equivalent federally enforceable mechanism.

On March 5, 2003, the SIP was further revised as follows:

(1) Adoption of Chapter 117 $NO_x$ emission limits for cement kilns;

(2) Estimation of $NO_x$ reductions from energy efficiency measures, using a methodology which is to be further refined before energy efficiency credit is formally requested in the SIP; and a

(3) Commitment to perform modeling with MOBILE6, the latest version of EPA's emission factor model for mobile sources.

Meanwhile, environmental groups challenged EPA's extension of attainment dates based on transport. Beaumont-Port Arthur (BPA) was one of three areas in the nation for which suits were filed. On December 11, 2002, the United States Fifth Circuit Court of Appeals ruled that EPA [is] was not authorized by the FCAA to extend the BPA's attainment date based on transport. EPA published a final action in the Federal Register on March 30, 2004, reclassifying BPA to serious with an attainment date of November 15, 2005, and requiring a new attainment demonstration to be submitted by April 30, 2005. Although the court decision is relevant specifically for BPA, the direct implication for DFW is that EPA cannot approve extensions of the DFW 1-hour ozone attainment date past 1999, the date mandated by the FCAA for serious areas.

Because EPA had never approved the commission's commitment to perform a mid-course review for the DFW area and because of uncertainties regarding the transition from the 1-hour to the 8-hour ozone standard, the commission did not submit a mid-course review for the DFW area.

On April 15, 2004, EPA designated several counties in the North Texas area as nonattainment for the 8-hour ozone standard. Those counties are: Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall and Tarrant. The newly expanded 9-county DFW area was classified as moderate for the 8-hour ozone standard and must attain the 8-hour NAAQS by June 15, 2010. In accordance with the EPA's 8-hour ozone rule, the area should monitor attainment in the ozone season of the year prior to 2010.

**Current Revision**

On April 30, 2004, EPA promulgated its Phase I 8-Hour Implementation Rule. In 40 CFR § 51.905(a)(ii) and subsequent guidance, EPA provided three options for areas that do not have an approved 1-hour ozone attainment plan:

A) Submit a 1-hour ozone attainment demonstration no later than one year after designation (by June 15, 2005);
B) Submit an 8-hour ozone plan no later than one year after designation (by June 15, 2005) that provides a 5 percent increment of progress from the area's 2002 emissions baseline that are in addition to federal measures and state measures already approved by EPA, and to achieve these reductions by June 15, 2007; or
C) Submit an 8-hour ozone attainment demonstration by June 15, 2005.

This SIP revision contains information and control measures to meet option B, which represents the best path forward for the DFW area at the present time. In light of EPA's pending revocation of the 1-hour ozone standard in June 2005, the agency's resources should be focused on the more protective 8-hour ozone standard. EPA has not yet issued Phase II of its 8-hour Implementation Rule for states to use in developing 8-hour ozone attainment demonstrations. Phase II is expected to be promulgated by EPA in 2005. The TCEQ is evaluating the performance of the DFW photochemical model to determine the viability of the 1999 episode for the development of local control strategies. Furthermore, a 2007 projected Ozone Season Day inventory demonstrates a downward trend of emissions. For these reasons, the commission, in coordination with EPA, selected option B, the 5 Percent Increment of Progress (IOP) plan, as a technically sound and expeditious approach to starting to achieve the reductions ultimately needed for attainment of the 8-hour ozone standard.

This revision contains several elements:

- 2002 Periodic Emissions Inventory (PEI) for the 9-county DFW ozone nonattainment area;
- An IOP plan that achieves a 5 percent reduction in emissions from the 2002 emissions inventory baseline;
- Control measures that achieve the necessary $NO_x$ and VOC emission reductions;
- Rules and programs necessary to implement the 5 percent IOP control measures; and
- Motor vehicle emissions budgets (MVEBs) for use in transportation conformity demonstrations.

**1.2 HEALTH EFFECTS**

In 1997, EPA revised the NAAQSs for ozone to incorporate scientific data that indicated longer-term exposures to moderate levels of ozone could cause health effects. Ozone can cause acute respiratory effects and aggravate asthma. To support the 8-hour ozone standard, EPA provided information indicating ozone can temporarily decrease lung capacity in some healthy adults and cause inflammation of lung tissue.

Children may be at higher risk from exposure to ozone. Children breathe more air per pound of body weight than adults. Since children's respiratory systems are still developing, they may be more susceptible than adults to changing air quality. The most likely time of year for elevated ozone readings in Texas is the last half of August to early October which coincides with school starting and an increase in school related activities.

Adults most at risk to ozone exposure are outdoor workers, people outside exercising, and individuals with preexisting respiratory diseases.

Ground-level ozone interferes with the ability of plants to produce and store food.

### 1.3 PUBLIC HEARING INFORMATION

The commission held public hearings at the following times and locations:

| CITY | DATE | TIME | LOCATION |
|---|---|---|---|
| Arlington | January 3, 2005 | 5:30 p.m. | North Central Texas Council of Governments<br>616 Six Flags Drive<br>3rd Floor |
| Austin | January 4, 2005 | 10:00 a.m. | Texas Commission on Environmental Quality<br>12100 North I-35<br>Building F, Room 2210 |
| Houston | January 5, 2005 | 2:30 p.m. | Houston-Galveston Area Council<br>3555 Timmons Lane<br>Conference Room A, 2nd Floor |

Written comments were also accepted via mail, fax, or e-mail. The public comment period closed on January 6, 2005.

### 1.4 SOCIAL AND ECONOMIC CONSIDERATIONS

For a detailed explanation of the social and economic issues involved with any of the measures, please refer to the preambles that precede each proposed rule package accompanying this SIP.

### 1.5 FISCAL AND MANPOWER RESOURCES

The state has determined that its fiscal and manpower resources are adequate and will not be adversely affected through the implementation of this plan.

# CHAPTER 2: EMISSIONS INVENTORY

## 2.1 OVERVIEW
The 1990 Amendments to the FCAA require that emissions inventories (EIs) be prepared for ozone nonattainment areas. Because ozone is photochemically produced in the atmosphere when VOCs are mixed with $NO_X$ in the presence of sunlight, the commission must compile information on the important sources of these precursor pollutants. The EI identifies the source types present in an area, the amount of each pollutant emitted, and the types of processes and control devices employed at each plant or source category. The EI provides data for a variety of air quality planning tasks, including establishing baseline emission levels, calculating reduction targets, control strategy development for achieving the required emission reductions, emission inputs into air quality simulation models, and tracking actual emission reductions against the established emissions growth and control budgets. The total inventory of emissions of VOC, $NO_x$, and other pollutants for an area is summarized from the estimates developed for five general categories of emissions sources: point, area, onroad, nonroad, and biogenic.

In accordance with the EPA's Consolidated Emissions Reporting Rule (CERR), the Texas 2002 Periodic Emissions Inventory (PEI) has been developed for VOC, $NO_x$, and other pollutants from point, area, onroad mobile, nonroad mobile, and biogenic sources. As directed by the CERR, the PEI includes statewide coverage, thus reporting emissions for the 1-hour ozone nonattainment areas as well as the 8-hour ozone nonattainment areas in Texas. Emissions are reported on a daily basis averaged over the peak ozone season.

EPA requires that the 2002 PEI for the nine county DFW area be available for public comment and be submitted as part of this five percent IOP SIP. This chapter describes and summarizes the 2002 PEI for the various source categories for the DFW area. References to appendices containing more detailed emissions information are included. Chapter 5 describes the methodology for calculating increment of progress for the DFW area.

## 2.2 POINT SOURCES
Major point sources are defined for inventory reporting purposes in nonattainment areas as industrial, commercial, or institutional sources that emit actual levels of criteria pollutants at or above the following amounts: 10 tons per year (tpy) of VOC, 25 tpy of $NO_X$, or 100 tpy of other criteria pollutants ( CO, $SO_2$, $PM_{10}$, $PM_{2.5}$, or lead). For the attainment areas of the state, any company that emits a minimum of 100 tpy of any criteria pollutant must complete an emissions inventory questionnaire (EIQ). Any source emitting or with the potential to emit at least 10 tpy of any single Hazardous Air Pollutant (HAP) or 25 tpy of aggregate HAP is also required to report emissions.

In order to collect emissions and industrial process operating data for these plants, the commission mails EIQs to all sources identified as having triggered the above level of emissions. Companies are asked to report not only emissions data for all emissions generating units and emission points, but also the type and, for a representative sample of sources, the amount of materials used in processes that result in emissions. Information is also requested in the EIQ on process equipment descriptions, operation schedules, emission control devices currently in use, abatement device control efficiency, and stack parameters such as location, height, and exhaust gas flow rate. All data submitted via the EIQ is quality assured and entered into State of Texas Air Reporting System (STARS).

The commission developed the 2007 future year point source emission estimates by projecting the 2002 base year point source inventory, accounting for growth and controls. The growth is projected by multiplying the base case EI by growth factors that represent the projection of industrial expansion to the year 2007. The controls that are applied represent all of the $NO_x$ and VOC controls that are already in place, by TCEQ rule and regulation, requiring reductions between 2002 and 2007. The following paragraphs discuss the projection methodologies.

Growth in $NO_x$ and VOC emissions in the DFW area was partially accounted for through the emissions banked in the Emissions Banking and Trading (EBT) database. Emission Reduction Credit (ERC) and Discreet Emission Reduction Credit (DERC) totals as of September 8, 2004 were used. These banked emissions could return to the airshed as actual emissions in the future. As required in 30 TAC Chapter 101, an ERC must be surplus to any federal, state or local rule. The credits that are in the bank have been devalued to show surplus using the Chapter 117 emission rate limitations. Additionally, the DERCs are subject to Chapter 101 10 percent environmental contributions, and a NSR permitting offset ratio of 1.15:1 was applied to the ERCs. A total of 19.07 tons per day (tpd) of $NO_x$ and 0.44 tpd of VOC were added to the 2007 DFW EI to account for these banked emissions. This adjustment presumes that all of the credits will be used within one year. However, such a worst-case scenario is unlikely, especially since the majority of the credits are DERCs, which are used after one use.

The commission also accounted for growth in the DFW area by including emissions from newly-permitted electric generating units (EGU). Electric generation capacity growth in Texas has come primarily from new, cleaner, more efficient EGUs, typically natural gas fired combined cycle plants, rather than from existing EGUs. With a few exceptions, new EGUs have been located in attainment counties because of strict nonattainment New Source Review (NSR) permitting requirements.

An Electric Reliability Council of Texas (ERCOT) report of projected electricity use estimates that in Texas, demand will be 75 percent of capacity in 2007 (Reference: ERCOT, The Texas Connection report, "Report on Existing and Potential Electric System Constraints and Needs Within the ERCOT Region," October 1, 2003). To account for growth in EGU emissions, the commission added to the 2007 future case EI, 75 percent of the permit allowable emissions from EGUs that were not in the 2002 base case, but that had received NSR permits prior to April 2004. This approach is more realistic and reasonable because it does not account for the decrease in emissions from less efficient existing EGUs that the new generation will displace. Plus, this approach assumes that all newly-permitted EGUs will ultimately be built and operated. This approach is more realistic and reasonable than assuming that all new EGUs will be operating at 100 percent of their permitted allowables while existing EGUs are operating at 2002 levels. In the 9-county DFW area, allowable emissions from newly-permitted EGU's total 8.61 tpd of $NO_x$ and 1.88 tpd of VOC.

The NEGU emissions were grown from 2002 to 2007 using factors derived from the Texas Industrial Production Index (TIPI). If TIPI 2-digit Standard Industrial Classification (SIC) factors were unavailable, Economic Growth Analysis System (EGAS) 4.0 growth factors were used. TIPI was used where possible, because its data are more recent than those in the EGAS 4.0 model. The EGAS model was last updated on January 26, 2001, and uses data and data models that date from the early 1980s to 1999. The Regional Economic Modeling, Inc. (REMI) model, which is the economic basis of EGAS 4.0, uses economic data that date from 1969 to 1996. Also, EGAS uses historical emissions data from the National Emissions Inventory (NEI) ranging from 1972 to 1992. (See the EGAS 4.0 Reference Manual, available on EPA's Clearinghouse for Inventories & Emission Factors (CHIEF) web site). TIPI uses more recent economic data from November 2003. TIPI-EGAS is the combination of these two databases. TIPI data from January 1967 through November 2003 was used in a linear regression analysis to project emissions from 2002 to 2007. According to the Federal Reserve Bank of Dallas, TIPI is a value-added index based on a weighted average of employment, man hours, and some production data. The underlying process to derive TIPI data is the same as the Bureau of Economic Analysis gross-state product used in EGAS.

Chapter 117 $NO_x$ rules affect EGUs and NEGUs in the DFW area. Distinct Chapter 117 controls were applied to the baseline inventory emissions to simulate these rules. The NEGU equipment regulated by Chapter 117, relevant to this exercise, are industrial boilers larger than 40 MMBtu/hr and placed into service prior to 1992 and industrial engines larger than 300 horsepower (hp) and placed into service prior to 1992. A total of 13 of these pieces of equipment still existed in the 2002 EI. In the 2002 inventory, EGUs accounted for 32.59 tpd $NO_x$ and 1.76 tpd VOC, while NEGUs contributed 46.72 tpd $NO_x$ and 26.54 tpd VOC. The 2005 allowed emission factor (EF), e.g., lb/MMBtu or g/hp-hr, for a piece of equipment is dictated by Chapter 117. To determine the reduction to apply to the unit from 2002, EFs used to calculate reported emissions in the 2002 point source inventory were compared to the Chapter 117 EFs, and the required reduction percentages necessary, if any, were calculated and applied. No VOC controls were applied.

Each EGU is subject to either a Chapter 117 limitation by 2005 or a SB7 allowance. EGUs in the DFW four county 1-hour ozone nonattainment area are subject to the Chapter 117 emission limitations. The EGUs in the other 5 counties are subject to the SB7 rules. For EGUs that are Acid Rain units, the EFs can be found in the third quarter 2002 Acid Rain Program Scorecard data on EPA's Clean Air Markets web page. Each EGU was assigned a reduction factor based on the actual EF compared to the Chapter 117 EF limitation.

The following TCEQ web page contains rules, guidance documents, and a listing of 2002 and other historical point source inventories of major pollutants (e.g. $NO_x$, VOC, $SO_2$, etc.):

http://www.tnrcc.state.tx.us/air/aqp/psei.html#tools

## 2.3 AREA SOURCES

Area sources of emissions are those that fall below the point source reporting levels and that are too numerous or too small to identify individually. Area sources are commercial, small-scale industrial, and residential categories that use materials or operate processes generating emissions. Area sources are divided into two groups characterized by the emission mechanism: hydrocarbon evaporative emissions or fuel combustion emissions. Examples of hydrocarbon evaporative emission sources include: printing operations, industrial coatings, degreasing solvents, house paints, leaking underground storage tanks, and gasoline service station underground tank filling and vehicle refueling operations. Fuel combustion emission sources include stationary source fossil fuel combustion at residences and businesses, outdoor burning, structural fires, and wildfires.

Emissions calculations of area sources are estimated as county-wide totals rather than as individual source emissions. These emissions, with some exceptions, may be calculated by multiplication of an established, EPA approved, emission factor (emissions per unit of activity) by the appropriate activity or activity surrogate responsible for generating emissions. Actual activity data is used when available. Examples include gallons of gasoline sold in a county, amount of printer ink used, number of wildfire acres burned, and amount of oil and natural gas produced. When actual activity data is unavailable, surrogates are used. These include total county population and employment data by industry type. Often actual activity data is available only at the state or national level and must be adapted to the county level using an appropriate surrogate.

The EPA's 2002 NEI was the starting point for the area source 2002 EI. NEI categories and emissions were reviewed and subsequently updated with current methodologies and local activity data when it was available.  Major efforts were made to locate appropriate activity data.  Specific categories were updated using information and data that represent 2002 activities.  Some of these categories benefitted from contracted work completed for year 2002 or for a prior year.  For some categories with emissions developed from these previous contracts the emissions were grown to 2002.  For other less significant categories emissions were grown from the 1999 EI to 2002.  The EPA's EGAS growth factors were used for growing these less significant categories.  Use of these various methodologies resulted in the 2002 area source EI being compiled from several sources of data, including work from various contracts, TCEQ research, and the NEI.

For those area source categories affected by TCEQ rules, Rule Effectiveness factors were applied to the uncontrolled emissions.  These factors address the efficiency of the controls and the percentage of the category's population affected by the rule.

The future year 2007 EI for area sources was compiled using the EGAS growth factors.  The EGAS contains individual growth factors for each category and for each forecasting year.  This is the EPA standard and accepted method for developing future year EIs.

Quality assurance of area source emissions involves ensuring that the activity data used for each separate category is current and valid.  Data such as current population figures, fuel usage, and material usage routinely change annually.  Sources of this information were contacted for updates as part of the inventory development process.  Current EPA documents were also obtained to keep abreast of changes in emission factors.  Other routine efforts such as checking calculations for errors and conducting reasonableness and completeness checks were implemented.

Complete documentation of the area source inventories is available in Appendix A.  Additional data relating to area source development are available from the commission upon request.

## 2.4 ONROAD MOBILE SOURCES

Onroad mobile sources consist of automobiles, trucks, motorcycles, and other motor vehicles traveling on roadways.  Combustion related emissions are estimated for vehicle engine exhaust; evaporative hydrocarbon emissions are estimated for the fuel tank and other evaporative leak sources on the vehicle. Emission factors have been developed using the EPA's onroad mobile emissions factor model, MOBILE6.  Various inputs are provided to the model to simulate the vehicle fleet driving in each particular nonattainment area.  Inputs include such parameters as vehicle speeds by roadway type, vehicle registration by vehicle type and age, percentage of vehicles in cold start mode, percentage of miles traveled by vehicle, type of vehicle I/M program in place, and gasoline vapor pressure.  All of these inputs have an impact on the emission factor calculated by the MOBILE6 model, and every effort is made to input parameters reflecting local conditions.

The 2002 CERR for the onroad mobile EI was modeled using the newest EPA onroad emission factor model, MOBILE6.2, to estimate emission factors.  The areas covered in the CERR analysis were Collin, Dallas, Denton, Ellis, Henderson, Hood, Hunt, Johnson, Kaufman, Parker, Rockwall, and Tarrant Counties.  The methodology used to develop the 2002 CERR was in accordance with the CERR (40 CFR Part 51, June 10, 2002) guidance report.  This emissions inventory analysis documents estimates of emissions of VOC and $NO_X$.

Nine of the 12 counties in the 2002 CERR (Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, and Tarrant Counties) were used to evaluate the 2002 and 2007 analysis years used in the five percent IOP due to the nonattainment status under the 8-hour ozone standard.  The total onroad emissions of $NO_x$ for 2002 and 2007 analysis years are 345.44 tpd and 206.72 tpd respectively and that of VOC are 156.34 tpd for 2002 and 104.14 tpd for 2007.

To calculate emissions, emission factors were applied to vehicle activity using the Texas Mobile Source Emission Software. Vehicle activity was generated using the Dallas-Fort Worth Regional Travel Model and collected from Roadway Inventory Functional Class Records data. Adjustments were applied to develop better regional emissions estimates. Inclusion of nonrecurring congestion, calculation of local street vehicle miles of travel, seasonal adjustments, and a transportation model adjustment to better reflect model estimates to actual data collected through the Highway Performance Monitoring System (HPMS) were applied to the modeling. Emissions results were summarized in 24 one-hour periods and for a daily total for all counties identified in the analysis.

TERP is included as an onroad mobile emission reduction control strategy toward the five percent goal. The assumption applied for this analysis includes a 33.1 percent onroad mobile and 66.9 percent nonroad mobile allocation of 22.2 tpd from TERP. TERP is expected to provide approximately 5.40 tpd of onroad mobile $NO_x$ emission reductions for the DFW nonattainment area by June 15, 2007. This control strategy is $NO_X$-focused and does not account for VOC reductions in the analysis. With the addition of TERP as a regional control strategy by 2007, the 2007 $NO_x$ motor vehicle emission budget (MVEB) is then calculated at 201.32 tpd. The 2007 VOC emissions are not impacted due to this emission reduction strategy, and therefore not adjusted. The 2007 VOC motor vehicle emission budget is calculated at 104.14 tpd.

In March 2005, it was discovered that incorrect diesel fraction inputs were used in the development of both the 2002 and 2007 onroad mobile inventories that were included in the 5 Percent IOP SIP proposal. The TCEQ and NCTCOG worked together to correct the problem and this SIP adoption includes the updated onroad mobile estimates of $NO_x$ and VOC emissions for both the 2002 base year and the 2007 future year. Appendices B and C were included with the 5 percent IOP SIP proposal and contain summaries of the 2000 and 2007 onroad mobile inventories developed by NCTCOG in 2004. Appendix K contains a summary of the problems identified with these onroad mobile inventories and the MOBILE6.2 input file revisions performed to correct the problems. Appendices L and M contain the electronic input and output summary files from NCTCOG used to develop the “incorrect” onroad emission inventories for 2002 and 2007, respectively. Appendices N and O contain the electronic input and output summary files from NCTCOG that were used to develop the “corrected” onroad emission inventories for 2002 and 2007, respectively.

## 2.5 MOTOR VEHICLE EMISSIONS BUDGETS (MVEB)

EPA requires that the 5 Percent IOP SIP establish MVEBs for transportation conformity purposes. A MVEB is the onroad mobile source allocation of the total allowable emissions for each applicable criteria pollutant or precursor, as defined in the SIP. Transportation conformity determinations must be performed using the budget test, once EPA determines the budget(s) adequate for transportation conformity purposes. To pass the budget test, areas must demonstrate that the estimated emissions from transportation plans, programs and projects do not cause the motor vehicle emissions budget(s) to be exceeded.

The MVEBs were calculated by subtracting creditable onroad strategies from the unadjusted onroad mobile source inventory. The 5.4 tpd $NO_x$ from TERP reductions, discussed in Section 2.4 above, is the onroad strategy applied toward the 5 Percent IOP plan. Subtraction results in the MVEB budget for $NO_x$. No specific onroad strategies for VOC were identified for the 5 Percent IOP plan. Please refer to Table 2-

1.

**Table 2-1: 2007 DFW Motor Vehicle Emissions Budgets**

| | VOC (tpd) | $NO_x$ (tpd) |
|---|---|---|
| 2007 onroad mobile source inventory, unadjusted | 104.14 | 206.72 |
| TERP credits | 0 | –5.4 |
| **2007 MVEB** | **104.14** | **201.32** |

## 2.6 NONROAD MOBILE SOURCES

Nonroad mobile categories include aircraft, railroad locomotives, recreational vehicles and boats, and a very broad range of equipment from 600-horsepower engines in the construction equipment class to one-horsepower string trimmers in the lawn and garden class. For all nonroad mobile categories except aircraft, locomotives, and commercial marine vessels the EPA NONROAD model is used to calculate emissions. This model generates emissions for over 200 individual types of equipment for the following classes:

- Agricultural
- Commercial
- Construction
- Industrial/Oilfield
- Lawn and Garden
- Logging
- Railway Maintenance
- Recreational
- Recreational Marine

See Table 2-2 for a summary of emissions in the nine county DFW nonattainment area from the 2002 nonroad mobile inventory and the projected 2007 inventory.

**Table 2-2: DFW Nonroad Mobile Emissions Summary for 2002 and 2007 by Nonroad Model Equipment Class**

| | 2002 | | 2007 | |
|---|---|---|---|---|
| CLASS | $NO_x$ (tpd) | VOC (tpd) | $NO_x$ (tpd) | VOC (tpd) |
| Agricultural | 4.23 | 0.60 | 3.90 | 0.47 |
| Commercial | 7.71 | 9.57 | 7.43 | 7.70 |
| Construction | 56.26 | 9.34 | 49.77 | 6.66 |
| Industrial/Oilfield | 19.17 | 4.58 | 15.35 | 3.38 |
| Lawn and Garden | 3.23 | 25.36 | 3.57 | 15.31 |
| Logging | 0.08 | 0.05 | 0.06 | 0.03 |
| Railway Maintenance | 0.15 | 0.04 | 0.14 | 0.03 |
| Recreational | 0.28 | 6.19 | 0.32 | 8.97 |
| Recreational Marine | 0.45 | 8.06 | 0.59 | 5.69 |

Activity data in the NONROAD model used to calculate emissions include the equipment count, horsepower ranges, and fuel types. The model will produce emissions for every county in the state, using default activity data prorated from national data to the state and county levels using appropriate surrogates. Operating the model with all the default surrogates in place is acceptable, however, EPA encourages states to update the model with local, county-level data based on surveys and other relevant information. As local, county-level data becomes available to the TCEQ, it is incorporated into the NONROAD model.

The latest NONROAD model, version 2004, was used to develop the DFW 2002 nonroad EI. Recent surveys and local data have improved Texas' use of the model. Improvements to the following classes include the major VOC and $NO_x$ nonroad mobile categories: construction, lawn and garden, oilfield, and recreational marine.

Emissions from commercial and military aircraft are calculated using the Emissions and Dispersion Modeling System (EDMS) model which uses actual recorded landing/takeoff (LTO) data and aircraft types to generate emissions. Smaller aircraft emissions are calculated using EPA emission factors and applicable LTO data. Emissions from ground support equipment at commercial airports were based on a recent survey of equipment in the DFW area.

Emissions from locomotives are based on fuel use and track mileage. Individual railroad lines were surveyed for actual data to use in emissions calculation. These surveys and discussions with the railroad lines are ongoing with the intent to continue to improve the locomotive EI.

The future year 2007 EI for nonroad mobile sources was also developed by the NONROAD model. The model produces future year EIs routinely, and the most recent version contains future estimated activities and rules that will have an effect on the emissions. Projected LTO data was used to develop the 2007 aircraft and ground support EIs, and railroad activity was projected to 2007 using previous year surveys and data collected from the railroad lines.

Quality assurance procedures for nonroad mobile source emissions rely mainly upon the quality of data used for each separate category. Data such as local equipment population figures and fuel usage routinely change annually. Sources of this information were contacted during the inventory development for updates. Using the current EPA NONROAD and EDMS models ensures that updates to equipment types, horsepower ranges, and results from applicable rules are applied to the emissions. Other routine efforts such as checking calculations for errors and conducting reasonableness and completeness checks were implemented.

Complete documentation of the nonroad mobile inventories is available in Appendix A. Additional data files are available from the commission upon request.

**2.7 BIOGENIC SOURCES**

Biogenic sources include pine and oak forests, crops, and lawn grass which produce VOC emissions such as isoprene, monoterpene, and alpha-pinene. In addition, nitric oxide emissions are produced by soils. EPA, using the latest Biogenic Emissions Inventory System (BEIS) model, provided the 2002 biogenic EI for the states. Data used in the model includes vegetation types and land use from satellite imaging, field biomass surveys, and emission factors for plant species.

EPA guidance on the 5 Percent IOP plan excludes biogenic emissions from the baseline and future inventories, and thus this submittal does not consider biogenics. However, biogenic emissions are important in determining the overall emissions profile of an area and therefore are required for regional air quality modeling, and will be discussed further in future SIPs.

**2.8 EMISSIONS SUMMARY**

The 2002 base year emissions inventory summary for the DFW ozone nonattainment area is shown in Figures 2-1 for VOC and 2-2 for $NO_x$. The largest man-made contribution of VOCs is from area sources and the largest man-made contribution of $NO_x$ is from onroad mobile sources. The contributions from VOC sources in the 2002 base year inventory are as follows: point sources 6 percent; nonroad mobile sources 15 percent; onroad mobile sources 34 percent; and area sources 45 percent. The contributions from $NO_x$ sources in the 2002 base year inventory are as follows: area sources 6 percent; point sources 13 percent; nonroad mobile sources 23 percent; and onroad mobile sources 58 percent. Table 2-4 shows VOC and $NO_x$ emissions for 2002 by county and major source category.

The 2007 future year emissions inventory for the DFW area is summarized in Figures 2-3 for VOC and 2-4 for $NO_x$. The 2007 future year emissions inventory is an estimation that is projected forward from the 2002 base year inventory, using specific procedures approved by the EPA. The contributions from VOC sources in the 2007 future year inventory are as follows: point sources 8 percent; nonroad mobile sources 13 percent; onroad mobile sources 26 percent; and area sources 53 percent. The contributions from $NO_x$ sources in the 2007 future year inventory are: area sources 9 percent; point sources 19 percent; nonroad mobile sources 27 percent; and onroad mobile sources 45 percent. Table 2-5 shows VOC and $NO_x$ emissions for 2007 by county and major category.

EPA's guidance states that in all likelihood, emissions growth in an area will be more than offset by the expected emission reductions because of onroad and nonroad fleet turnover. However, in a very rapidly growing area a net emission reduction might not be achieved from the 2002 inventory. According to the guidance, states should ensure that the projected future inventory is at least 5 percent less than the 2002 inventory or the appropriate percentage of $NO_x$ and VOC if a combination of pollutants is used. That is, the 2007 projected inventory must be no greater than 95 percent of the 2002 inventory.

This SIP revision demonstrates that Texas has met this requirement. The percentage reductions in the VOC and $NO_x$ inventory from 2002 (adjusted to include VOC emissions from portable fuel containers and $NO_x$ emissions from Alcoa outside the 9-county DFW nonattainment area) to 2007 (adjusted for 5 percent control strategies) are summarized below:

**Table 2-3: DFW Reductions from 2002 to 2007**

| Pollutant | Adjusted 2002 inventory (tpd) | Adjusted 2007 inventory (tpd) | Percentage reduction from 2002 to 2007 |
|---|---|---|---|
| VOC | 465.75 | 403.19 | 13.4% |
| $NO_x$ | 622.22 | 422.02 | 32.2% |

Table 2-3 shows that the 2007 inventories for both VOC and $NO_x$ in comparison to the 2002 inventories have each decreased by much more than 5 percent.

**Figure 2-1 2002 VOC Emissions in DFW**

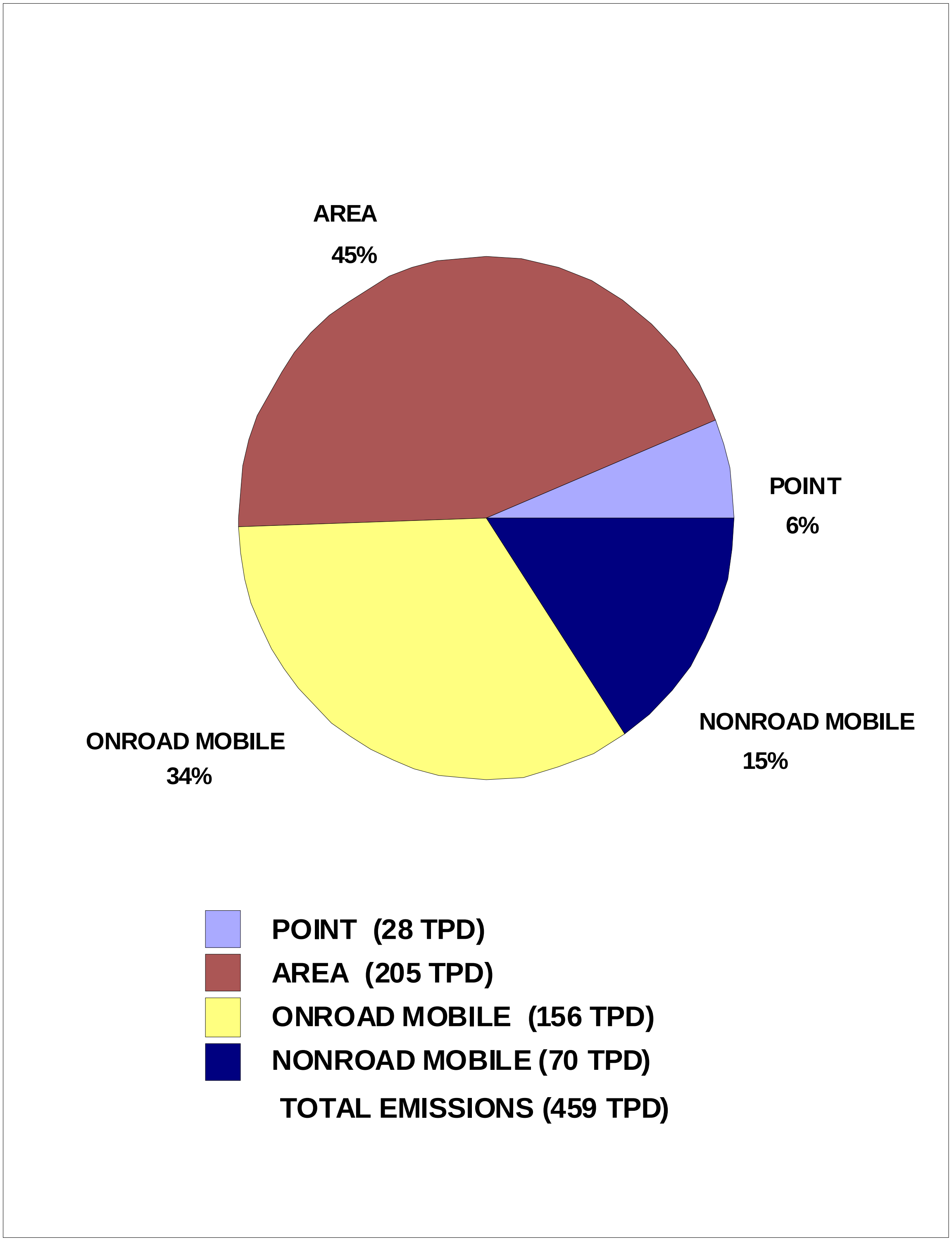


**Figure 2-2 2002 $NO_x$ Emissions in DFW**

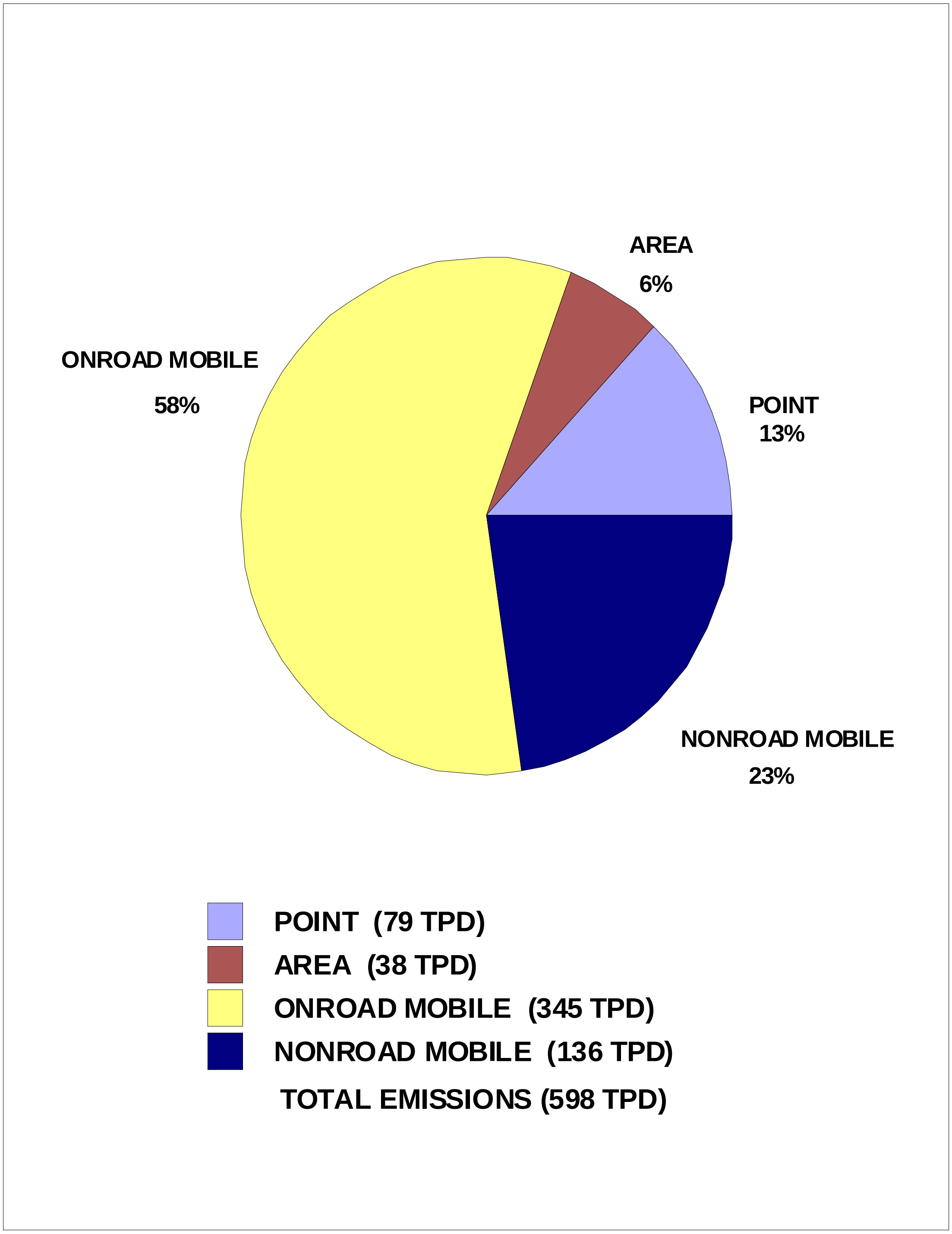


**Table 2-4: Unadjusted 2002 VOC and $NO_x$ Emissions by County and Major Category (in tpd)**

**2002 VOC Emissions**

| County | Point | Area | Onroad Mobile | Nonroad Mobile | County Totals |
|---|---|---|---|---|---|
| Collin | 1.13 | 15.07 | 13.36 | 7.59 | 37.15 |
| Dallas | 9.26 | 80.87 | 69.65 | 29.33 | 189.11 |
| Denton | 1.00 | 19.07 | 12.45 | 6.63 | 39.15 |
| Ellis | 5.72 | 6.40 | 4.41 | 2.33 | 18.86 |
| Johnson | 0.77 | 6.94 | 4.26 | 1.31 | 13.28 |
| Kaufman | 0.75 | 7.42 | 4.28 | 1.64 | 14.09 |
| Parker | 0.70 | 7.40 | 3.70 | 1.16 | 12.96 |
| Rockwall | 0.00 | 1.87 | 1.70 | 1.36 | 4.93 |
| Tarrant | 8.98 | 59.38 | 42.53 | 18.73 | 129.62 |
| Total | 28.31 | 204.42 | 156.34 | 70.08 | 459.15 |

**2002 $NO_x$ Emissions**

| County | Point | Area | Onroad Mobile | Nonroad Mobile | County Totals |
|---|---|---|---|---|---|
| Collin | 2.56 | 1.49 | 27.30 | 13.11 | 44.46 |
| Dallas | 15.93 | 14.44 | 140.77 | 46.78 | 217.92 |
| Denton | 0.58 | 11.16 | 27.71 | 10.39 | 49.84 |
| Ellis | 37.83 | 0.18 | 18.21 | 7.79 | 64.01 |
| Johnson | 4.01 | 0.23 | 10.64 | 6.41 | 21.29 |
| Kaufman | 0.35 | 0.16 | 12.36 | 2.53 | 15.40 |
| Parker | 2.62 | 1.32 | 11.74 | 1.78 | 17.46 |
| Rockwall | 0.00 | 0.10 | 7.40 | 1.14 | 8.64 |
| Tarrant | 15.43 | 8.95 | 89.31 | 46.31 | 160.00 |
| Total | 79.31 | 38.03 | 345.44 | 136.24 | 599.02 |

**Figure 2-3 2007 VOC Emissions in DFW**

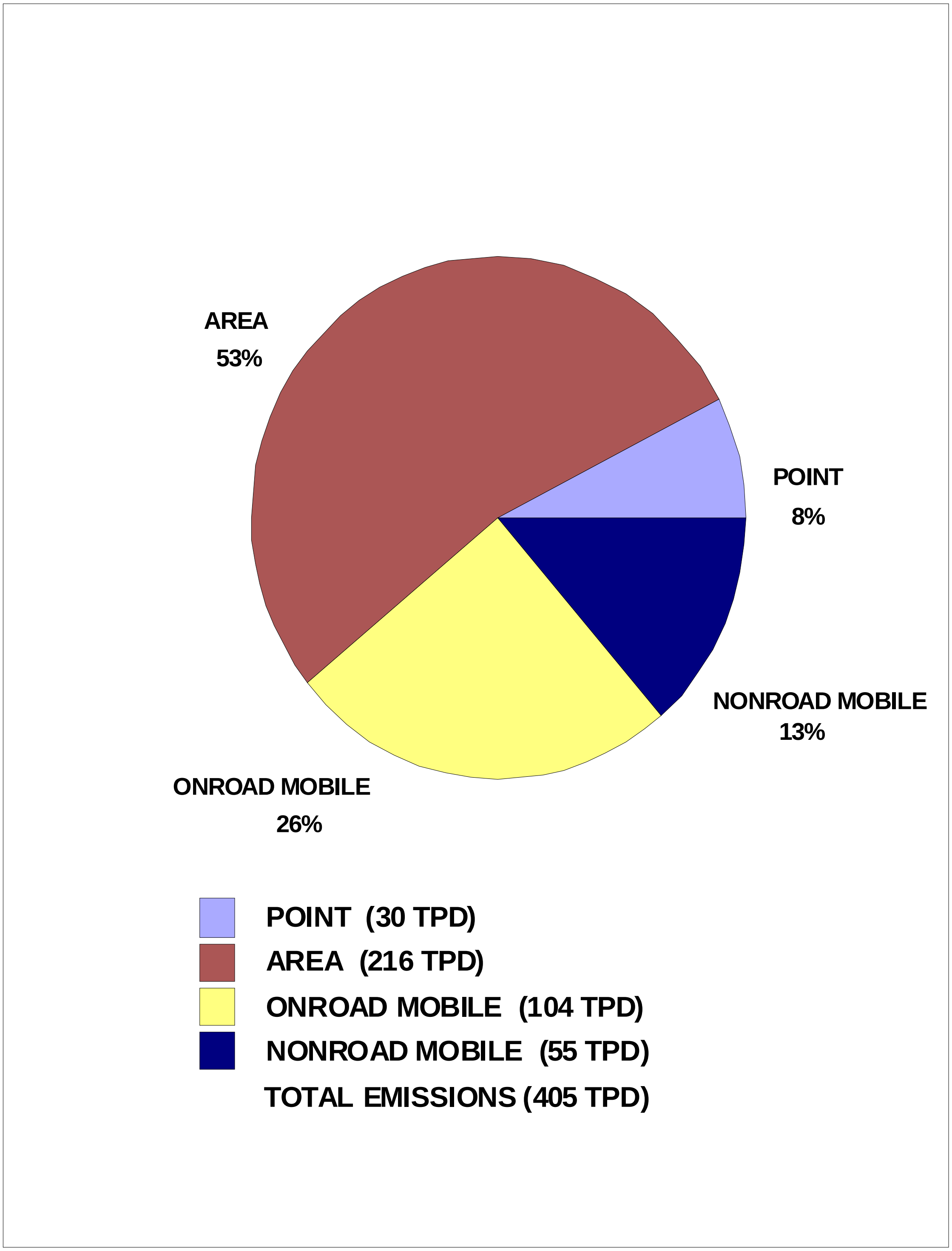


**Figure 2-4 2007 $NO_x$ Emissions in DFW**

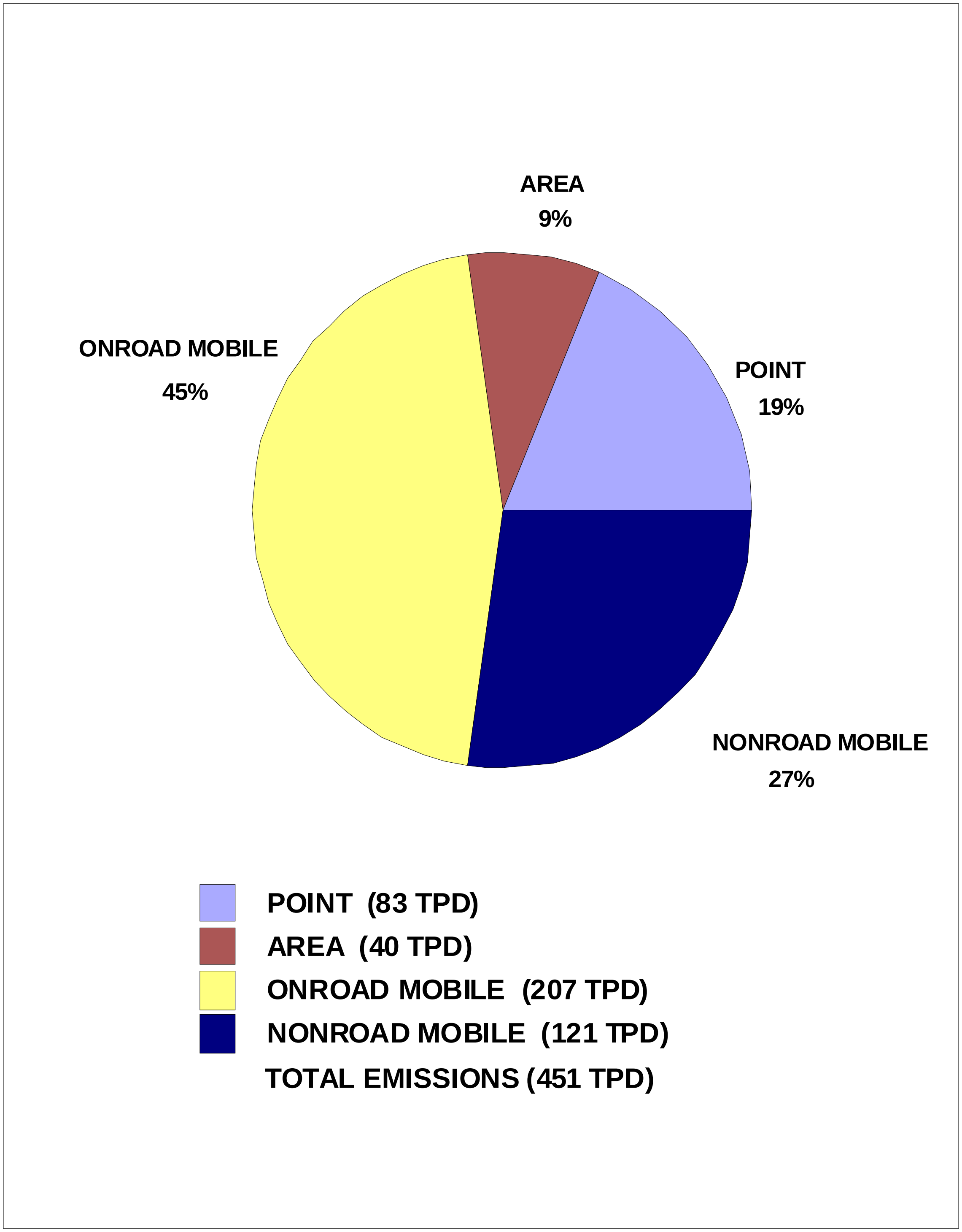


**Table 2-5: Unadjusted 2007 VOC and $NO_x$ Emissions by County and Major Category (in tpd)**

**2007 VOC Emissions**

| County | Point | Area | Onroad Mobile | Nonroad Mobile | County Totals |
|---|---|---|---|---|---|
| Collin | 1.18 | 15.69 | 8.96 | 6.80 | 32.63 |
| Dallas | 9.30 | 84.96 | 47.40 | 21.90 | 163.56 |
| Denton | 1.04 | 20.13 | 8.16 | 5.21 | 34.54 |
| Ellis | 6.08 | 6.75 | 2.67 | 1.77 | 17.27 |
| Johnson | 0.79 | 7.31 | 2.35 | 1.02 | 11.47 |
| Kaufman | 2.11 | 8.03 | 2.57 | 1.24 | 13.95 |
| Parker | 0.84 | 7.76 | 2.01 | 0.90 | 11.51 |
| Rockwall | 0.05 | 1.95 | 0.99 | 1.97 | 4.96 |
| Tarrant | 9.03 | 63.33 | 29.03 | 13.77 | 115.16 |
| Total | 30.42 | 215.91 | 104.14 | 54.58 | 405.05 |

**2007 $NO_x$ Emissions**

| County | Point | Area | Onroad Mobile | Nonroad Mobile | County Totals |
|---|---|---|---|---|---|
| Collin | 3.60 | 1.54 | 17.86 | 11.82 | 34.82 |
| Dallas | 7.87 | 14.97 | 85.71 | 42.17 | 150.72 |
| Denton | 2.67 | 11.75 | 16.82 | 10.76 | 42.00 |
| Ellis | 39.43 | 0.18 | 9.80 | 7.07 | 56.48 |
| Johnson | 6.00 | 0.23 | 5.75 | 6.93 | 18.91 |
| Kaufman | 8.22 | 0.16 | 6.82 | 2.50 | 17.70 |
| Parker | 6.35 | 1.39 | 6.11 | 1.92 | 15.77 |
| Rockwall | 2.12 | 0.10 | 3.64 | 1.04 | 6.90 |
| Tarrant | 7.26 | 9.32 | 54.21 | 36.62 | 107.41 |
| Total | 83.52 | 39.64 | 206.72 | 120.83 | 450.71 |

# CHAPTER 3: PHOTOCHEMICAL MODELING

(No change)

# CHAPTER 4: DATA ANALYSIS

## 4.1 INTRODUCTION

In its guidance for the 5 Percent IOP plan, EPA states that reductions from outside the nonattainment area that are not already in the approved SIP are creditable if consistent with previous EPA guidance, provided they occur within 100 km of the nonattainment area for VOCs or within 200 kilometers for $NO_x$. A demonstration must be made that, in addition to the 100km/200km criteria, the reductions have been shown to impact the nonattainment area. The guidance states that this demonstration may be met by analyzing wind rose data, available modeling, or similar technical documentation.

The guidance also states that the emissions from the source or sources where the reductions are occurring must be added to the baseline inventory. Furthermore, all measures for inclusion should meet the general criteria for SIP approval of being permanent, quantifiable and enforceable.

## 4.2 ANALYSIS OF AIR QUALITY SAMPLING FLIGHT NEAR Alcoa and TXU POWER PLANT

Air quality sampling near the Alcoa and TXU Power Plant shows that $NO_x$ emissions from the Alcoa facility significantly contribute to ozone concentrations downwind. On August 25, 1997, the Baylor University King Air Aircraft (contracted by TCEQ) conducted an air quality sampling mission around the Alcoa and TXU power plant (formerly known as TUGCO) near Rockdale in Milam county. The aircraft circled the power plant and then completed a series of downwind traverses approaching Georgetown and Round Rock to follow the emissions plume. Light east to southeast winds were observed to push the plume to the west-northwest. Figure 4-1 shows the ozone concentrations detected during the flight. As the aircraft flew west higher ozone concentrations were observed, peaking above 100 ppb on the furthest downwind traverse approximately 25-30 miles from Alcoa. $NO_Y$ concentrations during the flight are displayed in Figure 4-2. Very close to the source $NO_Y$ was measured above 200 ppb and a $NO_Y$ plume, 5-10 ppb above background levels, appeared to extend many traverses to the west. As expected, ozone levels close to the Alcoa plant drop because of the presence of high levels of $NO_y$.

## 4.3 WIND ROSE ANALYSES

Figure 4-3 shows the wind roses for high ozone days superimposed on a map centered on the DFW area, with the location of the Alcoa and TXU power plants highlighted. The windrose analysis provides a visual representation of the frequency of the direction of winds in the DFW on high ozone days. Winds from the south and south-southeast are the most common directions. This leads to the conclusion that reductions in sources from areas south and south-southeast of DFW may have a positive impact on air quality in the DFW area. As such, emission reductions from Alcoa are being included in the 5 percent IOP SIP.

## 4.4 UPWIND -DOWNWIND ANALYSIS

Figure 4-4 shows that high ozone days in the DFW area can have air parcels move into the area from any direction. Both the upwind-downwind and wind rose analyses show that sources in any direction can have an impact on ozone levels in the nine county DFW area. Therefore, reductions of VOCs through the statewide portable fuel container rule will improve air quality in the DFW area. The magnitude of those reductions are discussed further in Chapter 5.

**Figure 4-1: Alcoa and TXU Ozone Plume Analysis**

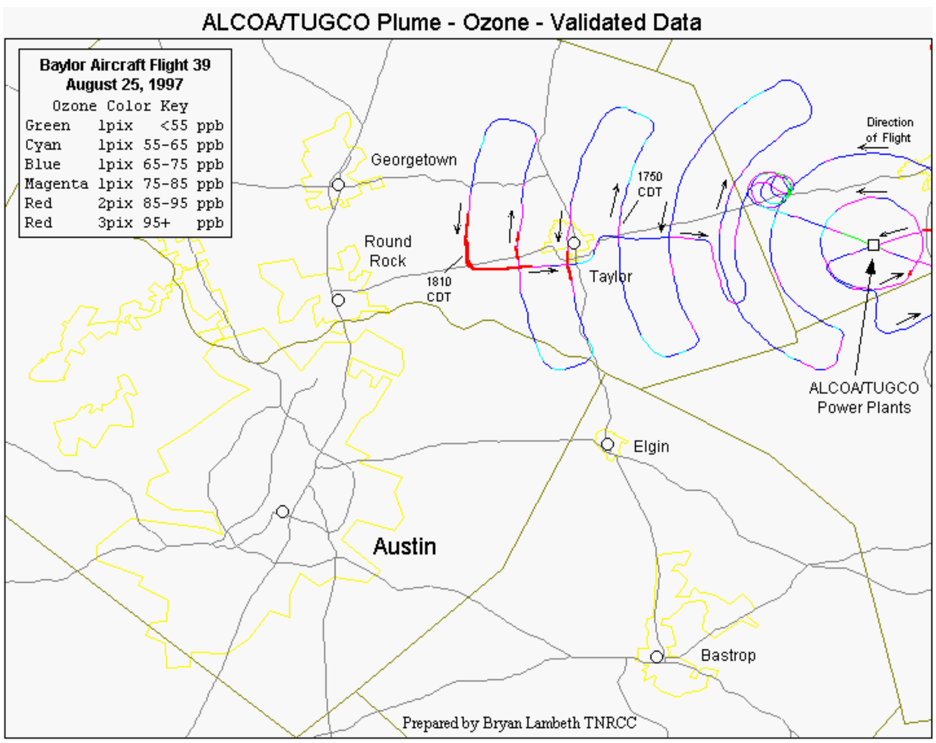


**Figure 4-2: Alcoa and TXU $NO_y$ Plume Analysis**

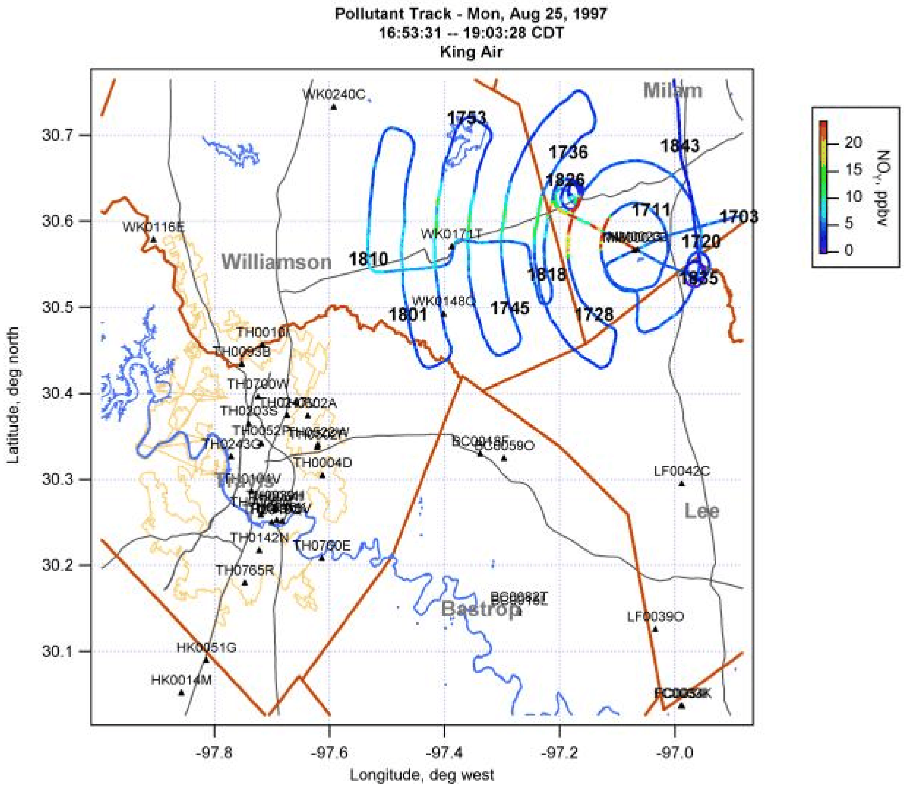
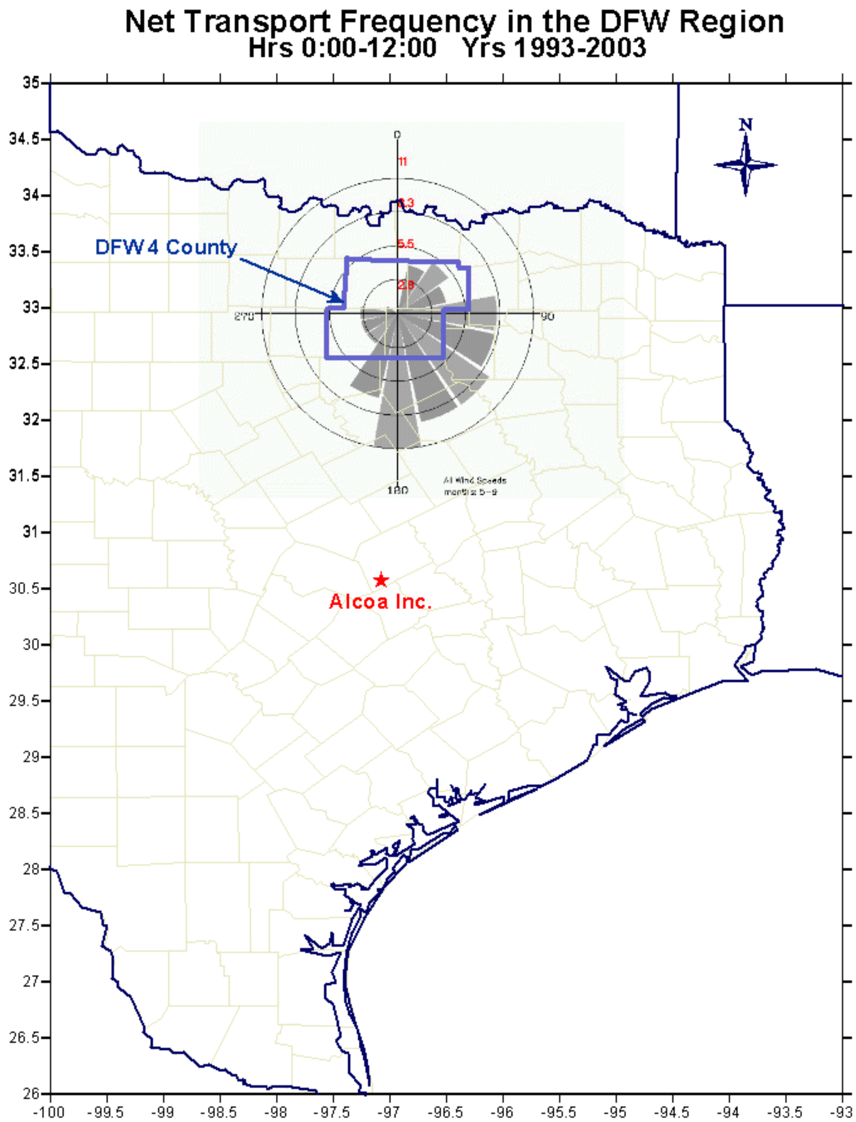


**Figure 4-3: DFW Wind Rose Diagram in Relation to Alcoa, Milam County**

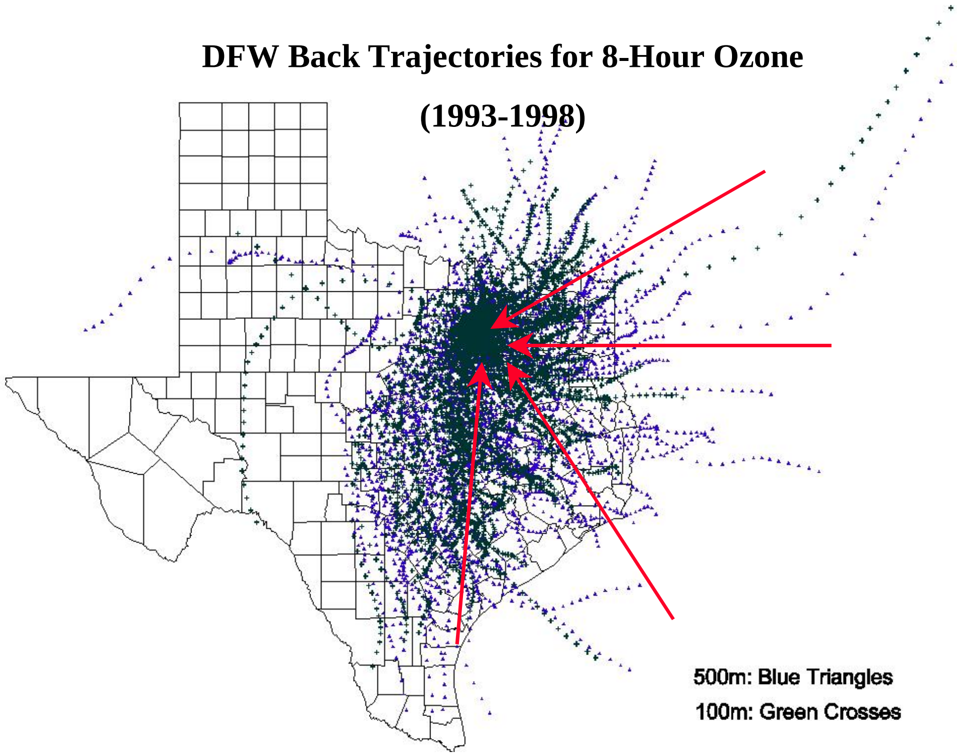



**The Wind Rose depicts the frequency of Net-Transport daily winds for 1-hour ozone greater then 125 ppb. The Wind Rose is centered over the DFW region and includes all sites for the calculation.**

**Figure 4-4:**

**DFW Back Trajectories for 8-Hour Ozone**

**(1993-1998)**



# CHAPTER 5: REQUIRED CONTROL STRATEGY ELEMENTS

## 5.1 INTRODUCTION

EPA's "Guidance on 5 Percent Increment of Progress, 40 CFR.905(a)(1)(ii)(B)" issued August 2004 contains guidance for states to use in preparing 5 Percent IOP plans. According to the guidance, an approvable 5 Percent IOP plan must contain the following elements:

1. Reductions must be made from the 2002 emission baseline. Specifically, the source of the emission reductions is anthropogenic or man-made emissions only, for the entire 8-hour ozone nonattainment area and the surrounding 100 km for VOC and 200 km for $NO_x$.
2. The 2002 anthropogenic inventory multiplied by 0.05 represents the amount of reductions that must be achieved by the 5 Percent IOP plan. Both $NO_x$ and VOC reductions may be used to meet the five percent reduction requirement. In this case, the selected percentage reductions are calculated for both the VOC and $NO_x$ 2002 inventories. The respective VOC and $NO_x$ percentages applied must equal five percent.
3. A 2007 inventory including growth, fleet turnover, and measures in the EPA-approved SIP which are already approved and/or which have been implemented by 2002.
4. The result from item 2 above subtracted from the result from item 3 establishes the target level of emissions to be achieved by June 15, 2007. The onroad mobile source portion of the 2007 adjusted inventory represents the MVEB.
5. The plan must have sufficient control measures to ensure that the area's emissions in 2007 will be less than or equal to the target level of emissions.

## 5.2 EXISTING CREDITABLE MEASURES

### 5.2.1 $NO_x$ Control Measures

5.2.1.1 Texas Emission Reduction Plan

In 2001, the 77th Texas Legislature passed SB 5 which established the Texas Emission Reduction Plan (TERP). The bill provided funding mechanisms for the program and the state anticipated that about $130 million in new fees would be collected to fund the emission reductions contemplated. The major funding source, a fee on out-of-state vehicle registrations, was found to be in violation of the commerce clause of the Fourteenth Amendment of the United States Constitution and Article I. Section 3 of the Texas Constitution, see *H.M. Dodd Motor Co. Inc. and Autoplex Automotive, LP. v. Texas Department of Public Safety, et al.*, Cause No GNID2585(200th Judicial District Court, Travis County, February 21, 2002). The 78th Texas Legislature enacted HB 1365 which restored funding to the TERP and provided a dedicated revenue mechanism for TERP through an increase in the vehicle title fee and changes to existing surcharges on the sale, lease or use of onroad heavy-duty diesel vehicles and nonroad equipment. TERP was also enhanced through the enactment of House Bill 1365 by the authorization of funding for projects that include stationary engines and equipment that use fuels other than diesel. Out of the $140 million per fiscal year in projected revenue through FY 2008, the Emissions Reduction Incentive Grants Program is allocated 87.5 percent of that total, or about $120.5 million per fiscal year. As a result, projected revenue for the program is expected to average about $130 million per fiscal year through FY 2008. This funding was authorized to pay for at least 16.3 tpd in $NO_x$ emission reductions in the DFW area to replace statutorily restricted rules and, based on an allocation approach established by the commission for future grant funding, may be enough to achieve over 22.2 tpd of reductions by 2007. The legislature also allocated funds to this program for other affected areas of the state.

The first emissions reduction incentive grant projects funded under TERP were for fiscal years 2002 - 2003 (September 1, 2001, through August 31, 2003). The funds available for award under the grants program were substantially less than the $130 million originally expected due to the loss of funding from the primary funding mechanism. Revenue generated for TERP was only $20.5 million per fiscal year, with approximately $14 million per fiscal year available for emission reduction incentive grants. As a result, applications were only accepted for projects in the HGB and DFW nonattainment areas. There were 68 projects funded for onroad and offroad diesel vehicles and equipment. The projects included the purchase of heavy-duty diesel equipment that met engine emission standards earlier than required, repower of older vehicles and equipment, installation of retrofit devices, and use of qualifying fuels. The TCEQ awarded a total of $26.5 million, with an average projected cost per ton of $NO_x$ reduced of $5,800 for both the DFW and HGB areas.

During the first part of FY 2004, a total of 43 projects in the eligible 41 counties were awarded funding for $15.3 million. The projected $NO_x$ reductions are 3,047 tons, at an average cost per ton of $5,008. In March 2004, 479 applications requesting over $350 million were received and reviewed. The 171 projects funded are anticipated to result in over 10,000 tons of $NO_x$ reductions, at an average cost per ton of $5,980. Overall, as of mid-January, there were contracts in place for 282 projects, totaling over $120 million for projected reductions in $NO_x$ emissions of over 21,100 tons, at an average cost per ton of $NO_x$ reduced of $5,714. Please refer to Appendix J for more detail. For the DFW area, this means approximately 5.2 tpd of $NO_x$ are projected to be reduced in 2007 from the over 100 TERP projects in place in the DFW area. Accounting for these projects already funded and, based on the approach established for allocating future TERP funds, TERP funding will be sufficient to achieve over 22.2 tpd of reductions in the DFW area by 2007.

For information on recent TERP activities, please visit the following web site: http://www.terpgrants.org For further information on obtaining a TERP grant, contact the TERP help line at 1-800-919-TERP.

5.2.1.2 Energy Efficiency

Energy efficiency measures are a critical part of the commission's plan for clean air. Not only do they decrease $NO_x$ emissions, they also produce reductions in other criteria pollutants such as PM, $SO_2$, VOC, and CO. The primary benefit of energy efficiency is its ability to decrease the demand for electrical generation, which provides for greater reliability, with the secondary benefit being emission reductions. When combined, various efficiency measures have the potential to add up to significant energy savings as well as emission reductions, thereby contributing to the overall goal of clean air in Texas.

The Texas Legislature anticipated the need for the energy efficiency programs in Texas and passed legislation to initiate such programs. The 76$^{th}$ Texas Legislature enacted SB 7, which included among other things, a commitment to improving air quality through an energy efficiency mandate to offset future growth in the demand of energy production. The details of this plan are set out in Chapter 25 of the Public Utility Commission of Texas' rules, which require at least a 10 percent reduction of electric utility's growth in demand by January 1, 2004, and each year thereafter. These reductions can be achieved through energy efficiency measures or by utilizing renewable energy, such as wind power. The 77$^{th}$ Texas Legislature enacted SB 5 which requires each political subdivision to establish a goal to reduce electricity consumption by five percent each year for five years, beginning January 1, 2002, with an annual report submitted to the State Energy Conservation Office demonstrating these reductions. To meet the goals set forth by the Texas Legislature, political subdivisions may develop municipal planning requirements, energy efficiency performance standards, home energy rating programs, and Energy Star programs. The bill also provided for a grant program to be administered through the PUC to provide financial incentives for energy efficiency measures. Furthermore, SB 5 establishes new building code requirements for all new construction statewide.
With EPA support, the TCEQ has managed a contract for the development of the Texas Energy and

Emissions Reduction Calculator (Ecalc). The goal is to provide Texans with an accurate, easy-to-use tool for calculating the emission reduction credits attributable to energy efficiency and renewable energy projects in residential and commercial buildings. In 2004, the Energy Systems Laboratory (ESL) developed the user-friendly web-based interface for Ecalc, and enhancing the features of the single-family and multifamily residences, including new models for office buildings, retail stores, models for solar thermal installations, models for solar photovoltaic installations, as well as the capability for calculating savings from retrofit to municipal buildings, water and wastewater facilities, street lights, traffic lights and wind energy projects. The 2004 enhancement also included the compilation and use of 1999 ozone modeling episode weather data for 9 sites and newly compiled 1999 emissions values, that allow Ecalc to calculate annual $NO_x$ emission reductions for 1999, and peak day $NO_x$ reductions for 1999 and 2007 ozone episode days.

The database and applications developed and used by the Ecalc system were used to calculate $NO_x$ reductions in the DFW nonattainment area. These reductions are enforceable and permanent because SB 5 mandates the statewide adoption of the International Residential Code (IRC) and the International Energy Conservation Code (IECC) for residential, commercial, and industrial buildings. The $NO_x$ reductions were calculated based on electricity and natural gas savings from implementation of the 2000 construction code to single and multi-family residences in 2003. The resulting annual $NO_x$ reductions for 2007 was calculated to be 0.72 tpd. Please refer to Appendix I for more detail.

The TCEQ plans to continue developing a system with tools that will help assess the impact of energy efficiency and renewable energy projects on air quality in Texas.

### 5.2.2 VOC Control Measures

<u>5.2.2.1 Statewide Portable Fuel Container Rule</u>

The portable fuel container rule establishes new requirements relating to the design criteria for portable fuel containers and portable fuel container spouts. The new rules will establish design criteria for "no-spill" portable fuel containers based in large part on the CARB standards. By December 31, 2005, these new rules will limit the type of portable fuel containers and portable fuel container spouts sold, offered for sale, manufactured, and/or distributed in the State of Texas. Fuel released into the environment leads to the contamination of both the state's air and water. These rules will ensure that portable fuel containers manufactured under these standards will release fewer amounts of fuel as the result of spillage and evaporation.

The source of emissions data was the 2002 emissions inventory, which was based on information on residential and commercial portable fuel containers obtained in surveys conducted in 2002 (Emissions from Portable Gasoline Containers in Texas Survey, Nustats, Inc. [June 10, 2002, Residential Gas Can Survey and August 30, 2004, Business Gas Can Survey]). The life expectancy of a portable fuel container was assumed to be 7 years, based on the 2002 Gas Can Inventory (Appendix H). This information, combined with surveyed replacement schedules, results in an estimated 28 percent of the containers being replaced by 2007. Table 5-1 below shows the 2002 emissions and estimated reductions from portable fuel containers in the 9-county DFW nonattainment area. The 2002 emissions from portable fuel containers in the 9 counties are 20.06 tpd of VOC. Therefore, the estimated VOC reduction by 2007 is 20.06 tpd VOC emissions x 0.80 Rule Effectiveness x 0.28 Rule Penetration x 0.62 Control Efficiency = 2.79 tpd VOC.

EPA's guidance for the 5 Percent IOP plan allows credit to be taken for VOC reductions occurring within 100 km of the ozone nonattainment area. The 100 km perimeter around the DFW ozone nonattainment area includes all or a predominant part of 34 counties, as shown in Table 5-2 below. (Also see the DFW 100/200 km radius map in Figure 5-1.) The 2002 emissions from portable fuel containers in the referenced 34 counties are 4.52 tpd VOC. Therefore, the estimated VOC reduction by 2007 is 4.52 tpd VOC emissions x 0.80 Rule Effectiveness x 0.28 Rule Penetration x 0.62 Control Efficiency = 0.63 tpd VOC.

**Table 5-1: Portable Fuel Container Emissions in the 9-county DFW Area**

| COUNTY | TPD VOC |
|---|---|
| **Collin** | 2.01 |
| **Dallas** | 9.65 |
| **Denton** | 1.68 |
| **Ellis** | 0.31 |
| **Johnson** | 0.43 |
| **Kaufman** | 0.2 |
| **Parker** | 0.27 |
| **Rockwall** | 0.15 |
| **Tarrant** | 5.36 |
| **TOTAL** | 20.06 |
| **Estimated Reductions** | 2.79 |

**Table 5-2: Portable Fuel Container Emissions in 100 km Radius Around the DFW Nonattainment Area**

| COUNTY | TPD VOC |
|---|---|
| **Anderson** | 0.13 |
| **Archer** | 0.03 |
| **Bosque** | 0.06 |
| **Clay** | 0.03 |
| **Comanche** | 0.04 |
| **Cooke** | 0.11 |
| **Delta** | 0.02 |
| **Eastland** | 0.06 |
| **Erath** | 0.1 |

| COUNTY | TPD VOC |
|---|---|
| **Fannin** | 0.09 |
| **Franklin** | 0.03 |
| **Freestone** | 0.05 |
| **Grayson** | 0.4 |
| **Hamilton** | 0.03 |
| **Henderson** | 0.26 |
| **Hill** | 0.1 |
| **Hood** | 0.14 |
| **Hopkins** | 0.1 |
| **Hunt** | 0.23 |
| **Jack** | 0.02 |
| **Lamar** | 0.15 |
| **Limestone** | 0.06 |
| **McLennan** | 0.82 |
| **Montague** | 0.06 |
| **Navarro** | 0.15 |
| **Palo Pinto** | 0.08 |
| **Rains** | 0.03 |
| **Smith** | 0.63 |
| **Somervell** | 0.02 |
| **Stephens** | 0.03 |
| **Van Zandt** | 0.15 |
| **Wise** | 0.14 |
| **Wood** | 0.11 |
| **Young** | 0.06 |
| **TOTAL** | 4.52 |

| COUNTY | TPD VOC |
| --- | --- |
| **Estimated Reductions** | 0.63 |

## 5.3 MEASURES REQUIRING RULEMAKING
### 5.3.1 $NO_x$ CONTROL MEASURES
5.3.1.1 Lean-Burn and Rich-Burn Engines

The reductions relied upon in the 5 percent IOP plan include the implementation of new $NO_x$ emission specifications and other compliance demonstration requirements for certain industrial, commercial, and institutional gas-fired stationary, reciprocating internal combustion engines. The rule associated with the adopted requirements are in Chapter 117, Subchapter B, Division 3 and apply to sites located in Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, and Tarrant Counties. The adopted rule requires each gas-fired rich-burn engine placed into service before January 1, 2000 and gas-fired lean-burn engine to achieve a 2.0 grams $NO_x$ per horsepower hour (g/hp-hr) emission limit. The adopted rule also requires gas-fired rich-burn engines placed into service on or after January 1, 2000 to achieve 0.5 g/hp-hr. A CO limit of 3.0 g/hp-hr limit applies to all gas-fired lean-burn and rich-burn engines as well as certain demonstration of compliance requirements. The $NO_x$ emission reductions resulting from the implementation of this rule are 1.87 tpd.

5.3.1.2 Alcoa, Milam County

EPA's guidance for the 5 Percent IOP plan allows credit to be taken for $NO_x$ reductions occurring within 200 km of the ozone nonattainment area. The Alcoa plant in Rockdale, Milam County is within 200 km of the boundary of the DFW ozone nonattainment area. As the result of enforcement actions, Alcoa is required to make reductions from its three lignite-fired boilers (Sandow Units 1, 2, and 3).

In other commitments entered into on April 19, 2000, Alcoa made an enforceable commitment to achieve 30 percent $NO_x$ reductions from these three boilers in a phased schedule, with a final compliance date of December 31, 2002. Since these reductions are reflected in the 2002 inventory, they are included in the baseline for the 5 percent increment of progress demonstration.

On April 9, 2003, a federal consent decree was signed with Alcoa which requires the company to elect by September 25, 2004 whether the three Sandow units will be controlled, replaced, or shut down. This consent decree is contained in Appendix D. The company is not considering the option to control the boilers. If Alcoa opts to shut down the boilers, this must occur by December 31, 2006. If the company chooses to replace the boilers with two lignite-fired circulating fluidized bed (CFB) boilers, it must replace the first boiler by May 25, 2007, and the second boiler by December 31, 2007. The allowables are specified in TCEQ Air Quality Permit No. 48437.

EPA's 5 Percent IOP guidance also requires that emissions from the source contributing the emissions credits be added to the 2002 baseline inventory. The 2002 $NO_x$ and VOC emissions inventories for Alcoa, 23.17 tpd and 2.13 tpd, respectively, have been added to the 2002 CERR inventory.

The reported $NO_x$ emissions in the 2002 emissions inventory and the reductions associated with shutdown or replacement of the boilers are supported by Appendices E, F, and G and are summarized in Table 5-3 below:

**Table 5-3: Alcoa Emissions Summary**

| $NO_x$ Emissions for the entire Alcoa site added to 2002 Baseline Inventory: 23.17 tpd | | | | | |
|---|---|---|---|---|---|
| **2002 Emissions Inventory** | **$NO_x$ Emissions (tpd)** | | **Permit Allowable for New Boilers (Permit No. 48437)** | **$NO_x$ (tpd) Allowable** | **Replace ment Deadline** |
| Boiler 1 | 6.88 | | CFB Boiler 1 | 3.55 | 04/25/07 |
| Boiler 2 | 7.26 | | CFB Boiler 2 | 3.55 | 12/31/07 |
| Boiler 3 | 8.05 | | | | |
| **Average** | **7.4** | | **Eligible $NO_x$ Reductions by June 15, 2007:** | | **3.9 tpd** |

All control measures that are a part of the 5 Percent IOP plan must be implemented by June 15, 2007. Alcoa has chosen to replace the existing boilers. Only one boiler will be replaced by June 15, 2007, and therefore only reductions for one boiler will be claimed for credit in this SIP. Since Alcoa has not indicated which boilers will be replaced and in what order the old ones will be shut down, the emissions from each of the three existing boilers were averaged for the purposes of calculating the eligible reductions for the purposes of this SIP. The average $NO_x$ emissions from the three boilers are 7.4 tpd. The permit allowable identified in permit number 48437 for $NO_x$ is 3.55 tpd for each new boiler. The permit allowable (3.55 tpd) was subtracted from the average $NO_x$ emissions from the boilers (7.4 tpd) to calculate a $NO_x$ reduction of 3.9 tpd.

### 5.3.2 VOC CONTROL MEASURES

5.3.2.1 Surface Coating

Various rules for surface coating operations have been in effect for the four core DFW counties in order to meet RACT and Control Technique Guideline (CTG) requirements. In rulemaking concurrent to this SIP, the commission is adopting a rule to extend the requirements for surface coating to the five newly designated DFW nonattainment counties. This control measure will result in 0.3 tpd VOC reductions.

5.3.2.2 Stage I Gasoline Unloading

Rules have already been in effect for Stage I gasoline unloading operations in the four core DFW counties, with an exemption for operations with a throughput equal to or less than 10,000 gallons per month. In rulemaking concurrent to this SIP, the commission is adopting a rule revision to extend these Stage I requirements, with the 10,000 gallons per month exemption, to the five newly designated DFW nonattainment counties. This control measure will result in 1.49 tpd VOC reductions.

## 5.4 SUMMARY

The control measures identified in the 5 Percent IOP plan have not been approved by EPA in previous SIPs and are listed in Table 5-4 below:

**Table 5-4: Control Measures for Achieving DFW 5 Percent Increment of Progress**

| **Source of reductions** | **TPD $NO_x$** | **TPD VOC** |
|---|---|---|
| **Eligible existing measures** | | |
| Alcoa (within 200 km radius) | 3.9 | |
| TERP | 22.2 | |
| Energy efficiency | 0.72 | |
| Portable fuel containers (9-county area) | | 2.79 |
| Portable fuel containers (within 100 km radius) | | 0.63 |
| **Subtotal** | 26.82 | 3.42 |
| **Control measures requiring rulemaking** | | |
| Nine county lean-burn and rich-burn engine rule | 1.87 | |
| Expand surface coating rule to 5 counties | | 0.3 |
| Lower Stage I exemption throughput to 10,000 gal/mo. in 5 counties (same as in 4 core counties) | | 1.49 |
| **Subtotal** | 1.87 | 1.79 |
| **TOTAL IDENTIFIED REDUCTIONS** | **28.69** | **5.21** |
| Minimum reductions required to meet 5% | 28.69 | 1.86 |
| **SURPLUS REDUCTIONS** | **0** | **3.35** |

The 2002 baseline inventory was adjusted by adding the VOC and $NO_x$ emissions from Alcoa. The adjusted baseline inventory is the basis for performing the 5 percent reduction calculations. As shown in Table 5-5, the adjusted baseline inventory for VOC is 470.8 465.75 tpd, and for $NO_x$ it is 622.22 tpd.

Next, 5 percent of the adjusted baseline $NO_x$ inventory was calculated: 622.22 tpd x 0.05 = 31.11 tpd. Since the identified $NO_x$ reductions of 28.69 tpd are less than this amount, a combined $NO_x$ and VOC emissions are being used to meet the 5 percent emission reduction requirement. The allocation of the 5 percent controls and the minimum reductions required between VOC and $NO_x$ are summarized in Table 5-5. The total of the VOC (0.4 percent) and $NO_x$ (4.6 percent) percentage allocations equals 5 percent. These VOC and $NO_x$ reductions achieved by control measures were then subtracted from the respective unadjusted 2007 inventories in Table 5-6. The results, 403.19 tpd VOC and 422.02 tpd $NO_x$, represent the 2007 target levels. The onroad portion of these target levels represents the VOC and $NO_x$ MVEBs, which are summarized in Table 2-2.

The control measures developed as part of this SIP will achieve the required 5 percent reductions from the 2002 baseline, and therefore satisfy the conditions of the 5 Percent IOP plan.

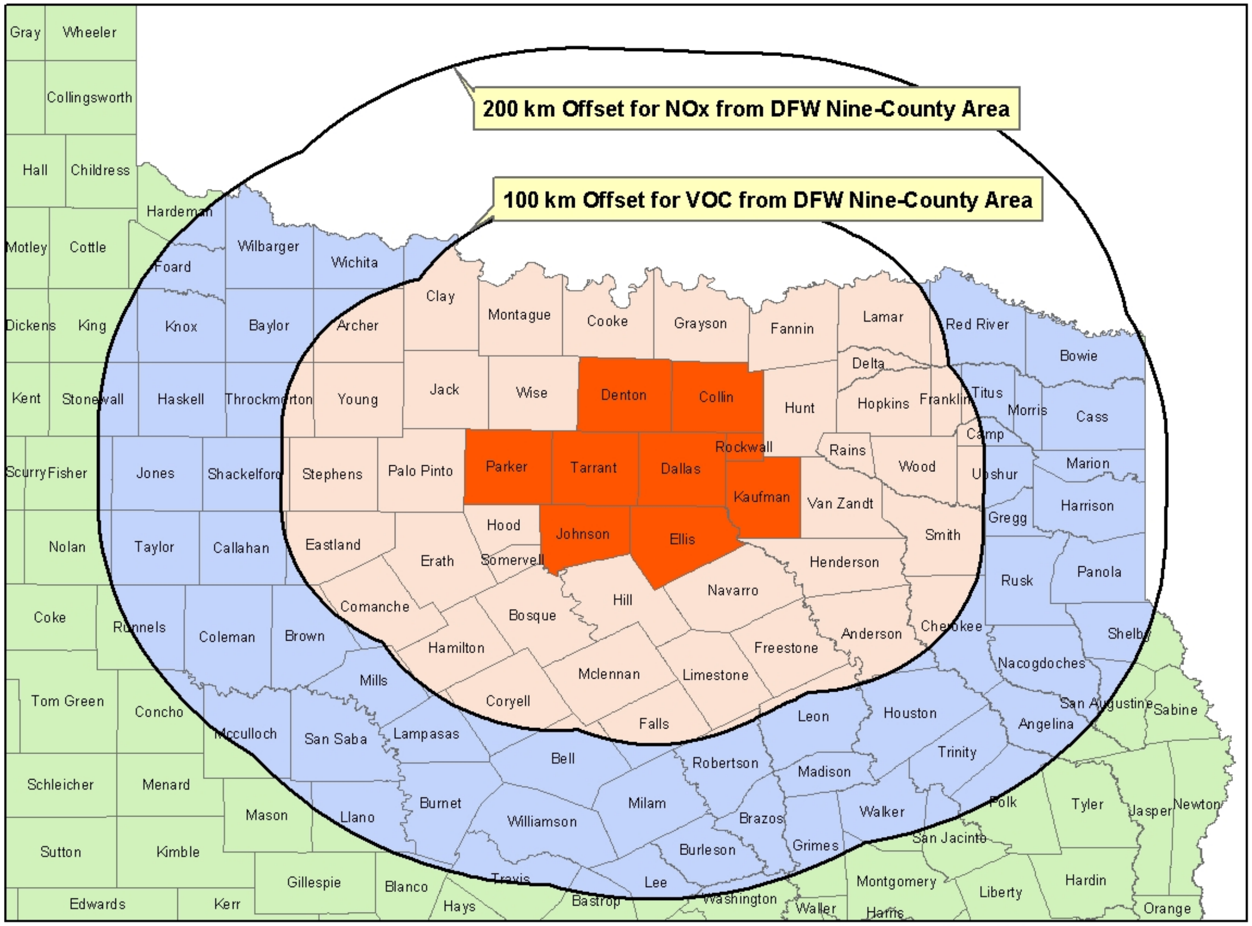
**Table 5-5: Calculation of 5 Percent $NO_x$ and VOC Reductions**

| | VOC (tpd) | $NO_x$ (tpd) |
|---|---|---|
| 2002 baseline inventory | 459.15 | 599.02 |
| Alcoa (outside DFW nonattainment area, within 200 km) | +2.10 | +23.20 |
| Portable fuel containers (outside DFW nonattainment area, within 100 km) | +4.50 | |
| Adjusted 2002 baseline inventory | 465.75 | 622.22 |
| Minimum reductions required to meet 5% | 1.86 | 28.69 |
| | (0.4% of 465.75 tpd adjusted 2002 baseline) | (4.6% of 622.22 tpd adjusted 2002 baseline) |

**Table 5-6: Calculation of 2007 Target Levels**

| | VOC (tpd) | $NO_x$ (tpd) |
|---|---|---|
| 2007 inventory (unadjusted) | 405.05 | 450.71 |
| Minimum reductions required to meet 5% | 1.86 | 28.69 |
| 2007 target level | 403.19 | 422.02 |

**Figure 5-1: 100-km and 200-km perimeters around the DFW area**



## CHAPTER 6: FUTURE ATTAINMENT PLANS

The TCEQ's planning for future attainment demonstrations has been difficult due to the uncertainty regarding the transition from the 1-hour ozone standard to the 8-hour ozone standard. On June 2, 2003, the Federal Register published EPA's proposed 8-Hour Ozone Implementation Rule, which outlined a number of options for implementing the 8-hour ozone standard and managing the existing 1-hour ozone standard. In April 2004, EPA finalized Phase I of the 8-Hour Ozone Implementation Rule. However, Phase II of the 8-Hour Ozone Implementation is not expected until later this year.

### 6.1. PATH FORWARD FOR THE 8-HOUR ATTAINMENT DEMONSTRATION

This revision is a 5 Percent Increment of Progress SIP and not an attainment demonstration SIP. The TCEQ is required to submit an 8-hour ozone attainment demonstration to EPA by June 15, 2007. The TCEQ continues to evaluate existing modeling episodes for application in developing an 8-hour ozone attainment demonstration. The TCEQ will be working towards an 8-hour ozone attainment demonstration which may include an evaluation of potential control measures, an assessment of the need for additional regional control strategies, and an analysis of the contribution to ozone formation from areas other than Texas. Several ongoing activities will provide the TCEQ with additional information in preparing an 8-hour ozone attainment demonstration which may include future control strategies or other actions that may be necessary to achieve the 8 hour ozone standard.

As part of the ongoing analytical, research, and photochemical modeling that will support all future DFW attainment modeling , the TCEQ plans to assess the range of reductions that will be required within the nonattainment area, from other areas in Texas, and other areas in the US. In addition, the TCEQ continues to work with TERC on projects to improve the inventory and gain a better understanding of the modeling in the DFW area.

Input from the North Texas Clean Air Steering Committee on the potential control strategies to reduce emissions within the nonattainment area is important. Local measures (those measures applicable in part or all of the nonattainment area) should be identified in 2005.

The TCEQ recognizes the desire of the North Texas community to develop and submit an early 8-hour ozone attainment demonstration and the TCEQ appreciates working with the North Texas Clean Air Steering Committee, the DFW Photochemical Modeling Technical Committee, and other stakeholders to complete a scientifically sound SIP as soon as practicable.

### 6.2 FUTURE INITIATIVES

The TCEQ continues to move forward with technology research and developments, building the science for ozone modeling and analysis, and addressing industrial, onroad and nonroad mobile, and area sources of emissions. These initiatives will be beneficial to improve air quality in Texas.

#### 6.2.1 New Technology Research and Development (NTRD) Program

The TCEQ's NTRD Program provides incentives to encourage and support research, development and commercialization of technologies that reduce pollution in Texas. The NTRD Program was formed because of legislative requirements that the TCEQ take over the functions of the Texas Council on Environmental Technology (TCET). The primary objective of the NTRD Program is to promote commercialization technologies that will support projects that are eligible for funding under the TERP Emissions Reduction Incentive Grants Program. The NTRD Program will also work to streamline and expedite the process through which the TCEQ and the EPA provide recognition and SIP credit for new, innovative and creative technological advancement. This program will help spur the entrepreneurial and inventive spirit of Texans to help develop new technologies to assist in solving Texas' air quality problems. For further information on this program please see the following web site: http://www.tnrcc.state.tx.us/oprd/sips/research.html

### 6.2.2 Texas Air Quality Study Phase II (TexAQS II)

The Texas 2000 Air Quality Study, the most comprehensive and successful air quality study conducted to date in the U.S., with over 40 research organizations and over 250 scientists, has provided and will continue to provide a large part of the scientific basis for reassessing the ozone problem in eastern Texas. The second phase of this study, TexAQS II, is scheduled for 2005 and 2006 and will cover the area of Texas east of, and including the, I-35/37 corridor. The pre-study work has already begun. The meteorological, pollutant concentration, and transport data will be collected from May 2005 through October 2006 with the intensive field study period lasting from August to September 2006. The TCEQ will be involved in this research in order to improve regulatory analysis and prediction tools used for developing ozone SIPs. The study will assess formation and accumulation of ozone, year-round air pollution meteorology, and inventories of ozone. Research will also be conducted on ozone transport into, within and out of Texas. For documentation of TexAQS II, please see the following web site: http://www.tceq.state.tx.us/policy/ta/am/TexAQS_II.html

### 6.2.3 ONGOING RELATED DFW AIR QUALITY TECHNICAL/SCIENTIFIC ACTIVITIES

The commission has a long history of supporting enhancements of air quality models and associated applications and input data. These endeavors are critical to supporting SIP development for Texas areas and will continue to be a top priority. The commission is committed to working in cooperation with the regulated community, academia, research consortiums, and others to ensure that the modeling used to develop effective control strategies will use the most current scientific methodologies and information to replicate high ozone episodes in a given area.

Because the level of scientific knowledge is constantly evolving, a comprehensive description of ongoing or planned research projects is not provided at this time. However, the TCEQ does maintain documentation of analytical and modeling projects relating to the DFW area which can be found at the following web site:
http://www.tnrcc.state.tx.us/air/aqp/sipmod/dfwaq_techcom.html

The TCEQ has also been active in the Science Coordinating Committee to support air quality planning activities. This committee is the agency's advisory group for air quality research to improve the understanding of air quality in Texas and insure an effective SIP. The Science Coordinating Committee is composed of over 200 researchers from universities, governmental agencies, industry, and environmental organizations from throughout the country.

Information on the committee is located at:
http://www.tceq.state.tx.us/policy/ta/am/scc.html

# Appendices Available Upon Request

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TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

# AGENDA ITEM REQUEST

for State Implementation Plan Revision Adoption

**AGENDA REQUESTED:** July 6, 2016

**DATE OF REQUEST:** June 17, 2016

**INDIVIDUAL TO CONTACT REGARDING CHANGES TO THIS REQUEST, IF NEEDED:** Joyce Spencer-Nelson, (512) 239-5017

**CAPTION: Docket No. 2015-1380-SIP.** Consideration for adoption of revisions to the Dallas-Fort Worth (DFW) 2008 Eight-Hour Ozone Nonattainment Area Attainment Demonstration (AD) State Implementation Plan (SIP) Revision for the 2017 Attainment Year. The counties affected include Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, Tarrant, and Wise.

In the DFW AD SIP revision for the 2008 eight-hour ozone National Ambient Air Quality Standard (NAAQS) submitted to the EPA on July 10, 2015, a commitment was made to address the United States Court of Appeals for the District of Columbia Circuit decision that changed the attainment deadlines for the 2008 eight-hour ozone NAAQS to a July 20, 2018 attainment date and a 2017 attainment year. This SIP revision includes a photochemical modeling analysis, a weight of evidence analysis, and a reasonably available control measures analysis that reflect the 2017 attainment year. (Kathy Singleton, Terry Salem) (Non-rule Project No. 2015-014-SIP-NR)

Steve Hagle, P.E.
**Deputy Director**

David Brymer
**Division Director**

Joyce Nelson
**Agenda Coordinator**

**Copy to CCC Secretary? NO X YES**

# Texas Commission on Environmental Quality
## Interoffice Memorandum

**To:** Commissioners **Date:** June 17, 2016

**Thru:** Bridget C. Bohac, Chief Clerk
Richard A. Hyde, P.E., Executive Director

**From:** Steve Hagle, P.E., Deputy Director
Office of Air

**Docket No.:** 2015-1380-SIP

**Subject:** Commission Approval for Adoption of the Dallas-Fort Worth (DFW) 2008 Eight-Hour Ozone Nonattainment Area Attainment Demonstration (AD) State Implementation Plan (SIP) Revision for the 2017 Attainment Year

DFW 2008 Eight-Hour Ozone Standard AD SIP Revision
SIP Project No. 2015-014-SIP-NR

**Background and reason(s) for the SIP revision:**
The Federal Clean Air Act (FCAA) requires states to submit plans to demonstrate attainment of the National Ambient Air Quality Standards (NAAQS) for nonattainment areas within the state. On May 1, 2012, the 10-county DFW area, consisting of Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, Tarrant, and Wise Counties, was designated a moderate nonattainment area for the 2008 eight-hour ozone standard. The attainment date for the DFW moderate nonattainment area was established in the United States Environmental Protection Agency's (EPA) implementation rule for the 2008 ozone NAAQS published in the *Federal Register* (FR) on May 21, 2012 (77 FR 30160) and was set as December 31, 2018. Attainment of the standard (expressed as 0.075 parts per million) is achieved when an area's design value does not exceed 75 parts per billion (ppb).

On December 23, 2014, the United States Court of Appeals for the District of Columbia Circuit (D.C. Circuit Court) ruled on a lawsuit that resulted in vacatur of the EPA's December 31, 2018 attainment date for the 2008 0zone NAAQS. As a result of the court case, the attainment date for the DFW moderate nonattainment area was changed to July 20, 2018 with a 2017 attainment year (80 FR 12264). Due to the timing of the D.C. Circuit Court ruling and finalization of the 2008 ozone SIP requirements rule (effective April 6, 2015), the SIP development schedule did not allow for a full update of the DFW AD SIP revision to address the change in attainment year from 2018 to 2017. The DFW AD SIP revision that was submitted to the EPA on July 10, 2015 was developed based on the EPA's May 21, 2012 implementation rule for the 2008 ozone NAAQS (77 FR 30160), which set 2018 as the attainment year for areas classified as moderate. The deadline to submit AD SIP revisions for areas classified as moderate for the 2008 ozone NAAQS was July 20, 2015, which the EPA did not alter after the court's opinion. The DFW AD SIP revision included a commitment to develop a new AD SIP revision for the DFW 2008 eight-hour ozone nonattainment area to reflect the 2017 attainment year. This DFW AD SIP revision includes the following analyses to reflect the 2017 attainment year: a modeled AD, a reasonably available control measures (RACM) analysis, a weight of evidence (WoE) analysis, and a motor vehicle emissions budget (MVEB).

Re: Docket No. 2015-1380-SIP

**Scope of the SIP revision:**
This memo applies to the DFW AD SIP revision for the 2008 Ozone NAAQS requirement under a moderate ozone nonattainment classification for the 2017 attainment year.

**A.) Summary of what the SIP revision will do:**
This DFW AD SIP revision demonstrates attainment of the 2008 eight-hour ozone NAAQS by July 20, 2018 based on a photochemical modeling analysis of reductions in nitrogen oxides ($NO_X$) and volatile organic compounds (VOC) emissions from existing control strategies and a WoE analysis.

**B.) Scope required by federal regulations or state statutes:**
The DFW AD SIP revision is consistent with the requirements of FCAA, §182(b)(1) and the EPA's 2008 ozone standard SIP requirements rule, published on March 6, 2015 (80 FR 12264). The FCAA-required SIP elements include a RACM analysis and an MVEB. Consistent with EPA guidance, this SIP revision also includes a modeled AD and a WoE analysis. As discussed above, due to the change in the required attainment date, this SIP revision, including the modeled AD, WoE, RACM, and MVEB elements, has been updated to address the 2017 attainment year. The peak ozone design value in 2017 for the DFW nonattainment area is projected to be 77 ppb using older EPA modeling guidance from 2007 and 76 ppb using newer draft guidance released by the EPA in December 2014.

**C.) Additional staff recommendations that are not required by federal rule or state statute:**
None

**Statutory authority:**
The authority to propose and adopt SIP revisions is derived from the following sections of Texas Health and Safety Code, Chapter 382, Texas Clean Air Act (TCAA), §382.002, which provides that the policy and purpose of the TCAA is to safeguard the state's air resources from pollution; §382.011, which authorizes the commission to control the quality of the state's air; and §382.012, which authorizes the commission to prepare and develop a general, comprehensive plan for the control of the state's air. This DFW AD SIP revision is required by FCAA, §110(a)(1) and implementing rules in 40 Code of Federal Regulations Part 51.

The DFW nonattainment area for the 1997 eight-hour ozone standard, comprised of Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, and Tarrant Counties, is required to continue to meet the mandates of FCAA, §172(c)(2) and §182(c)(2)(B) and requirements established under Phase II of the EPA's implementation rule for the 1997 eight-hour ozone NAAQS (70 FR 71615) for nonattainment areas classified as serious.

Re: Docket No. 2015-1380-SIP

**Effect on the:**

**A.) Regulated community:**
None

**B.) Public:**
The general public in the DFW ozone nonattainment area would benefit from improved air quality as a result of lower ozone levels.

**C.) Agency programs:**
None

**Stakeholder meetings:**
The North Central Texas Council of Governments hosted a meeting of the Air Quality Technical Committee on November 6, 2015. The purpose of this committee is to exchange information and provide a forum for public input on air quality issues in the DFW nonattainment area. Agenda topics included the status of DFW photochemical modeling development for the DFW 2008 Eight-Hour Ozone Standard Nonattainment Area AD SIP Revision for the 2017 Attainment Year. The committee includes representatives from industry, county and city government, environmental groups, and the public. More information about this committee is available on the NCTGOC's Air Quality Technical Committee Web page (http://www.nctcog.org/trans/committees/AQTC/index.asp).

**Public comment:**
The public comment period opened on December 11, 2015 and closed on January 29, 2016. The commission conducted a public hearing in Arlington on January 21, 2016, at 6:30 p.m., and in Austin on January 26, 2016, at 10:00 a.m. During the comment period, staff received comments from Amanda Crowe for United States Congresswoman Eddie Bernice Johnson (Congresswoman Johnson), the DFW Chapter of System Change Not Climate Change, Dallas City Councilmember Sandy Greyson (Councilmember Greyson), the Dallas County Medical Society, the Denton Drilling Awareness Group, Downwinders at Risk (Downwinders), Empowering Oak Cliff, Erin Moore for Dallas County Commissioner Dr. Theresa Daniel (Commissioner Daniel), the Fort Worth League of Neighborhood Associations, Frack Free Denton, Keep America Moving, the League of Women Voters of Dallas, the League of Women Voters of Irving, Liveable Arlington, the Lone Star Chapter of the Sierra Club, the North Texas Renewable Energy Group, Public Citizen, the Regional Transportation Council, the Sierra Club, the Sierra Club of Dallas, the Texas Campaign for the Environment, the Texas Medical Association, the EPA, and 51 individuals.

Generally, the commenters expressed their extreme displeasure with the poor air quality in DFW and how it adversely affects the public health, and with the SIP planning process that the commenters asserted has been ineffective for over 20 years. Also, many commenters expressed concern that the DFW nonattainment area continually falls short of complying with federal standards and stated that the current SIP revision should not be approved by the EPA without new controls and should be replaced with a federal implementation plan (FIP). Specific concerns by selected commenters are noted below.

- Congresswoman Johnson, Commissioner Daniel, Public Citizen, the Sierra Club of Dallas, the Dallas County Medical Society, the Texas Medical Association, Liveable Arlington, the Sierra Club and Downwinders, the Fort Worth League of Neighborhood Associations, Empowering Oak Cliff, and 40 individuals expressed concern for the DFW area's air quality and its impact on human health.

- Councilmember Greyson commented that after 20 years of plans that have not met clean air standards, the Texas Commission on Environmental Quality (TCEQ) needs to put a better plan in place than the one currently proposed.

- Many individuals commented that there is a need for meaningful pollution standards on oil and gas equipment, coal plants, cement kilns, and other major pollution sources. Several commenters expressed anger about ineffective SIP revisions, including the proposed DFW AD SIP revision, and expressed concern that the TCEQ does not adequately consider or address public comment through the SIP development process. Many commented that the people of DFW have suffered for many years under inadequate clean air plans, that the proposed SIP revision will not help to achieve cleaner air, and that the TCEQ does not consider the health and welfare of the public when developing SIP revisions.

- The Sierra Club and Downwinders provided information from a photochemical modeling analysis performed by the University of North Texas, which the commenters asserted shows that a mix of controls on oil and gas production, cement kilns in Ellis County, and coal fired power plants in East Texas will bring the DFW area into attainment of the 2008 ozone standard while yielding substantial economic development and creating jobs.

- The EPA commented that with the shorter attainment date, the EPA remains concerned that there are no new measures beyond federal measures and fleet turnover and additional local and regional ozone precursor emission reductions will be necessary to reach attainment by 2017. The EPA expressed appreciation for the TCEQ's consideration of the numerous measures to reduce emissions of ozone precursors, and noted that the TCEQ analysis indicates that a number of the measures would require local action to implement. The EPA encouraged the TCEQ to support local, voluntary implementation of the most cost effective measures, to the extent possible.

Summaries of public comments and TCEQ responses are included as part of the DFW AD SIP Revision.

Re: Docket No. 2015-1380-SIP

**Significant changes from proposal:**
None

**Potential controversial concerns and legislative interest:**
In its comments on the previous DFW AD SIP revision for the 2008 ozone NAAQS submitted to the EPA on July 10, 2015, the EPA indicated that the proposed reasonably available control technology (RACT) analysis for cement kilns should be reevaluated. In particular, the EPA indicated that the retirement of the higher emitting wet kilns and operation of more energy efficient and lower emitting dry kilns in Ellis County makes it necessary for the TCEQ to revisit its $NO_X$ cap limit set forth in 2007 at 17.4 tons per day. The EPA further indicated that failure to conduct a thorough RACT analysis for cement kilns, which would include appropriate emission limits, would prevent it from approving the RACT portion of the attainment plan submittal. This SIP revision does not make any revisions to the cement kiln $NO_X$ cap limit.

The EPA commented that it is unlikely the model projections of an additional 8 ppb reduction between 2015 and 2017 can be achieved without additional $NO_X$ reduction on the order of 100 to 200 tons per day in the local area or a combination of local and larger upwind reductions are needed to achieve an 8 ppb drop in two years. Without emission reductions on this scale, the EPA commented that it is unlikely that the area will attain by the attainment date.

**Does this SIP revision affect any current policies or require development of new policies?**
No

**What are the consequences if this SIP revision does not go forward? Are there alternatives to this SIP revision?**
The commission could choose to not comply with requirements to develop and submit this DFW AD SIP revision to the EPA. If the DFW AD SIP revision is not submitted, the EPA could impose sanctions on the state and promulgate a FIP. Sanctions could include transportation funding restrictions, grant withholdings, and 200% emissions offsets requirements for new construction and major modifications of stationary sources in the DFW nonattainment area. The EPA could impose such sanctions and implement a FIP until the state submitted, and the EPA approved, a replacement DFW 2008 eight-hour ozone AD SIP revision for the area.

**Agency contacts:**
Kathy Singleton, SIP Project Manager, (512) 239-0703, Air Quality Division
Terry Salem, Staff Attorney, (512) 239-0469, Environmental Law Division

Re: Docket No. 2015-1380-SIP

cc: Chief Clerk, 2 copies
Executive Director's Office
Marshall Coover
Erin Chancellor
Stephen Tatum
Jim Rizk
Office of General Counsel
Kathy Singleton

REVISIONS TO THE STATE OF TEXAS AIR QUALITY IMPLEMENTATION PLAN FOR THE CONTROL OF OZONE AIR POLLUTION

DALLAS-FORT WORTH EIGHT-HOUR OZONE NONATTAINMENT AREA


TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
P.O. BOX 13087
AUSTIN, TEXAS 78711-3087


# DALLAS-FORT WORTH 2008 EIGHT-HOUR OZONE STANDARD NONATTAINMENT AREA ATTAINMENT DEMONSTRATION STATE IMPLEMENTATION PLAN REVISION FOR THE 2017 ATTAINMENT YEAR

PROJECT NUMBER 2015-014-SIP-NR

Adoption
July 6, 2016

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# EXECUTIVE SUMMARY

On March 12, 2008, the United States Environmental Protection Agency (EPA) strengthened the eight-hour ozone standard from 0.08 parts per million (ppm) to 0.075 ppm. Under the 0.075 ppm (75 parts per billion [ppb]) standard, the EPA designated Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, Tarrant, and Wise Counties as nonattainment with a moderate classification, effective July 20, 2012. These 10 counties form the Dallas-Fort Worth (DFW) 2008 eight-hour ozone standard moderate nonattainment area. The attainment date for moderate nonattainment areas was established in the EPA's implementation rule for the 2008 ozone National Ambient Air Quality Standard (NAAQS), published in the *Federal Register* (FR) on May 21, 2012 (77 FR 30160), and was set as December 31, 2018.

On December 23, 2014, the United States Court of Appeals for the District of Columbia Circuit (D.C. Circuit Court) ruled on a lawsuit which resulted in vacatur of the EPA's December 31, 2018 attainment date for the 2008 0zone NAAQS. As a result of the court case, the attainment date for the DFW moderate nonattainment area was changed to July 20, 2018 with a 2017 attainment year (80 FR 12264). Due to the timing of the D.C. Circuit Court ruling and finalization of the 2008 ozone state implementation plan (SIP) requirements rule (effective April 6, 2015), the SIP development schedule did not allow for a full update of the DFW attainment demonstration (AD) SIP revision to address the change in attainment year from 2018 to 2017. The DFW AD SIP revision that was submitted to the EPA on July 10, 2015 was developed based on the EPA's May 21, 2012 implementation rule for the 2008 ozone NAAQS (77 FR 30160), which set 2018 as the attainment year for areas classified as moderate. The deadline to submit AD SIP revisions for areas classified as moderate for the 2008 ozone NAAQS was July 20, 2015, which the EPA did not alter. The DFW AD SIP revision included a commitment to develop a 2017 DFW AD SIP revision for the 2008 eight-hour ozone nonattainment area to reflect the 2017 attainment year.

This 2017 DFW AD SIP revision includes the following analyses to reflect the 2017 attainment year: a modeled AD, a reasonably available control measures analysis, a weight of evidence (WoE), and a motor vehicle emissions budget. This 2017 DFW AD SIP revision demonstrates attainment of the 2008 eight-hour ozone NAAQS by July 20, 2018 based on a photochemical modeling analysis of reductions in nitrogen oxides ($NO_X$) and volatile organic compounds (VOC) emissions from existing control strategies and a WoE analysis. The peak ozone design value predicted through credited reductions, but without considering additional reductions discussed as WoE, in 2017 for the DFW nonattainment area is projected to be 77 ppb using EPA guidance from April 2007 and 76 ppb using draft guidance released by the EPA in December 2014.

This 2017 DFW AD SIP revision for the 2008 ozone NAAQS also provides ozone reduction trends analyses and other supplementary data and information to demonstrate that the DFW 10-county nonattainment area will attain the 2008 eight-hour ozone standard by the July 20, 2018 attainment date. The quantitative and qualitative corroborative analyses in Chapter 5: *Weight of Evidence* demonstrates attainment of the 2008 eight-hour ozone standard. This 2017 DFW AD SIP revision includes base case modeling of an eight-hour ozone episode that occurred during June and August/September 2006. These time periods were chosen because they are representative of the times of the year that eight-hour ozone levels above 75 ppb have historically been monitored within the DFW nonattainment area. The model performance evaluation of the 2006 base case indicates the modeling is suitable for use in conducting the modeling attainment test. The modeling attainment test was applied by modeling a 2006 baseline year and 2017 future year to project 2017 eight-hour ozone design values.

Table ES-1: *Summary of 2006 Baseline and 2017 Future Year Anthropogenic Modeling Emissions for DFW* lists the anthropogenic modeling emissions in tons per day (tpd) by source category for the 2006 baseline and 2017 future year for $NO_X$ and VOC ozone precursors. The differences in modeling emissions between the 2006 baseline and the 2017 future year reflect the net of growth and reductions from existing controls. The existing controls include both state and federal measures that have already been promulgated. The electric utility emissions for the 2006 ozone season are an average of actual emission measurements, while the 2017 electric utility emission projections are based on the maximum ozone season caps required under the Cross-State Air Pollution Rule (CSAPR).[1] The emission inputs in Table ES-1 were based on the latest available information at the time development work was done for this 2017 DFW AD SIP revision. A file format conversion error was detected with the 2017 airport emission estimates included with the proposal that has been corrected, resulting in an increase of 0.04 $NO_X$ tpd and 0.10 VOC tpd and no change to the final 2017 future design values.

**Table ES-1: Summary of 2006 Baseline and 2017 Future Year Anthropogenic Modeling Emissions for DFW**

| DFW Nonattainment Area Source Type | 2006 $NO_X$ (tpd) | 2017 $NO_X$ (tpd) | 2006 VOC (tpd) | 2017 VOC (tpd) |
|---|---|---|---|---|
| On-Road | 284.27 | 130.77 | 116.50 | 64.91 |
| Non-Road | 98.06 | 45.54 | 64.69 | 34.01 |
| Off-Road – Locomotives | 20.14 | 12.88 | 1.28 | 0.67 |
| Off-Road – Airports | 12.78 | 12.36 | 4.46 | 2.99 |
| Area Sources | 29.02 | 26.55 | 290.46 | 236.70 |
| Oil and Gas – Production | 61.84 | 10.80 | 43.72 | 31.86 |
| Oil and Gas – Drill Rigs | 18.23 | 3.07 | 1.16 | 0.32 |
| Point – Oil and Gas | 11.53 | 16.50 | 21.82 | 25.80 |
| Point – Electric Utilities | 9.63 | 13.98 | 1.03 | 0.55 |
| Point – Cement Kilns | 22.08 | 17.64 | 1.94 | 0.77 |
| Point – Other | 14.31 | 6.68 | 25.65 | 20.26 |
| Total | 581.89 | 296.77 | 572.71 | 418.84 |

Table ES-2: *Summary of Modeled 2006 Baseline and 2017 Future Year Eight-Hour Ozone Design Values for DFW Monitors* lists the eight-hour ozone design values in ppb for the 2006 baseline year design value ($DV_B$) and 2017 future year design value ($DV_F$) for the regulatory ozone monitors in the DFW nonattainment area. In accordance with the EPA's *Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$ and Regional Haze,* April 2007, the 2017 $DV_F$ figures presented have been rounded to one decimal place and then truncated. The 2007 version of this modeling guidance recommends that the attainment test used to calculate $DV_F$ figures rely on all baseline episode

[1] On July 28, 2015, the D.C. Circuit Court found that the CSAPR 2014 $SO_2$ and ozone season $NO_X$ budgets for Texas and certain other states were invalid because the budgets required more emission reductions than were necessary. The court remanded the rule without vacatur to the EPA for reconsideration of the emission budgets. On December 3, 2015, the EPA proposed to address the ozone season $NO_X$ budgets as part of the CSAPR Update Rule for the 2008 eight-hour ozone standard (80 FR 75706). Remanded $SO_2$ budgets are still to be resolved. Therefore, while the current CSAPR budgets for Texas are still in effect, the budgets may be subject to change in the future after the EPA's reconsideration, finalization of the CSAPR Update Rule, or changes resulting from further appeals.

days modeled above a specific threshold such as 75 ppb. The EPA released a draft update to this modeling guidance in December 2014 that recommends the attainment test rely on only the 10 days from the baseline episode with the highest modeled ozone. Table ES-2 includes the $DV_F$ figures for both the "all days" and "top 10 days" tests. Since the modeling cannot provide an absolute prediction of future year ozone design values, additional information from corroborative analyses are used in assessing whether the area will attain the ozone standard by July 20, 2018.

**Table ES-2: Summary of Modeled 2006 Baseline and 2017 Future Year Eight-Hour Ozone Design Values for DFW Monitors**

| 2006 DFW Nonattainment Area Monitor and Continuous Air Monitoring Station (CAMS) Code | DFW Monitor Alpha Code | 2006 Baseline Design Value (ppb) | 2017 "All Days" $DV_F$ (ppb) | 2017 "Top 10 Days" $DV_F$ (ppb) |
|---|---|---|---|---|
| Denton Airport South - C56 | DENT | 93.33 | 77 | 76 |
| Eagle Mountain Lake - C75 | EMTL | 93.33 | 77 | 76 |
| Grapevine Fairway - C70 | GRAP | 90.67 | 77 | 75 |
| Keller - C17 | KELC | 91.00 | 76 | 75 |
| Fort Worth Northwest - C13 | FWMC | 89.33 | 75 | 74 |
| Frisco - C31 | FRIC | 87.67 | 74 | 73 |
| Dallas North #2 - C63 | DALN | 85.00 | 73 | 72 |
| Dallas Executive Airport - C402 | REDB | 85.00 | 72 | 72 |
| Parker County - C76 | WTFD | 87.67 | 72 | 72 |
| Cleburne Airport - C77 | CLEB | 85.00 | 71 | 69 |
| Dallas Hinton Street - C401 | DHIC | 81.67 | 71 | 69 |
| Arlington Municipal Airport - C61 | ARLA | 83.33 | 70 | 69 |
| Granbury - C73 | GRAN | 83.00 | 68 | 68 |
| Midlothian Tower - C94* | MDLT | 80.50 | 67 | 67 |
| Pilot Point - C1032* | PIPT | 81.00 | 67 | 66 |
| Rockwall Heath - C69 | RKWL | 77.67 | 65 | 65 |
| Midlothian OFW - C52* | MDLO | 75.00 | 63 | 62 |
| Kaufman - C71 | KAUF | 74.67 | 62 | 62 |
| Greenville - C1006 | GRVL | 75.00 | 61 | 62 |

*PIPT, MDLT, and MDLO did not measure enough data from 2004 through 2008 to calculate a complete $DV_B$. The $DV_B$ shown uses all available data.

[#]The 2006 $DV_B$ is different from the 2006 regulatory design value ($DV_R$). Figure 3-1: 2006 *Baseline Design Value Calculation* illustrates how the 2006 $DV_B$ is calculated using the three years of $DV_R$ data.

The 2017 $DV_F$ calculations are provided using both the all days and top 10 days attainment tests discussed above. A WoE range of 73-78 ppb is inferred from the April 2007 guidance, and use of the older "all days" attainment test results in a peak ozone design value of 77 ppb that falls within this 73-78 ppb range. The draft guidance from December 2014 does not specify a WoE range, and instead requires that the $DV_F$ figures be "close to the NAAQS." The newer "top 10 days" attainment test results in a peak ozone design value of 76 ppb that meets this requirement.

Differences in the application of these two tests are more thoroughly described in Chapter 3: *Photochemical Modeling*, Section 3.7.2: *Future Baseline Modeling*.

Because this SIP revision only provides an analyses to reflect the 2017 attainment year, all other sections have been labeled "no change." An electronic version of the 2018 DFW AD SIP revision for the 2008 Ozone NAAQS submitted to the EPA on July 10, 2015 can be found at the Texas Commission on Environmental Quality's (TCEQ) Dallas-Fort Worth: Latest Ozone Planning Activities Web page (https://www.tceq.texas.gov/airquality/sip/dfw/dfw-latest-ozone).

The TCEQ is committed to developing and applying the best science and technology towards addressing and reducing ozone formation as required in the DFW and other ozone nonattainment areas in Texas. This 2017 DFW AD SIP revision also includes a description of how the TCEQ continues to use new technology and investigate possible emission reduction strategies and other practical methods to make progress in air quality improvement.

## SECTION V-A: LEGAL AUTHORITY

General

The Texas Commission on Environmental Quality (TCEQ) has the legal authority to implement, maintain, and enforce the National Ambient Air Quality Standards (NAAQS) and to control the quality of the state's air, including maintaining adequate visibility.

The first air pollution control act, known as the Clean Air Act of Texas, was passed by the Texas Legislature in 1965. In 1967, the Clean Air Act of Texas was superseded by a more comprehensive statute, the Texas Clean Air Act (TCAA), found in Article 4477-5, Vernon's Texas Civil Statutes. The legislature amended the TCAA in 1969, 1971, 1973, 1979, 1985, 1987, 1989, 1991, 1993, 1995, 1997, 1999, 2001, 2003, 2005, 2007, 2009, 2011, and 2013 and 2015. In 1989, the TCAA was codified as Chapter 382 of the Texas Health and Safety Code.

Originally, the TCAA stated that the Texas Air Control Board (TACB) is the state air pollution control agency and is the principal authority in the state on matters relating to the quality of air resources. In 1991, the legislature abolished the TACB effective September 1, 1993, and its powers, duties, responsibilities, and functions were transferred to the Texas Natural Resource Conservation Commission (TNRCC). With the creation of the TNRCC, the authority over air quality is found in both the Texas Water Code and the TCAA. Specifically, the authority of the TNRCC is found in Chapters 5 and 7. Chapter 5, Subchapters A - F, H - J, and L, include the general provisions, organization, and general powers and duties of the TNRCC, and the responsibilities and authority of the executive director. Chapter 5 also authorizes the TNRCC to implement action when emergency conditions arise and to conduct hearings. Chapter 7 gives the TNRCC enforcement authority. In 2001, the 77th Texas Legislature continued the existence of the TNRCC until September 1, 2013, and changed the name of the TNRCC to the TCEQ. In 2009, the 81st Texas Legislature, during a special session, amended section 5.014 of the Texas Water Code, changing the expiration date of the TCEQ to September 1, 2011, unless continued in existence by the Texas Sunset Act. In 2011, the 82nd Texas Legislature continued the existence of the TCEQ until 2023.

The TCAA specifically authorizes the TCEQ to establish the level of quality to be maintained in the state's air and to control the quality of the state's air by preparing and developing a general, comprehensive plan. The TCAA, Subchapters A - D, also authorize the TCEQ to collect information to enable the commission to develop an inventory of emissions; to conduct research and investigations; to enter property and examine records; to prescribe monitoring requirements; to institute enforcement proceedings; to enter into contracts and execute instruments; to formulate rules; to issue orders taking into consideration factors bearing upon health, welfare, social and economic factors, and practicability and reasonableness; to conduct hearings; to establish air quality control regions; to encourage cooperation with citizens' groups and other agencies and political subdivisions of the state as well as with industries and the federal government; and to establish and operate a system of permits for construction or modification of facilities.

Local government authority is found in Subchapter E of the TCAA. Local governments have the same power as the TCEQ to enter property and make inspections. They also may make recommendations to the commission concerning any action of the TCEQ that affects their territorial jurisdiction, may bring enforcement actions, and may execute cooperative agreements with the TCEQ or other local governments. In addition, a city or town may enact and enforce ordinances for the control and abatement of air pollution not inconsistent with the provisions of the TCAA and the rules or orders of the commission.

Subchapters G and H of the TCAA authorize the TCEQ to establish vehicle inspection and maintenance programs in certain areas of the state, consistent with the requirements of the Federal Clean Air Act; coordinate with federal, state, and local transportation planning agencies to develop and implement transportation programs and measures necessary to attain and maintain the NAAQS; establish gasoline volatility and low emission diesel standards; and fund and authorize participating counties to implement vehicle repair assistance, retrofit, and accelerated vehicle retirement programs.

<u>Applicable Law</u>
The following statutes and rules provide necessary authority to adopt and implement the state implementation plan (SIP). The rules listed below have previously been submitted as part of the SIP.

<u>Statutes</u>
All sections of each subchapter are included, unless otherwise noted.

| | |
|---|---|
| Texas Health and Safety Code, Chapter 382 | September 1, 2015 |
| Texas Water Code | September 1, 2015 |

Chapter 5: Texas Natural Resource Conservation Commission
- Subchapter A: General Provisions
- Subchapter B: Organization of the Texas Natural Resource Conservation Commission
- Subchapter C: Texas Natural Resource Conservation Commission
- Subchapter D: General Powers and Duties of the Commission
- Subchapter E: Administrative Provisions for Commission
- Subchapter F: Executive Director (except §§5.225, 5.226, 5.227, 5.2275,5.231, 5.232, and 5.236)
- Subchapter H: Delegation of Hearings
- Subchapter I: Judicial Review
- Subchapter J: Consolidated Permit Processing
- Subchapter L: Emergency and Temporary Orders (§§5.514, 5.5145, and 5.515 only)
- Subchapter M: Environmental Permitting Procedures (§5.558 only)

Chapter 7: Enforcement
- Subchapter A: General Provisions (§§7.001, 7.002, 7.0025, 7.004, and 7.005 only)
- Subchapter B: Corrective Action and Injunctive Relief (§7.032 only)
- Subchapter C: Administrative Penalties
- Subchapter D: Civil Penalties (except §7.109)
- Subchapter E: Criminal Offenses and Penalties: §§7.177, 7.179-7.183

<u>Rules</u>
All of the following rules are found in 30 Texas Administrative Code, as of the following latest effective dates:

Chapter 7: Memoranda of Understanding, §§7.110 and 7.119
December 13, 1996 and May 2, 2002

| | |
|---|---|
| Chapter 19: Electronic Reporting | March 15, 2007 |
| Chapter 35: Subchapters A-C, K: Emergency and Temporary Orders and Permits; Temporary Suspension or Amendment of Permit Conditions | July 20, 2006 |

| | |
|---|---|
| Chapter 39: Public Notice, §§39.402(a)(1) - (6), (8), and (10) - (12), 39.405(f)(3) and (g), (h)(1)(A) - (4), (6), (8) - (11), (i) and (j), 39.407, 39.409, 39.411(a), (e)(1) - (4)(A)(i) and (iii), (4)(B), (5)(A) and (B), and (6) - (10), (11)(A)(i) and (iii) and (iv), (11)(B ) - (F), (13) and (15), and (f)(1) - (8), (g) and (h), 39.418(a), (b)(2)(A), (b)(3), and (c), 39.419(e), 39.420 (c)(1)(A) - (D)(i)(I) and (II), (D)(ii), (c)(2), (d) - (e), and (h), and 39.601 - 39.605 | December 31, 2015 |
| Chapter 55: Requests for Reconsideration and Contested Case Hearings; Public Comment, §§55.150, 55.152(a)(1), (2), (5), and (6) and (b), 55.154(a), (b), (c)(1) - (3), and (5), and (d) - (g), and 55.156(a), (b), (c)(1), and (g) | December 31, 2015 |
| Chapter 101: General Air Quality Rules | June 25, 2015 |
| Chapter 106: Permits by Rule, Subchapter A | April 17, 2014 |
| Chapter 111: Control of Air Pollution from Visible Emissions and Particulate Matter February 6, 2014 | |
| Chapter 112: Control of Air Pollution from Sulfur Compounds | July 16, 1997 |
| Chapter 113: Standards of Performance for Hazardous Air Pollutants and for Designated Facilities and Pollutants | May 14, 2009 |
| Chapter 114: Control of Air Pollution from Motor Vehicles | May 21, 2015 |
| Chapter 115: Control of Air Pollution from Volatile Organic Compounds | June 25, 2015 |
| Chapter 116: Permits for New Construction or Modification | July 31, 2014 |
| Chapter 117: Control of Air Pollution from Nitrogen Compounds | June 25, 2015 |
| Chapter 118: Control of Air Pollution Episodes | March 5, 2000 |
| Chapter 122: §122.122: Potential to Emit | April 17, 2014 |
| Chapter 122: §122.215: Minor Permit Revisions | June 3, 2001 |
| Chapter 122: §122.216: Applications for Minor Permit Revisions | June 3, 2001 |
| Chapter 122: §122.217: Procedures for Minor Permit Revisions | December 11, 2002 |
| Chapter 122: §122.218: Minor Permit Revision Procedures for Permit Revisions Involving the Use of Economic Incentives, Marketable Permits, and Emissions Trading | June 3, 2001 |

## SECTION VI: CONTROL STRATEGY

A. Introduction (No change)

B. Ozone (Revised)

  1. Dallas-Fort Worth (Revised)

     Chapter 1: General

     Chapter 2: Anthropogenic Emissions Inventory (EI) Description

     Chapter 3: Photochemical Modeling

     Chapter 4: Control Strategies and Required Elements

     Chapter 5: Weight of Evidence

     Chapter 6: Ongoing and Future Initiatives

  2. Houston-Galveston-Brazoria (No change)
  3. Beaumont-Port Arthur (No change)
  4. El Paso (No change)
  5. Regional Strategies (No change)
  6. Northeast Texas (No change)
  7. Austin Area (No change)
  8. San Antonio Area (No change)
  9. Victoria Area (No change)

C. Particulate Matter (No change)

D. Carbon Monoxide (No change)

E. Lead (No change)

F. Oxides of Nitrogen (No change)

G. Sulfur Dioxide (No change)

H. Conformity with the National Ambient Air Quality Standards (No change)

I. Site Specific (No change)

J. Mobile Sources Strategies (No change)

K. Clean Air Interstate Rule (No change)

L. Transport (No change)

M. Regional Haze (No change)

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## LIST OF ACRONYMS

| | |
|---|---|
| 3-D | three-dimensional |
| ACT | alternative control techniques |
| AD | attainment demonstration |
| AGL | above ground level |
| AMPD | Air Markets Program Data |
| APCA | Anthropogenic Precursor Culpability Assessment |
| AQRP | Air Quality Research Program |
| ARLA | Arlington Monitor (C61) |
| Auto-GC | automated gas chromatograph |
| BACT | best available control technology |
| BOEMRE | United States Bureau of Ocean Energy Management Service |
| CAIR | Clean Air Interstate Rule |
| CAMS | Continuous Ambient Monitoring station |
| CAMx | Comprehensive Air Model with Extension(s) |
| CB05 | Carbon Bond 05 |
| CB6 | Carbon Bond 6 |
| CFR | Code of Federal Regulations |
| CISL | Computational and Information Systems Laboratory |
| CLEB | Cleburne Monitor (C77) |
| CLVL | Clarksville Monitor (C648) |
| CO | carbon monoxide |
| CSAPR | Cross-State Air Pollution Rule |
| CTG | control techniques guidelines |
| D.C. | District of Columbia |
| DALN | Dallas North Monitor (C63) |
| DENT | Denton Monitor (C56) |
| DERI | Diesel Emissions Reduction Incentive Program |
| DFW | Dallas-Fort Worth |
| DHIC | Dallas Hinton Monitor (C401) |
| $DV_B$ | baseline year design value |
| $DV_F$ | future year design value |
| $DV_R$ | regulatory design value |
| EDMS | Emissions Dispersion Modeling System |

| | |
|---|---|
| EE | energy efficiency |
| EE/RE | energy efficiency and renewable energy |
| EGU | electric generating unit |
| EI | emissions inventory |
| EMTL | Eagle Mountain Lake Monitor (C75) |
| EPA | United States Environmental Protection Agency |
| EPS | Emissions Processing System |
| ERG | Eastern Research Group, Inc. |
| ESL | Energy Systems Laboratory |
| FAA | Federal Aviation Administration |
| FCAA | Federal Clean Air Act |
| FINN | Fire Inventory of NCAR |
| FR | *Federal Register* |
| FTP | File Transfer Protocol |
| FRIC | Frisco Monitor (C31) |
| FWMC | Fort Worth Northwest Monitor (C13) |
| FY | fiscal year |
| GCIP | Continental-International Project |
| GEOS-Chem | Goddard Earth Observing Station global atmospheric model with Chemistry |
| GEWEX | Global Energy and Water Cycle Experiment |
| GloBEIS | Global Biosphere Emissions and Interactions System |
| gm/hp-hr | grams per horsepower-hour |
| GOES | Geostationary Operational Environmental Satellite |
| GRAN | Granbury Monitor (C73) |
| GRAP | Grapevine Monitor (C70) |
| GRVL | Greenville Monitor (C1006) |
| GSE | ground support equipment |
| GWEI | Gulf-Wide Emissions Inventory |
| HB | House Bill |
| HECT | Highly Reactive Volatile Organic Compound Emissions Cap and Trade |
| HGB | Houston-Galveston-Brazoria |
| hp | horsepower |
| HPMS | Highway Performance Monitoring System |
| HRVOC | highly reactive volatile organic compounds |
| I/M | inspection and maintenance |

| | |
|---|---|
| ICI | industrial, commercial, and institutional |
| INEGI | National Institute of Statistics and Geography |
| ITHS | Italy High School (C60) |
| KAUF | Kaufman Monitor (C71) |
| KELC | Keller Monitor (C17) |
| km | kilometer |
| Kv | vertical diffusity |
| KVPATCH | landuse based minimum Kv for all domains |
| LAI | leaf area index |
| LAIv | fractional vegetated leaf area index |
| LANDFIRE | Landscape Fire and Resource Management |
| LCC | Lambert Conformal Conic |
| LIP | Local Initiative Projects |
| LIRAP | Low Income Vehicle Repair Assistance, Retrofit, and Accelerated Vehicle Retirement Program |
| m | meter |
| m/s | meters per second |
| MATS | Modeled Attainment Test Software |
| MACT | maximum achievable control technology |
| MDLO | Midlothian Old Fort Worth Monitor (C52) |
| MDLT | Midlothian Tower Monitor (C94) |
| MECT | Mass Emissions Cap and Trade |
| MEGAN | Model of Emissions of Gases and Aerosols from Nature |
| MM5 | Mesoscale Meteorological Model, Fifth Generation |
| MMBTU | million British Thermal Units |
| MMcf | million cubic feet |
| MNB | Mean Normalized Bias |
| MNGE | Mean Normalized Gross Error |
| MODIS | Moderate-Resolution Imaging Spectroradiometer |
| MOVES | Motor Vehicle Emission Simulator |
| MOZART | Model for Ozone and Related Chemical Tracers |
| MPE | model performance evaluation |
| MVEB | motor vehicle emissions budget |
| MW | megawatt |
| MWh | megawatt-hours |

| | |
|---|---|
| NAAQS | National Ambient Air Quality Standard |
| NCAR | National Center for Atmospheric Research |
| NCEP | National Center for Environmental Prediction |
| NCTCOG | North Central Texas Council of Governments |
| NEI | National Emissions Inventory |
| NLCD | National Land Cover Dataset |
| NMIM | National Mobile Inventory Model |
| $NO_2$ | nitrogen dioxide |
| NOAH | National Centers for Environmental Prediction, Oregon State, Air Force, and Hydrologic Research Laboratory |
| $NO_X$ | nitrogen oxides |
| NSR | new source review |
| OMI | Ozone Monitoring Instrument |
| OSAT | Ozone Source Apportionment Technology |
| PAR | photosynthetically active radiation |
| PBL | planetary boundary layer |
| PEI | periodic emissions inventory |
| PFT | plant functional types |
| PiG | Plume-in-Grid |
| PIPT | Pilot Point Monitor (C1032) |
| PLTN | Palestine Monitor (C647) |
| $PM_{2.5}$ | particulate matter with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers |
| ppb | parts per billion |
| ppm | parts per million |
| PUCT | Public Utility Commission of Texas |
| RACM | reasonably available control measures |
| RACT | reasonably available control technology |
| RE | renewable energy |
| REDB | Dallas Executive Airport Monitor (C402) |
| RFP | reasonable further progress |
| RKWL | Rockwall Health Monitor (C69) |
| RRC | Railroad Commission of Texas |
| RRF | relative response factor |
| RRTM | Rapid Radiative Transfer Model |
| RS | redesignation substitute |

| | |
|---|---|
| RVP | Reid vapor pressure |
| SAGA | San Augustine Airport Monitor (C646) |
| SB | Senate Bill |
| SECO | State Energy Conservation Office |
| SIC | standard industrial classification |
| SIP | state implementation plan |
| SLAMS | State and Local Air Monitoring Stations |
| $SO_2$ | sulfur dioxide |
| STARS | State of Texas Air Reporting System |
| TAC | Texas Administrative Code |
| TACB | Texas Air Control Board |
| TATU | TCEQ Attainment Test for Unmonitored Areas |
| TCAA | Texas Clean Air Act |
| TCEQ | Texas Commission on Environmental Quality (commission) |
| TCFP | Texas Clean Fleet Program |
| TCM | transportation control measure |
| TDM | travel demand model |
| TERP | Texas Emission Reduction Plan |
| TexAER | Texas Air Emissions Repository |
| TexAQS II | Texas Air Quality Study 2006 |
| TexN | Texas NONROAD |
| TNGVGP | Texas Natural Gas Vehicle Grant Program |
| TNMOC | total non-methane organic carbon |
| TNRCC | Texas Natural Resource Conservation Commission |
| tpd | tons per day |
| tpy | tons per year |
| TTI | Texas Transportation Institute |
| TUC | Texas Utilities Code |
| TxDOT | Texas Department of Transportation |
| U.S. | United States |
| UMA | unmonitored area |
| UPA | Unpaired Peak Accuracy |
| UT-Austin | University of Texas at Austin |
| VMT | vehicle miles traveled |
| VNA | Voroni Neighbor Averaging |

| | |
|---|---|
| VOC | volatile organic compounds |
| WoE | weight of evidence |
| WPS | Weather Research and Forecasting Model Preprocessing System |
| WRF | Weather Research and Forecasting Model |
| WTFD | Weatherford Parker County Monitor (C76) |
| YSU | Yonsei University |

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# CHAPTER 1: GENERAL

## 1.1 BACKGROUND (NO CHANGE)

## 1.2 INTRODUCTION (NO CHANGE)

### 1.2.1 One-Hour National Ambient Air Quality Standard (NAAQS) History (No change)

1.2.1.1 March 1999 (No change)

1.2.1.2 April 2000 (No change)

1.2.1.3 August 2001 (No change)

1.2.1.4 March 2003 (No change)

1.2.1.5 EPA Determination of One-Hour Ozone Attainment

Since the early 1990s, when the Dallas-Fort Worth (DFW) area was designated as nonattainment for the one-hour ozone standard, much has been done to bring the area into attainment with federal air quality standards. Contributions to improved air quality in the DFW nonattainment area include: Texas Commission on Environmental Quality (TCEQ)-implemented control strategies, local control strategies adopted by the North Central Texas Council of Governments (NCTCOG), and on-road and non-road mobile source measures implemented by the United States Environmental Protection Agency (EPA). Multiple state implementation plan (SIP) revisions have been submitted to the EPA and air quality in the DFW nonattainment area continues to improve.

In June 2005, the one-hour ozone standard was revoked after being replaced by the more stringent eight-hour ozone standard in 1997. By 2006, ambient monitoring data reflected attainment of the one-hour standard. On October 16, 2008, the EPA published final determination (73 *Federal* Register [FR] 61357) that the DFW area one-hour ozone nonattainment counties (Collin, Dallas, Denton, and Tarrant) had attained the one-hour ozone standard with a design value of 124 parts per billion (ppb), based on verified 2004 through 2006 monitoring data and continues to demonstrate attainment with a design value of 102 ppb based on certified data through 2014.

Since the DFW four-county area was not redesignated to attainment prior to the revocation of the one-hour ozone standard, anti-backsliding requirements for contingency measures and new source review (NSR) permitting requirements for serious nonattainment areas still apply. The EPA's *Implementation of the 2008 National Ambient Air Quality Standards for Ozone: State Implementation Plan Requirements; Final Rule* (2008 ozone standard SIP requirements rule) published in the *Federal Register* on March 6, 2015 (80 FR 12264), includes a mechanism for lifting anti-backsliding obligations under a revoked ozone NAAQS, termed a redesignation substitute (RS), based on Federal Clean Air Act (FCAA), §107(d)(3)(E) redesignation criteria. The EPA's approval of an RS would have the same effect on the area's nonattainment anti-backsliding obligations as would a redesignation to attainment for the revoked standard.

On August 18, 2015, the TCEQ submitted a DFW RS demonstration to the EPA in the form of a letter and attached report, followed by the formal SIP revision adoption in April 2015 should submittal of a SIP revision be necessary. The DFW RS demonstration is intended to satisfy the anti-backsliding obligations for the revoked one-hour and 1997 eight-hour ozone NAAQS by ensuring that the EPA's requirements for the redesignation of revoked ozone standards are met for the DFW ozone nonattainment area. The DFW RS demonstration was submitted to the EPA as provided for by the 2008 ozone standard SIP requirements rule instead of a redesignation request and maintenance plan, which the FCAA requires to remove anti-backsliding obligations under a standard that has not been revoked.

The DFW RS demonstrates that the DFW one-hour and 1997 eight-hour ozone areas will continue to attain the standards due to permanent and enforceable emission reductions and demonstrates continued attainment of both standards through 2028 via emissions inventory trends, 2012 attainment inventory, and projected future emissions. Since removing anti-backsliding obligations is contingent upon the EPA's approval, the TCEQ has set a horizon year of 2028. This 10-year period also aligns with the EPA's requirement of maintenance plans to demonstrate attainment for a 10-year period following the date of redesignation.

### 1.2.2 1997 Eight-Hour Ozone NAAQS History (No change)

1.2.2.1 May 23, 2007 (No change)

1.2.2.2 Reclassification to Serious for the 1997 Eight-Hour Ozone Standard (No change)

1.2.2.3 EPA Determination of Attainment for the 1997 Eight-Hour Ozone NAAQS

Under the serious classification, the DFW nonattainment area was given until June 15, 2013 to attain the 1997 eight-hour ozone NAAQS. The area did not monitor attainment by that date but at the end of the 2014 ozone season, the eight-hour design value was 81 ppb, based on 2012, 2013, and 2014 air monitoring data, which is in attainment of the 1997 eight-hour ozone standard. On February 24, 2015, the TCEQ submitted early certification of 2014 ozone air monitoring data to the EPA, along with a request for a determination of attainment for the 1997 eight-hour ozone standard for the DFW area. On September 1, 2015, the EPA published a determination of attainment for the DFW 1997 eight-hour ozone nonattainment area and disapproval of portions of the 2011 DFW 1997 Eight-Hour Ozone Attainment Demonstration (AD) SIP Revision (80 FR 52630). A revised attainment demonstration for the 1997 eight-hour ozone standard will not be required as a result of the EPA's determination of attainment.

The EPA revoked the 1997 eight-hour ozone standard in its 2008 ozone standard SIP requirements rule (80 FR 12264). Since the DFW nine-county area was not redesignated to attainment prior to the revocation of the one-hour or the 1997 eight-hour ozone standards, anti-backsliding requirements for contingency measures and NSR permitting requirements for serious nonattainment areas still apply.

As discussed in Section 1.2.1.5, *EPA Determination of One-Hour Ozone Attainment*, the TCEQ submitted a DFW RS demonstration to the EPA on August 18, 2015 in the form of a letter and attached report, followed by the formal SIP revision adoption in April 2016 should submittal be necessary. The DFW RS is intended to satisfy the anti-backsliding obligations for the revoked one-hour and 1997 eight-hour ozone NAAQS by ensuring that the EPA's requirements for the redesignation of revoked ozone standards are met for the DFW ozone nonattainment area.

### 1.2.3 2008 Eight-Hour Ozone NAAQS (No change)

### 1.2.4 AD SIP Revision for the 2008 Ozone NAAQS (No change)

### 1.2.5 Current AD SIP Revision for 2008 Ozone NAAQS for the 2017 Attainment Year

In the *DFW AD SIP Revision for the 2008 Ozone NAAQS* submitted to the EPA on July 10, 2015, the TCEQ committed to develop a new 2017 DFW AD SIP revision for the 2008 eight-hour ozone nonattainment area to include the following analyses to reflect the 2017 attainment year: a modeled AD, corroborative analysis, a reasonably available control measures analysis, and a motor vehicle emissions budget.

Because this SIP revision only provides an analyses to reflect the 2017 attainment year, all other sections have been labeled "no change." An electronic version of the 2018 DFW AD SIP revision for the 2008 Ozone NAAQS submitted to the EPA on July 10, 2015 can be found at the TCEQ's Dallas-Fort Worth: Latest Ozone Planning Activities Web page (https://www.tceq.texas.gov/airquality/sip/dfw/dfw-latest-ozone).

This 2017 DFW AD SIP revision demonstrates attainment of the 2008 eight-hour ozone NAAQS by July 20, 2018 based on a photochemical modeling analysis of reductions in nitrogen oxides ($NO_X$) and volatile organic compounds (VOC) emissions from existing control strategies and a weight of evidence analysis. The peak ozone design value in 2017 for the DFW nonattainment area is projected to be 77 ppb using EPA guidance from April 2007 and 76 ppb using draft guidance released by the EPA in December 2014.

### 1.2.6 Existing Ozone Control Strategies

Existing control strategies implemented to address the one-hour and eight-hour ozone standards are expected to continue to reduce emissions of ozone precursors in the DFW nonattainment area and positively impact progress toward attainment of the 1997 eight-hour ozone standard and the 2008 eight-hour ozone standard. The one-hour and eight-hour ozone design values for the DFW nonattainment area from 1991 through 2014 are illustrated in Figure 1-1: *One-Hour and Eight-Hour Ozone Design Values and DFW Population*. Both design values have decreased over the past 24 years. The 2015 one-hour ozone design value was 102 ppb, representing a 27% decrease from the value for 1991 (140 ppb). The 2015 eight-hour ozone design value was 83 ppb, a 21% decrease from the 1991 value of 105 ppb. These decreases occurred despite a 69% increase in area population from 1991 through 2014, as shown in Figure 1-1.

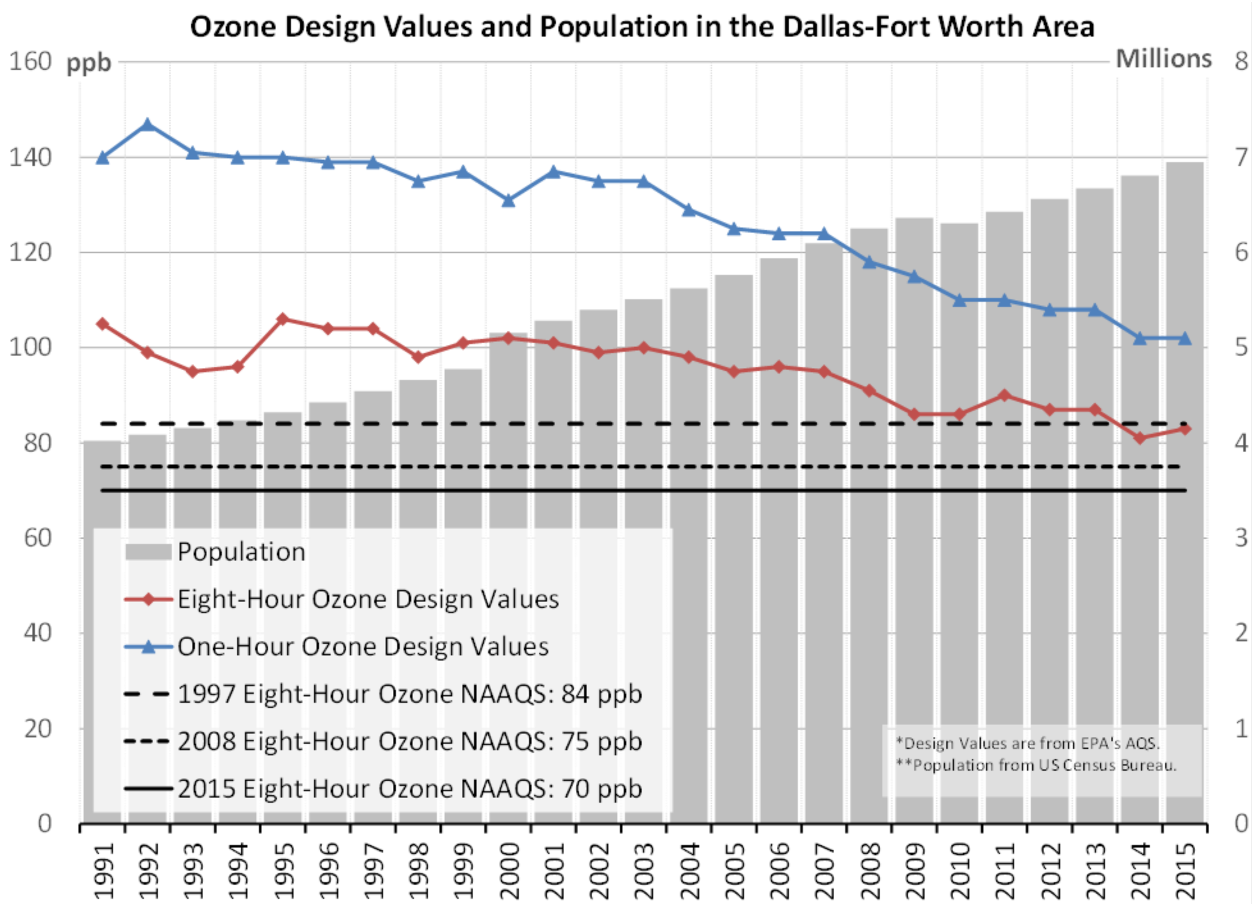



**Figure 1-1: One-Hour and Eight-Hour Ozone Design Values and DFW Population**

## 1.3 HEALTH EFFECTS (NO CHANGE)

## 1.4 STAKEHOLDER PARTICIPATION

### 1.4.1 DFW Air Quality Technical Committee Meetings

The NCTCOG hosted a meeting of the Air Quality Technical Committee on November 6, 2015. The purpose of this committee is to exchange information and provide a forum for public input on air quality issues in the DFW nonattainment area. Agenda topics included the status of DFW photochemical modeling development for the DFW 2008 Eight-Hour Ozone Standard Nonattainment Area AD SIP Revision for the 2017 Attainment Year. The committee includes representatives from industry, county and city government, environmental groups, and the public. More information about this committee is available on the NCTGOC's Air Quality Technical Committee Web page (http://www.nctcog.org/trans/committees/AQTC/index.asp).

## 1.5 PUBLIC HEARING INFORMATION

The public comment period opened on December 11, 2015, and closed on January 29, 2016. Notice of public hearings for this 2017 DFW AD SIP revision was published in the *Texas Register* and various newspapers. Written comments were accepted via mail, fax, and through the eComments (http://www1.tceq.texas.gov/rules/ecomments/index.cfm) system.

The commission conducted a public hearing in Arlington on January 21, 2016, at 6:30 p.m., and offered a public hearing in Austin on January 26, 2016, at 10:00 a.m. During the comment period, staff received comments from the DFW Chapter of System Change Not Climate Change, Dallas City Council member Sandy Greyson, Dallas County Commissioner Dr. Theresa Daniel, the Dallas County Medical Society, the Denton Drilling Awareness Group, Downwinders at Risk, Empowering Oak Cliff, the Fort Worth League of Neighborhoods, Frack Free Denton, Keep America Moving, the League of Women Voters of Dallas, the League of Women Voters of Irving, Liveable Arlington, the Lone Star Chapter of the Sierra Club, the North Texas Renewable Energy Group, the Regional Transportation Council, the Texas Campaign for the Environment, the Texas Medical Association, Public Citizen, the Regional Transportation Council, the Sierra Club, the Sierra Club of Dallas, United States Congresswoman Eddie Bernice Johnson, the EPA, and 51 individuals. Summaries of public comments and TCEQ responses are included as part of this 2017 DFW AD SIP revision.

An electronic version of the 2017 DFW AD SIP revision for the 2008 Ozone NAAQS and appendices can be found at the TCEQ's Dallas-Fort Worth: Latest Ozone Planning Activities Web page (https://www.tceq.texas.gov/airquality/sip/dfw/dfw-latest-ozone).

## 1.6 SOCIAL AND ECONOMIC CONSIDERATIONS (NO CHANGE)

## 1.7 FISCAL AND MANPOWER RESOURCES (NO CHANGE).

# CHAPTER 2: ANTHROPOGENIC EMISSIONS INVENTORY (EI) DESCRIPTION

## 2.1 INTRODUCTION (NO CHANGE)

## 2.2 POINT SOURCES (NO CHANGE)

## 2.3 AREA SOURCES

Stationary sources that do not meet the reporting requirements for point sources are classified as area sources. Area sources are small-scale industrial, commercial, and residential sources that use materials or perform processes that generate emissions. Examples of sources of volatile organic compounds (VOC) emissions include the following: oil and gas production facilities, printing processes, industrial coating and degreasing operations, gasoline service station underground tank filling, and vehicle refueling operations. Examples of typical fuel combustion sources include the following: oil and gas production facilities, stationary source fossil fuel combustion at residences and businesses, outdoor burning, structural fires, and wildfires.

Emissions for area sources are calculated as county-wide totals rather than as individual sources. Area source emissions are typically calculated by applying a United States Environmental Protection Agency (EPA)-established emission factor (emissions per unit of activity) by the appropriate activity or activity surrogate responsible for generating emissions. Population is one of the more commonly used activity surrogates for area source calculations. Other activity data commonly used are the amount of gasoline sold in an area, employment by industry type, and crude oil and natural gas production.

The air emissions data from the different area source categories are collected, reviewed for quality assurance, stored in the Texas Air Emissions Repository database system, and compiled to develop the statewide area source EI. This area source periodic emissions inventory (PEI) is reported every third year (triennially) to the EPA for inclusion in the National Emissions Inventory. The Texas Commission on Environmental Quality (TCEQ) submitted the most recent PEI for calendar year 2014.

## 2.4 NON-ROAD MOBILE SOURCES

Non-road vehicles do not normally operate on roads or highways and are often referred to as off-road or off-highway vehicles. Non-road emissions sources include, but are not limited to: agricultural equipment; commercial and industrial equipment; construction and mining equipment; lawn and garden equipment; aircraft and airport equipment; locomotives; and commercial marine vessels. A Texas-specific version of the EPA's latest NONROAD 2008a model, called the Texas NONROAD (TexN) model, was used to calculate emissions from all non-road mobile source equipment and recreational vehicles, with the exception of airports, locomotives, and drilling rigs used in upstream oil and gas exploration activities. While the TexN model utilizes input files and post-processing routines to estimate Texas specific emissions estimates, it retains the EPA NONROAD 2008a model to conduct the basic emissions estimation calculations. Several input files provide necessary information to calculate and allocate emission estimates. The inputs used in the TexN model include emission factors, base year equipment population, activity, load factor, meteorological data, average lifetime, scrappage function, growth estimates, emission standard phase-in schedule, and geographic and temporal allocation. TexN 1.7.1 was used to estimate non-road emissions for this Dallas-Fort Worth (DFW) Attainment Demonstration (AD) State Implementation Plan (SIP) revision.

Because emissions for airports and locomotives are not included in either the NONROAD model or the TexN model, the emissions for these categories are estimated using other EPA-approved methods and guidance. Emissions for the source categories that are not in the EPA NONROAD

2008a model are estimated using other EPA-approved methods and guidance documents. Airport emissions are calculated using the Federal Aviation Administration's Emissions and Dispersion Modeling System. Locomotive emission estimates for Texas are based on specific fuel usage data derived from railway segment level gross ton mileage activity (line haul locomotives) and hours of operation (yard locomotives) provided directly by the Class I railroad companies operating in Texas. Although emissions for oilfield drilling rigs are included in the NONROAD model, alternate emissions estimates were developed for that source category in order to develop more accurate inventories. Drilling rig inventories are developed using improved drilling rig emissions characterization profiles based on 2015 survey data from Texas oil and gas companies. These drilling rig emissions characterization profiles are combined with drilling activity data obtained from the Railroad Commission of Texas (RRC) to develop drilling rig emissions estimates. The equipment populations for drilling rigs were set to zero in the TexN model to avoid double counting emissions from these sources.

## 2.5 ON-ROAD MOBILE SOURCES (NO CHANGE)

## 2.6 EI IMPROVEMENT

The TCEQ EI reflects years of emissions data improvement, including extensive point and area source inventory reconciliation with ambient emissions monitoring data. The following projects have significantly improved the DFW point source and area source inventory for oil and gas related activities in recent years.

- TCEQ Work Order Nos. 582-7-84003-FY-10-26 and 582-7-84005-FY-10-29 quantified nitrogen oxides ($NO_X$) and VOC emissions from various oil and gas processes and produced water storage tanks at upstream oil and gas operations Texas, which the TCEQ has added to the area source inventory.
- The TCEQ conducted a special inventory of companies that own or operate leases or facilities associated with Barnett Shale oil and gas operations. The TCEQ conducted the special EI under the authority of 30 Texas Administrative Code §101.10(b)(3) to determine the location, number, and type of emission sources associated with upstream and midstream oil and gas operations in the Barnett Shale. The results of the special inventory were used to improve the compressor engine population profiles in both the DFW nine-county 1997 eight-hour ozone nonattainment area as well as the ozone nonattainment Barnett Shale counties. This improved profile was used in determining the area source emissions estimates for this source category.
- The TCEQ conducted two surveys of pneumatic devices at oil and gas wells. The first survey was conducted in 2011 and focused on the Barnett Shale area. The second survey was conducted in 2012 and focused on the remainder of the state. The results of the 2011 pneumatic device survey were used to update emission factors and activity data (including the average number of pneumatic devices per well) in the Barnett Shale area. In addition, revised bleed rate information from the EPA's Oil and Gas Emission Estimation Tool was used in the development of the emission factors.
- TCEQ Work Order No. 582-11-99776-FY11-05 developed improved drilling rig emissions characterization profiles. The drilling rig emissions characterization profiles from this study were combined with drilling activity data obtained from the RRC to develop area source emissions estimates for this source category.
- TCEQ Work Order No. 582-11-99776-FY12-12 developed projection factors for oil and gas sources from a 2011 baseline year through 2035. Using historical data from the RRC, different projection methodologies were considered with the most robust one being based on the Hubbert peak curve theory. Yearly production factors are provided for the Barnett, Eagle Ford, and Haynesville shale formations, with separate factors for oil, natural gas, and

condensate. The Barnett Shale factors were used for the DFW ten-county 2008 eight-hour ozone nonattainment area.

- TCEQ Work Order No. 582-11-99776-FY12-11 refined emissions factors and methods to estimate emissions from condensate storage tanks for area source inventory development at the county-level. The project developed region-specific emission factors and control factors for eight geographic regions in the state.
- A study contracted to Eastern Research Group, Inc. (ERG) was completed on August 1, 2014 that updated emission rates for hydraulic pump engines and mud degassing activities associated with oil and gas production. The oil and gas emissions estimates included with the 2018 DFW AD SIP revision were developed with older emission factors for this type of activity.
- Revised 2014 historical production data became available from the RRC, which impacted 2017 projections of emissions from natural gas compressor engines. These updated RRC data sets were used for projecting the 2017 oil and gas emission estimates included with this 2017 DFW AD SIP revision.

In addition to these projects, the TCEQ annually updates and publishes *Emissions Inventory Guidelines* (RG-360), a comprehensive guidance document that explains all aspects of the point source EI process. The latest version of this document is available on the TCEQ's Point Source Emissions Inventory Web page (http://www.tceq.state.tx.us/implementation/air/industei/psei/psei.html). Currently, six technical supplements provide detailed guidance on determining emissions from potentially underreported VOC emissions sources such as cooling towers, flares, and storage tanks.

# CHAPTER 3: PHOTOCHEMICAL MODELING

## 3.0 INTRODUCTION

This chapter describes modeling conducted in support of the 2017 Dallas-Fort Worth (DFW) Attainment Demonstration (AD) State Implementation Plan (SIP) Revision for the 2008 Eight-Hour Ozone Standard. The DFW ozone nonattainment area consists of Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, Tarrant, and Wise Counties. The 1990 Federal Clean Air Act (FCAA) Amendments require that ADs be based on photochemical grid modeling or any other analytical methods determined by the United States Environmental Protection Agency (EPA) to be at least as effective. When development work on this 2017 DFW AD SIP revision commenced in 2012, the EPA's April 2007 *Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze* (EPA, 2007) was the latest modeling guidance available. The EPA released an update to this guidance in December 2014 entitled *Draft Modeling Guidance for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze* (EPA, 2014). The April 2007 document will be referred to as either the "2007 guidance" or "2007 modeling guidance," and the December 2014 version will be referred to as either the "draft guidance" or "draft modeling guidance."

Both the 2007 and draft guidance documents recommend air quality modeling procedures for predicting attainment of the eight-hour ozone National Ambient Air Quality Standard (NAAQS). They recommend several qualitative methods for preparing ADs that acknowledge the limitations and uncertainties of photochemical models when used to project ozone concentrations into future years. First, both modeling guidance documents recommend using model results in a relative sense and applying the model response to the observed ozone data. Second, both modeling guidance documents recommend using available air quality, meteorology, and emissions data to develop a conceptual model for eight-hour ozone formation and to use that analysis in episode selection. Third, both modeling guidance documents recommend using other analyses, i.e., weight of evidence (WoE), to supplement and corroborate the model results and support the adequacy of a proposed control strategy package.

A large portion of the modeling and technical analysis for this 2017 DFW AD SIP revision was done prior to release of the current draft guidance, so the development work is consistent with the 2007 guidance. However, most of these procedures are very similar between the 2007 guidance and draft guidance. A notable difference is that the 2007 guidance recommends the attainment test be performed for all baseline episode days modeled above a specific threshold, while the draft guidance recommends performing the test for only the 10 days from the baseline with the highest modeled ozone values. Chapter 3: *Photochemical Modeling*, Section 3.7.2: *Future Baseline Modeling*, summarizes these attainment tests in more detail and provides the results for both approaches.

The remainder of this chapter includes an overview of the photochemical modeling, while portions of Chapter 5: *Weight of Evidence* discuss the conceptual model and WoE analyses. More detail on each of these components can be found in the following appendices to this 2017 DFW AD SIP revision:

- Appendix A: *Meteorological Modeling for the DFW Attainment Demonstration SIP Revision for the 2008 Eight-Hour Ozone Standard*;
- Appendix B: *Emissions Modeling for the DFW Attainment Demonstration SIP Revision for the 2008 Eight-Hour Ozone Standard*;
- Appendix C: *Photochemical Modeling for the DFW Attainment Demonstration SIP Revision for the 2008 Eight-Hour Ozone Standard*;

- Appendix D: *Conceptual Model for the DFW Attainment Demonstration SIP Revision for the 2008 Eight-Hour Ozone Standard*; and
- Appendix E: *Modeling Protocol for the DFW Attainment Demonstration SIP Revision for the 2008 Eight-Hour Ozone Standard*.

The 1990 FCAA Amendments established five classifications for ozone nonattainment areas based on the magnitude of the regional one-hour ozone design value. Based on the monitored one-hour ozone design value at that time, four counties in the DFW area (Collin, Dallas, Denton, and Tarrant) were classified as a moderate nonattainment area. As published in the October 16, 2008 edition of the *Federal Register* (FR), the EPA determined the four-county DFW area to be in attainment of the one-hour ozone standard based on 2004 through 2006 monitored data (73 FR 61357).

With the change of the ozone NAAQS from a one-hour standard to an eight-hour standard in 1997, the EPA classified the DFW area as a moderate ozone nonattainment area in 2004 with an attainment date of June 15, 2010. Five additional counties (Ellis, Johnson, Kaufman, Parker, and Rockwall) were added to the four original one-hour standard nonattainment counties to create the nonattainment area for the 1997 eight-hour standard. Ozone AD SIP revisions addressing the 1997 eight-hour ozone standard were required to be submitted to the EPA by June 15, 2007. In May 2007, photochemical modeling and other analyses conducted by the Texas Commission on Environmental Quality (TCEQ) were included in the AD SIP revision submitted to the EPA supporting the DFW area's attainment of the 1997 eight-hour ozone standard by June 15, 2010. The EPA published final conditional approval of the May 2007 DFW AD SIP Revision on January 14, 2009 (*74 FR 1903*).

In 2009, the monitored design value (complete ozone season prior to the attainment date) for the DFW area was 86 parts per billion (ppb), which is 2 ppb above the attainment level. The EPA published the final rule to determine the DFW area's failure to attain the 1997 eight-hour ozone standard and reclassify the DFW area as a serious nonattainment area on December 10, 2010 (*75 FR 79302*). The attainment date for the serious classification was June 15, 2013. The EPA prescribed that the attainment test be applied to the 2012 previous ozone season to determine compliance with the 2013 attainment date. Based on the fourth highest ozone readings per monitor from 2010, 2011, and 2012, 15 of the 17 regulatory monitors active within DFW during this time period had three-year ozone design values ranging from 69 to 83 ppb. However, two regulatory monitors had three-year ozone design values above the 84 ppb standard. The Keller monitor had a 2012 design value of 87 ppb, and the Grapevine Fairway monitor had a 2012 design value of 86 ppb. Both of these monitors are located in the northwest quadrant of the DFW nonattainment area where the highest ozone concentrations have historically been measured.

Ozone nonattainment designations under the revised 2008 eight-hour ozone standard became effective on July 20, 2012. Wise County was added to the nine nonattainment counties, which resulted in a 10-county DFW nonattainment area for the 2008 eight-hour ozone standard. The DFW area was classified as moderate nonattainment with a required attainment date of December 31, 2018. In July 2015, photochemical modeling and other analyses conducted by the TCEQ were included in the AD SIP revision submitted to the EPA supporting the DFW area's attainment of the 1997 eight-hour ozone standard by December 31, 2018.

On December 23, 2014, the United States Court of Appeals for the District of Columbia Circuit (D.C. Circuit Court) ruled on a lawsuit filed by the Natural Resources Defense Council, which resulted in vacatur of the EPA's December 31 attainment date for the 2008 0zone NAAQS. As a result, the attainment date for the DFW moderate nonattainment area was changed from December 31, 2018 to July 20, 2018, which requires modeling a 2017 future year for the AD because it contains the full ozone season immediately preceding the attainment date. This 2017 DFW AD SIP revision uses photochemical modeling in combination with corroborative analyses to support a conclusion that the 10-county DFW nonattainment area will attain the 2008 eight-hour ozone standard of 75 ppb by July 20, 2018. Also, the limited data collected in the DFW nonattainment area during Texas Air Quality Study 2006 (TexAQS II) is used to evaluate the model's performance and to improve understanding of the physical and chemical processes leading to ozone formation.

## 3.1 OVERVIEW OF THE OZONE PHOTOCHEMICAL MODELING PROCESS

The modeling system is composed of a meteorological model, several emissions processing models, and a photochemical air quality model. The meteorological and emission models provide the major inputs to the air quality model.

Ozone is a secondary pollutant; it is not generally emitted directly into the atmosphere. Ozone is created in the atmosphere by a complex set of chemical reactions between sunlight and several primary (directly emitted) pollutants. The reactions are photochemical and require ultraviolet energy from sunlight. The majority of primary pollutants directly involved in ozone formation fall into two groups, nitrogen oxides ($NO_X$) and volatile organic compounds (VOC). In addition, carbon monoxide (CO) is also an ozone precursor, but much less effective than either $NO_X$ or VOC in forming ozone. As a result of $NO_X$ and VOC reacting in the presence of sunlight, higher eight-hour concentrations of ozone are most common during the summer when daytime hours are extended, with concentrations peaking during the day and falling during the night and early morning hours.

Ozone chemistry is complex, involving hundreds of chemical compounds and chemical reactions. As a result, ozone cannot be evaluated using simple dilution and dispersion algorithms. Due to this chemical complexity, the 2007 and draft modeling guidance documents strongly recommend using photochemical computer models to simulate ozone formation and to evaluate the effectiveness of future control strategies. Computer simulations are the most effective tools to address both the chemical complexity and the future case evaluation.

## 3.2 OZONE MODELING

Ozone modeling involves two major phases, the base case modeling phase and the future year modeling phase. The purpose of the base case modeling phase is to evaluate the model's ability to adequately replicate measured ozone and ozone precursor concentrations during recent periods with high ozone concentrations. The purpose of the future year modeling phase is to predict attainment year ozone design values at each monitor and to evaluate the effectiveness of controls in reaching attainment. The TCEQ developed a modeling protocol, which is attached as Appendix E, describing the process to be followed to evaluate the ozone in the urban area as prescribed by the 2007 guidance available at the time. This modeling protocol was originally submitted to the EPA in August 2013.

### 3.2.1 Base Case Modeling

Base case modeling involves several steps. First, ozone episodes are analyzed to determine what factors were associated with ozone formation in the area and whether those factors were consistent with the conceptual model and the EPA's episode selection criteria. Once an episode is selected, emissions and meteorological data are generated and quality assured. Then the meteorological and emissions ($NO_X$, VOC, and CO) data are input to the photochemical model and the ozone photochemistry is simulated, resulting in predicted ozone and ozone precursor concentrations.

Base case modeling results are evaluated by comparing them to the observed measurements of ozone and ozone precursors that were monitored during the base case period. Typically, this step is an iterative process incorporating feedback from successive evaluations to ensure that the model is adequately replicating observations throughout the modeling episode. The adequacy of the model in replicating observations is assessed statistically and graphically as recommended in the 2007 and draft modeling guidance documents. Additional analyses using special study data are included when available. Satisfactory performance of the base case modeling provides a degree of reliability that the model can be used to predict future year ozone concentrations (future year design values), as well as to evaluate the effectiveness of possible control measures.

### 3.2.2 Future Year Modeling

Future year modeling involves several steps. The procedure for predicting a future year ozone design value (attainment test) involves determining the ratio of the future year to the baseline year modeled ozone concentrations. This ratio is called the relative response factor (RRF). Whereas the emissions data for the base case modeling are episode-specific, the emissions data for the baseline year are based on typical ozone season emissions. Similarly, the emissions data for the future year are developed by applying growth and control factors to the baseline year emissions. Growth projections are based on expected increases in factors such as human population, vehicle miles traveled (VMT), and demand for goods and services. Controls are applied to reflect expected emission rate reductions that are scheduled to occur from state, local, and federal programs. For example, the periodic tightening of vehicle emission standards leads to lower average tailpipe emission rates over time.

Both the baseline and future years are modeled using their respective ozone season emissions and the base case episode meteorological data as inputs. The same meteorological data are used for modeling both the baseline and future years. Thus, the ratio of future year modeled ozone concentrations to the baseline year concentrations provides a measure of the response of ozone concentrations to the change in emissions from projected growth and controls.

A future year ozone design value is calculated by multiplying the RRF by a baseline year ozone design value ($DV_B$). The $DV_B$ is the average of the regulatory design values for the three consecutive years containing the baseline year, as show in Figure 3-1: *2006 Baseline Design Value Calculation*. A calculated future year ozone design value of less than or equal to 75 ppb signifies modeled attainment. The model can also be used to test the effectiveness of various control measures when evaluating control strategies.

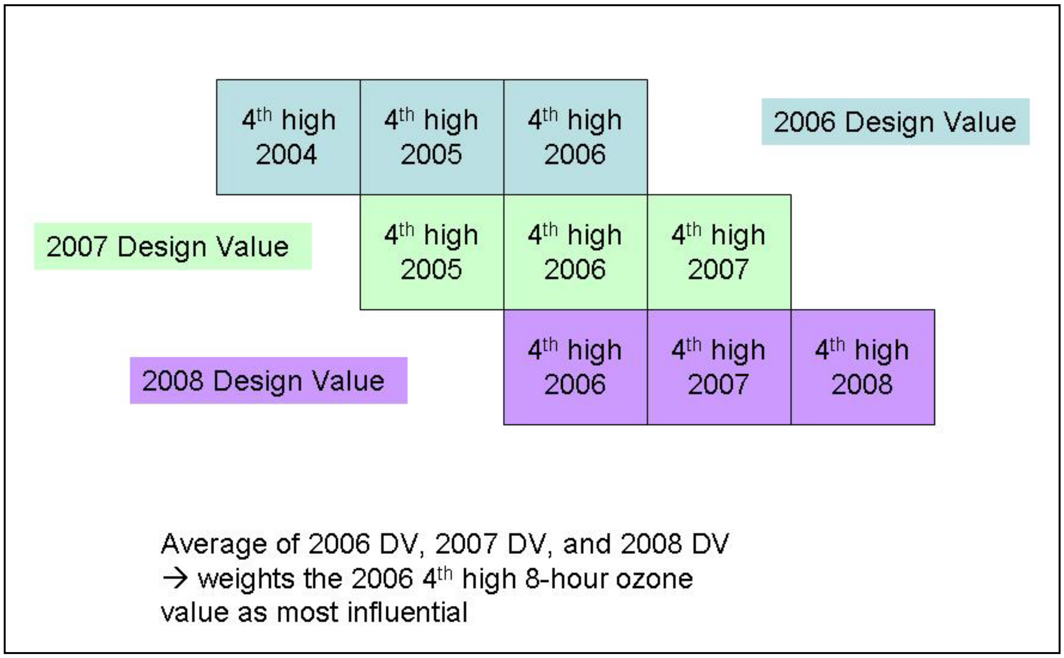



**Figure 3-1: 2006 Baseline Design Value Calculation**

## 3.3 EPISODE SELECTION

### 3.3.1 EPA Guidance for Episode Selection

When development work commenced for this 2017 DFW AD SIP revision in 2012, the EPA's 2007 guidance for the 1997 eight-hour ozone standard of 84 ppb was in effect. The episode selection work for this attainment analysis was done in accordance with this 2007 guidance, but the requirements are similar for the draft guidance. The primary criteria for selecting ozone episodes for eight-hour ozone AD modeling are set forth in the 2007 guidance (as modified for the 2008 eight-hour ozone standard) and shown below.

- Select periods reflecting a variety of meteorological conditions that frequently correspond to observed eight-hour daily maximum ozone concentrations greater than 75 ppb at different monitoring sites.
- Select periods during which observed eight-hour ozone concentrations are close to the eight-hour ozone design values at monitors with a $DV_B$ greater than or equal to 75 ppb.
- Select periods for which extensive air quality and/or meteorological data sets exist.
- Model a sufficient number of days so that the modeled attainment test can be applied at all of the ozone monitoring sites that are in violation of the eight-hour ozone NAAQS.

Based on these criteria, the TCEQ selected ozone episodes from June 2006 and August/September 2006 for use in this 2017 DFW AD SIP revision.

### 3.3.2 DFW Ozone Episode Selection Process

As shown in Figure 3-2: *DFW Eight-Hour Ozone Days Above 75 ppb by Month from 1991 through 2014*, the highest ozone levels in DFW typically follow a bi-modal pattern with peaks in June and August-September. The 1997 eight-hour ozone DFW AD SIP revision from December 2011 relied on a 33-day June 2006 episode ranging from May 31 through July 2, 2006. A primary goal of the episode selection process for the current modeling work was to reflect this historical bi-modal pattern by including both June and August-September (August 13 through September 15, 2006) episodes.

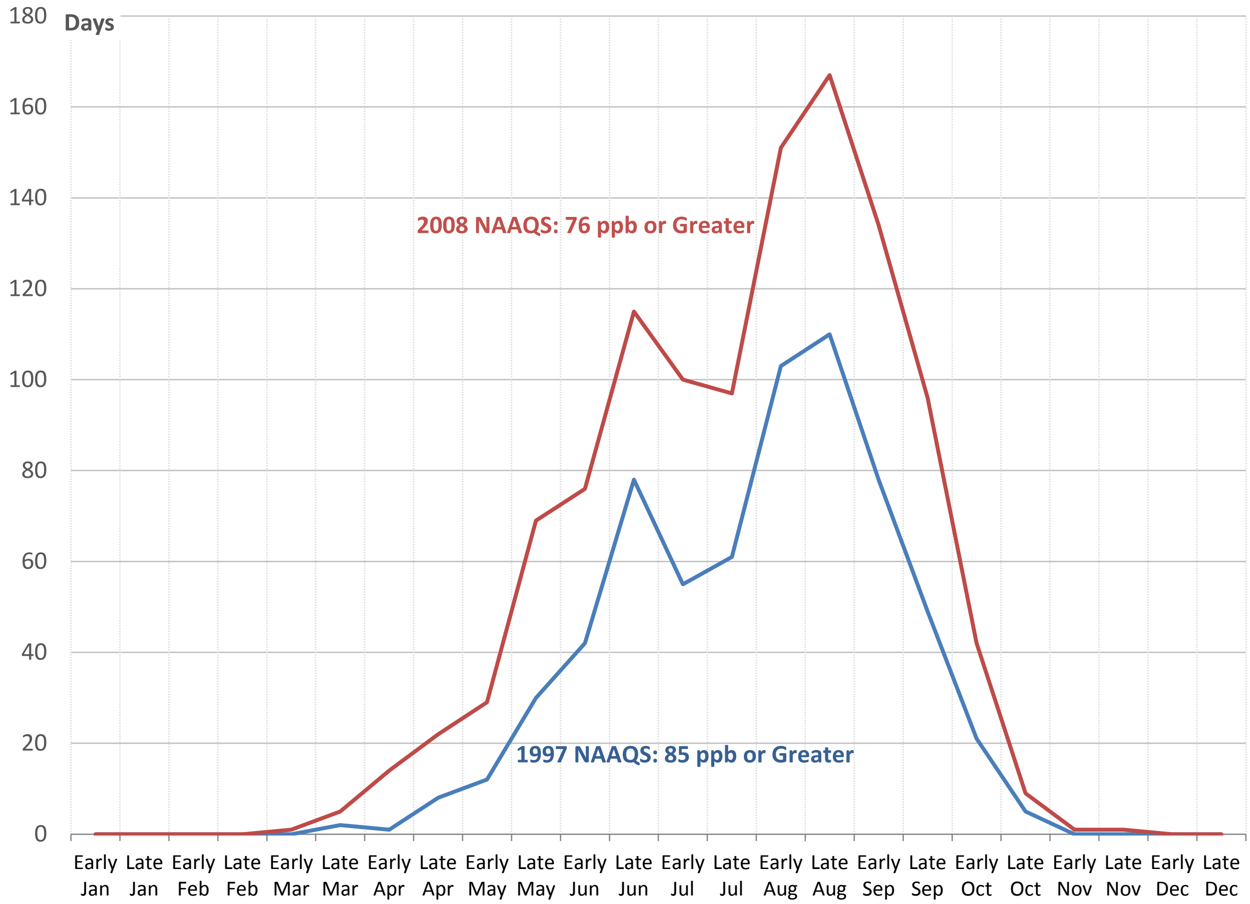



**Figure 3-2: DFW Eight-Hour Ozone Days Above 75 ppb by Month from 1991 through 2014**

Table 3-1: *DFW Days with Ozone Above 75 ppb by Month from 2006 through 2014* shows that there were 50 days with a DFW area monitor above 75 ppb in 2006 with 18 occurring in June and 13 in August-September. Annual days with a DFW area monitor measuring above 75 ppb in subsequent years ranged from 12 in 2014 to 40 in 2011. An evaluation of these post-2006 years indicated that 2012 would be the best candidate for development of a new ozone episode. The nine days above 75 ppb in June 2012 combined with the 16 in August-September correlate well with the historical bi-modal pattern shown in Figure 3-2. The 2011 calendar year was not representative of this historical norm because there were only four days in June and 26 in August-September with ozone monitored above 75 ppb, which is an unusual ozone season distribution for the DFW nonattainment area. The years 2007, 2010, 2013, and 2014 also had a relatively low number of days above 75 ppb in June compared with August-September.

Both 2008 and 2009 had a June/August-September total of 21 days with at least one monitor measuring above 75 ppb. While 2008 and 2009 could be considered as suitable candidates for seasonal ozone modeling, 2012 is a more recent option that would benefit from the use of more recently available emission inventory data sets, such as the 2011 National Emissions Inventory (NEI) submitted by states to the EPA. Also, the EPA has a 2011 national scale modeling platform that will provide useful data sets for a 2012 Texas ozone episode. Even though only the DFW nonattainment area high ozone days are shown here, the TCEQ has begun development of a 2012 seasonal episode because it is a suitable representation for DFW and other metropolitan areas of the state such as Houston-Galveston-Brazoria (HGB). However, the 2012 ozone episode is not within the performance bounds required for AD SIP submissions, and therefore work on this newer episode is still in progress.

**Table 3-1: DFW Days with Ozone Above 75 ppb by Month from 2006 through 2014**

| Month | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|---|---|---|---|---|
| January | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| February | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| March | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| April | 2 | 3 | 1 | 1 | 0 | 2 | 0 | 0 | 0 |
| May | 3 | 1 | 3 | 5 | 4 | 0 | 4 | 1 | 0 |
| June | 18 | 2 | 6 | 8 | 3 | 4 | 9 | 2 | 1 |
| July | 9 | 3 | 5 | 7 | 0 | 6 | 5 | 8 | 5 |
| August | 8 | 11 | 7 | 8 | 9 | 15 | 11 | 7 | 3 |
| September | 5 | 5 | 8 | 5 | 2 | 11 | 5 | 13 | 3 |
| October | 4 | 2 | 0 | 0 | 0 | 2 | 0 | 1 | 0 |
| November | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| December | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Annual Total | 50 | 27 | 30 | 34 | 18 | 40 | 36 | 32 | 12 |
| June Only | 18 | 2 | 6 | 8 | 3 | 4 | 9 | 2 | 1 |
| August-September Only | 13 | 16 | 15 | 13 | 11 | 26 | 16 | 20 | 6 |
| June/August-September Total | 31 | 18 | 21 | 21 | 14 | 30 | 25 | 22 | 7 |

To ensure that both early and late summer ozone periods are represented in the current modeling, and that all necessary modeling work for this AD could be completed in a timely manner, the 34-day period from August 13 through September 15, 2006 was added to the 33-day June 2006 episode for a total 67-day period representative of historical high ozone patterns in DFW. This August-September episode incorporates the extensive monitoring data collected during TexAQS II, including data from radar wind profilers and was used in the March 2010 HGB AD SIP revision. Throughout this discussion, the terms June episode and August-September episode will be used when the episodes need to be referenced separately. When analyses are performed on both, the term 67-day episode will be used to reflect the combination.

### 3.3.3 Summary of the Combined 67-Day 2006 Ozone Episode

Figure 3-3: *DFW Area Ozone Monitoring Locations* shows the spatial distribution of ozone monitors in the DFW nonattainment area. Monitors are located in the upwind areas to the east and south, within the urban core, and in the downwind locations to the north and west. Table 3-2: *Greater DFW Area Ozone Monitor Reference Table* provides the names, Continuous Ambient Monitoring Station (CAMS) code, alpha code, and activation/deactivation dates for 22 ozone monitors located within and surrounding the DFW nonattainment counties. 19 of these monitors had been active for a sufficient amount of time in 2006 that $DV_B$ figures are available for the attainment test that utilizes RRF values. Table 3-3: *Monitor Specific Days Above 75 ppb During 67-Day Combined 2006 Episode* shows that 12 of the DFW area monitors measured ozone above the 75 ppb standard on at least 10 days of the 2006 episodes, which is the minimum preferred by the 2007 modeling guidance. Use of the 67-day combined episode results in a range of 19 to 25 days above 75 ppb at the five downwind northwestern monitors that have typically monitored the highest ozone levels in the DFW nonattainment area: Denton Airport South, Eagle Mountain Lake, Grapevine Fairway, Keller, and Fort Worth Northwest. Seven of the DFW nonattainment area monitors had fewer than 10 days with eight-hour ozone above 75 ppb during this period. However, these seven are all located along the upwind eastern and southern perimeters of DFW where the lowest regional ozone levels are typically monitored. Use of the secondary 70 ppb threshold suggested by the 2007 modeling guidance results in all of the monitors above the preferred 10 days for RRF calculations.

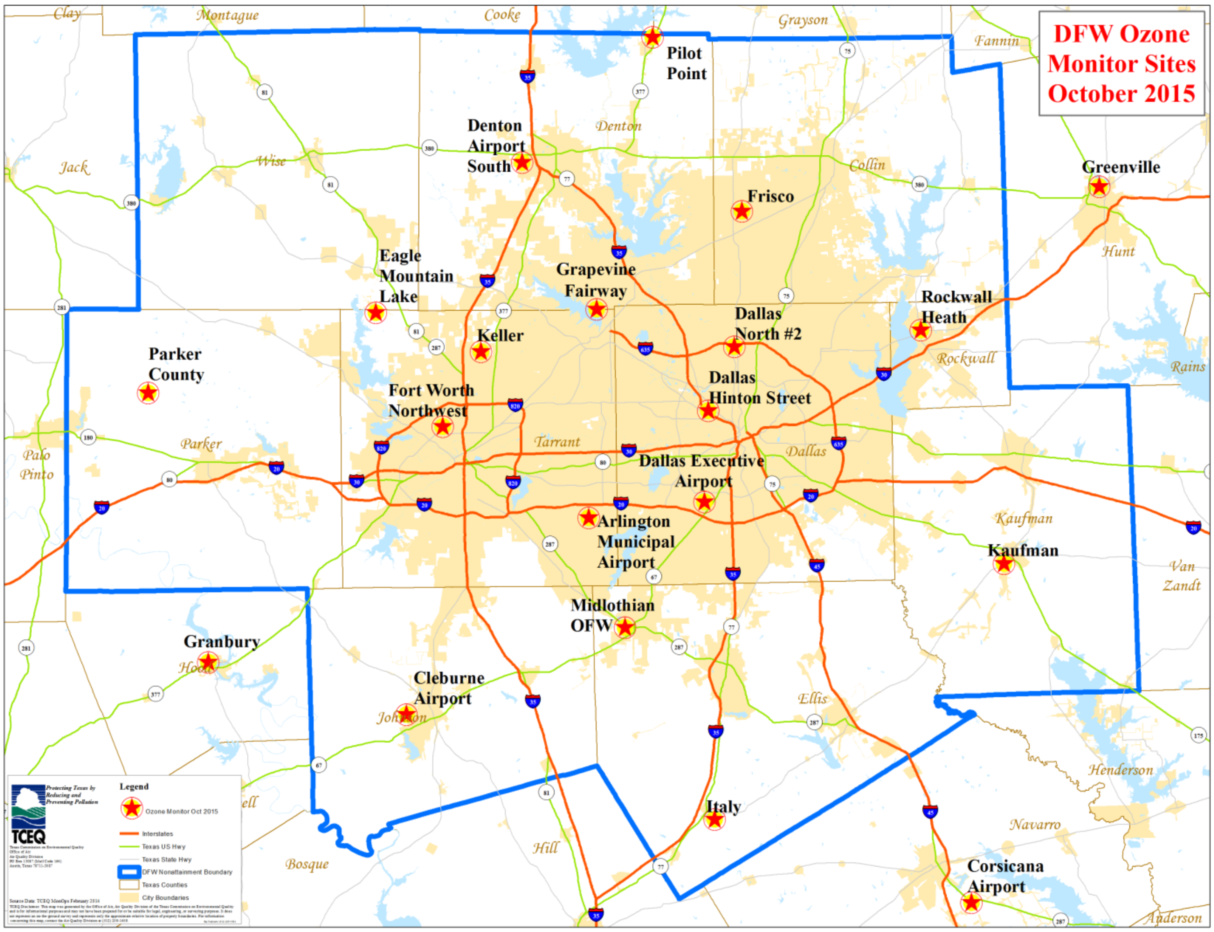



**Figure 3-3: DFW Area Ozone Monitoring Locations**

**Table 3-2: Greater DFW Area Ozone Monitor Reference Table**

| DFW Area Ozone Monitor Name | CAMS Code | Alpha Code | County of Operation | Date Ozone Active | Date Ozone Deactivated |
|---|---|---|---|---|---|
| Frisco | C31 | FRIC | Collin | 07/29/1997 | NA |
| Dallas Executive Airport | C402 | REDB | Dallas | 12/13/1999 | NA |
| Dallas Hinton Street | C401 | DHIC | Dallas | 12/15/1999 | NA |
| Dallas North #2 | C63 | DALN | Dallas | 11/13/1998 | NA |
| Denton Airport South | C56 | DENT | Denton | 03/22/1998 | NA |
| Pilot Point | C1032 | PIPT | Denton | 05/03/2006 | NA |
| Italy | C1044 | ITLY | Ellis | 09/09/2007 | NA |
| Italy High School | C650 | ITHS | Ellis | 08/23/2005 | 11/05/2006 |
| Midlothian OFW | C52 | MDLO | Ellis | 03/29/2006 | NA |
| Midlothian Tower | C94 | MDLT | Ellis | 08/31/1997 | 08/22/2007 |
| Cleburne Airport | C77 | CLEB | Johnson | 05/10/2000 | NA |
| Kaufman | C71 | KAUF | Kaufman | 09/23/2000 | NA |
| Parker County | C76 | WTFD | Parker | 08/03/2000 | NA |
| Rockwall Heath | C69 | RKWL | Rockwall | 08/08/2000 | NA |
| Arlington Municipal Airport | C61 | ARLA | Tarrant | 01/17/2002 | NA |
| Eagle Mountain Lake | C75 | EMTL | Tarrant | 06/06/2000 | NA |
| Fort Worth Northwest | C13 | FWMC | Tarrant | 08/14/1997 | NA |
| Grapevine Fairway | C70 | GRAP | Tarrant | 08/23/2000 | NA |
| Keller | C17 | KELC | Tarrant | 07/16/1997 | NA |
| Granbury | C73 | GRAN | Hood | 05/10/2000 | NA |
| Greenville | C1006 | GRVL | Hunt | 03/21/2003 | NA |
| Corsicana Airport | C1051 | CRSA | Navarro | 06/17/2009 | NA |

**Table 3-3: Monitor Specific Days Above 75 ppb During 67-Day Combined 2006 Episode**

| DFW Area Monitor and CAMS Code | Maximum Eight-Hour Ozone (ppb) | Number of Days Above 70 ppb | Number of Days Above 75 ppb | Number of Days Above 85 ppb | Baseline Design Value (ppb) |
|---|---|---|---|---|---|
| Denton Airport South - C56 | 106 | 29 | 22 | 11 | 93.33 |
| Eagle Mountain Lake - C75 | 107 | 27 | 22 | 9 | 93.33 |
| Grapevine Fairway - C70 | 98 | 26 | 19 | 9 | 90.67 |
| Keller - C17 | 103 | 33 | 25 | 11 | 91.00 |
| Fort Worth Northwest - C13 | 101 | 27 | 21 | 9 | 89.33 |
| Frisco - C31 | 101 | 25 | 20 | 9 | 87.67 |
| Dallas North #2 - C63 | 90 | 19 | 14 | 3 | 85.00 |
| Parker - County - C76 | 101 | 19 | 12 | 4 | 87.67 |
| Dallas Executive Airport - C402 | 95 | 28 | 18 | 5 | 85.00 |
| Cleburne Airport - C77 | 98 | 18 | 8 | 2 | 85.00 |
| Arlington Municipal Airport - C61 | 91 | 18 | 14 | 3 | 83.33 |
| Dallas Hinton Street - C401 | 96 | 22 | 13 | 2 | 81.67 |
| Granbury - C73 | 92 | 16 | 8 | 3 | 83.00 |
| Midlothian Tower - C94 | 98 | 17 | 8 | 1 | NA |
| Pilot Point - C1032 | 101 | 23 | 17 | 9 | NA |
| Rockwall Heath - C69 | 86 | 16 | 9 | 1 | 77.67 |
| Midlothian OFW - C52 | 96 | 14 | 5 | 1 | NA |
| Greenville - C1006 | 84 | 13 | 3 | 0 | 75.00 |
| Kaufman - C71 | 86 | 11 | 5 | 1 | 74.67 |

Midlothian Tower, Pilot Point, and Midlothian OFW did not measure enough data from 2004 through 2008 for calculation of a complete 2006 baseline design value. Greenville and Granbury are not in the 2008 eight hour ozone nonattainment area.

Appendix D describes the general meteorological conditions that are typically present on days when monitored eight-hour ozone concentrations are higher than 75 ppb. High ozone is typically formed in the DFW nonattainment area on days with slower wind speeds out of the east and southeast. These prevailing winds also typically bring higher background ozone levels into the DFW nonattainment area. High background ozone concentrations are then amplified as an air mass moves over the urban core of Dallas and Tarrant Counties, both of which contain large amounts of $NO_X$ emissions. Those emissions are then transported across the DFW nonattainment area to the northwest, where the highest eight-hour ozone concentrations are observed.

The conditions that typically lead to high ozone were present in the 33-day June 2006 episode. High pressure developed over the area from June 5 through June 10, which resulted in mostly sunny days with high temperatures above 90 degrees Fahrenheit. High pressure also caused winds that were calm or light out of the southeast. With light winds a gradual buildup of ozone and ozone precursors developed over the DFW nonattainment area, peaking in an eight-hour ozone concentration of 106 ppb at Eagle Mountain Lake and Denton Airport South on June 9, as shown in Figure 3-4: *Maximum Eight-Hour Ozone by Monitor from May 31 through July 2, 2006*. High pressure began to erode away as a weak frontal boundary approached from the north. Wind speeds then increased over the area, causing ozone dilution and lowering the eight-hour ozone concentrations over the area. As winds switched directions and began blowing from the east-northeast on the backside of the frontal boundary, ozone concentrations again increased. Winds from the east-northeast have the potential for long range transport from the direction of the Ohio River Valley. Transport from the east-northeast likely contributed to an eight-hour ozone concentration of 107 ppb at Eagle Mountain Lake on June 14. Over the next few days, low pressure moved into the area from the Gulf of Mexico. This low pressure caused an increase in cloudiness and wind speed, which reduced the potential for ozone formation. High pressure returned to the area from June 27 through June 30. With the resultant high temperatures and low wind speeds, conditions were again favorable for ozone formation.

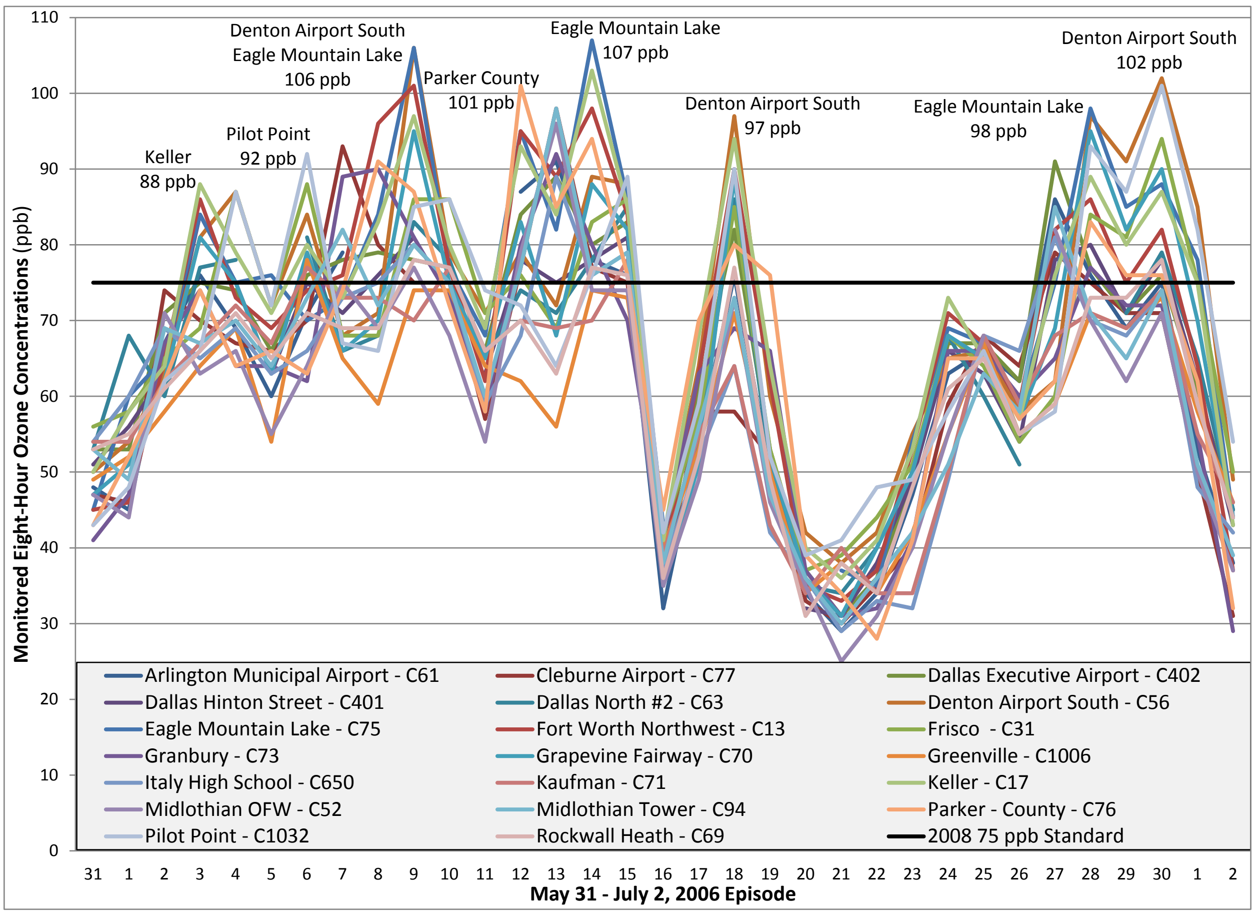



**Figure 3-4: Maximum Eight-Hour Ozone by Monitor from May 31 through July 2, 2006**

As shown in Figure 3-5: *Maximum Eight-Hour Ozone by Monitor from August 13 through September 15, 2006*, the 34-day August-September episode also had conditions favorable for elevated ozone concentrations. Strong southerly winds and a weak warm front kept ozone concentrations below 76 ppb from August 13 through August 17. High pressure settled in by August 18 with clear sunny skies and slow southerly winds allowing for the build-up of ozone concentrations, such as the 91 ppb peaks at Denton Airport South and Grapevine Fairway. Another weak front entered the area on August 22, causing winds to shift from the northeast, indicating possible transport of polluted air from the Ohio and Mississippi River valleys. The weak front stalled just north of the DFW nonattainment area through August 24 keeping winds slow and allowing pollutants to accumulate. Stronger south winds returned by August 25, keeping ozone concentrations low through August 28. A stronger cold front moved through the DFW nonattainment area on August 29, bringing north winds and clouds. Clear skies with light north winds followed, which allowed for ozone concentrations to exceed the NAAQS through September 1, such as the 101 ppb peak at Frisco and 102 ppb peak at Denton Airport South. Another cold front brought cloudy skies and cooler temperatures, which limited ozone production. High pressure and ozone-conducive conditions returned from September 7 through 10 resulting in peak levels of 87 ppb at Frisco and Pilot Point. Northeast winds after a cold front may have again transported polluted air from areas east and north of DFW on September 14.

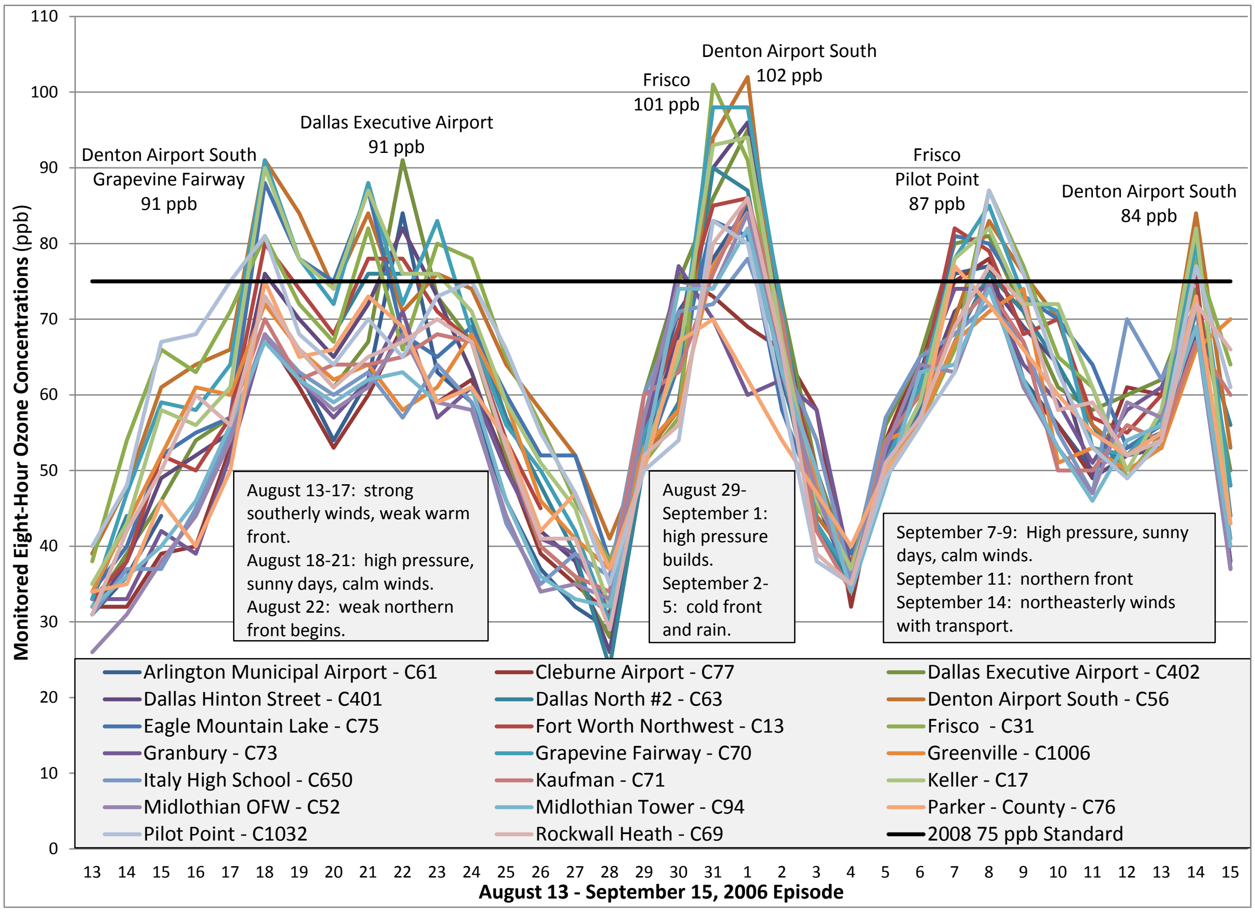



**Figure 3-5: Maximum Eight-Hour Ozone by Monitor from August 13 through September 15, 2006**

Back trajectories from the Eagle Mountain Lake monitor extending backwards in time for 48 hours and terminating at 500 meters above ground level (AGL) are shown for every day of the extended June 2006 episode in Figure 3-6: *Eagle Mountain Lake Monitor Back Trajectories for May 31 through July 2, 2006*. The left panel shows the May 31 through June 15, 2006, period while the right panel shows the June 16 through July 2, 2006, period. Similar 48-hour back trajectories for every day of the August-September episode are shown in Figure 3-7: *Denton Airport South Monitor Back Trajectories for August 13 through September 15, 2006*. The trajectories in both Figure 3-6 and Figure 3-7 depict air coming from north, east, and southerly directions. Westerly winds are not common during the summer months in the DFW nonattainment area, so there are no trajectories coming from the west to northwest. These trajectories illustrate that the combined 67-day episode includes periods of synoptic flow from each of the directions commonly associated with elevated eight-hour ozone concentrations as more fully described in Appendix D.

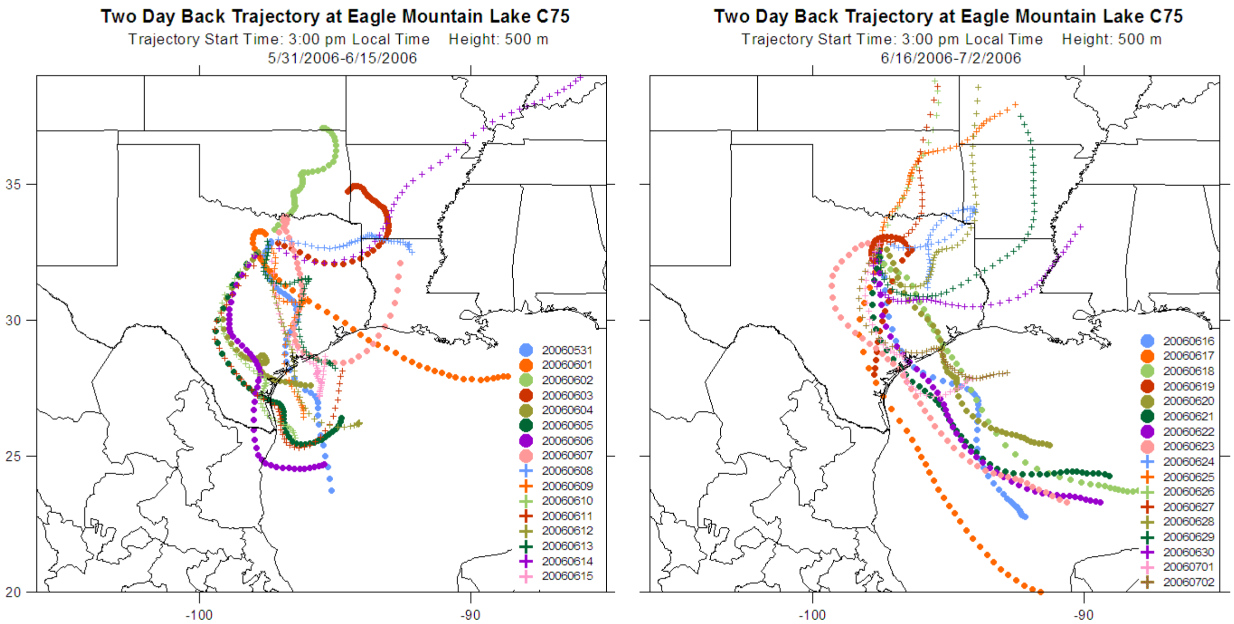



**Figure 3-6: Eagle Mountain Lake Monitor Back Trajectories for May 31 through July 2, 2006**

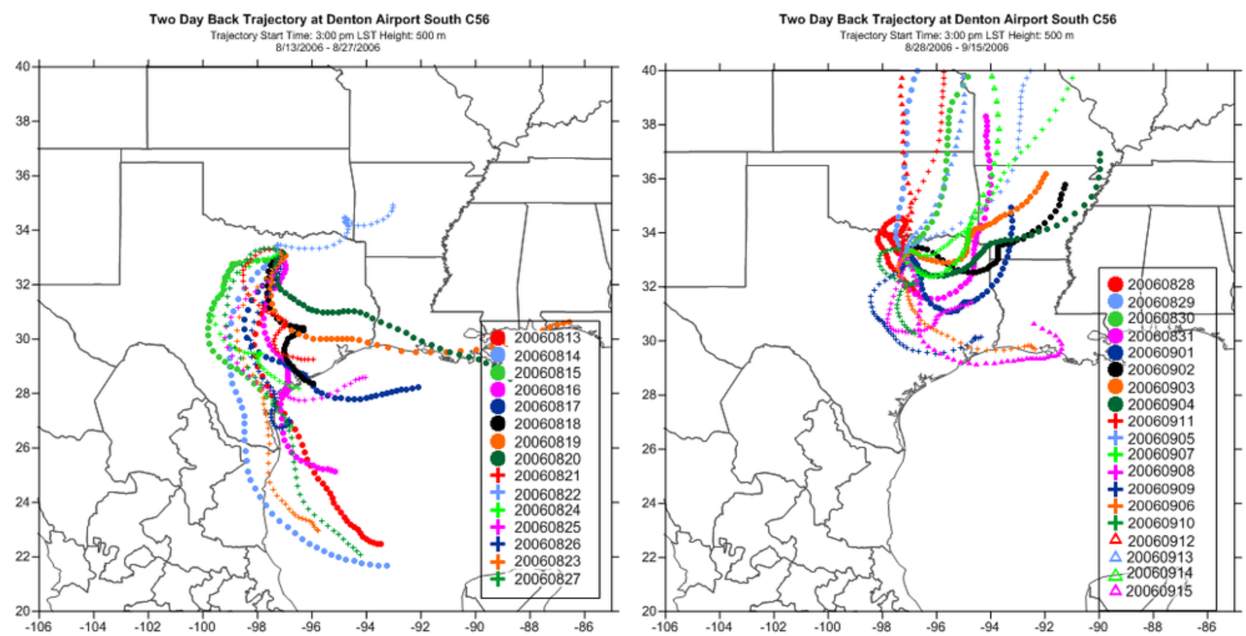


**Figure 3-7: Denton Airport South Monitor Back Trajectories for August 13 through September 15, 2006**

## 3.4 METEOROLOGICAL MODEL

The TCEQ is using the Weather Research and Forecasting Model (WRF), which has now largely replaced the Penn State University/National Center for Atmospheric Research (NCAR) Mesoscale Meteorological Model, Fifth Generation (MM5) for both forecasting and retrospective modeling of historical episodes. The WRF model development was driven by a community effort to provide a modeling platform that supported the most recent research and allowed testing in forecast environments. WRF was designed to be completely mass conservative and built to allow better flux calculations, both of which are of central importance to the air quality community. The model was also designed with higher order numerical techniques than MM5 for many physical calculations. These model improvements over MM5 as well as a decision by NCAR to no longer support MM5 prompted the TCEQ as well as various Texas universities, the Central Regional Air Planning Association, and the EPA to adopt WRF for their respective meteorological modeling platforms.

### 3.4.1 Modeling Domains

As shown in Figure 3-8: *WRF Modeling Domains*, the meteorological modeling was configured with three nested grids at a resolution of 36 kilometers (km) for North America (na_36km), 12 km for Texas plus portions of surrounding states (sus_12km), and 4 km for the eastern portion of Texas (4 km). The extent of each of the WRF modeling domains was selected to accommodate the embedding of the commensurate air quality modeling domains. Table 3-4: *WRF Modeling Domain Definitions* provides the specific northing and easting parameters for these grid projections.

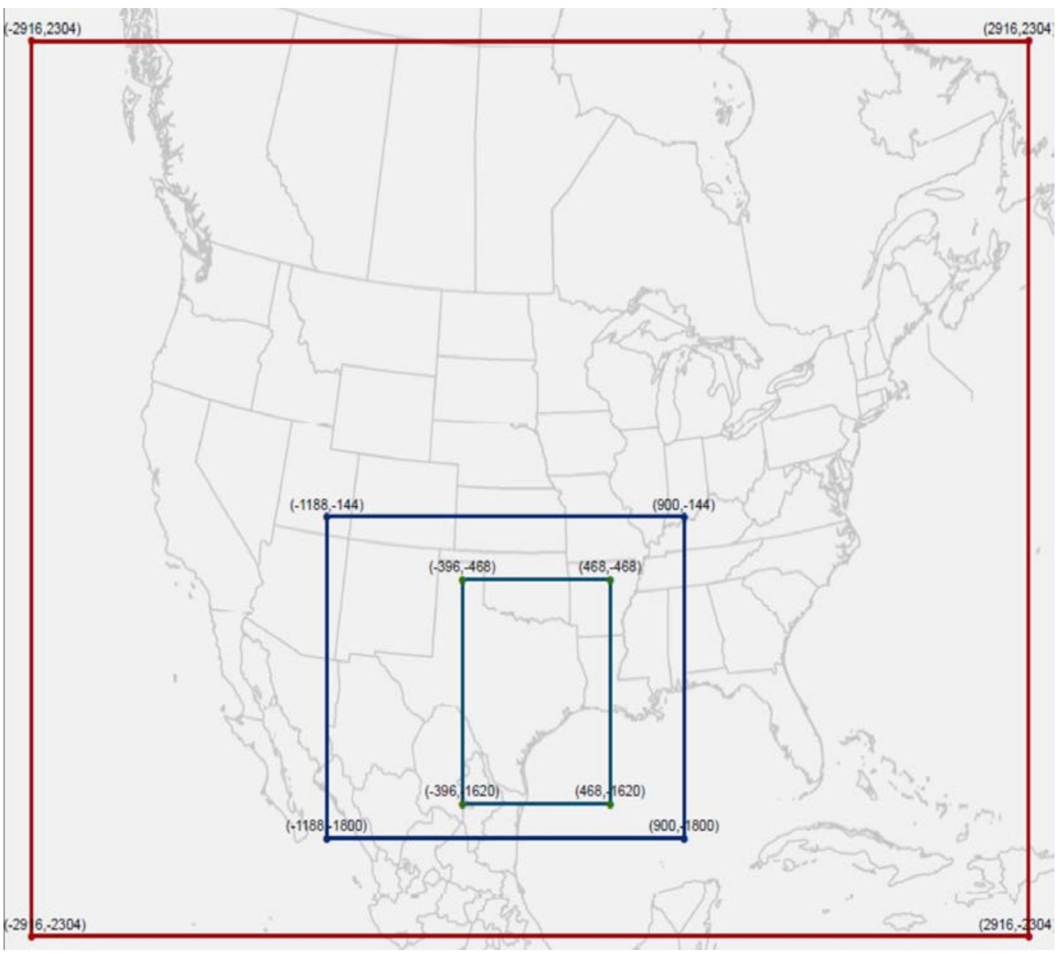



**Figure 3-8: WRF Modeling Domains**

**Table 3-4: WRF Modeling Domain Definitions**

| Domain | Easting Range (km) | Northing Range (km) | East/West Grid Points | North/South Grid Points |
|---|---|---|---|---|
| na_36 km | (-2916,2916) | (-2304,2304) | 163 | 129 |
| sus_12km | (-1188,900) | (-1800,-144) | 175 | 139 |
| 4 km | (-396,468) | (-1620,-468) | 217 | 289 |

As shown in Figure 3-9: *WRF Vertical Layer Structure*, the vertical configuration of the WRF modeling domains consists of a varying 43-layer structure used with all of the horizontal domains. The first 21 vertical layers are identical to the same layers used with the Comprehensive Air Quality Model with Extensions (CAMx), while CAMx layers 22 through 28 each comprise multiple WRF layers.

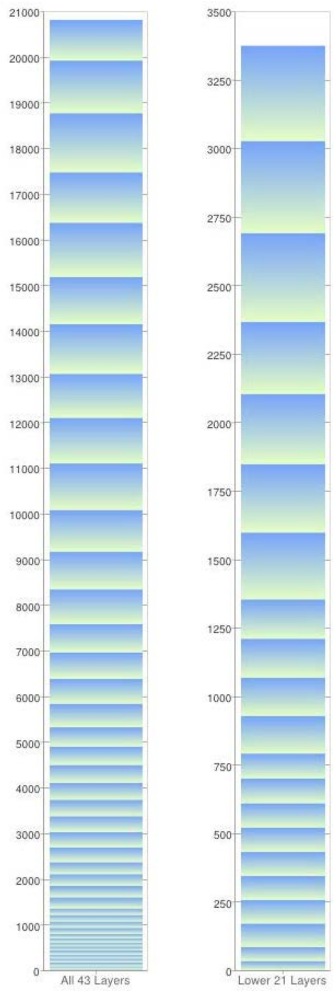



**Figure 3-9: WRF Vertical Layer Structure**

### 3.4.2 Meteorological Model Configuration

The selection of the final meteorological modeling configuration for the two episodes during 2006 resulted from numerous sensitivity tests and model performance evaluation. The preparation of WRF input files involves the execution of different models within the WRF Preprocessing System (WPS). To further improve WRF performance, two types of nudging were utilized that help keep modeled meteorological values in line with observational data. The first type is the analysis nudging, both three-dimensional (3-D) and surface. The 3-D analysis nudging was used on all three domains (4 km, 12 km, and 36 km) to nudge the wind, temperature and moisture. The surface analysis nudging was only used on the 4 km domain to nudge the wind and temperature. The second type is the observational nudging, which uses the radar profiler data for nudging the wind to the 4 km domain. The analysis nudging files are generated as part of WPS preparation of WRF input and boundary condition files. The observational nudging files were developed separately using TCEQ-generated programs.

For optimal photochemical model performance, low-level wind speed and direction are of greater importance than surface temperature. Additional meteorological features of critical importance for air quality modeling include cloud coverage and the strength and depth of the planetary boundary layer (PBL). Observational nudging using TexAQS II radar profiler data and one-hour surface analysis nudging improved wind performance. Switching from the National Centers for Environmental Prediction, Oregon State, Air Force, and Hydrologic Research Laboratory (NOAH) Land-Surface Model to the five-layer soil model also improved the representation of precipitation, temperature, and PBL depths.

The TCEQ continued to improve upon the performance of WRF for the June and August-September 2006 episodes through a series of sensitivities. The final WRF parameterization schemes and options selected are shown in Table 3-5: *WRF Model Configuration Parameters*. The selection of these schemes and options was based on extensive testing of model configurations that built upon experience with MM5 in previous SIP modeling. Among all the meteorological variables that can be validated, minimizing wind speed bias was the highest priority for model performance consideration. WRF output was post-processed using the WRFCAMx version 6.3 utility to convert the WRF meteorological fields to the appropriate CAMx grid and input format. The WRFCAMx now generates several alternative vertical diffusivity (Kv) files based upon multiple methodologies for estimating mixing given the same WRF meteorological fields. The Kv option to match the WRF Yonsei University (YSU) PBL scheme was used for the CAMx runs for the 2006 episodes. The Kv coefficients were also modified on a land-use basis to maintain vertical mixing within the first 100 meters of the model overnight using the landuse based minimum for Kv for all domains (KVPATCH) program (Environ, 2005).

**Table 3-5: WRF Model Configuration Parameters**

| Domain | Nudging Type | PBL | Cumulus | Radiation | Land-Surface | Microphysics |
|---|---|---|---|---|---|---|
| 36 km and 12 km | 3-D | YSU | Kain-Fritsch | RRTM / Dudhia * | 5-layer soil model | WSM6 † |
| 4 km | 3-D, Surface Analysis, and Observations | YSU | N/A | RRTM / Dudhia * | 5-layer soil model | WSM6 † |

* RRTM = Rapid Radiative Transfer Model

† WSM6 = WRF Single-Moment 6-Class Microphysics Scheme

Appendix A provides additional detail on the meteorological modeling inputs presented here.

### 3.4.3 WRF Performance Evaluation

The WRF modeling was evaluated by comparing the hourly modeled and measured wind speed, wind direction, and temperature for all monitors in the DFW nonattainment area. Figure 3-10: *June 2006 WRF Modeling Performance* exhibits the percent of hours for which the average absolute difference between the modeled and measured wind speed and direction was within the specified accuracy benchmarks for specific DFW nonattainment area monitors, as well as a regional average. These benchmarks are less than 30 degrees for wind direction, less than 2 meters per second (m/s) for wind speed, and less than 2 degrees Fahrenheit for temperature.

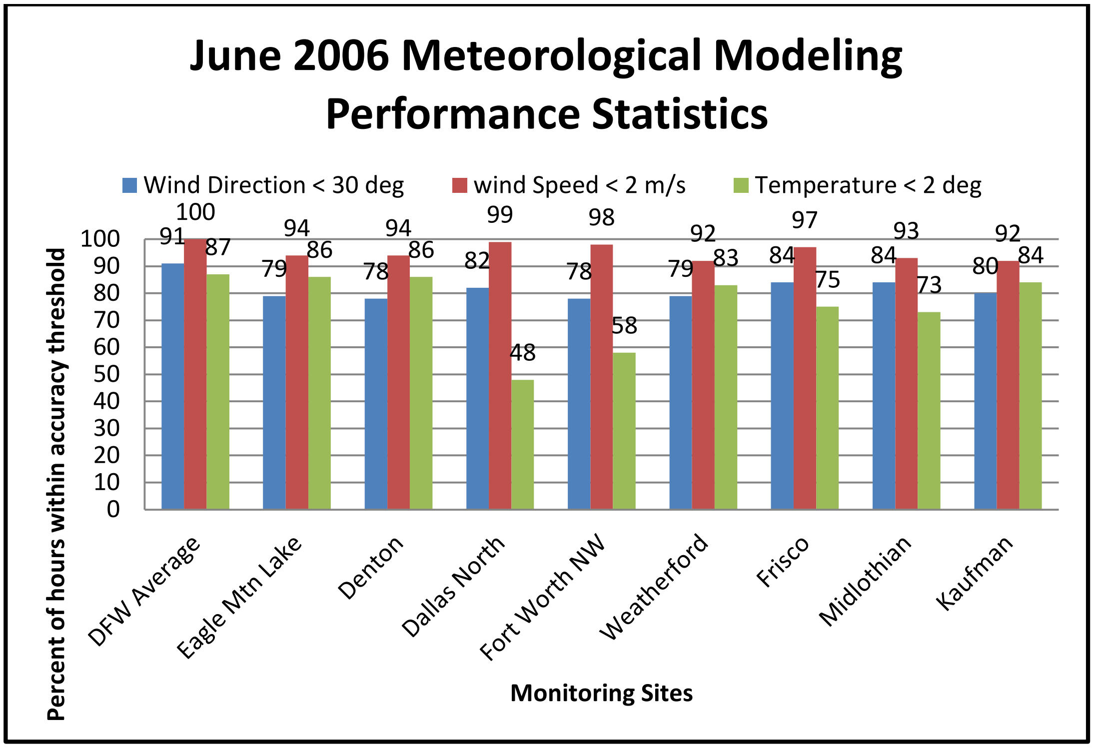



**Figure 3-10: June 2006 WRF Modeling Performance**

As Figure 3-10 shows, WRF performed well for wind speed and wind direction, and reasonably well for temperature. As noted above, the WRF configuration was selected for optimal performance on low-level wind speed since this meteorological variable strongly impacts CAMx performance. Wind speed performance was excellent at the individual monitors, but observed wind direction is less accurate when wind speeds are low, a condition often observed during high ozone days. Table 3-6: *WRF Meteorological Modeling Percent Accuracy for June 2006* provides an additional evaluation of WRF predictions to stricter benchmarks (Emery et al., 2001). The model's ability to replicate wind direction and speed within 20 degrees and 1 m/s on average enhances the confidence in this modeling setup. Appendix A includes more detail on the June, August, and September 2006 WRF modeling performance.

**Table 3-6: WRF Meteorological Modeling Percent Accuracy for June 2006**

| DFW Area Monitor | Wind Direction (°) Error ≤ 30 / 20 / 10 | Wind Speed (m/s) Error ≤ 2 / 1 / 0.5 | Temperature (°C) Error ≤ 2 / 1 / 0.5 |
|---|---|---|---|
| DFW Area Average | 91 / 83 / 65 | 100 / 89 / 64 | 87 / 39 / 14 |
| Eagle Mountain Lake | 79 / 69 / 48 | 94 / 68 / 40 | 86 / 44 / 18 |
| Denton | 78 / 64 / 35 | 94 / 64 / 32 | 86 / 66 / 45 |
| Dallas North | 82 / 71 / 42 | 99 / 83 / 51 | 48 / 23 / 08 |
| Fort Worth NW | 78 / 68 / 42 | 98 / 83 / 54 | 58 / 20 / 08 |
| Weatherford | 79 / 67 / 42 | 92 / 66 / 37 | 83 / 44 / 20 |

| DFW Area Monitor | Wind Direction (°) Error ≤ 30 / 20 / 10 | Wind Speed (m/s) Error ≤ 2 / 1 / 0.5 | Temperature (°C) Error ≤ 2 / 1 / 0.5 |
|---|---|---|---|
| Frisco | 84 / 73 / 47 | 97 / 74 / 42 | 75 / 35 / 16 |
| Midlothian Tower | 84 / 72 / 45 | 93 / 70 / 41 | 73 / 41 / 24 |
| Kaufman | 80 / 68 / 43 | 92 / 67 / 34 | 84 / 46 / 25 |

## 3.5 MODELING EMISSIONS

For the stationary emission source types, which consist of point and area sources, routine emission inventories provided the major inputs for the emissions modeling processing. Emissions from mobile and biogenic sources were derived from relevant emission models. Specifically, link-based on-road mobile source emissions were derived from travel demand model (TDM) activity output coupled with the EPA Motor Vehicle Emissions Simulator (MOVES) emission factor model. The point, area, on-road, non-road, and off-road emission estimates were processed to air quality model-ready format using version three of the Emissions Processing System (EPS3; Environ, 2015). Biogenic emissions were derived from version 2.1 of the Model of Emissions of Gases and Aerosols from Nature (MEGAN 2.1), which outputs air quality model-ready emissions (Guenther, et al., 2012).

An overview is provided here of the emission inputs used for the 2006 base case, 2006 baseline, and 2017 future case. These emission inputs were based on the latest available information at the time development work was done for this 2017 DFW AD SIP proposal. Appendix B contains more detail on the development and processing of the emissions using the various EPS3 modules. Table 3-7: *Emissions Processing Modules* summarizes many of the steps taken to prepare chemically speciated, temporally allocated, and spatially distributed emission files needed for the air quality model. Model-ready emissions were developed for the combined 67-day episode. The following sections give a brief description of the development of each emissions source category.

**Table 3-7: Emissions Processing Modules**

| EPS3 Module | Description |
|---|---|
| PREAM | Prepare area and non-link based area and mobile sources emissions for further processing |
| LBASE | Spatially allocate link-based mobile source emissions among grid cells |
| PREPNT | Group point source emissions into elevated and low-level categories for further processing |
| CNTLEM | Apply controls to model strategies, apply adjustments, make projections, etc. |
| TMPRL | Apply temporal profiles to allocate emissions by day type and hour |
| SPCEMS | Chemically speciate emissions into nitrogen oxide, nitrogen dioxide ($NO_2$), and various Carbon Bond 6 (CB6) VOC species |
| GRDEM | Spatially distribute emissions by grid cell using source category surrogates |
| MRGUAM | Merge and adjust multiple gridded files for model-ready input |
| PIGEMS | Assigns Plume-in-Grid (PiG) emissions and merges elevated point source files |

### 3.5.1 Biogenic Emissions

The TCEQ used MEGAN 2.1 to develop the biogenic emission inputs for CAMx. The MEGAN model requires inputs by model grid cell area of:

- emission factors for nineteen chemical compounds or compound groups;

- plant functional types (PFT);
- leaf area index (LAI) and fractional vegetated leaf area index (LAIv); and
- meteorological information including air and soil temperatures, photosynthetically active radiation (PAR), barometric pressure, wind speed, water vapor mixing ratio, and accumulated precipitation.

The TCEQ used the default emission factors and PFTs that are provided with MEGAN. To process the emission factors and PFTs to the TCEQ air modeling domain structures, gridded layers of each emission factor file were created in ArcMap version 9.3. The TCEQ created 2006-specific LAIv data using the level-4 Moderate-Resolution Imaging Spectroradiometer (MODIS) global LAI MCD15A2 product. For each eight-day period, the satellite tiles covering North America in a Sinusoidal grid were mosaicked together using the MODIS Reprojection Tool. Urban LAI cells, which MODIS excludes, were filled according to a function that follows the North American average for four urban land cover types. The MODIS quality control flags were applied to use only the high quality data from the main retrieval algorithm. The resultant LAI was divided by the percentage of vegetated PFT per grid cell to yield the final LAIv.

The WRF model provided the meteorological data needed for MEGAN input, except for PAR. The episode-specific satellite-based PAR inputs were obtained from the historical data center operated by the Global Energy and Water Cycle Experiment (GEWEX) Continental International Project (GCIP) and GEWEX Americas Prediction Project at the University of Maryland. The PAR data were derived from hourly Geostationary Operational Environmental Satellite (GOES) imagery of cloud cover, which were processed with a solar irradiation model.

The MEGAN model was run for each 2006 episode day. Since biogenic emissions are dependent upon the meteorological conditions on a given day, the same episode-specific emissions for the 2006 baseline were used in the 2017 future case modeling scenarios. The summaries of biogenic emissions for each day of the 67-day combined episode are provided in Appendix B. Figure 3-11: *Sample Biogenic VOC Emissions for June 12, 2006 Episode Day* provides a graphical plot of biogenic VOC emissions distribution at a resolution of 4 km throughout eastern Texas.

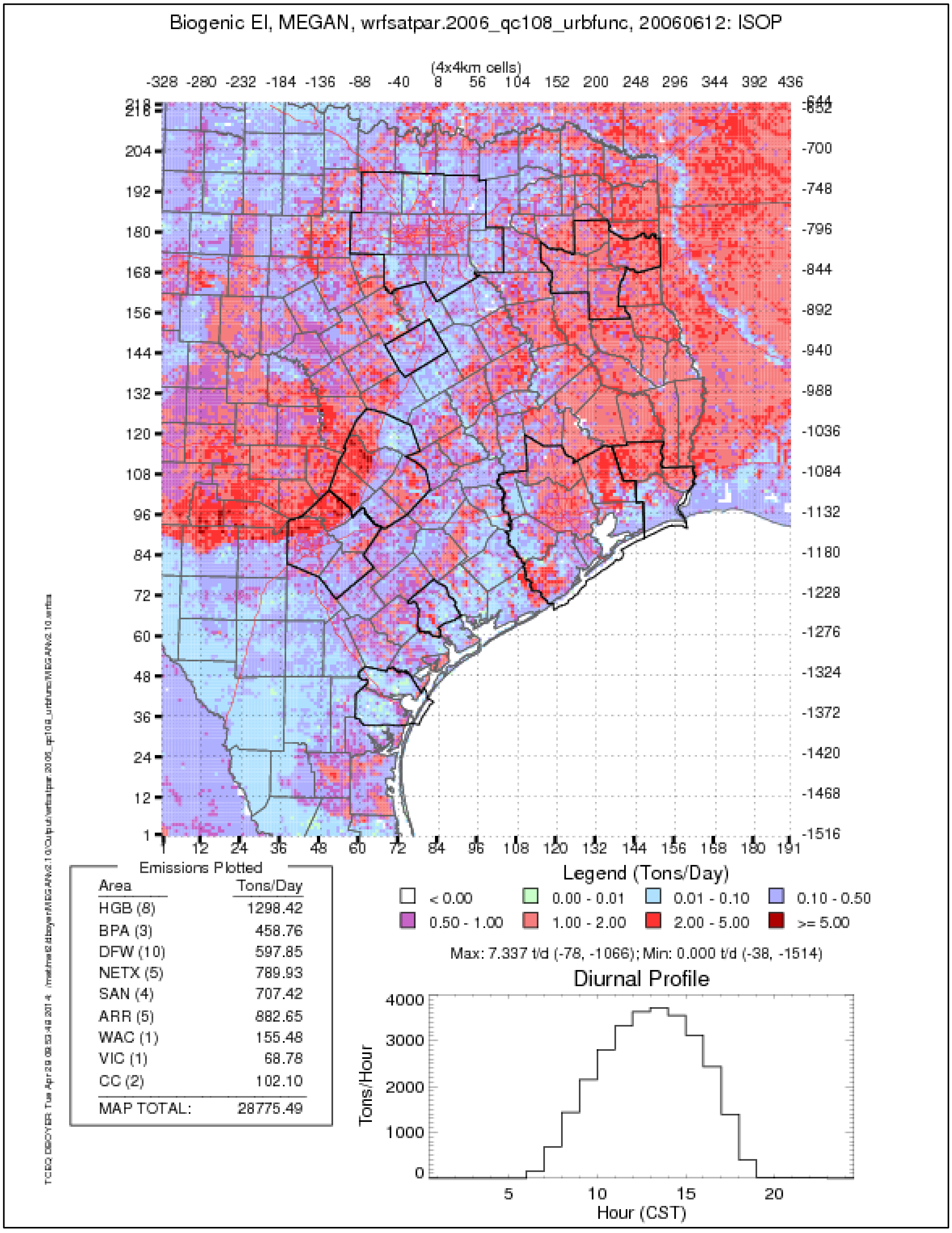



**Figure 3-11: Sample Biogenic VOC Emissions for June 12, 2006 Episode Day**

### 3.5.2 2006 Base Case

3.5.2.1 Point Sources

Point source modeling emissions were developed from regional inventories such as the EPA's NEI, the EPA's Air Markets Program Data (AMPD), state inventories including the State of Texas Air Reporting System (STARS), and local inventories. Data were processed with EPS3 to generate model-ready emissions, and similar procedures were used to develop the 67-day base case episode.

*Outside Texas*

Point source emissions data for the regions of the modeling domains outside of Texas were obtained from a number of different sources. Emissions from point sources in the Gulf of Mexico (e.g., oil and gas production platforms) were obtained from the 2005 Gulf-Wide Emissions Inventory (GWEI) provided by the United States (U.S.) Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE), formerly the Minerals Management Service, as monthly totals. Canadian emissions were obtained from the 2006 National Pollutant Release Inventory from Environment Canada, while 1999 Mexican emissions data were obtained from Phase III of the Mexican NEI. The Gulf of Mexico and 1999 Mexican inventories were not grown to 2006 due to the lack of historical operations data, applied controls, and/or a projection methodology. For the non-Texas U.S. portion of the modeling domain, hourly $NO_X$ emissions for major electric generating units (EGU) were obtained from the AMPD for each hour of each base case episode day. Emissions for non-AMPD sources in states beyond Texas were obtained from the EPA's 2008 NEI-based modeling platform.

*Within Texas*

Hourly $NO_X$ emissions from EGUs within Texas were obtained from the AMPD for each base case episode day. Emissions from non-AMPD sources were obtained from a STARS database emissions extract for the year 2006. In addition, agricultural and forest fire emissions for 2006 were obtained from the Fire INventory of NCAR (FINN) database, courtesy of Environ's work for the East Texas Council of Governments (Environ, 2008). Fires are treated as point sources.

Table 3-8: *2006 Sample Base Case Point Source Emissions for 10-County DFW* provides a summary of the DFW nonattainment area point source emissions for the Wednesday June 14, 2006 episode day. The EGU emissions are different for each day and hour of the episode based on real-time continuous emissions monitoring data that are reported to the EPA's AMPD. Emission estimates for the remaining non-AMPD point source categories of cement kilns, oil and gas facilities, and "other" do not vary by specific episode day, but are averaged over the entire period of June 1 through August 31, 2006.

**Table 3-8: 2006 Sample Base Case Point Source Emissions for 10-County DFW Area**

| DFW Point Source Category | $NO_X$ tons per day (tpd) | VOC (tpd) | CO (tpd) |
|---|---|---|---|
| Point - EGUs on June 14, 2006 | 8.42 | 1.02 | 3.85 |
| Point - Cement Kilns | 22.08 | 1.94 | 17.45 |
| Point - Oil and Gas | 11.53 | 21.82 | 8.74 |
| Point – Other | 14.31 | 25.65 | 17.26 |
| DFW Nonattainment Area Total | 56.34 | 50.43 | 47.30 |

On-Road Mobile Sources

The 2006 on-road mobile source emission inputs were developed using the 2014 version of the MOVES model (MOVES2014). The VMT activity data sets that were used for these efforts are:

- the TDM managed by the North Central Texas Council of Governments (NCTCOG) for the DFW nonattainment area;
- Highway Performance Monitoring System (HPMS) data collected by the Texas Department of Transportation (TxDOT) for the non-DFW portions of Texas contained within the modeling domain; and
- the EPA default information included with the MOVES2014 database for the non-Texas U.S. portions of the modeling domain.

The output from these emission modeling applications were processed through EPS3 to generate the on-road speciated and gridded inputs for photochemical modeling applications.

*DFW Nonattainment Area*

For the 10-county DFW nonattainment area, link-based on-road emissions were developed by NCTCOG using 2006 TDM output and MOVES2014 emission rates to generate average school and summer season on-road emissions for four day types of Monday-Thursday average weekday, Friday, Saturday, and Sunday. For the June 2006 base case episode, the summer season day-type emissions were used. For the August-September 2006 period, the school season day-type emissions were used.

*Non-DFW Portions of Texas*

For the Texas counties outside of the DFW nonattainment area, on-road emissions were developed by the Texas Transportation Institute (TTI) using MOVES2014 emission rates and 2006 HPMS VMT estimates for each county. Average school and summer season emissions by vehicle type and roadway type were estimated for the four day types of Monday-Thursday average weekday, Friday, Saturday, and Sunday.

*Outside of Texas*

For the non-Texas U.S. portions of the modeling domain, the TCEQ used MOVES2014 in default mode to generate 2006 average summer weekday emission estimates for every non-Texas U.S. county. Temporal profiles based on the Texas on-road inventories from TTI and NCTCOG were developed to adjust these summer weekday emissions to the remaining day and season type combinations referenced above.

Table 3-9: *Summary of On-Road Mobile Source Emissions Development* contains additional detail about the on-road mobile inventory development in different regions of the modeling domain.

**Table 3-9: Summary of On-Road Mobile Source Emissions Development**

| On-Road Inventory Development Parameter | DFW | Non-DFW Texas | Non-Texas States/Counties |
|---|---|---|---|
| VMT Source and Resolution | TDM Roadway Links | HPMS Data Sets 19 Roadway Types | MOVES2014 12 Roadway Types |
| Season Types | School and Summer Seasons | School and Summer Seasons | Summer Season Adjusted to School |

| On-Road Inventory Development Parameter | DFW | Non-DFW Texas | Non-Texas States/Counties |
|---|---|---|---|
| Day Types | Weekday, Friday, Saturday, and Sunday | Weekday, Friday, Saturday, and Sunday | Weekday Adjusted to Friday, Saturday, and Sunday |
| Roadway Speed Distribution | Varies by Hour and Link | Varies by Hour and Roadway Type | MOVES2014 Default |
| MOVES Fuel and Source Use Types | Gasoline and Diesel 13 Source Use Types | Gasoline and Diesel 13 Source Use Types | Gasoline and Diesel 13 Source Use Types |

Table 3-10: *2006 Base Case On-Road Modeling Emissions for 10-County DFW* summarizes the on-road mobile source emission estimates for the 2006 base case episode for the 10-county DFW nonattainment area for all combinations of season and day type.

**Table 3-10: 2006 Base Case On-Road Modeling Emissions for 10-County DFW Area**

| Season and Day Type | $NO_X$ (tpd) | VOC (tpd) | CO (tpd) |
|---|---|---|---|
| Summer Weekday | 284.27 | 116.50 | 1,315.46 |
| Summer Friday | 294.54 | 120.41 | 1,430.74 |
| Summer Saturday | 208.95 | 107.91 | 1,228.21 |
| Summer Sunday | 188.15 | 101.29 | 1,066.20 |
| School Weekday | 284.90 | 116.80 | 1,320.26 |
| School Friday | 292.87 | 120.07 | 1,424.23 |
| School Saturday | 206.38 | 107.40 | 1,216.60 |
| School Sunday | 185.99 | 100.89 | 1,057.09 |

#### 3.5.2.2 Non-Road and Off-Road Mobile Sources

Non-road mobile sources include vehicles, engines, and equipment used for construction, agriculture, transportation, recreation, and many other purposes. Off-road mobile sources include aircraft, locomotives, and commercial marine vessels. Non-road and off-road mobile source modeling emissions were developed using Texas NONROAD (TexN) for non-road emissions within Texas, the National Mobile Inventory Model (NMIM) for non-road emissions outside of Texas, the EPA's NEI databases, and data sets from the TCEQ Texas Air Emissions Repository (TexAER). The output from these emission modeling applications and databases were processed through EPS3 to generate the air quality model-ready emission files for non-road and off-road sources.

*Outside Texas*

For the non-Texas U.S. portion of the modeling domains, the TCEQ used the EPA's NMIM to generate average summer weekday non-road mobile source emissions by county and ran it specifically for 2006. For the off-road categories of aircraft, locomotive, and commercial marine, the TCEQ used the EPA's 2008 NEI to create 2006 average summer weekday off-road emissions for the non-Texas U.S. portions of the modeling domain. Summer weekend day emissions for the non-road and off-road mobile source categories were developed as part of the EPS3 processing using temporal profiles specific to each source category.

*Within Texas*

The TCEQ used the TexN model to generate average summer weekday non-road mobile source category emissions by county for 2006. Airport ground support equipment (GSE) and oil and gas drilling rig emissions were estimated separately as detailed below. During EPS3 processing, temporal adjustments were made to create Saturday and Sunday non-road emission estimates. Table 3-11: *2006 Base Case Non-Road Modeling Emissions for 10-County DFW* Area summarizes these non-road inputs by day type. The non-road emission estimates in Table 3-11 were developed with version 1.7.1 of TexN.

**Table 3-11: 2006 Base Case Non-Road Modeling Emissions for 10-County DFW Area**

| 2006 Day Type | $NO_X$ (tpd) | VOC (tpd) | CO (tpd) |
|---|---|---|---|
| Monday – Friday Average Weekday | 98.06 | 64.69 | 806.01 |
| Saturday | 68.72 | 94.19 | 977.67 |
| Sunday | 50.08 | 82.22 | 823.17 |

Airport emission inventories were developed with the Federal Aviation Administration (FAA) Emissions Dispersion Modeling System (EDMS). EDMS outputs emission estimates for aircraft engines, auxiliary power units (APUs), and GSE. Table 3-12: *2006 Base Case Airport Modeling Emissions for 10-County DFW* Area summarizes these estimates for DFW International Airport, Love Field, and the remaining smaller regional airports within DFW. Love Field contracted with Leigh-Fisher to develop emission estimates for 2006 using EDMS. The remaining airport specific emission estimates are based on an NCTCOG study done under contract to the TCEQ.

**Table 3-12: 2006 Base Case Airport Modeling Emissions for 10-County DFW Area**

| DFW Nonattainment Area Airport or Airport Group | $NO_X$ (tpd) | VOC (tpd) | CO (tpd) |
|---|---|---|---|
| DFW International | 9.84 | 2.37 | 16.69 |
| Love Field | 1.22 | 0.57 | 3.39 |
| Regional Airports | 1.72 | 1.52 | 28.01 |
| DFW Area Total for All Airports | 12.78 | 4.46 | 48.09 |

The 2006 locomotive emission estimates were developed by backcasting 2008 data from an Eastern Research Group (ERG, 2015) trends study done for the years from 2008 through 2040. Emissions were estimated separately for Class I line-haul locomotives, Class II and III line-haul locomotives, and rail yard switcher locomotives. The 2008 emissions were adjusted to 2006 levels based on fleet average emission factors available from the EPA. Table 3-13: *2006 Base Case Locomotive Modeling Emissions for 10-County DFW* Area summarizes the estimates for all locomotive activity in DFW.

**Table 3-13: 2006 Base Case Locomotive Modeling Emissions for 10-County DFW**

| Locomotive Source Classification Description | $NO_X$ (tpd) | VOC (tpd) | CO (tpd) |
|---|---|---|---|
| Line-Haul Locomotives – Class I | 16.19 | 1.00 | 2.67 |
| Line-Haul Locomotives – Classes II and III | 0.39 | 0.02 | 0.04 |
| Rail Yard Switcher Locomotives | 3.56 | 0.25 | 0.44 |
| DFW Nonattainment Area Total | 20.14 | 1.28 | 3.16 |

#### 3.5.2.3 Area Sources

Area source modeling emissions were developed using the EPA NEI and the TCEQ's TexAER database. The emissions information in these databases was processed through EPS3 to generate the air quality model-ready area source emission files.

*Outside Texas*

For the non-Texas U.S. portions of the modeling domain, the TCEQ used the EPA's 2008 NEI to create 2006 daily area source emissions.

*Within Texas*

The TCEQ obtained emissions data from the 2008 TexAER database (TCEQ, 2011) and backcast these estimates to 2006 using Texas-specific economic growth factors for 2008 to 2006. Temporal profiles were applied with EPS3 to obtain the figures presented in Table 3-14: *2006 Base Case Area Source Emissions for 10-County DFW Area*.

**Table 3-14: 2006 Base Case Area Source Emissions for 10-County DFW Area**

| 2006 Day Type | $NO_X$ (tpd) | VOC (tpd) | CO (tpd) |
|---|---|---|---|
| Monday – Friday Average Weekday | 29.02 | 290.46 | 85.59 |
| Saturday | 22.21 | 136.92 | 75.57 |
| Sunday | 15.41 | 88.36 | 65.69 |

The 2006 county-level drilling rig emissions were based on work done under contract by Eastern Research Group, Inc. (ERG, 2011) using activity data from the Railroad Commission of Texas (RRC), and are summarized in Table 3-15: *2006 Oil and Gas Drilling Rig Emissions for 10-County DFW Area*.

**Table 3-15: 2006 Oil and Gas Drilling Rig Emissions for 10-County DFW Area**

| Equipment Type | $NO_X$ (tpd) | VOC (tpd) | CO (tpd) |
|---|---|---|---|
| Drilling Rigs | 18.23 | 1.16 | 3.57 |

For oil and gas production sources, county-specific 2006 oil and gas emissions were calculated based on a TCEQ-contracted research project (ERG, 2010). The emissions were estimated according to 2006 county-specific oil and gas production information from the RRC and emission factors compiled in the 2010 ERG study. Emission estimates by equipment type are summarized in Table 3-16: *2006 Oil and Gas Production Emissions for 10-County DFW Area*.

**Table 3-16: 2006 Oil and Gas Production Emissions for 10-County DFW Area**

| Oil and Gas Production Equipment | $NO_X$ (tpd) | VOC (tpd) | CO (tpd) |
|---|---|---|---|
| Natural Gas 4-Cycle Rich Burn Compressors - 50 To 499 HP | 56.19 | 0.10 | 2.54 |
| Natural Gas Well Heaters | 2.11 | 0.12 | 1.77 |
| Natural Gas 2-Cycle Lean Burn Compressors - 50 To 499 HP | 1.45 | 0.14 | 0.21 |
| Natural Gas 4-Cycle Rich Burn Compressors - 500+ HP w/NSCR | 0.84 | 0.16 | 7.25 |
| Natural Gas 4-Cycle Lean Burn Compressors - 500+ HP | 0.71 | 1.43 | 6.77 |
| Oil Production - Artificial Lift | 0.32 | 0.00 | 0.50 |
| Oil Production - Heater Treater | 0.14 | 0.01 | 0.11 |
| Natural Gas Well Dehydrators | 0.08 | 1.65 | 0.23 |
| Oil Production - All Processes | 0.00 | 0.01 | 0.01 |
| Natural Gas 4-Cycle Rich Burn Compressors - 50 To 499 HP w/NSCR | 0.00 | 0.01 | 0.61 |
| Natural Gas Condensate - Storage Tanks | 0.00 | 18.06 | 0.00 |
| Natural Gas Well Pneumatic Devices | 0.00 | 7.07 | 0.00 |
| Natural Gas Exploration - Well Completion, All Processes | 0.00 | 3.34 | 0.00 |
| Oil and Gas Production - Produced Water | 0.00 | 2.30 | 0.00 |
| Natural Gas Fugitives – Other | 0.00 | 2.04 | 0.00 |
| Natural Gas Fugitives – Valves | 0.00 | 1.73 | 0.00 |
| Natural Gas Well Venting | 0.00 | 1.19 | 0.00 |
| Crude Oil Storage Tanks | 0.00 | 1.18 | 0.00 |
| Natural Gas Condensate - Tank Truck/Railcar Loading | 0.00 | 0.57 | 0.00 |
| Oil Production – Wellhead | 0.00 | 0.55 | 0.00 |
| Oil Well Pneumatic Devices | 0.00 | 0.46 | 0.00 |
| Natural Gas Fugitives – Flanges | 0.00 | 0.28 | 0.00 |
| Natural Gas Fugitives – Connectors | 0.00 | 0.27 | 0.00 |
| Oil Well Completion - All Processes | 0.00 | 0.23 | 0.00 |
| Natural Gas Fugitives - Open Ended Lines | 0.00 | 0.21 | 0.00 |
| Oil Production Fugitives – Other | 0.00 | 0.15 | 0.00 |
| Crude Oil Truck/Railcar Loading | 0.00 | 0.11 | 0.00 |
| Natural Gas Fugitives – Pumps | 0.00 | 0.11 | 0.00 |
| Oil Production Fugitives – Valves | 0.00 | 0.10 | 0.00 |
| Oil Production Fugitives – Pumps | 0.00 | 0.05 | 0.00 |
| Natural Gas Production - Compressor Engines | 0.00 | 0.04 | 0.06 |
| Oil Production Fugitives – Connectors | 0.00 | 0.04 | 0.00 |
| Oil Production Fugitives - Open Ended Lines | 0.00 | 0.01 | 0.00 |
| Natural Gas 2-Cycle Lean Burn Compressors < 50 HP | 0.00 | 0.00 | 0.01 |
| Oil Production Fugitives – Flanges | 0.00 | 0.00 | 0.00 |
| Natural Gas 4-Cycle Rich Burn Compressors - <50 HP | 0.00 | 0.00 | 0.01 |
| Oil and Gas Production Total | 61.84 | 43.72 | 20.09 |

Some facilities associated with oil and gas production, such as natural gas processing plants and compressor stations, are required to report to the TCEQ as point sources. Emissions for 2006 from these facilities are not included above within Table 3-16, but are summarized by standard industrial classification (SIC) in Table 3-17: *2006 Point Source Oil and Gas Emissions for 10-County DFW Area*. Table 3-17 provides detail for the "Point - Oil and Gas" category from Table 3-8.

**Table 3-17: 2006 Point Source Oil and Gas Emissions for 10-County DFW Area**

| SIC Description | SIC Code | $NO_X$ (tpd) | VOC (tpd) | CO (tpd) |
|---|---|---|---|---|
| Crude Petroleum and Natural Gas | 1311 | 4.78 | 15.67 | 4.88 |
| Natural Gas Liquids | 1321 | 5.43 | 2.70 | 2.58 |
| Natural Gas Transmission | 4922 | 1.03 | 0.81 | 0.96 |
| Petroleum Bulk Stations and Terminals | 5171 | 0.08 | 1.89 | 0.12 |
| Mixed, Manufactured, LPG Production | 4925 | 0.21 | 0.00 | 0.19 |
| Refined Petroleum Pipelines | 4613 | 0.01 | 0.74 | 0.02 |
| DFW Nonattainment Area Total | NA | 11.53 | 21.82 | 8.74 |

3.5.2.4 Base Case Summary

Table 3-18: *2006 Sample Base Case Anthropogenic Emissions for 10-County DFW Area* summarizes the typical weekday emissions in the 10-county DFW nonattainment area by source type for the base case episode. The EGU emissions presented are specific to the June 14, 2006 episode day, and are different for each of the remaining 66 days in the combined 67-day episode. Table 3-18 is for an average weekday during the June episode, which uses the summer season on-road inventories. For the August-September base case emissions, the school season on-road inventories presented in Table 3-10 were used.

**Table 3-18: 2006 Sample Base Case Anthropogenic Emissions for 10-County DFW Area**

| DFW Nonattainment Area Source Type | $NO_X$ (tpd) | VOC (tpd) | CO (tpd) |
|---|---|---|---|
| On-Road | 284.27 | 116.50 | 1,315.46 |
| Non-Road | 98.06 | 64.69 | 806.01 |
| Off-Road – Locomotives | 20.14 | 1.28 | 3.16 |
| Off-Road – Airports | 12.78 | 4.46 | 48.09 |
| Area Sources | 29.02 | 290.46 | 85.59 |
| Oil and Gas – Production | 61.84 | 43.72 | 20.09 |
| Oil and Gas – Drill Rigs | 18.23 | 1.16 | 3.57 |
| Point – Oil and Gas | 11.53 | 21.82 | 8.74 |
| Point – EGUs on June 14, 2006 | 8.42 | 1.02 | 3.85 |
| Point – Cement Kilns | 22.08 | 1.94 | 17.45 |
| Point – Other | 14.31 | 25.65 | 17.26 |
| Total | 580.68 | 572.70 | 2,329.27 |

### 3.5.3 2006 Baseline

The baseline modeling emissions are based on typical ozone season emissions, whereas the base case modeling emissions are episode day-specific. The biogenic emissions, dependent on the day-specific meteorology, are an exception in that the same episode day-specific emissions are used in both the 2006 base case and baseline. In addition, the 2006 baseline emissions for on-road, non-road, off-road, oil and gas, and area sources are the same as used for the 2006 base case episode, since they are based on typical ozone season emissions. Unlike the base case, fire emissions were not included in the 2006 baseline as they are not typical ozone season day emissions.

For the non-AMPD point sources, the 2006 baseline emissions are the same as the modeling emissions used for the 67-day episode base case with a couple of exceptions. The 2006 baseline EGU emissions were estimated using the average of the June-September hourly AMPD emissions from 2006 to more accurately reflect EGU emissions during the peak ozone season. The highly reactive VOC (HRVOC) emissions reconciliation in the HGB area developed for the 2006 base case was used for the 2006 baseline. For the Gulf of Mexico, Canada, and Mexico, the 2006 baseline used the same emissions as the base case.

Table 3-19: *2006 Summer Baseline Anthropogenic Emissions for 10-County DFW Area* provides the baseline emissions for an average summer weekday. The non-AMPD emissions are the same as the base case, since they are ozone season day averages. The averaged baseline AMPD emissions are not the same as any specific day in the base case, but typical of the entire episode. The only difference between Table 3-18 and Table 3-19 is that the former has episode day specific EGU emissions of 8.42 $NO_X$ tpd for June 14, 2006 while the latter has a peak ozone season average of 9.63 $NO_X$ tpd. The 2006 August-September baseline has the same emission estimates with the exception of including school season on-road emissions instead of those for summer.

**Table 3-19: 2006 Summer Baseline Anthropogenic Emissions for 10-County DFW Area**

| DFW Nonattainment Area Source Type | $NO_X$ (tpd) | VOC (tpd) | CO (tpd) |
|---|---|---|---|
| On-Road | 284.27 | 116.50 | 1,315.46 |
| Non-Road | 98.06 | 64.69 | 806.01 |
| Off-Road – Locomotives | 20.14 | 1.28 | 3.16 |
| Off-Road – Airports | 12.78 | 4.46 | 48.09 |
| Area Sources | 29.02 | 290.46 | 85.59 |
| Oil and Gas – Production | 61.84 | 43.72 | 20.09 |
| Oil and Gas – Drill Rigs | 18.23 | 1.16 | 3.57 |
| Point – Oil and Gas | 11.53 | 21.82 | 8.74 |
| Point – EGUs (Ozone Season Average) | 9.63 | 1.03 | 4.77 |
| Point – Cement Kilns | 22.08 | 1.94 | 17.45 |
| Point – Other | 14.31 | 25.65 | 17.26 |
| Total | 581.89 | 572.71 | 2,330.19 |

Table 3-20: *2006 DFW Point Source Baseline Emission Estimates by Industry Type* provides a summary by SIC of the 17 major industrial categories within the DFW nonattainment area that each emitted more than 0.25 $NO_X$ tpd in 2006, with the remaining 73 industry types emitting a

total of 3.26 $NO_X$ tpd. As of 2006, there were 394 point source facilities throughout the DFW nonattainment area with three in the cement kiln category (SIC of 3241), twelve in electric services (SIC of 4911), and 379 that comprise the remaining 88 SIC types. Based on submissions to the TCEQ STARS database, these 379 non-cement kiln non-EGU facilities were estimated to emit 25.84 $NO_X$ tpd in 2006.

**Table 3-20: 2006 DFW Point Source Baseline Emission Estimates by Industry Type**

| SIC Code | SIC Description | $NO_X$ (tpd) | VOC (tpd) | CO (tpd) |
|---|---|---|---|---|
| 3241 | Cement, Hydraulic | 22.08 | 1.94 | 17.45 |
| 4911 | Electric Services | 9.63 | 1.03 | 4.77 |
| 1321 | Natural Gas Liquids | 5.43 | 2.70 | 2.58 |
| 1311 | Crude Petroleum and Natural Gas | 4.78 | 15.67 | 4.88 |
| 3274 | Lime | 3.83 | 0.02 | 0.46 |
| 3296 | Mineral Wool | 2.20 | 0.73 | 1.69 |
| 3312 | Blast Furnaces and Steel Mills | 1.37 | 1.00 | 4.74 |
| 4922 | Natural Gas Transmission | 1.03 | 0.81 | 0.96 |
| 3221 | Glass Containers | 0.88 | 0.04 | 0.04 |
| 2099 | Food Preparations | 0.57 | 0.03 | 0.25 |
| 2952 | Asphalt Felts and Coatings | 0.46 | 0.60 | 0.63 |
| 4581 | Airports, Flying Fields, and Services | 0.43 | 0.24 | 0.20 |
| 3511 | Turbines and Turbine Generator Sets | 0.40 | 0.08 | 0.07 |
| 2013 | Sausages and Other Prepared Meat Products | 0.33 | 0.01 | 0.16 |
| 3674 | Semiconductors and Related Devices | 0.32 | 0.79 | 0.23 |
| 4953 | Refuse Systems | 0.30 | 0.47 | 1.20 |
| 3251 | Brick and Structural Clay Tile | 0.26 | 0.43 | 0.99 |
| | Remaining 73 SICs Below 0.25 $NO_X$ tpd | 3.26 | 23.86 | 6.92 |
| | DFW Area Total for 90 SIC Codes | 57.55 | 50.44 | 48.21 |

### 3.5.4 2017 Future Case Emissions

The biogenic emissions used for the 2017 future case modeling are the same episode day-specific emissions used in the base case. In addition, similar to the 2006 baseline, no wildfire emissions were included in the 2017 future case modeling.

#### 3.5.4.1 Point Sources

*Outside Texas*

The non-AMPD point source emissions data in the regions outside Texas were derived from the EPA's 2018 emissions modeling platform, which is projected from the 2011 NEI. For non-Texas EGUs, the TCEQ applied Cross-State Air Pollution Rule (CSAPR) caps at the state level. For the Canada and Mexico portions of the modeling domain, the 2017 point source emissions were the same as the emissions used in the 2006 baseline. The Gulf of Mexico emissions for 2017 were based on 2011 estimates, and held constant at 2011 levels for the 2017 future year.

*Within Texas*

2017 future case EGU emission estimates within Texas were based on the prescribed CSAPR state budgets of 137,701 $NO_X$ tons for an entire calendar year and 65,560 $NO_X$ tons for the five-month ozone season of May through September.[2] Future year operational $NO_X$ caps were based on the ozone season budget and its latest unit level allocations from the EPA. Since electricity generation is higher during the hottest months, operational profiles based on 2014 measurements were used to allocate higher estimates for ozone season modeling purposes. Assignment of ozone season $NO_X$ emissions to EGUs operational in 2014 resulted in a total less than the 2017 CSAPR unit level allocations. The remaining $NO_X$ was combined with the set aside allocations for new units under CSAPR. This $NO_X$ combination was first assigned to the maximum allowable emission levels for newly permitted EGUS, and then spread proportionally among all existing EGUs.

The three cement kilns operating within the DFW nonattainment area were assigned the maximum ozone season caps that are specified in 30 Texas Administrative Code (TAC) §117.3123. Emissions for the remaining non-EGU facilities within the DFW nonattainment area were projected from the 2012 levels reported to STARS by each point source facility. An ERG study (ERG, 2010) entitled *Projection Factors for Point and Area Sources* was used as the basis for providing adjustments to the reported 2012 levels based on a combination of the type of industry and county of operation for each facility. Table 3-21: *2012 DFW Area Point Source Emission Estimates by Industry Type* provides a summary by SIC of the 17 major industries within the DFW nonattainment area that emitted more than 0.1 $NO_X$ tpd in 2012, with the remaining 77 industry types emitting a total of 1.57 $NO_X$ tpd. As of 2012 there were 412 point source facilities throughout the DFW nonattainment area: three in the cement kiln category, 12 in electric services, and 397 that comprise the remaining 92 SIC types. Based on submissions to the TCEQ STARS database, these 397 non-cement kiln non-EGU facilities were estimated to emit 23.54 $NO_X$ tpd in 2012.

**Table 3-21: 2012 DFW Area Point Source Emission Estimates by Industry Type**

| SIC Code | SIC Description | $NO_X$ (tpd) | VOC (tpd) | CO (tpd) |
|---|---|---|---|---|
| 3241 | Cement, Hydraulic | 9.03 | 0.86 | 9.20 |
| 4911 | Electric Services | 8.25 | 3.16 | 13.86 |
| 1311 | Crude Petroleum and Natural Gas | 11.00 | 16.49 | 9.00 |
| 1321 | Natural Gas Liquids | 4.59 | 4.94 | 3.88 |
| 3274 | Lime | 1.43 | 0.01 | 0.34 |
| 4922 | Natural Gas Transmission | 1.09 | 2.26 | 0.77 |
| 3312 | Blast Furnaces and Steel Mills | 0.88 | 0.89 | 4.10 |

[2] On July 28, 2015, the United States Court of Appeals for the District of Columbia Circuit found that the CSAPR 2014 $SO_2$ and ozone season $NO_X$ budgets for Texas and certain other states were invalid because the budgets required more emission reductions than were necessary. The court remanded without vacatur to the EPA for reconsideration of the emission budgets. On December 3, 2015, the EPA proposed to address the ozone season $NO_X$ budgets as part of the CSAPR Update Rule for the 2008 eight-hour ozone standard (80 FR 75706). Remanded $SO_2$ budgets are still to be resolved. Therefore, while the current CSAPR budgets for Texas are still in effect, the budgets may be subject to change in the future after the EPA's reconsideration, finalization of the CSAPR Update Rule, or changes resulting from further appeals.

| SIC Code | SIC Description | $NO_X$ (tpd) | VOC (tpd) | CO (tpd) |
|---|---|---|---|---|
| 3296 | Mineral Wool | 0.57 | 0.56 | 1.27 |
| 4953 | Refuse Systems | 0.55 | 0.67 | 2.16 |
| 2952 | Asphalt Felts and Coatings | 0.46 | 0.49 | 0.59 |
| 4581 | Airports, Flying Fields, and Services | 0.33 | 0.17 | 0.05 |
| 3711 | Motor Vehicles and Car Bodies | 0.23 | 3.78 | 0.16 |
| 3253 | Ceramic Wall and Floor Tile | 0.20 | 0.16 | 0.82 |
| 3511 | Turbines and Turbine Generator Sets | 0.19 | 0.05 | 0.05 |
| 2631 | Paperboard Mills | 0.16 | 0.06 | 0.17 |
| 3341 | Secondary Nonferrous Metals | 0.16 | 0.16 | 1.88 |
| 4952 | Sewerage Systems | 0.15 | 0.03 | 0.12 |
| | Remaining 77 SICs Below 0.1 $NO_X$ tpd | 1.57 | 15.16 | 3.53 |
| | DFW Area Total for 94 SIC Codes | 40.82 | 49.88 | 51.95 |

Table 3-22: *2017 DFW Area Point Source Emission Projections by Industry Type* provides a summary of the 2017 point source emission projections by SIC. For the cement kiln and electric utility sources, the required emission caps are modeled in the future year even if historical operational levels have only been roughly 50% of these caps. For example, the cement kilns operated at an average ozone season day level of 9.03 $NO_X$ tpd in 2012, but the 2017 future year is still modeled at the 17.64 $NO_X$ tpd cap. In a similar fashion, the EGUs emitted an average of 8.25 $NO_X$ tpd in 2012, but the 2017 future year is modeled at the CSAPR caps of 13.98 $NO_X$ tpd. This conservative approach of modeling the maximum allowable emission levels ensures that future estimates are not underestimated for these large $NO_X$ sources on high ozone days. Specific caps do not apply to the non-cement kiln non-EGU facilities, which are projected to emit 23.18 $NO_X$ tpd in 2017 after application of the ERG projection factors discussed previously.

**Table 3-22: 2017 DFW Area Point Source Emission Projections by Industry Type**

| SIC Code | SIC Description | $NO_X$ (tpd) | VOC (tpd) | CO (tpd) |
|---|---|---|---|---|
| 3241 | Cement, Hydraulic | 17.64 | 0.77 | 10.92 |
| 4911 | Electric Services | 13.98 | 0.55 | 6.87 |
| 1311 | Crude Petroleum and Natural Gas | 10.83 | 16.56 | 8.59 |
| 1321 | Natural Gas Liquids | 4.52 | 4.96 | 3.36 |
| 3274 | Lime | 1.41 | 0.01 | 0.38 |
| 4922 | Natural Gas Transmission | 1.07 | 2.27 | 0.78 |
| 3312 | Blast Furnaces and Steel Mills | 0.87 | 0.89 | 4.86 |
| 3296 | Mineral Wool | 0.56 | 0.56 | 1.59 |
| 4953 | Refuse Systems | 0.54 | 0.67 | 2.28 |
| 2952 | Asphalt Felts and Coatings | 0.45 | 0.49 | 0.57 |
| 4581 | Airports, Flying Fields, and Services | 0.33 | 0.17 | 0.07 |
| 3711 | Motor Vehicles and Car Bodies | 0.22 | 3.79 | 0.15 |

| SIC Code | SIC Description | $NO_X$ (tpd) | VOC (tpd) | CO (tpd) |
|---|---|---|---|---|
| 3253 | Ceramic Wall and Floor Tile | 0.20 | 0.16 | 0.86 |
| 3511 | Turbines and Turbine Generator Sets | 0.19 | 0.05 | 0.06 |
| 2631 | Paperboard Mills | 0.16 | 0.06 | 0.21 |
| 3341 | Secondary Nonferrous Metals | 0.16 | 0.16 | 2.05 |
| 4952 | Sewerage Systems | 0.14 | 0.03 | 0.14 |
| | Remaining 77 SICs Below 0.1 $NO_X$ tpd | 1.54 | 15.23 | 3.93 |
| | DFW Area Total for 94 SIC Codes | 54.80 | 47.38 | 47.68 |

A similar approach was taken for projecting non-EGU emission levels from 2012 to 2017 in the non-DFW areas of Texas. Within the eight-county HGB area, point source $NO_X$ emissions are limited by the Mass Emissions Cap and Trade Program (MECT), while HRVOC emissions are limited by the HRVOC Emissions Cap and Trade Program (HECT). These MECT and HECT limits were taken into account while projecting 2017 point source levels for both EGUs and non-EGUs operating in the HGB area.

#### 3.5.4.2 On-Road Mobile Sources

The 2017 on-road mobile source inputs were developed using MOVES2014 in combination with the following vehicle activity data sets:

- the TDM managed by NCTCOG for the DFW nonattainment area;
- HPMS data collected by TxDOT for the non-DFW portions of Texas contained within the modeling domain; and
- the EPA default information included with the MOVES2014 database for the non-Texas U.S. portions of the modeling domain.

The output from these emission modeling applications were processed through EPS3 to generate the on-road speciated and gridded inputs for photochemical modeling applications.

*DFW and Non-DFW Areas of Texas*

For all 254 Texas counties, HPMS-based on-road emissions were developed by TTI for 2017 using MOVES2014. Similar to the approach taken for 2006, 2017 on-road emissions were estimated for the four day types of weekday, Friday, Saturday, and Sunday for both the school and summer seasons. For the 10-county DFW nonattainment area, 2017 link-based on-road emissions were estimated using MOVES2014 and TDM output from NCTCOG.

*Outside of Texas*

For the non-Texas U.S. portions of the modeling domain, the TCEQ used MOVES2014 in default mode to generate 2017 average summer weekday emissions for every non-Texas county. Temporal profiles based on the Texas on-road inventories from TTI and NCTCOG were developed to adjust these summer weekday emissions to the remaining day and season type combinations referenced above.

Table 3-23: *2017 Future Case On-Road Modeling Emissions for 10-County DFW* summarizes the on-road mobile source emissions for the 2017 future case for the 10-county DFW nonattainment area for all combinations of season and day type.

**Table 3-23: 2017 Future Case On-Road Modeling Emissions for 10-County DFW**

| Season and Day Type | $NO_X$ (tpd) | VOC (tpd) | CO (tpd) |
|---|---|---|---|
| Summer Weekday | 130.77 | 64.91 | 1,016.95 |
| Summer Friday | 134.55 | 66.63 | 1,113.21 |
| Summer Saturday | 99.46 | 61.22 | 948.41 |
| Summer Sunday | 92.87 | 58.90 | 828.74 |
| School Weekday | 131.08 | 65.04 | 1,021.32 |
| School Friday | 134.11 | 66.56 | 1,111.16 |
| School Saturday | 98.68 | 61.08 | 942.45 |
| School Sunday | 91.74 | 58.67 | 819.69 |

For the 10-county DFW nonattainment area, the on-road mobile source $NO_X$ emissions are reduced roughly 54% from the 2006 baseline (284.27 tpd) to the 2017 future case (130.77 tpd). VOC emissions are reduced roughly 44% from the 2006 baseline (116.50 tpd) to the 2017 future case (64.91 tpd). Due to the ongoing fleet turnover effect where older high-emitting vehicles are replaced with newer low-emitting ones, these substantial on-road reductions are projected to occur even with projected growth in VMT between the years of 2006 and 2017.

#### 3.5.4.3 Non- and Off-Road Mobile Sources

*Outside Texas*

For the non-Texas U.S. portion of the modeling domains, the TCEQ used the EPA's NMIM specifically for 2017 to generate average summer weekday non-road mobile source emission projections by county. For the off-road categories of aircraft, locomotive, and commercial marine, the TCEQ used the EPA's 2011 NEI to create 2017 average summer weekday off-road emissions for the non-Texas U.S. portions of the modeling domain. Summer weekend day emissions for the non-road and off-road mobile source categories were developed as part of the EPS3 processing using temporal profiles specific to each source category.

*Within Texas*

The TCEQ used the TexN model to generate average summer weekday non-road mobile source category emissions by county for 2017. Airport GSE and oil and gas drilling rig emissions were estimated separately as detailed below. During EPS3 processing, temporal adjustments were made to create Saturday and Sunday non-road emission estimates. Table 3-24: *2017 Future Case Non-Road Modeling Emissions for 10-County DFW* summarizes these non-road inputs by day type. The non-road emission estimates in Table 3-24 were developed with version 1.7.1 of TexN.

For the 10-county DFW nonattainment area, non-road $NO_X$ emissions are reduced by roughly 54% from the 2006 baseline (98.06 tpd) to the 2017 future case (45.54 tpd). VOC emissions are decreased roughly 47% from the 2006 baseline (64.69 tpd) to the 2017 future case (34.01 tpd). Due to the ongoing fleet turnover effect where older high-emitting equipment is replaced with newer low-emitting equipment, these substantial non-road reductions are projected to occur even with expected growth in overall non-road equipment population and activity between the years of 2006 and 2017.

**Table 3-24: 2017 Future Case Non-Road Modeling Emissions for 10-County DFW**

| 2017 Day Type | $NO_X$ (tpd) | VOC (tpd) | CO (tpd) |
|---|---|---|---|
| Monday – Friday Average Weekday | 45.54 | 34.01 | 580.39 |
| Saturday | 33.18 | 49.19 | 741.99 |
| Sunday | 25.23 | 43.93 | 642.77 |

Airport emission inventories were developed with the FAA EDMS tool, which outputs emission estimates for aircraft engines, APUs, and GSE. Table 3-25: *2017 Future Case Airport Modeling Emissions for 10-County DFW* summarizes these estimates for DFW International Airport, Love Field, and the remaining smaller regional airports within DFW. Love Field contracted with Leigh-Fisher to develop emission estimates for 2018 using EDMS, and these were held constant for modeling 2017. The remaining airport specific emission estimates are based on an ERG airport emissions trends study for 2008 through 2040 (ERG, 2015a) done under contract to the TCEQ. A file format conversion error was detected with the 2017 airport emission estimates included with the proposal that has been corrected, resulting in an increase of 0.04 $NO_X$ tpd and 0.10 VOC tpd.

**Table 3-25: 2017 Future Case Airport Modeling Emissions for 10-County DFW**

| DFW Nonattainment Area Airport or Airport Group | $NO_X$ (tpd) | VOC (tpd) | CO (tpd) |
|---|---|---|---|
| DFW International | 10.28 | 2.13 | 13.06 |
| Love Field | 1.70 | 0.43 | 2.43 |
| Regional Airports | 0.38 | 0.43 | 11.80 |
| DFW Area Total | 12.36 | 2.99 | 27.29 |

The 2017 locomotive emission estimates were developed from an ERG trends study (ERG, 2015). Emissions were estimated separately for Class I line-haul locomotives, Class II and III line-haul locomotives, and rail yard switcher locomotives. Table 3-26: *2017 Future Case Locomotive Emissions for 10-County DFW* summarizes these estimates for all locomotive activity in DFW.

For the 10-county DFW nonattainment area, the locomotive $NO_X$ emissions are reduced by about 36% from the 2006 baseline (20.14 tpd) to the 2017 future case (12.88 tpd), and the VOC emissions are decreased about 48% from the 2006 baseline (1.28 tpd) to the 2017 future case (0.67 tpd). These substantial locomotive emissions reductions are projected to occur due to the ongoing fleet turnover effect where older high-emitting locomotive diesel engines are replaced with newer low-emitting ones.

**Table 3-26: 2017 Future Case Locomotive Emissions for 10-County DFW**

| Locomotive Source Classification Description | $NO_X$ (tpd) | VOC (tpd) | CO (tpd) |
|---|---|---|---|
| Line-Haul Locomotives – Class I | 9.63 | 0.46 | 2.51 |
| Line-Haul Locomotives – Classes II and III | 0.38 | 0.02 | 0.04 |
| Rail Yard Switcher Locomotives | 2.87 | 0.19 | 0.43 |
| DFW Nonattainment Area Total | 12.88 | 0.67 | 2.99 |

3.5.4.4 Area Sources

*Outside Texas*

For the non-Texas U.S. within the modeling domains, the TCEQ used the EPA's 2011 NEI with to create 2018 daily area source emissions.

*Within Texas*

The TCEQ used data from the 2014 TexAER database (TCEQ, 2015), and projected these estimates to 2017 using the Texas-specific economic growth factors for 2014 to 2017. Temporal profiles were applied with EPS3 to obtain the figures presented in Table 3-27: *2017 Future Case Area Source Emissions for 10-County DFW*.

**Table 3-27: 2017 Future Case Area Source Emissions for 10-County DFW**

| 2017 Day Type | $NO_X$ (tpd) | VOC (tpd) | CO (tpd) |
|---|---|---|---|
| Monday – Friday Average Weekday | 26.55 | 236.70 | 61.25 |
| Saturday | 20.76 | 133.80 | 53.72 |
| Sunday | 14.98 | 85.58 | 46.26 |

The 2017 county-level drilling rig emission estimates were based on the latest available drilling activity data obtained from the RRC, which are summarized in Table 3-28: *2014 Oil and Gas Drilling Activity for the 10-County DFW Area*. A 2017 drilling rig emission rate for each of the three categories referenced in Table 3-28 was multiplied by the corresponding number of feet drilled. These emission rates for 2012 through 2040 are documented in Chapter 6 of an ERG report entitled *2014 Statewide Drilling Rig Emissions Inventory with Updated Trends Inventories* (ERG, 2015b). The results are summarized in Table 3-29: *2017 Oil and Gas Drilling Rig Emissions for 10-County DFW Area*.

**Table 3-28: 2014 Oil and Gas Drilling Activity for the 10-County DFW Area**

| Type and Depth of 2014 Drilling Levels | 2014 Thousands of Feet Drilled |
|---|---|
| Vertical/Horizontal Drilling | 3,256 |
| Vertical Drilling less than 7,000 Feet | 540 |
| Vertical Drilling greater than 7,000 Feet | 1,467 |

**Table 3-29: 2017 Oil and Gas Drilling Rig Emissions for 10-County DFW Area**

| Equipment Type | $NO_X$ (tpd) | VOC (tpd) | CO (tpd) |
|---|---|---|---|
| Drilling Rigs | 3.07 | 0.32 | 1.05 |

The 2017 future year emission estimates for oil and gas production were projected using 2014 RRC data, which is the latest full year for which such activity information is available. The 2014-to-2017 projection factors were obtained from an ERG study entitled *Forecasting Oil and Gas Activities* (https://www.tceq.texas.gov/assets/public/implementation/air/am/contracts/reports/ei/5821199776FY1212-20120831-erg-forecasting_oild_gas_activities.pdf ) (ERG, 2012) where several methodologies were evaluated for the purposes of projecting oil and gas production levels. The recommended approach is based on the Hubbert peak theory that relies on a bell-shaped curve to predict the rate of fossil fuel extraction over time from a specific region. Table 3-30: *Barnett*

*Shale Emission Projection Factors from 2014 to 2017* summarizes these projection factors from the ERG study for natural gas, crude oil, and condensate.

**Table 3-30: Barnett Shale Emission Projection Factors from 2014 to 2017**

| Fossil Fuel Type | Barnett Shale Projection Factor from 2014 to 2017 |
|---|---|
| Natural Gas | 62.82% |
| Crude Oil | 67.11% |
| Condensate | 29.70% |

The 2014 emission estimates based directly on historical RRC data were then multiplied by the projection factors in Table 3-30 to obtain the 2017 emissions estimates by equipment type presented in Table 3-31: *2017 Oil and Gas Production Emissions for 10-County DFW Area*.

**Table 3-31: 2017 Oil and Gas Production Emissions for 10-County DFW Area**

| Oil and Gas Production Equipment | $NO_X$ (tpd) | VOC (tpd) | CO (tpd) |
|---|---|---|---|
| Natural Gas 4-Cycle Rich Burn Compressors 50-499 HP | 6.13 | 0.07 | 2.36 |
| Natural Gas 4-Cycle Rich Burn Compressors 50-499 HP w/NSCR | 1.33 | 0.06 | 2.53 |
| Oil and Gas Production - Hydraulic Fracturing Pumps | 1.18 | 0.08 | 0.00 |
| Natural Gas 4-Cycle Rich Burn Compressors <50 HP | 0.82 | 0.00 | 0.09 |
| Natural Gas 4-Cycle Rich Burn Compressors 500+ HP w/NSCR | 0.81 | 0.03 | 1.36 |
| Oil Production - Artificial Lift | 0.19 | 0.00 | 0.00 |
| Natural Gas 4-Cycle Rich Burn Compressors 500+ HP | 0.09 | 0.00 | 0.08 |
| Natural Gas 4-Cycle Lean Burn Compressors 50 To 499 HP | 0.07 | 0.04 | 0.16 |
| Natural Gas 4-Cycle Lean Burn Compressors <50 HP | 0.04 | 0.00 | 0.01 |
| Natural Gas 2-Cycle Lean Burn Compressors 50 To 499 HP | 0.03 | 0.04 | 0.08 |
| Natural Gas 2-Cycle Lean Burn Compressors 500+ HP | 0.03 | 0.00 | 0.00 |
| Natural Gas Well Heaters | 0.02 | 0.00 | 0.00 |
| Natural Gas Well Dehydrators | 0.02 | 1.85 | 0.17 |
| Natural Gas 4-Cycle Lean Burn Compressors 500+ HP | 0.01 | 0.01 | 0.04 |
| Natural Gas Condensate - Storage Tanks | 0.01 | 3.37 | 0.03 |
| Natural Gas Production - Compressor Engines | 0.01 | 0.01 | 0.02 |
| Oil Production - All Processes | <0.01 | 0.01 | 0.01 |
| Oil Production - Heater Treater | <0.01 | 0.00 | 0.00 |
| Crude Oil Storage Tanks | <0.01 | 0.51 | 0.00 |
| Natural Gas Condensate - Tank Truck/Railcar Loading | <0.01 | 0.06 | 0.00 |
| Crude Oil Truck/Railcar Loading | <0.01 | 0.04 | 0.00 |
| Natural Gas Well Pneumatic Devices | 0.00 | 7.69 | 0.00 |
| Natural Gas Exploration - Well Pneumatic Pumps | 0.00 | 7.37 | 0.00 |
| Natural Gas Fugitives – Other | 0.00 | 2.70 | 0.00 |
| Natural Gas Exploration - Mud Degassing | 0.00 | 1.71 | 0.00 |
| Natural Gas Well Venting | 0.00 | 1.57 | 0.00 |
| Natural Gas Fugitives – Valves | 0.00 | 1.37 | 0.00 |

| Oil and Gas Production Equipment | $NO_X$ (tpd) | VOC (tpd) | CO (tpd) |
|---|---|---|---|
| Oil and Gas Production - Produced Water | 0.00 | 1.04 | 0.00 |
| Natural Gas Fugitives - Flanges | 0.00 | 0.37 | 0.00 |
| Natural Gas Fugitives - Connectors | 0.00 | 0.36 | 0.00 |
| Oil Production – Wellhead | 0.00 | 0.33 | 0.00 |
| Natural Gas Fugitives - Open Ended Lines | 0.00 | 0.28 | 0.00 |
| Oil Well Pneumatic Devices | 0.00 | 0.25 | 0.00 |
| Natural Gas Fugitives – Pumps | 0.00 | 0.15 | 0.00 |
| Oil Well Completion - All Processes | 0.00 | 0.10 | 0.00 |
| Oil Production Fugitives - Other | 0.00 | 0.09 | 0.00 |
| Oil Exploration - Mud Degassing | 0.00 | 0.08 | 0.00 |
| Oil Well Pneumatic Pumps | 0.00 | 0.07 | 0.00 |
| Oil Production Fugitives - Valves | 0.00 | 0.06 | 0.00 |
| Oil Production Fugitives - Pumps | 0.00 | 0.03 | 0.00 |
| Oil Production Fugitives - Connectors | 0.00 | 0.02 | 0.00 |
| Natural Gas Exploration - Well Completion, All Processes | 0.00 | 0.02 | 0.00 |
| Oil Production Fugitives - Open Ended Lines | 0.00 | <0.01 | 0.00 |
| Oil Production Fugitives - Flanges | 0.00 | <0.01 | 0.00 |
| Oil and Gas Production Total | 10.80 | 31.86 | 6.96 |

Comparison of the 2006 oil and gas production emission estimates in Table 3-16 with the 2017 projections in Table 3-31 shows that compressor engine emissions are the primary source of $NO_X$ from oil and gas activity in the Barnett Shale, but that the 2017 levels are lower than 2006. This is primarily due to the introduction of TCEQ Chapter 117 rules for compressor engines rated above 50 horsepower, which took effect starting in 2007. Without these rules, the average natural gas compressor engine emission rate would be 7.57 $NO_X$ grams/horsepower-hour (gm/hp-hr). Introduction of this rule lowered this emission rate by roughly 93% to 0.56 $NO_X$ gm/hp-hr.

Some facilities associated with oil and gas production, such as natural gas processing plants and compressor stations, are required to report to the TCEQ as point sources. The 2017 emission projections for these facilities are not included within Table 3-31, but are summarized by SIC in Table 3-32: *2017 Point Source Oil and Gas Emissions for 10-County DFW Area*. The emissions in Table 3-32 are part of the total 2017 emissions detailed in Table 3-22.

**Table 3-32: 2017 Point Source Oil and Gas Emissions for 10-County DFW Area**

| SIC Description | SIC Code | $NO_X$ (tpd) | VOC (tpd) | CO (tpd) |
|---|---|---|---|---|
| Crude Petroleum and Natural Gas | 1311 | 10.83 | 16.56 | 8.59 |
| Natural Gas Liquids | 1321 | 4.52 | 4.96 | 3.36 |
| Natural Gas Transmission | 4922 | 1.07 | 2.27 | 0.78 |
| Petroleum Bulk Stations and Terminals | 5171 | 0.06 | 1.64 | 0.14 |
| Mixed, Manufactured, LPG Production | 4925 | 0.02 | 0.00 | 0.11 |
| Refined Petroleum Pipelines | 4613 | 0.01 | 0.37 | 0.02 |
| DFW Nonattainment Area Total | NA | 16.50 | 25.80 | 13.00 |

Figure 3-12: *Barnett Shale Drilling and Natural Gas Production from 1993-2015* summarizes Barnett Shale drilling and production levels from 1993 through 2015 based on regularly updated information available on the RRC Barnett Shale Information Web page (http://www.rrc.state.tx.us/oil-gas/major-oil-gas-formations/barnett-shale-information/). The blue line in Figure 3-12 is the daily average natural gas production rate from 1993 through 2015. As shown, Barnett Shale natural gas production has followed a bell-shaped curve with production levels peaking in 2012 when the daily average extraction rate was 5,744 million cubic feet (MMcf) per day. From this 2012 peak, the 2013 daily average was 5,354 MMcf/day (7% lower), the 2014 daily average was 4,931 MMcf/day (14% lower), and the 2015 average was 4,366 MMcf/day (24% lower).

The black line in Figure 3-12 is the Henry Hub natural gas spot price, which hovered in the $7-9 range during the Barnett Shale drilling boom years of 2005-2008, and then dropped to the $3-4 range where it has remained since. The red line in Figure 3-12 shows how the number of drilling permits issued reached a peak of roughly 4,000 in 2008, declined steeply through 2009 as natural gas prices fell, and were in the range of roughly 1,000 per year from 2012 through 2014, similar to the pre-drilling boom years of 2001-2004. The RRC reports that there were 184 drilling permits issued for the Barnett Shale in 2015. A University of Texas at Austin (UT-Austin) study entitled *Barnett Study Determines Full-Field Reserves, Production Forecast* (http://www.beg.utexas.edu/info/docs/OGJ_SFSGAS_pt2.pdf ) (UT-Austin, 2013) evaluated historical production data per well to determine that the natural gas extraction rate is highest in the first year and then begins to decline exponentially. For an average production span of 25 years per well, roughly 50% of the natural gas is extracted in the first five years, with the remaining 50% extracted within the subsequent twenty years. The decline in natural gas production since 2012 is expected because wells that began producing during the drilling boom years of 2005 through 2008 are now past this five-year mark, and drilling levels from 2009 onwards have not been sufficient to keep production either at or near the 2012 peak. The TCEQ will continue to monitor the monthly updates provided by the RRC to determine if any changes occur in these recent drilling and production trends.

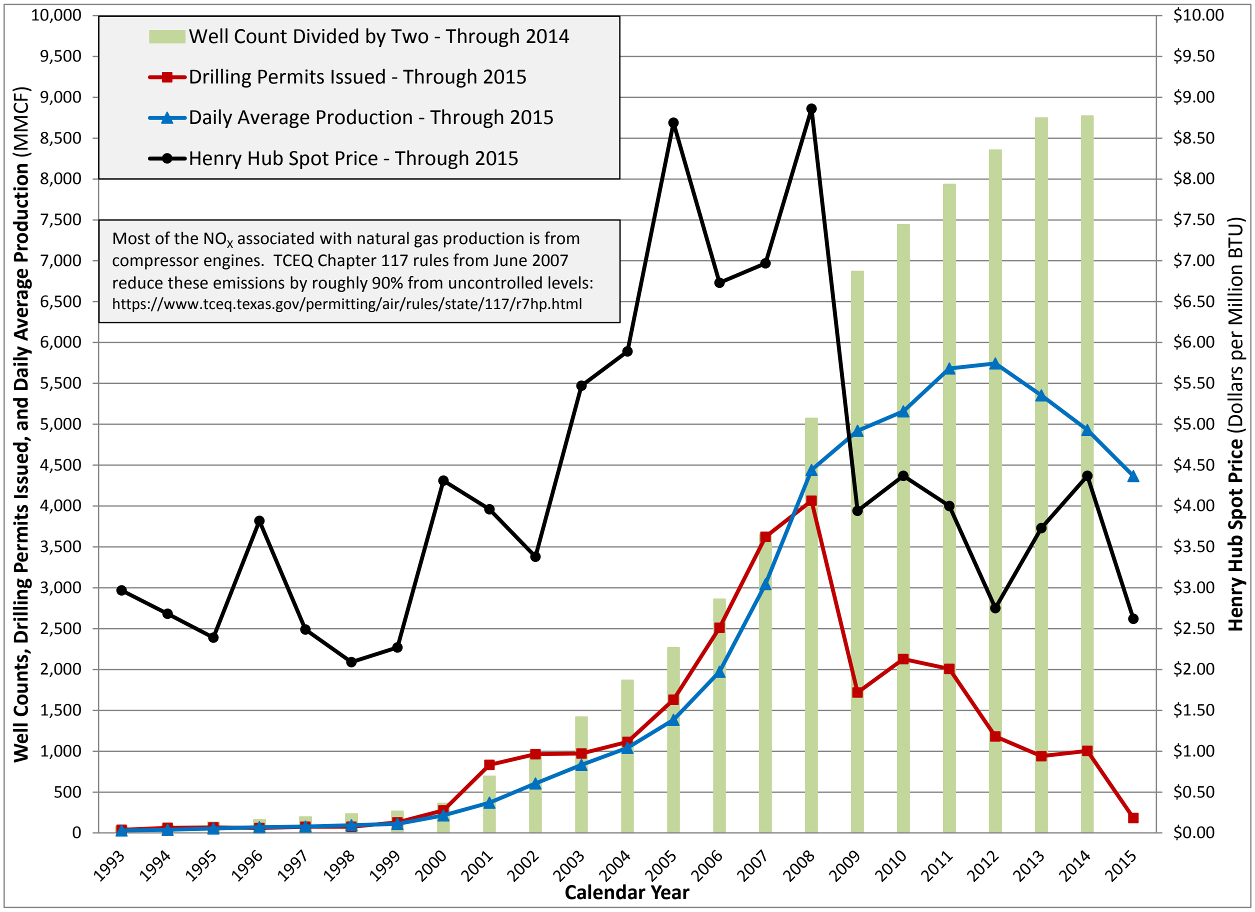



**Figure 3-12: Barnett Shale Drilling and Natural Gas Production from 1993 through 2015**

3.5.4.5 Future Base Summary

Table 3-33: *2017 Future Case Anthropogenic Emissions for 10-County DFW* summarizes the typical summer weekday emissions in the 10-county DFW nonattainment area by source type for the 2017 future case modeling. A file format conversion error was detected with the 2017 airport emission estimates included with the proposal that has been corrected, resulting in an increase of 0.04 $NO_X$ tpd and 0.10 VOC tpd.

**Table 3-33: 2017 Future Case Anthropogenic Emissions for 10-County DFW**

| DFW Nonattainment Area Source Type | $NO_X$ (tpd) | VOC (tpd) | CO (tpd) |
|---|---|---|---|
| On-Road | 130.77 | 64.91 | 1,016.96 |
| Non-Road | 45.54 | 34.01 | 580.39 |
| Off-Road – Locomotives | 12.88 | 0.67 | 2.99 |
| Off-Road – Airports | 12.36 | 2.99 | 27.29 |
| Area Sources | 26.55 | 236.70 | 61.25 |
| Oil and Gas – Production | 10.80 | 31.86 | 6.96 |
| Oil and Gas – Drill Rigs | 3.07 | 0.32 | 1.05 |
| Point – Oil and Gas | 16.50 | 25.80 | 13.00 |
| Point – EGUs (Peak Ozone Season Average) | 13.98 | 0.55 | 6.87 |
| Point – Cement Kilns | 17.64 | 0.77 | 10.92 |
| Point – Other | 6.68 | 20.26 | 16.88 |
| Total | 296.77 | 418.84 | 1,744.56 |

### 3.5.5 2006 and 2017 Modeling Emissions Summary for DFW

Table 3-34: *2006 Baseline and 2017 Future Modeling Emissions for DFW Area* provides side-by-side comparisons of the $NO_X$ and VOC emissions by major source category from Table 3-19 and Table 3-33 for an average summer weekday. The total 10-county DFW nonattainment area anthropogenic $NO_X$ emissions are projected to be reduced by roughly 49% from 2006 (581.89 tpd) to 2017 (296.77 tpd). The total 10-county DFW nonattainment area anthropogenic VOC emissions are projected to be reduced by 27% from 2006 (572.71 tpd) to 2017 (418.84 tpd).

**Table 3-34: 2006 Baseline and 2017 Future Modeling Emissions for DFW Area**

| DFW Nonattainment Area Source Type | 2006 $NO_X$ (tpd) | 2017 $NO_X$ (tpd) | 2006 VOC (tpd) | 2017 VOC (tpd) |
|---|---|---|---|---|
| On-Road | 284.27 | 130.77 | 116.50 | 64.91 |
| Non-Road | 98.06 | 45.54 | 64.69 | 34.01 |
| Off-Road – Locomotives | 20.14 | 12.88 | 1.28 | 0.67 |
| Off-Road – Airports | 12.78 | 12.36 | 4.46 | 2.99 |
| Area Sources | 29.02 | 26.55 | 290.46 | 236.70 |
| Oil and Gas – Production | 61.84 | 10.80 | 43.72 | 31.86 |
| Oil and Gas – Drill Rigs | 18.23 | 3.07 | 1.16 | 0.32 |
| Point – Oil and Gas | 11.53 | 16.50 | 21.82 | 25.80 |
| Point – EGUs (Ozone Season Average) | 9.63 | 13.98 | 1.03 | 0.55 |
| Point – Cement Kilns | 22.08 | 17.64 | 1.94 | 0.77 |
| Point – Other | 14.31 | 6.68 | 25.65 | 20.26 |
| Total | 581.89 | 296.77 | 572.71 | 418.84 |

Figure 3-13: *2006 Baseline and 2017 Future Modeling Emissions for DFW Area* graphically compares the anthropogenic $NO_X$ and VOC emission estimates presented in Table 3-34.

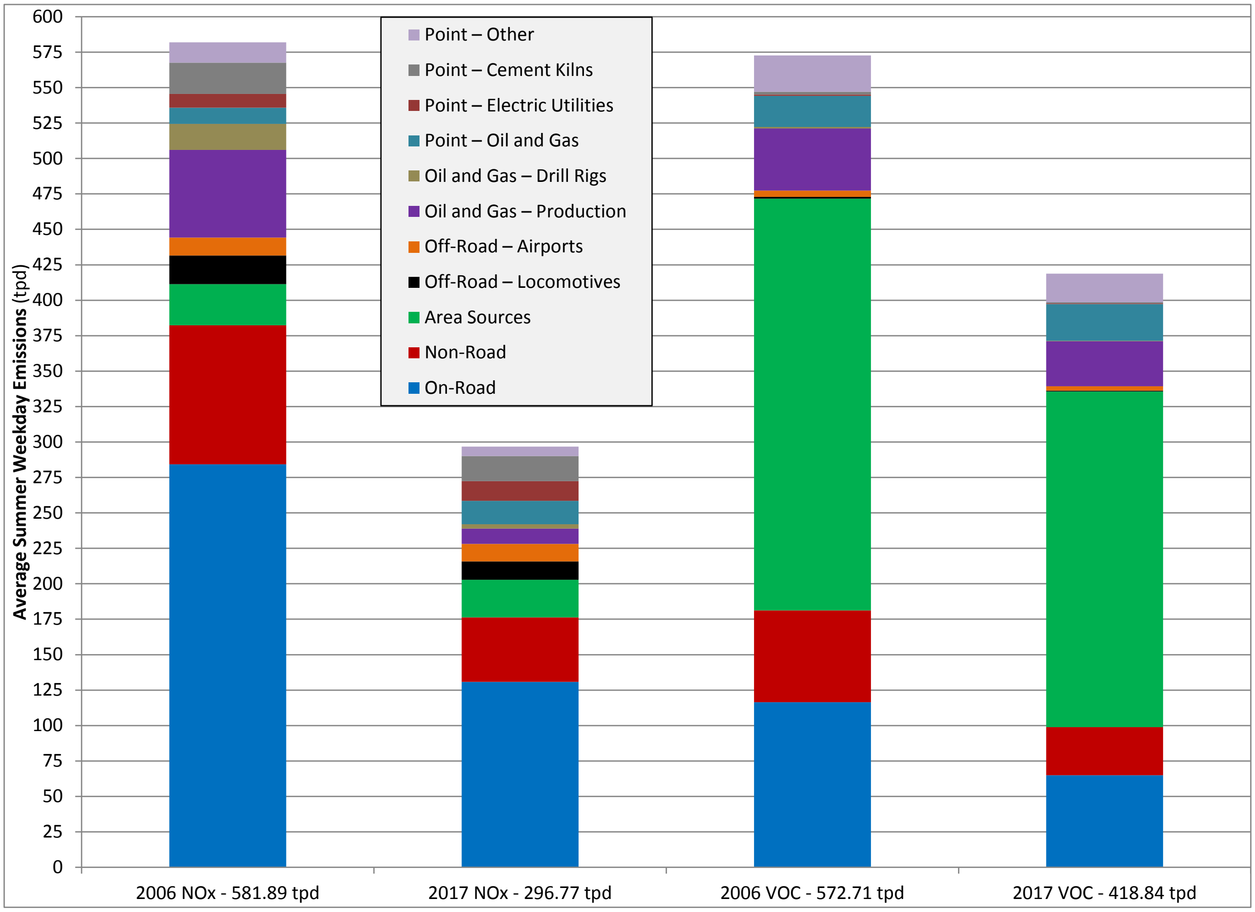



**Figure 3-13: 2006 Baseline and 2017 Future Modeling Emissions for DFW Area**

## 3.6 PHOTOCHEMICAL MODELING

To ensure that a modeling study can be successfully used as technical support for an AD SIP revision, the air quality model must be scientifically sound and appropriate for the intended application and freely accessible to all stakeholders. In a regulatory environment, it is crucial that oversight groups (e.g., the EPA), the regulated community, and the public have access to and have reasonable assurance of the suitability of the model. The following three prerequisites were identified for selecting the air quality model to be used in the DFW AD. The model must:

- have a reasonably current, peer-reviewed, scientific formulation;
- be available at no or low cost to stakeholders; and
- be consistent with air quality models being used for Texas SIP development.

The only model to meet all three of these criteria is CAMx. The model is based on well-established treatments of advection, diffusion, deposition, and chemistry. Another important feature is that $NO_X$ emissions from large point sources can be treated with the PiG submodel, which helps avoid the artificial diffusion that occurs when large, hot, point source emissions are introduced into a grid volume. The model software, including the PiG submodel, and the CAMx user's guide are publicly available (Environ, 2015a). In addition, the TCEQ has many years of experience with CAMx as it was used for the modeling conducted in the HGB ozone nonattainment area, the Beaumont-Port Arthur ozone maintenance area, previous DFW ADs, and modeling being conducted in other areas of Texas (e.g., Austin and San Antonio).

### 3.6.1 Modeling Domains and Horizontal Grid Cell Size

Figure 3-14: *CAMx Modeling Domains* and Table 3-35: *CAMx Modeling Domain Definitions* depict and define the fine resolution 4 km domain covering eastern Texas, a medium resolution 12 km domain covering all of Texas plus some or all of surrounding states, and a coarse resolution 36 km domain covering the continental U.S. plus southern Canada and northern Mexico. The 4 km domain is nested within the 12 km domain, which in turn is nested within the 36 km domain. All three domains were projected in a Lambert Conformal Conic (LCC) projection with the origin at 97 degrees west and 40 degrees north.

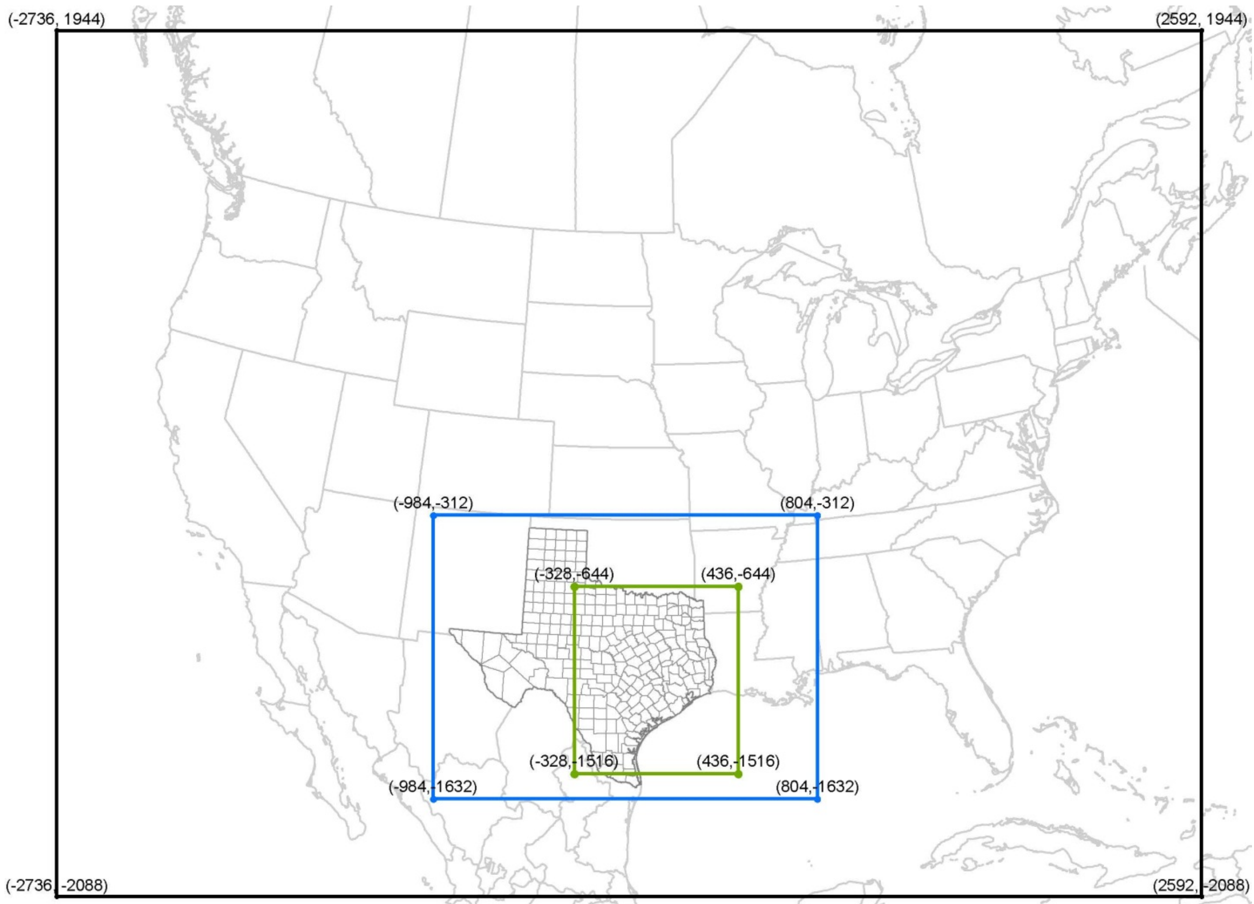



**Figure 3-14: CAMx Modeling Domains**

**Table 3-35: CAMx Modeling Domain Definitions**

| Domain Code | Domain Cell Size | Dimensions (grid cells) | Lower left-hand corner | Upper right-hand corner |
|---|---|---|---|---|
| 36 km | 36 x 36 km | 148 x 112 | (-2736,-2088) | (2592,1944) |
| 12 km | 12 x 12 km | 149 x 110 | (-984,-1632) | (804,-312) |
| 4 km | 4 x 4 km | 191 x 218 | (-328,-1516) | (436,-644) |

### 3.6.2 Vertical Layer Structure

The vertical configuration of the CAMx modeling domains consists of 28 layers of varying depths in units of meters (m) AGL as shown in Table 3-36: *CAMx Vertical Layer Structure*.

**Table 3-36: CAMx Vertical Layer Structure**

| CAMx Layer | WRF Layer | Top (m AGL) | Center (m AGL) | Thickness (m) |
|---|---|---|---|---|
| 28 | 38 | 15,179.1 | 13,637.9 | 3,082.5 |
| 27 | 36 | 12,096.6 | 10,631.6 | 2,930.0 |
| 26 | 32 | 9,166.6 | 8,063.8 | 2,205.7 |
| 25 | 29 | 6,960.9 | 6,398.4 | 1,125.0 |
| 24 | 27 | 5,835.9 | 5,367.0 | 937.9 |
| 23 | 25 | 4,898.0 | 4,502.2 | 791.6 |
| 22 | 23 | 4,106.4 | 3,739.9 | 733.0 |
| 21 | 21 | 3,373.5 | 3,199.9 | 347.2 |
| 20 | 20 | 3,026.3 | 2,858.3 | 335.9 |
| 19 | 19 | 2,690.4 | 2,528.3 | 324.3 |
| 18 | 18 | 2,366.1 | 2,234.7 | 262.8 |
| 17 | 17 | 2,103.3 | 1,975.2 | 256.2 |
| 16 | 16 | 1,847.2 | 1,722.2 | 249.9 |
| 15 | 15 | 1,597.3 | 1,475.3 | 243.9 |
| 14 | 14 | 1,353.4 | 1,281.6 | 143.6 |
| 13 | 13 | 1,209.8 | 1,139.0 | 141.6 |
| 12 | 12 | 1,068.2 | 998.3 | 139.7 |
| 11 | 11 | 928.5 | 859.5 | 137.8 |
| 10 | 10 | 790.6 | 745.2 | 90.9 |
| 9 | 9 | 699.7 | 654.7 | 90.1 |
| 8 | 8 | 609.7 | 565.0 | 89.3 |
| 7 | 7 | 520.3 | 476.1 | 88.5 |
| 6 | 6 | 431.8 | 387.9 | 87.8 |
| 5 | 5 | 344.0 | 300.5 | 87.1 |
| 4 | 4 | 256.9 | 213.8 | 86.3 |
| 3 | 3 | 170.6 | 127.8 | 85.6 |
| 2 | 2 | 85.0 | 59.4 | 51.0 |
| 1 | 1 | 33.9 | 17.0 | 33.9 |

### 3.6.3 Model Configuration

The TCEQ used CAMx version 6.20, which includes a number of upgrades and features from previous versions. The following CAMx 6.20 options were employed:

- revised gridded file formats for meteorology inputs, initial/boundary conditions, emission inputs, output concentration values, and deposition fields;
- photolysis rate updates based on inputs for surface albedo, height above ground, terrain height, solar zenith, clouds, temperature, and barometric pressure; and

- new gas-phase chemistry mechanisms for CB6 speciation and CB6 “revision 2” (CB6r2), which revises isoprene and aromatics extensively, and has additional $NO_X$ recycling from organic nitrates.

In addition to the CAMx inputs developed from the meteorological and emissions modeling, inputs are needed for initial and boundary conditions, spatially resolved surface characteristic parameters, spatially resolved albedo/haze/ozone (i.e., opacity) and photolysis rates, and a chemistry parameters file. The TCEQ contracted with Environ (Environ, 2012) to derive episode-specific boundary conditions from the Goddard Earth Observing Station global atmospheric model with Chemistry (GEOS-Chem) model runs for 2006 and 2018. The 2018 boundary conditions were applied to the 2017 future case. Boundary conditions were developed for each grid cell along all four edges of the outer 36 km modeling domain at each of the 28 vertical layers for each episode hour. This work also produced initial conditions for each of the 67 days within both episodes. The TCEQ used these episode-specific initial and lateral boundary conditions for this modeling study.

Surface characteristic parameters, including topographic elevation, LAI, vegetative distribution, and water/land boundaries are input to CAMx via a land-use file. The land-use file provides the fractional contribution (0 to 1) of 26 land-use categories, as defined by Zhang et al (2003). For the 36 km domain, the TCEQ developed the land-use file using version 3 of the Biogenic Emissions Landuse Database (BELD3) for areas outside the U.S. and the 2006 National Land Cover Dataset (NLCD) for the U.S. For the 4 km and 12 km domains, the TCEQ used updated land-use files developed by Texas A&M University (Popescu et al., 2012), which were derived from more highly resolved data collected by the Texas Parks and Wildlife Department, Landscape Fire and Resource Management Planning Tools Project (LANDFIRE), LandSat, National Institute of Statistics and Geography (INEGI), and the NLCD. Monthly averaged LAI was created from the eight-day 1 km resolution MODIS MCD15A2 product.

Spatially-resolved opacity and photolysis rates are input to CAMx via a photolysis rates file and an opacity file. These rates, which are specific to the chemistry parameters file for the CB6 mechanism, are also input to CAMx. The TCEQ used episode-specific satellite data from the Total Ozone Mapping Spectrometer to prepare the clear-sky photolysis rates and opacity files. Photolysis rates are internally adjusted by CAMx according to cloud and aerosol properties using the inline Troposheric Ultraviolet Visible model.

### 3.6.4 Model Performance Evaluation

The CAMx model configuration was applied to the 2006 base case using the episode-specific meteorological parameters, biogenic emission inputs, and anthropogenic emission inputs. The CAMx modeling results were compared to the measured ozone and ozone precursor concentrations at all regulatory monitoring sites, which resulted in a number of modeling iterations to implement improvements to the meteorological modeling, emissions modeling, and subsequent CAMx modeling. A detailed performance evaluation for the 2006 base case modeling episode is included in Appendix C. In addition, all performance evaluation products are available on the TCEQ modeling files File Transfer Protocol (FTP) site (ftp://amdaftp.tceq.texas.gov/pub/TX/).

#### 3.6.4.1 Performance Evaluations Overview

The performance evaluation of the base case modeling demonstrates the adequacy of the model to correctly replicate the relationship between meteorological conditions, emissions of $NO_X$ and VOC precursors, and the levels of ozone formed. The model’s ability to suitably replicate this relationship is necessary to have confidence in the model’s prediction of the future year ozone and the response to various control measures. As recommended in the 2007 modeling guidance, the TCEQ has incorporated the recommended eight-hour performance measures into its evaluations but also focuses on one-hour performance analyses, especially in the DFW nonattainment area. The localized small-scale (i.e., high resolution) meteorological and emissions features characteristic of the DFW nonattainment area require model evaluations to be performed at the highest resolution possible to determine whether or not the model is getting the right answer for the right reasons.

#### 3.6.4.2 Operational Evaluations

Statistical measures including the Unpaired Peak Accuracy (UPA), the Mean Normalized Bias (MNB), and the Mean Normalized Gross Error (MNGE) were calculated by comparing monitored (measured) and four-cell bi-linearly interpolated modeled ozone concentrations for all episode days and monitors. For one-hour ozone comparisons, the EPA recommends ranges of ±20% for UPA and ±15% for MNB, and a 30% level for MNGE, which is always positive because it is an absolute value. There are no recommended eight-hour ozone criteria for UPA, MNB, and MNGE. Graphical measures including time series and scatter plots of hourly measured and bi-linearly interpolated modeled ozone were developed. For monitoring locations where specific measurements were available, similar graphical plots were developed for ozone precursors such as nitrogen oxide, $NO_2$, ethylene, and isoprene. In addition, plots of modeled daily maximum eight-hour ozone concentrations were developed and overlaid with the measured daily maximum eight-hour ozone concentrations. Detailed operational evaluations for the 2006 base case modeling episode are included in Appendix C.

*Statistical Evaluations*

Figure 3-15: *DFW Observed versus Modeled Peak Eight-Hour Ozone for June Episode* compares the observed and modeled daily maximum eight-hour ozone concentrations for each of the 33 days in the June episode. Although there are no recommended criteria for the eight-hour UPA, error bars of ±20% are shown. In general, ozone concentrations are over-estimated on most days, but the majority of modeled maximum values fall within the ±20% range. Nine of the 33 episode days are out of this ±20% range, but seven of these nine days had monitored peak ozone values between 40-70 ppb, which is well below the 75 ppb level. Figure 3-16: *DFW Observed versus Modeled Peak Eight-Hour Ozone for August-September Episode* compares the observed and modeled daily maximum eight-hour ozone concentrations for each of the 34 days in the August-September episode. Compared with the June model performance, there is greater over-estimation of peak eight-hour ozone levels in the August-September episode. Twenty-one of the 34 days fall outside of the ±20% range, but 14 of these 21 days had peak eight-hour ozone levels below 75 ppb.

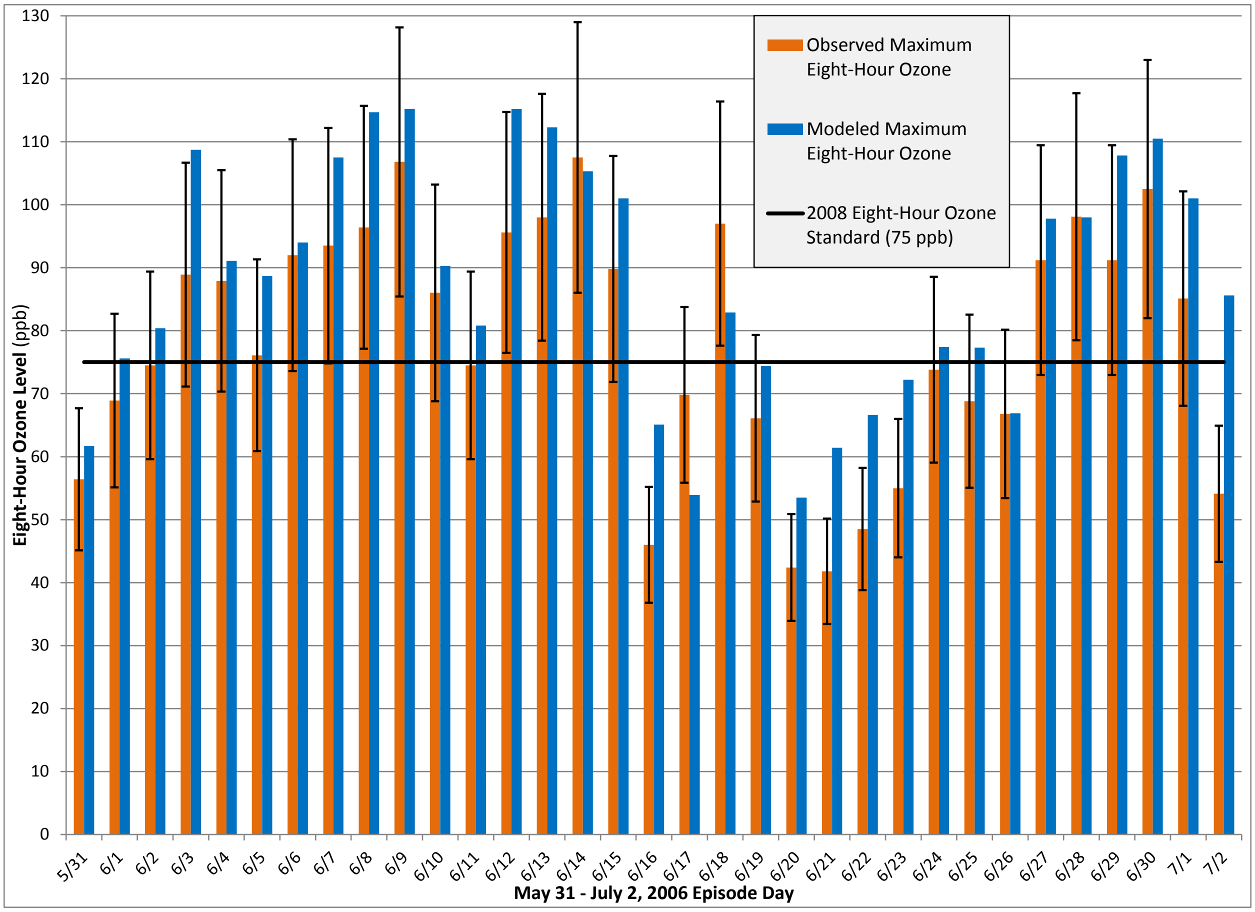



**Figure 3-15: DFW Observed versus Modeled Peak Eight-Hour Ozone for June Episode**

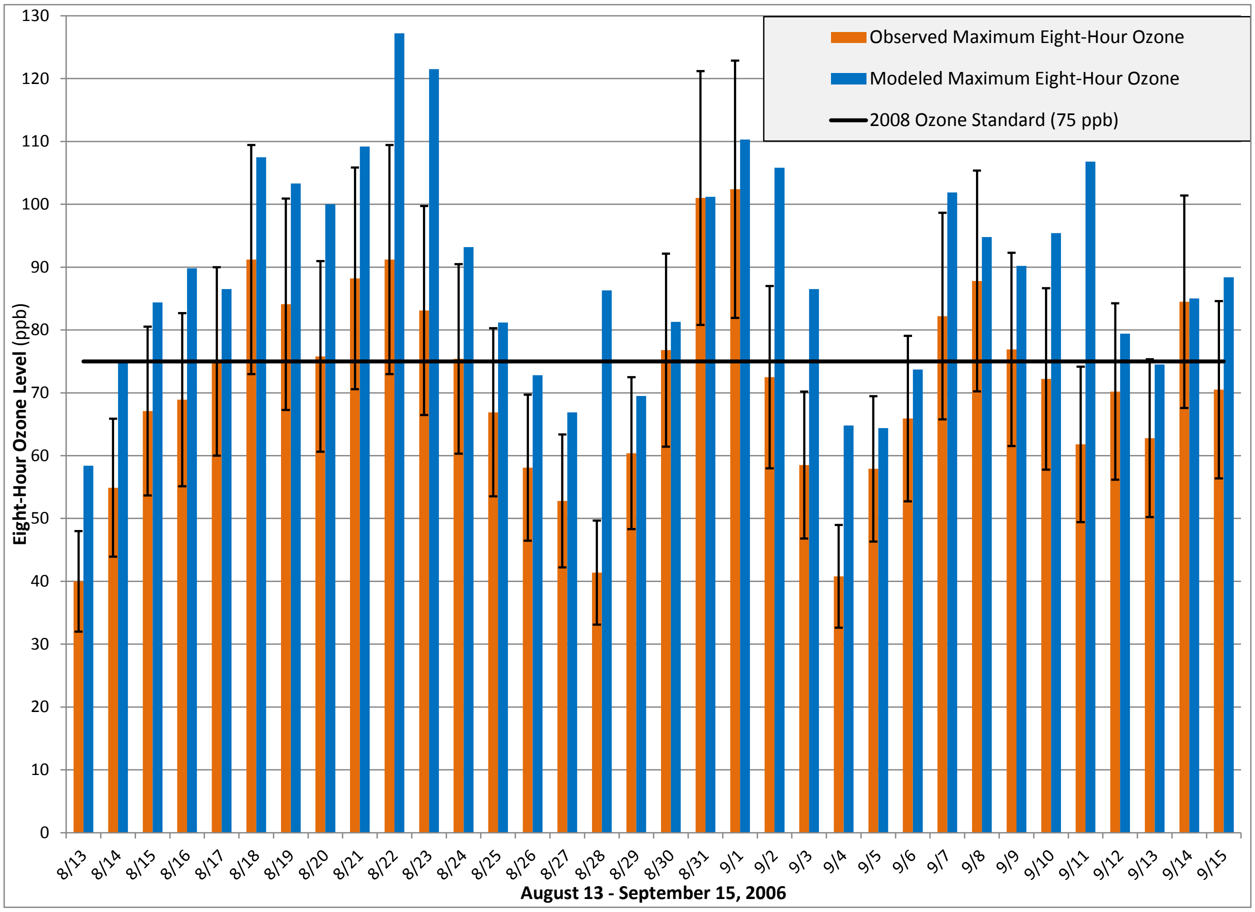



**Figure 3-16: DFW Observed versus Modeled Peak Eight-Hour Ozone for August-September Episode**

Figure 3-17: *MNB and MNGE Hourly Ozone Statistics for June Episode Days* presents the hourly MNB and MNGE results from May 31 through July 2, 2006. The EPA recommended criteria of ±15% for MNB and 30% for MNGE are shown as the black and red bars, respectively. Three of the 33 days in this episode are out of the recommended MNB range, while two exceed the recommended MNGE level. June 17 is one of the three days exceeding the MNB range, but its peak eight-hour ozone level was below 75 ppb. The remaining two days out of the MNB range are June 18 and July 1. June 18 experienced a slow-moving frontal passage, which was difficult for the meteorological model to replicate. July 1 was a cloudy day, which limited ozone production, but the meteorological model predicted fewer clouds and thus more ozone.

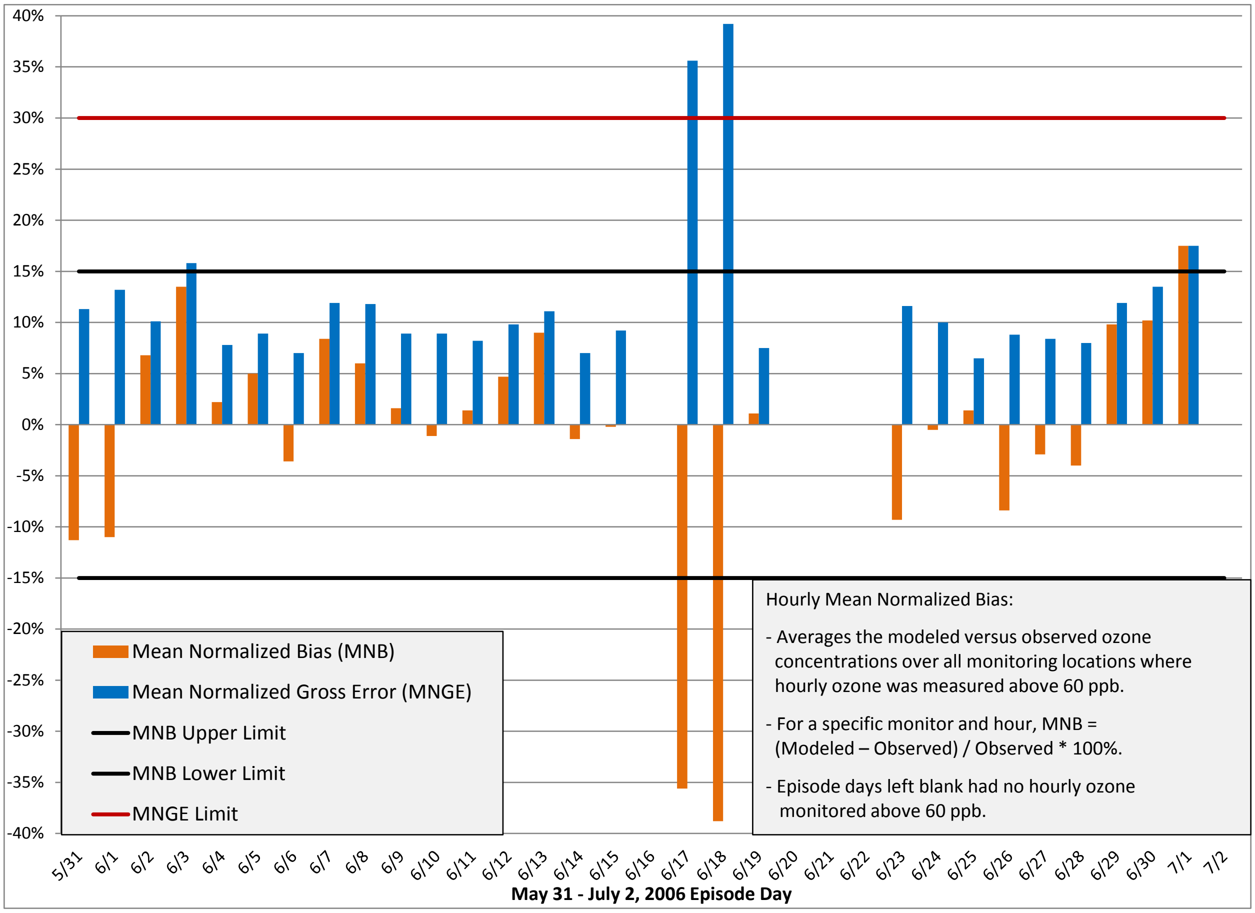



**Figure 3-17: MNB and MNGE Hourly Ozone Statistics for June Episode Days**

Figure 3-17: *MNB and MNGE Hourly Ozone Statistics for June Episode Days* presents the hourly MNB and MNGE results for August 13 through September 15, 2006. Similar to Figure 3-16, Figure 3-18: *MNB and MNGE Hourly Ozone Statistics for August-September Days* demonstrates the consistent over-prediction of modeled ozone during this episode, particularly for days when peak eight-hour ozone was monitored below 75 ppb. Twelve of the 34 episode days are out of the recommended MNB range, while three exceed the recommended MNGE level. Eight of the 12 episode days out of the MNB range are when peak eight-hour ozone was monitored below 75 ppb.

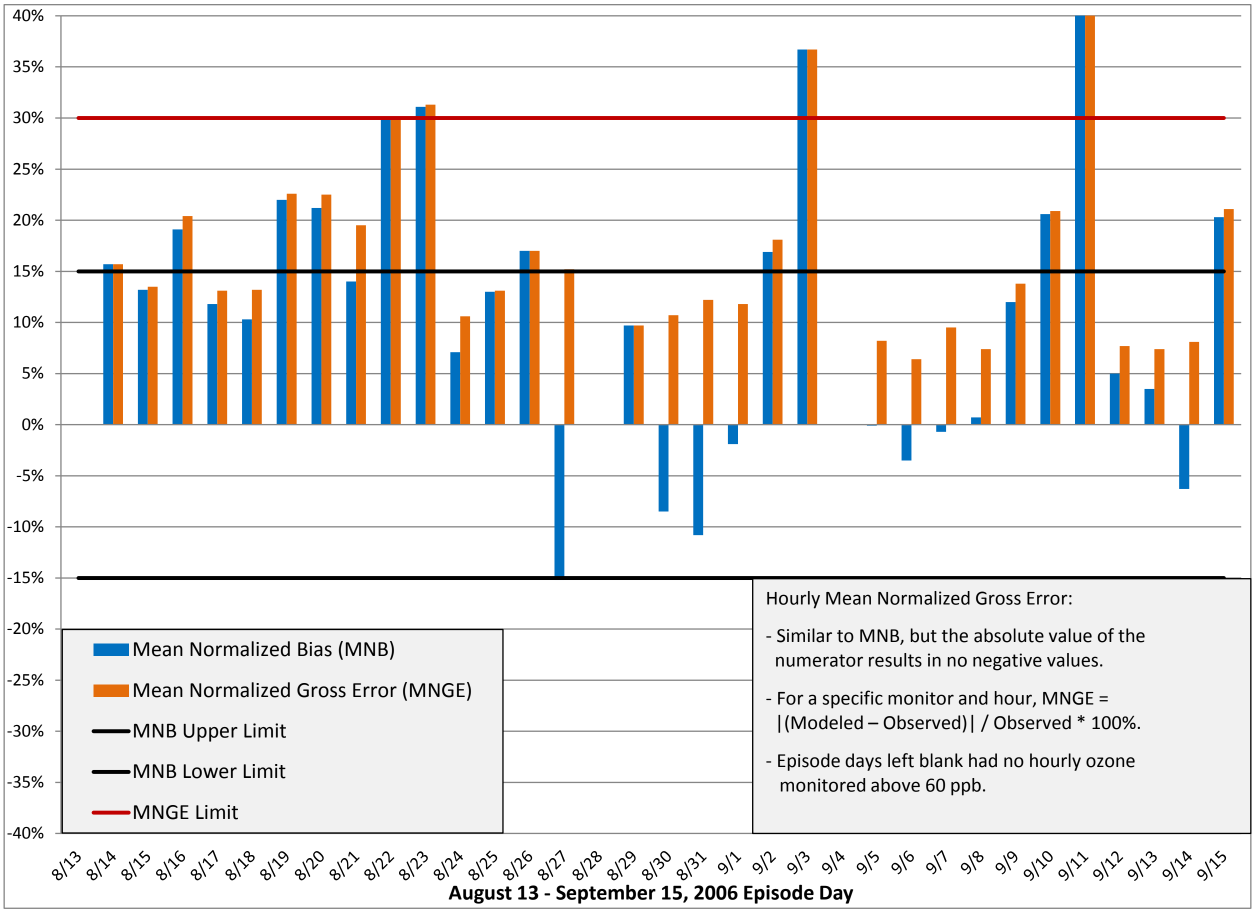



**Figure 3-18: MNB and MNGE Hourly Ozone Statistics for August-September Days**

In general, the modeling over-predicts monitored ozone for both the June and August-September episodes, but the effect tends to be more pronounced on low ozone days. For the June episode, 15 of the 33 days (45%) had peak eight-hour monitored levels below 75 ppb, while the August-September episode had 19 of 34 days (56%) with peak eight-hour monitored levels below 75 ppb. Compared with the June episode, the August-September episode also had more frontal passages and varying cloud conditions to simulate, both of which are challenging for meteorological modeling.

Combining the 67 days from both episodes, there are 34 days with peak eight-hour ozone levels below 75 ppb and 33 days above. Of these 33 days above 75 ppb from the combined episode, 9 are out of the ±20% UPA range and 6 are out the ±15% MNB range. Those days that exceed the MNGE level of 30% are included within the 6 out of the MNB range. Considering that the majority of eight-hour days above 75 ppb from the combined episodes meet the recommended performance criteria, the model suitably simulates the frequency and magnitude of daily maximum eight-hour ozone concentrations at area monitors.

*Graphical Evaluations*

A selection of graphical evaluations of modeling results is presented here, but more detail is contained in Appendix C where five representative monitoring locations were chosen for detailed evaluation. Time series and scatterplots are ideal for examining model performance at specific monitoring locations. Time series plots offer the opportunity to follow ozone formation through the course of a day, while scatter plots provide a visual means to see how the model performs across the range of observed ozone and precursor concentrations.

As shown in Figure 3-3, the Kaufman monitor is located in the far southeastern corner of the DFW nonattainment area. Since it is primarily upwind during most of the ozone season, Kaufman is usually one of the monitors recording the lowest ozone levels in DFW. Figure 3-19: *Kaufman June Episode Time Series and Scatter Plots* presents time series of hourly ozone and $NO_X$ concentrations from May 31 through July 2, 2006. Observed concentrations are shown as red dots and the blue lines are modeled concentrations. In general, the model well replicates the diurnal pattern of higher ozone during the day and decreasing at night. On average the model over-predicts ozone concentrations, particularly when monitored concentrations are quite low, such as the 20-40 ppb range that often occurs during the night and early morning hours. This is also evident in the ozone scatter plot, which shows improved correlation of modeled versus observed ozone at higher levels versus lower ones. Figure 3-20: *Kaufman August-September Episode Time Series and Scatter Plots* presents similar information at the Kaufman monitor for August 13 through September 15, 2006. The same pattern is shown here where the overall diurnal pattern and ozone peaks are relatively well modeled, but that lower levels of ozone during the night and early morning hours are over-predicted.

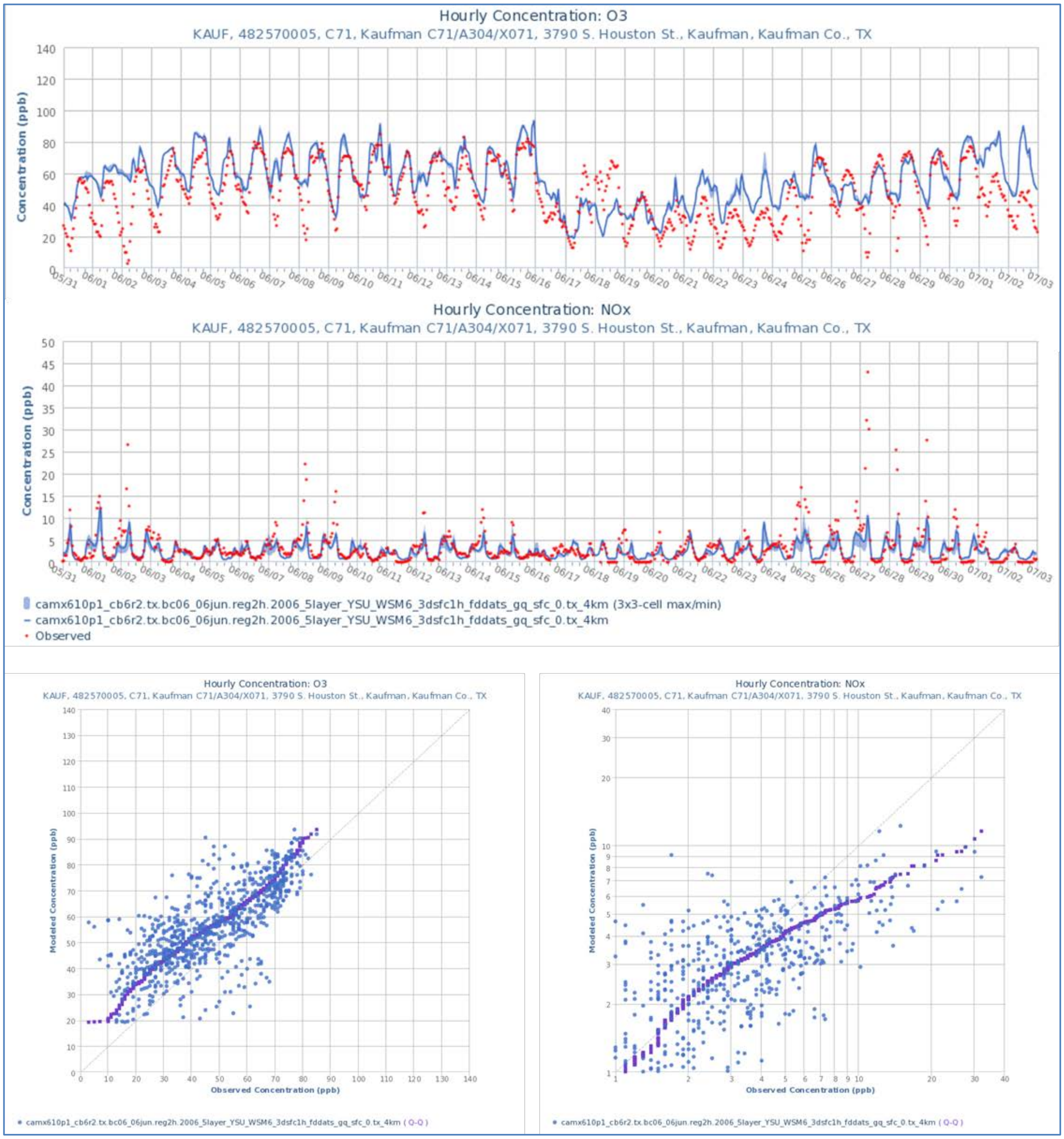



**Figure 3-19: Kaufman June Episode Time Series and Scatter Plots**

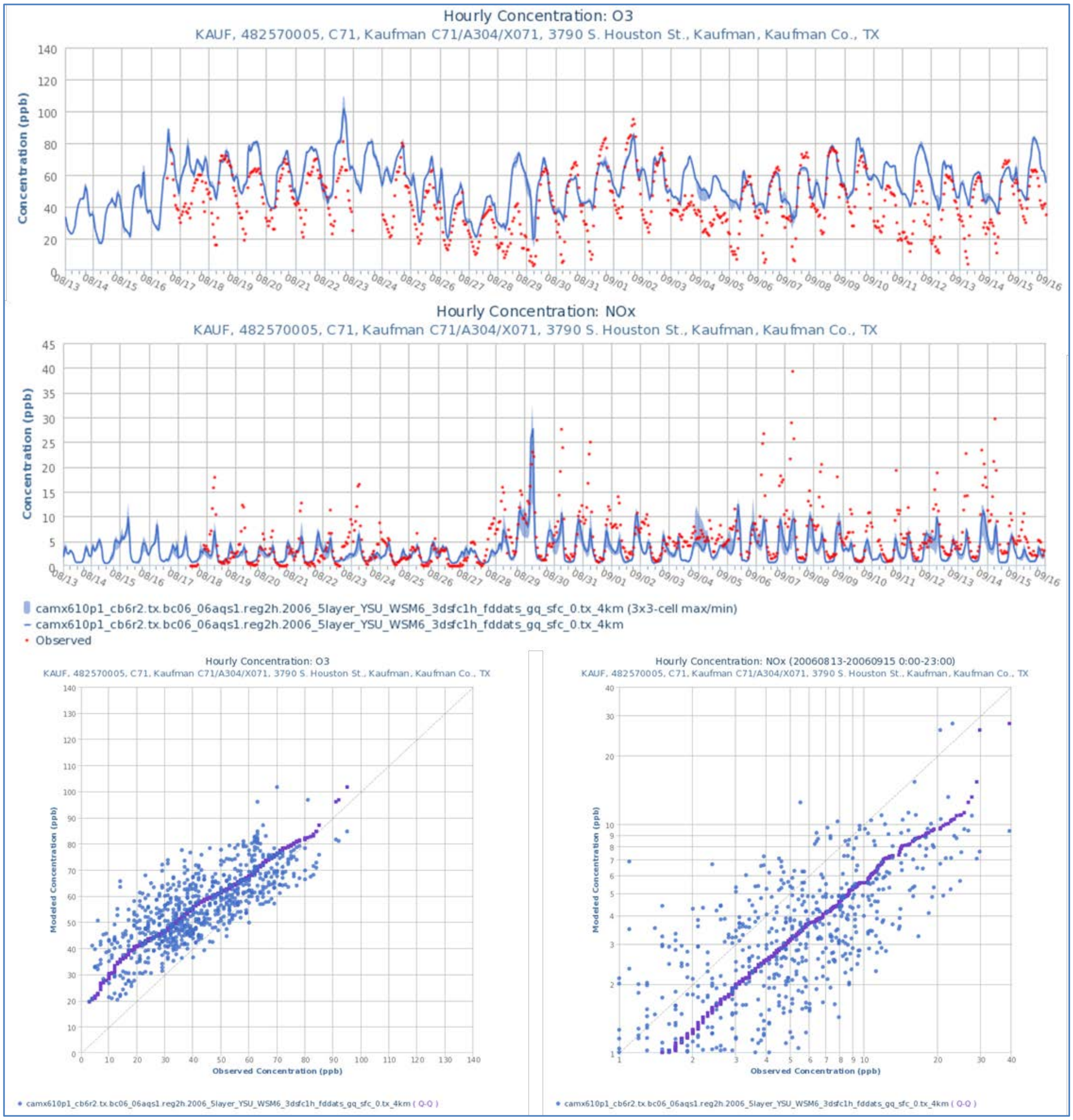



**Figure 3-20: Kaufman August-September Episode Time Series and Scatter Plots**

As shown in Figure 3-3, the Denton Airport South monitor is located in the far northwestern corner of the DFW nonattainment area. Since it is primarily downwind of the urban core during most of the ozone season, Denton Airport South is usually one of the monitors recording the highest ozone levels in DFW. Comparisons of hourly modeled versus observed ozone are presented in Figure 3-21: *Denton June Episode Time Series and Scatter Plots* and Figure 3-22: *Denton August-September Episode Time Series and Scatter Plots*. As with the Kaufman performance presented in Figure 3-19 and Figure 3-20, the model does a reasonable job at Denton Airport South of replicating the diurnal peaks during both episodes with some over-prediction apparent, particularly at low ozone levels during the night and early morning hours. The model significantly under-predicted only one day (June 18) when eight-hour ozone was measured above 75 ppb, which was due to the previously mentioned difficulty that the meteorological model encountered in replicating a slow moving frontal passage.

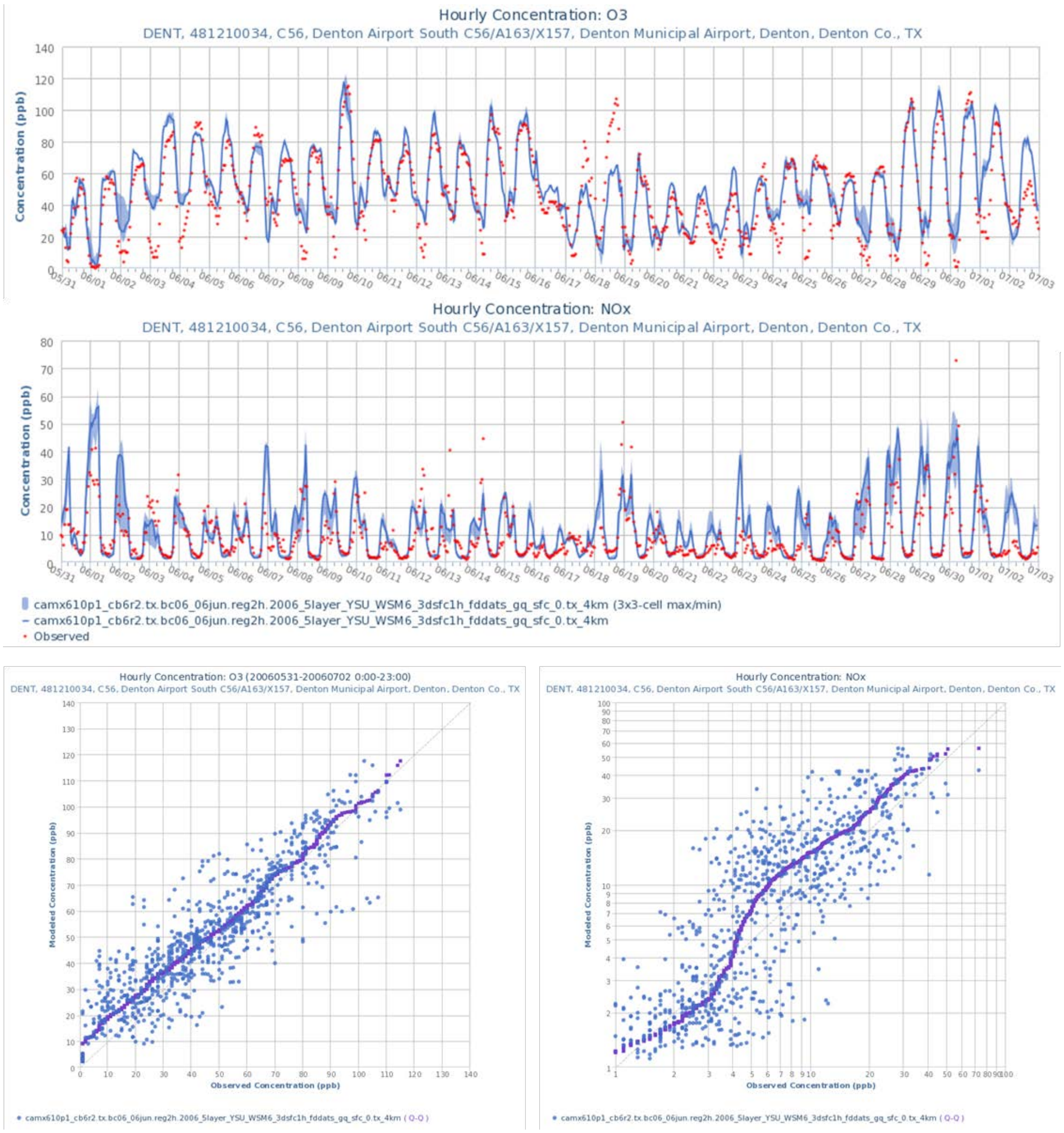



**Figure 3-21: Denton June Episode Time Series and Scatter Plots**

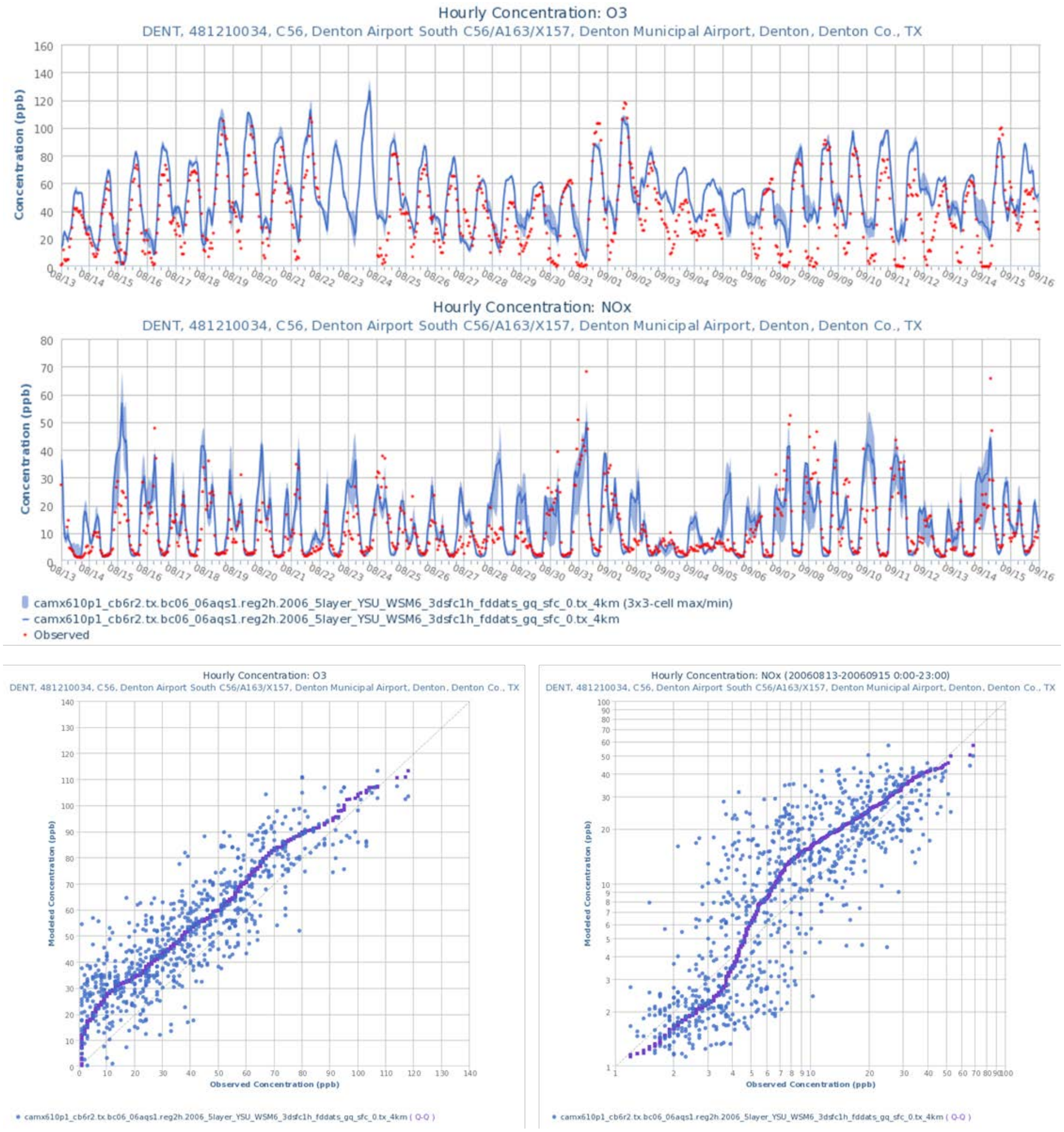


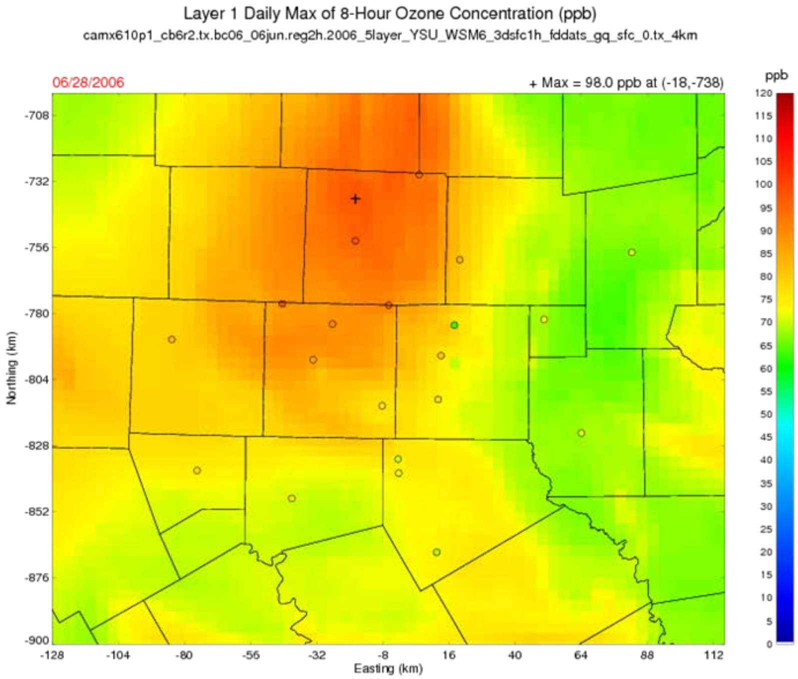

**Figure 3-22: Denton August-September Episode Time Series and Scatter Plots**

The Kaufman and Denton Airport South monitors were chosen as examples for discussing model performance because they generally represent the farthest upwind and downwind locations during ozone season, which roughly corresponds to the lowest and highest monitoring locations, respectively. Appendix C provides more detail with time series and scatter plots for the additional monitoring locations of Dallas Hinton Street, Eagle Mountain Lake, and Fort Worth Northwest. Comparison of modeled versus observed concentrations of VOC are presented for the Dallas Hinton Street and Fort Worth Northwest monitors because these locations are equipped with auto-GC instrumentation. In general, estimation of isoprene concentrations is quite good at Dallas Hinton Street, but weaker at Fort Worth Northwest.

Conversely, estimation of concentrations for alkanes, ethylene, and olefins is better at Fort Worth Northwest than at Dallas Hinton Street.

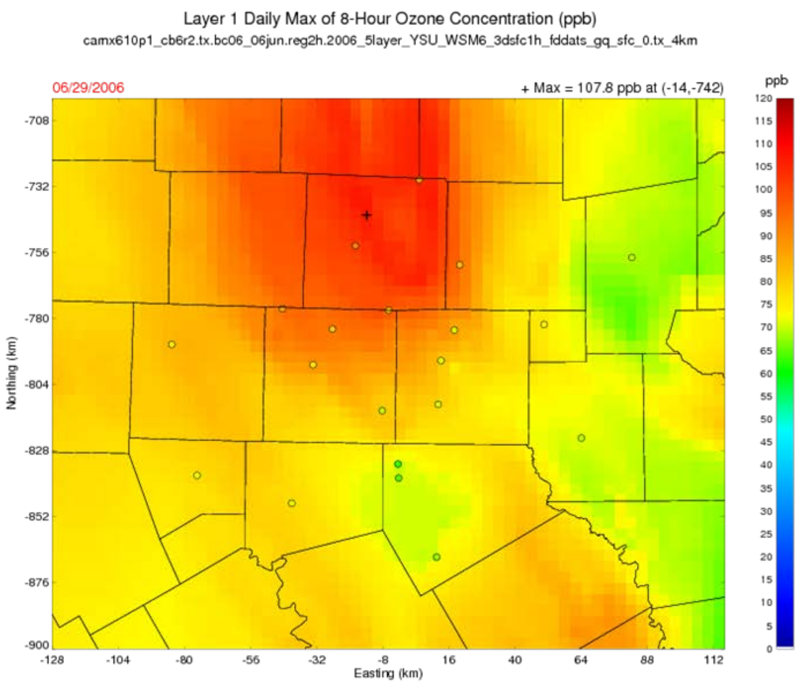
When evaluating model performance, the TCEQ also employs graphical plots showing the daily peak ozone across the modeling domain. This plot is akin to the contour plots often used to display terrain elevations, and is a good tool for visually comparing the modeled peak ozone across the domain with observations. The plots are not snapshots in time, but instead show the maximum eight-hour ozone value for each grid cell regardless of when it occurred during the day. Areas downwind of the urban core will generally have ozone peaks that occur later in the day than upwind areas.

Appendix C contains these graphical plots for each episode day where observed maximum daily average eight-hour ozone was above 75 ppb. These days are June 3 through 10, June 12 through 14, June 18, June 27 through July 1, August 17 through 24, August 30 through September 1, September 7 through 9, and September 14. Example plots for four of these episode days are presented here in Figure 3-23: *Modeled versus Observed Maximum Ozone on June 28 and 29* and Figure 3-24: *Modeled versus Observed Maximum Ozone on August 30 and 31*. Observed maximum daily average eight-hour ozone concentrations are represented by small circles at the monitor locations. When the color of the dot matches closely the surrounding colors, the model is predicting the observed maximum values well. In general, the model performed very well during the June 2006 episode with a few days exhibiting weaker performance. The August-September 2006 episode is characterized by more over-prediction, particularly in August and early September. However, a few days in this latter episode do show good performance. In both episodes, the model locates the plumes of highest ozone concentration very well with a few exceptions.




## June 28, 2006

**MDA8 Ozone**
Obs: 98.1 ppb (EMTL)
Mod: 98.0 ppb




## June 29, 2006

**MDA8 Ozone**
Obs: 91.2 ppb (DENT)
Mod: 107.8 ppb

**Figure 3-23: Modeled versus Observed Maximum Ozone on June 28 and 29**

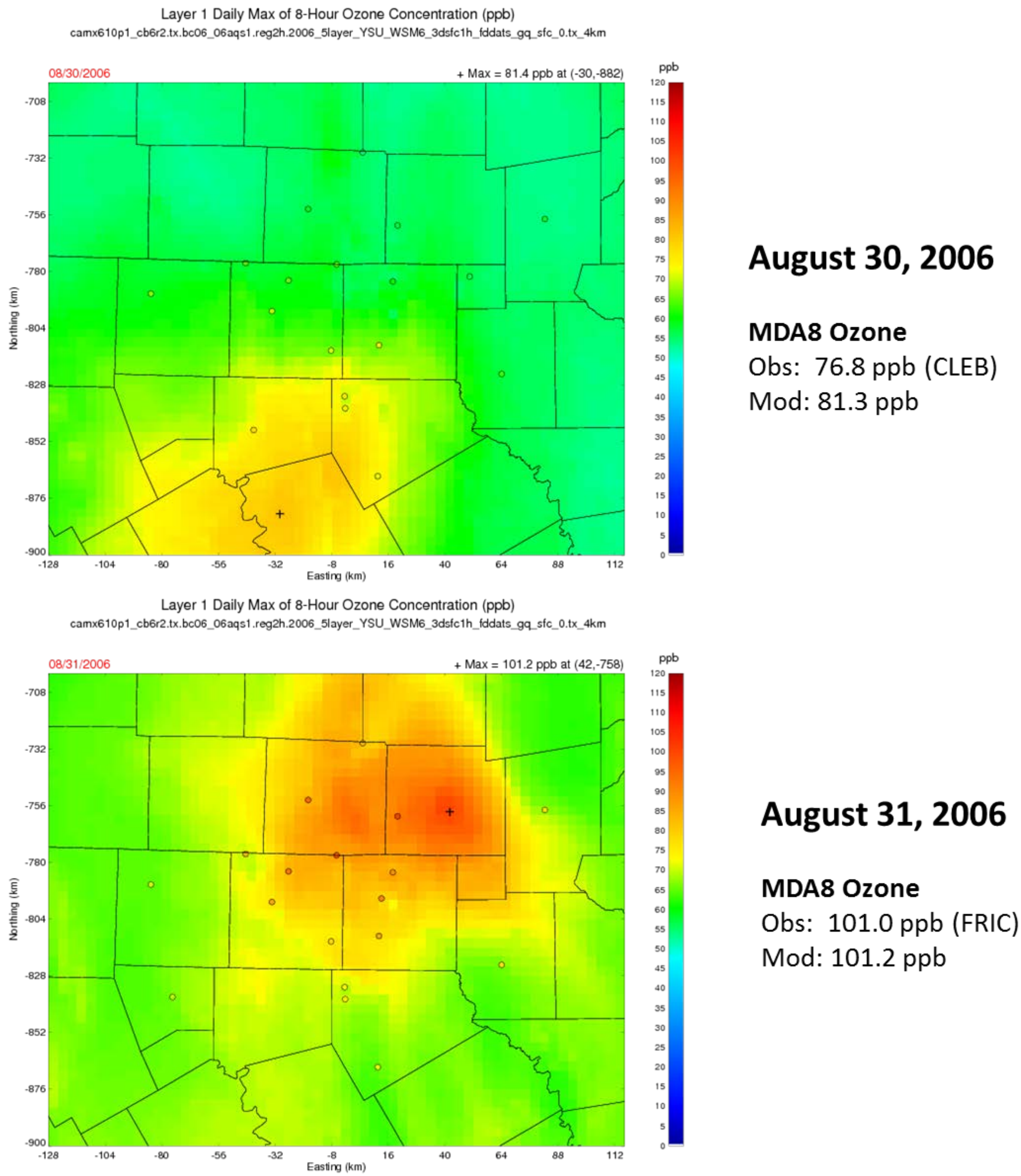



**Figure 3-24: Modeled versus Observed Maximum Ozone on August 30 and 31**

*Evaluations Based on TexAQS II Rural Monitoring Network Data*

The TCEQ also evaluated how well the model predicted ozone and precursor concentrations at rural sites located upwind of the DFW nonattainment area during the episodes. A brief discussion is presented here, but more detail and references are provided in Appendix C. Figure 3-25: *Rural Monitoring Sites Used for Performance Evaluation* shows the locations of these sites as red dots. They are Italy High School (ITHS, C60) about 30 miles south of Dallas, Palestine (PLTN, C647) about 80 miles southeast of Dallas, Clarksville (CLVL, C648) about 100 miles northeast of Dallas, and San Augustine (SAGA, C646) about 160 miles from Dallas near the Louisiana border.

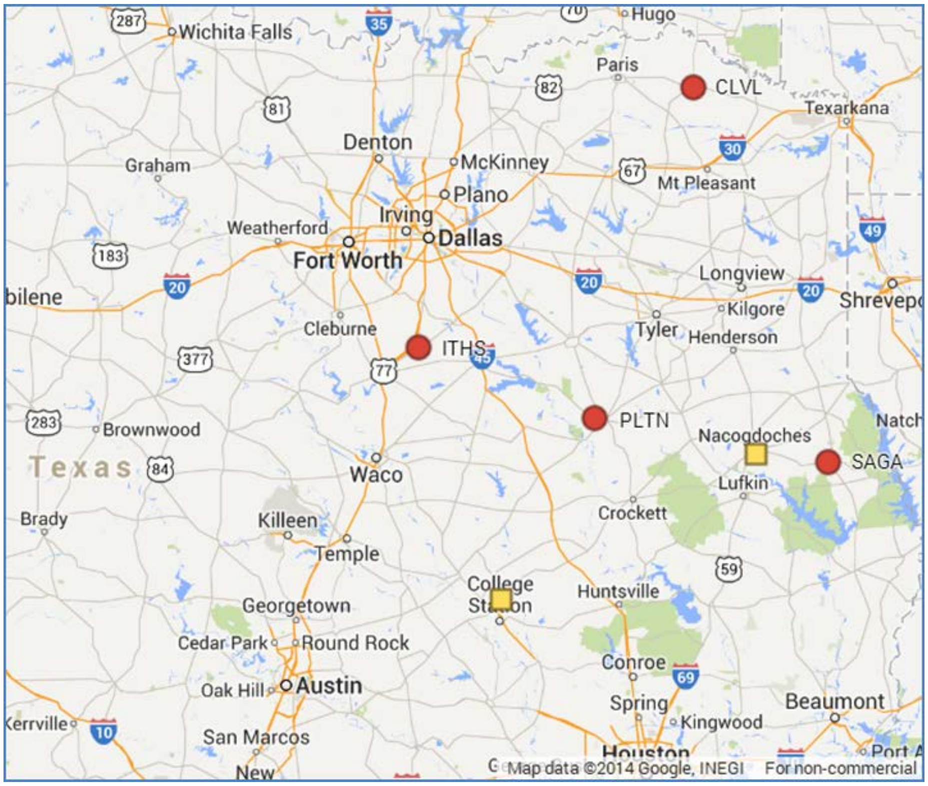



**Figure 3-25: Rural Monitoring Sites Used for Performance Evaluation**

In general, peak ozone during the June episode was well predicted at Italy High School and Clarksville, with moderate over-prediction at Palestine and San Augustine. During the August-September episode, Italy High School model performance was good, with over-prediction at the remaining three monitors, although the model predicted the peaks on some days quite well. Similar to the ozone monitors within or near the urban core, the model generally over-predicted overnight and early morning ozone concentrations during both episodes.

The yellow squares in Figure 3-25 show locations near College Station and Nacogdoches where instrumented balloons to measure ozone (ozonesondes) were launched during the June 2006 episode as part of the Tropospheric Ozone Pollution Project, which was conducted as part of the TexAQS II study (Morris, 2006). The ozonesonde data provided a unique and valuable means for assessing the model's performance. Besides simply allowing modeled concentrations to be compared with measurements aloft, the detailed profiles provided insight into how well the model characterizes vertical mixing compared to the real atmosphere. The most striking difference between observed and modeled vertical ozone profiles is the wide variability in ozone concentrations with altitude observed on most days. The model tends to vary much more slowly, which is not unexpected since it tends to organize wind flow and vertical motion, and also because the model's vertical resolution becomes coarser with increasing elevation.

Another aspect of the TexAQS II study included aircraft measurements of ozone and precursors within the DFW nonattainment area on September 13, 2006 (Gulf of Mexico Atmospheric Composition and Climate Study, National Oceanic & Atmospheric Administration [NOAA], 2006). The instrumented aircraft flew at an elevation of around 500 meters from 1:30-4:00 PM on this day. Analysis of the aircraft measurements indicates that the model predicted the observed ozone quite well except for a small over-prediction as the aircraft passed through the urban plume downwind of the DFW metropolitan area. The modeled winds are more southerly than the observations, and showed little variability through the sampling period. Appendix C contains more detail than presented here on the evaluation of rural monitors, ozonesonde data, and aircraft flight measurements.

#### 3.6.4.3 Diagnostic Evaluations

While most model performance evaluation (MPE) focuses on how well the model reproduces observations in the base case, a second and perhaps more important aspect of model performance is how well the model predicts changes as a result of modifications to its inputs (Smith, 2010). The former type of MPE is static in the sense that it is based on a fixed set of observations that never change, while evaluating the model's response to perturbations in its inputs is dynamic in the sense that the change in the model's output is evaluated. Dynamic MPE is performed much less often than static MPE, simply because there is often little observational data available that can be directly related to quantifiable changes in model inputs. Since the AD is based on modeling the future by changing the model's inputs due to growth and controls, it is beneficial to pursue dynamic MPE. The 2007 and draft guidance documents recommend assessing the model's response to emission changes. Two such dynamic MPEs are described below: prospective modeling analysis and weekday/weekend analysis.

*Prospective Modeling – Revised 2012 Future Case Analysis*

The purpose of this diagnostic analysis is to test the model in a forecast mode where the answer is known in advance. For the DFW AD SIP revision in December 2011, a retrospective analysis was performed where 1999 ozone concentrations were estimated with 1999 anthropogenic emission inputs run with the June 2006 base case meteorological and biogenic inputs. These 1999 anthropogenic emission inputs were already available from the DFW AD SIP revision adopted in May 2007. These 1999 anthropogenic inputs cannot be used with the current 2006 modeling configuration because of incompatibility with the new modeling domains described in Table 3-35.

The TCEQ has started developing a 2012 base case episode on the newer domains shown in Figure 3-14, but has not yet obtained satisfactory model performance with it. However, the latest available 2012 anthropogenic emission inputs from these efforts were available to perform a prospective future case analysis with the 2006 base case meteorology and biogenic inputs. Ozone season emission inputs for the 2012 future year were needed for the DFW AD SIP revision adopted in December 2011. At the time that work was performed, the latest available scientific tools and inputs were used for modeling attainment in the 2012 future year. Table 3-37: *Summary of Ozone Modeling Platform Changes* summarizes these older tools and inputs, and compares them to the latest ones currently being used.

**Table 3-37: Summary of Ozone Modeling Platform Changes**

| Modeling Platform Category | December 2011 AD SIP Revision | Proposed 2016 AD SIP Revision |
|---|---|---|
| 4 km Fine Grid Modeling Domain | DFW nonattainment area and adjacent counties | All of eastern Texas plus some non-Texas counties |
| 12 km Medium Grid Modeling Domain | Eastern Texas plus some adjacent states | All of Texas plus some adjacent states |
| 36 km Coarse Grid Modeling Domain | Eastern half of continental U.S. | All of continental U.S. plus southern Canada and northern Mexico |

| Modeling Platform Category | December 2011 AD SIP Revision | Proposed 2016 AD SIP Revision |
|---|---|---|
| Meteorological Model | MM5 3.7.3 | WRF 3.2 |
| CAMx Version | CAMx 5.20.1 | CAMx 6.20 |
| Chemical Mechanism | Carbon Bond 05 (CB05) | Carbon Bond 6 (CB6) |
| Boundary Conditions | Model for Ozone and Related Chemical Tracers (MOZART) Model | GEOS-Chem Model |
| Biogenics Model | Global Biosphere Emissions and Interactions System (GloBEIS) | MEGAN 2.10 |

A prospective 2012 future case analysis was run with the June 2006 episode, but relied on all of the newer tools and inputs referenced in the far right column of Table 3-37. Table 3-38: *2012 Future Case with June 2006 Episode on Old and New Platforms* summarizes these results. For reference purposes, the 2012 future design value ($DV_F$) results from the December 2011 AD SIP are included and truncated in accordance with the 2007 modeling guidance. In Table 3-38, comparing the older 2012 $DV_F$ figures (second column) with the $DV_F$ figures from the new modeling platform (third column) indicates that the current projected eight-hour ozone design values are 4-8 ppb higher with the results varying by individual monitor. These results can only be presented for monitors that were operational during 2006. The 2012 $DV_B$ and measured regulatory design value ($DV_R$) values cannot be provided for the Midlothian Tower monitor, which is no longer operational.

Table 3-38 also includes the 2012 $DV_R$ (fourth column) and 2012 $DV_B$ (last column) for each monitor. The 2012 $DV_R$ is obtained by truncating the average of the fourth-highest eight-hour observation for each year over the full three years of 2010, 2011, and 2012. The $DV_R$ is used to determine if the area is either in nonattainment or has reached attainment of the NAAQS. As was shown in Figure 3-1, a $DV_B$ is an average of three years of $DV_R$ values. These 2012 $DV_B$ figures were obtained by averaging the 2012 $DV_R$, 2013 $DV_R$, and 2014 $DV_R$ per monitor. The attainment test of multiplying an RRF by a $DV_B$ essentially predicts a future year $DV_B$, even though the $DV_R$ in the future year is the final metric for determining attainment of the NAAQS.

**Table 3-38: 2012 Future Case with June 2006 Episode on Old and New Platforms**

| 2006 DFW Area Monitor and CAMS Code | 2011 AD $DV_F$ for 2012 (ppb) | Current $DV_F$ for 2012 (ppb) | 2012 $DV_R$ (ppb) | 2012 $DV_B$ (ppb) |
|---|---|---|---|---|
| Denton Airport South - C56 | 77 | 84 | 83 | 83.67 |
| Eagle Mountain Lake - C75 | 78 | 82 | 82 | 80.67 |
| Grapevine Fairway - C70 | 76 | 82 | 86 | 84.00 |
| Keller - C17 | 76 | 81 | 87 | 83.00 |
| Fort Worth Northwest - C13 | 75 | 80 | 79 | 80.00 |
| Frisco - C31 | 74 | 79 | 83 | 81.67 |
| Dallas North #2 - C63 | 71 | 77 | 81 | 80.33 |
| Parker County - C76 | 72 | 78 | 78 | 77.00 |

| 2006 DFW Area Monitor and CAMS Code | 2011 AD $DV_F$ for 2012 (ppb) | Current $DV_F$ for 2012 (ppb) | 2012 $DV_R$ (ppb) | 2012 $DV_B$ (ppb) |
|---|---|---|---|---|
| Dallas Executive Airport - C402 | 70 | 77 | 81 | 78.00 |
| Cleburne Airport - C77 | 70 | 76 | 79 | 78.00 |
| Arlington Municipal Airport - C61 | 70 | 75 | 83 | 79.33 |
| Dallas Hinton Street - C401 | 67 | 74 | 82 | 81.33 |
| Granbury - C73 | 69 | 74 | 77 | 76.67 |
| Midlothian Tower - C94 | 66 | 73 | Not Operating | Not Operating |
| Pilot Point - C1032 | 67 | 73 | 82 | 81.67 |
| Rockwall Heath - C69 | 63 | 70 | 77 | 75.67 |
| Midlothian OFW - C52 | 62 | 68 | 76 | 74.67 |
| Greenville - C1006 | 59 | 67 | 72 | 71.67 |
| Kaufman - C71 | 60 | 67 | 70 | 71.33 |

Note: $DV_F$ and $DV_R$ figures are typically truncated, while $DV_B$ figures are reported to two decimal places.

Table 3-39: *2012 Future Case with 67-Day Episode on Old and New Platforms* presents similar information as Table 3-38, but for the entire 67-day episode from both June 2006 and August-September 2006. Similar to the results shown in Table 3-38, the 2012 $DV_F$ figures for the current modeling platform are 4-8 ppb higher than the older one with results varying by monitor. The results in both Table 3-38 and Table 3-39 demonstrate that the current modeling platform with a 2006 base case does a satisfactory job of forecasting ozone design values with anthropogenic emission inputs for alternate years. More detail on this analysis is included in Appendix C.

**Table 3-39: 2012 Future Case with 67-Day Episode on Old and New Platforms**

| 2006 DFW Area Monitor and CAMS Code | 2011 AD $DV_F$ for 2012 (ppb) | Current $DV_F$ for 2012 (ppb) | 2012 $DV_R$ (ppb) | 2012 $DV_B$ (ppb) |
|---|---|---|---|---|
| Denton Airport South - C56 | 77 | 83 | 83 | 83.67 |
| Eagle Mountain Lake - C75 | 78 | 82 | 82 | 80.67 |
| Grapevine Fairway - C70 | 76 | 81 | 86 | 84.00 |
| Keller - C17 | 76 | 81 | 87 | 83.00 |
| Fort Worth Northwest - C13 | 75 | 79 | 79 | 80.00 |
| Frisco - C31 | 74 | 79 | 83 | 81.67 |
| Dallas North #2 - C63 | 71 | 77 | 81 | 80.33 |
| Parker County - C76 | 72 | 77 | 78 | 77.00 |
| Dallas Executive Airport - C402 | 70 | 76 | 81 | 78.00 |
| Cleburne Airport - C77 | 70 | 75 | 79 | 78.00 |
| Arlington Municipal Airport - C61 | 70 | 74 | 83 | 79.33 |
| Dallas Hinton Street - C401 | 67 | 73 | 82 | 81.33 |
| Granbury - C73 | 69 | 73 | 77 | 76.67 |

| 2006 DFW Area Monitor and CAMS Code | 2011 AD $DV_F$ for 2012 (ppb) | Current $DV_F$ for 2012 (ppb) | 2012 $DV_R$ (ppb) | 2012 $DV_B$ (ppb) |
|---|---|---|---|---|
| Midlothian Tower - C94 | 66 | 72 | Not Operating | Not Operating |
| Pilot Point - C1032 | 67 | 72 | 82 | 81.67 |
| Rockwall Heath - C69 | 63 | 70 | 77 | 75.67 |
| Midlothian OFW - C52 | 62 | 67 | 76 | 74.67 |
| Greenville - C1006 | 59 | 67 | 72 | 71.67 |
| Kaufman - C71 | 60 | 66 | 70 | 71.33 |

Note: $DV_F$ and $DV_R$ figures are typically truncated, while $DV_B$ figures are reported to two decimal places.

*Observational Modeling – Weekday/Weekend*

Weekend emissions of $NO_X$ and VOC in urban areas tend to be lower than weekday emissions because of fewer vehicle miles driven. The effect is most pronounced on weekend mornings, especially Sundays, since there is significantly reduced commuting for work purposes. Figure 3-26: *2006 DFW Area 6 AM Anthropogenic Emissions by Day of Week* shows a comparison of modeled 6 AM $NO_X$ and VOC emissions for Wednesdays, Saturdays, and Sundays. The on-road mobile sources are the largest contributor to differences in emissions for weekdays and weekends. 6 AM was chosen because a more stable comparison of emission estimates and monitored concentrations can be made prior to the commencement of photochemical processes in the presence of sunlight.

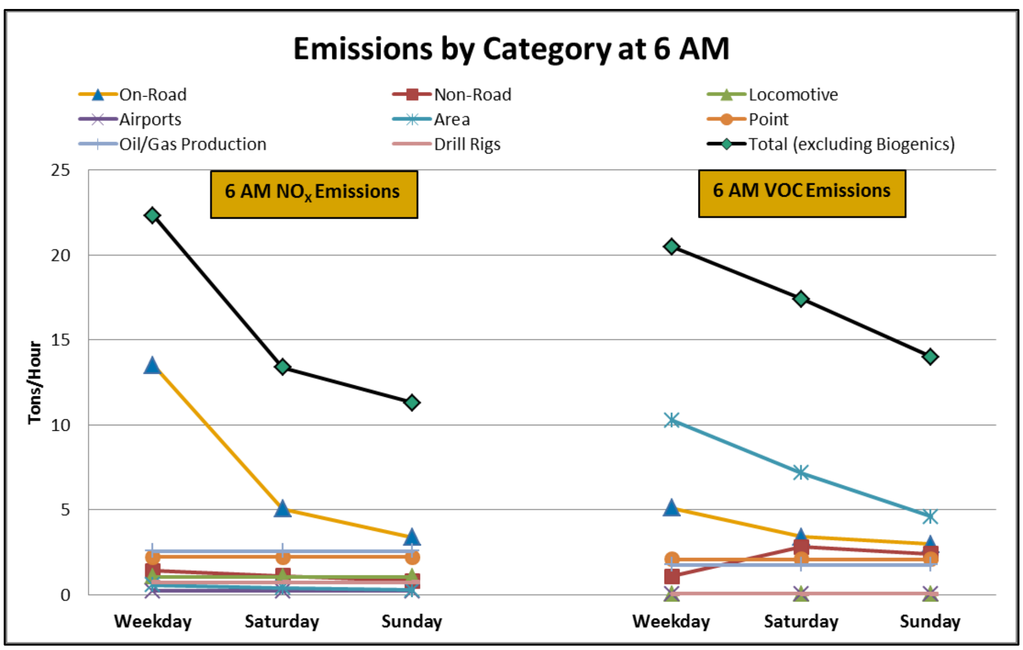



**Figure 3-26: 2006 DFW Area 6 AM Anthropogenic Emissions by Day of Week**

Early morning emissions tend to be especially important in determining peak eight-hour ozone levels (MacDonald, 2010), so the weekday/weekend differences should manifest themselves noticeably in the relative levels of weekday and weekend ozone concentrations. Since there are relatively few Saturdays, Sundays, and Wednesdays (chosen to represent typical weekdays) in the episode, the TCEQ employed a novel approach by applying Saturday, Sunday, and Wednesday emissions inputs to the meteorological inputs for each day of the episode, which resulted in a total of 67 episode days modeled for the 2006 baseline with anthropogenic emission estimates for each of these three day types. This approach is possible since meteorology is independent of the day of week. By replacing the emissions of any episode day with those for just a Wednesday, just a Saturday, and just a Sunday, a representation of the day of week effects can be obtained.

For comparison with the modeled emissions from each of these 67-day scenarios by inventory day type, median monitored 6:00 AM $NO_X$ concentrations were calculated for every Wednesday, Saturday, and Sunday from May 15 through October 15 for the years 2004 through 2008. Within each year, a total of 79 to 133 observations were observed for this timeframe at 11 $NO_X$ monitoring sites in DFW. Figure 3-27: *Mean 6 AM $NO_X$ Concentrations by Monitor Relative to Wednesday* presents these results and compares them to the change in modeled concentrations from the Wednesday, Saturday, and Sunday day type modeling scenarios. All sites show observed $NO_X$ concentrations declining from Wednesday to Saturday, and then from Saturday to Sunday. The modeled values show greater variability than their observed counterparts, with all sites having modeled decreases between 37% and 67% from Wednesday to Sunday. The observed decreases at all sites were in the range of 40% and 70%.

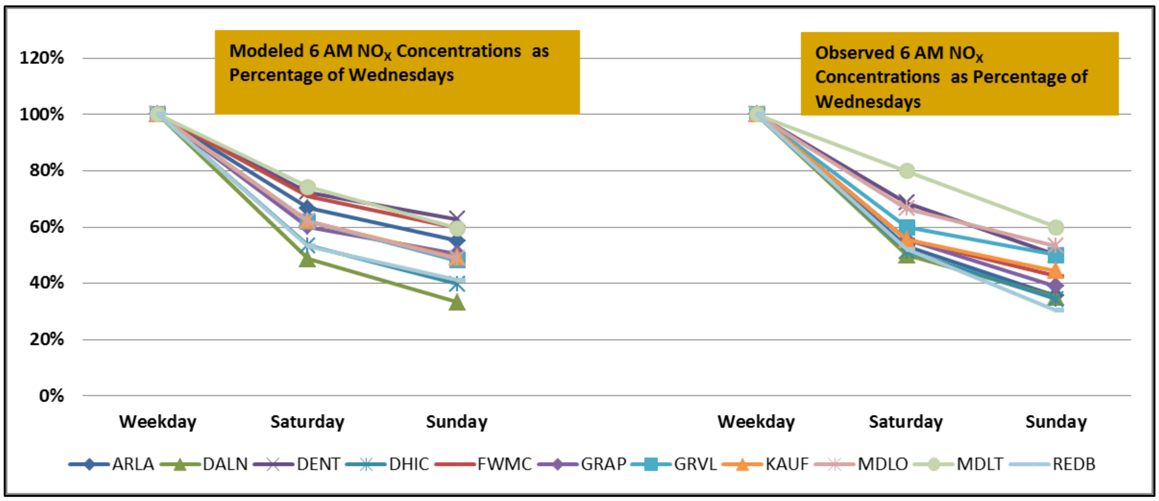



**Figure 3-27: Mean 6 AM $NO_X$ Concentrations by Monitor Relative to Wednesday**

Figure 3-28: *Observed and Modeled 95th Percentile Peak Ozone by Day Type* compares the median observed concentrations for high ozone days with the modeled concentrations by day of week for 19 DFW area monitors. The observed 95th percentile concentrations range between a 1% increase to a 10% decrease on Saturday compared with Wednesday, while all sites showed a Sunday decrease between 6% and 16% compared with Wednesday. The modeled values consistently decreased between 2% and 6% on Saturday compared with Wednesday, and between 2% and 11% on Sunday compared with Wednesday. The model is satisfactorily replicating the observed weekday-weekend $NO_X$ and ozone differences, especially for the higher ozone days. More detail on this analysis is included in Appendix C.

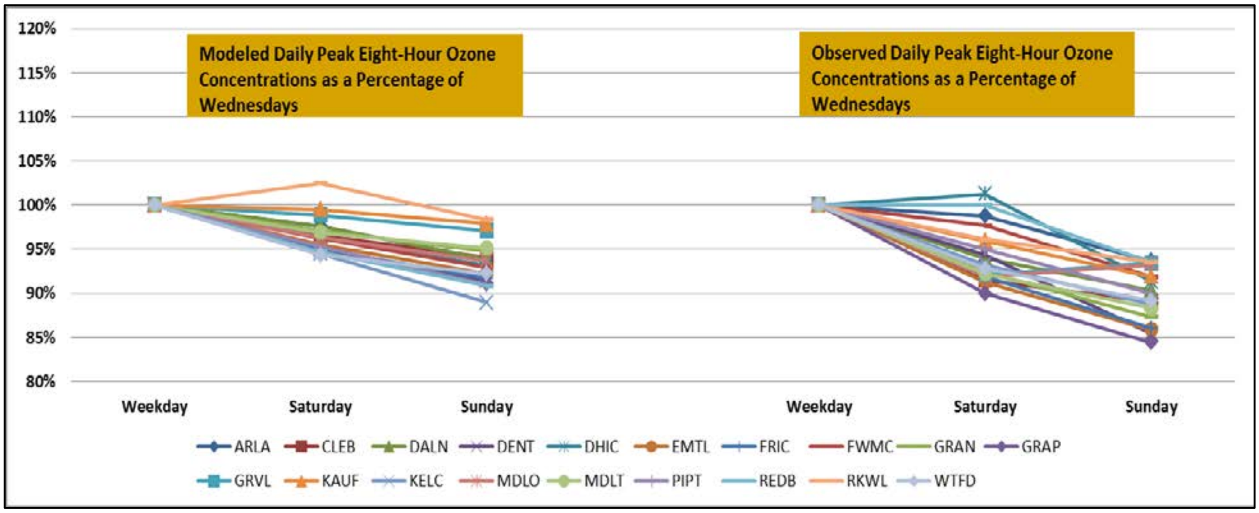



**Figure 3-28: Observed and Modeled 95th Percentile Peak Ozone by Day Type**

## 3.7 2006 BASELINE AND 2017 FUTURE CASE MODELING

### 3.7.1 2006 Baseline Modeling

The TCEQ selected 2006 as the baseline year for conducting the attainment modeling. The 2006 baseline emissions discussed in Section 3.5.3: *2006 Baseline* were used as model inputs. All 2006 baseline episode days with modeled eight-hour maximum concentrations above 75 ppb were used for the modeled attainment test. Since there were more than 10 days for each monitor modeled above 75 ppb in the 2006 baseline, there was no need to fall back on a lower threshold, such as the 70 ppb level suggested in the 2007 modeling guidance. Figure 3-29: *Location of DFW Ozone Monitors with 4 km Grid Cell Array* shows the proximity of each monitor to adjacent ones within the 4 km fine grid domain. The EPA's default recommendation for a 4 km domain in the 2007 guidance is to use an array of seven-by-seven cells for application of the attainment test. This process is suitable for areas where ozone monitors are separated by several kilometers, but would lead to a significant blending of the results among monitors in the more dense DFW area network. The maximum concentrations from an array of three-by-three grid cells surrounding each monitor was chosen for the DFW area attainment test so that better resolution could be obtained in the results for individual monitors. The EPA's draft modeling guidance currently recommends a three-by-three array for the attainment test.

For each DFW area ozone monitor operational in 2006, Table 3-40: *2006 Baseline Design Value Summary for the All Days Attainment Test* details the $DV_B$, the modeled average of episode days above 75 ppb, and the total number of days from the 67-day episode when eight-hour ozone concentrations were modeled above 75 ppb.

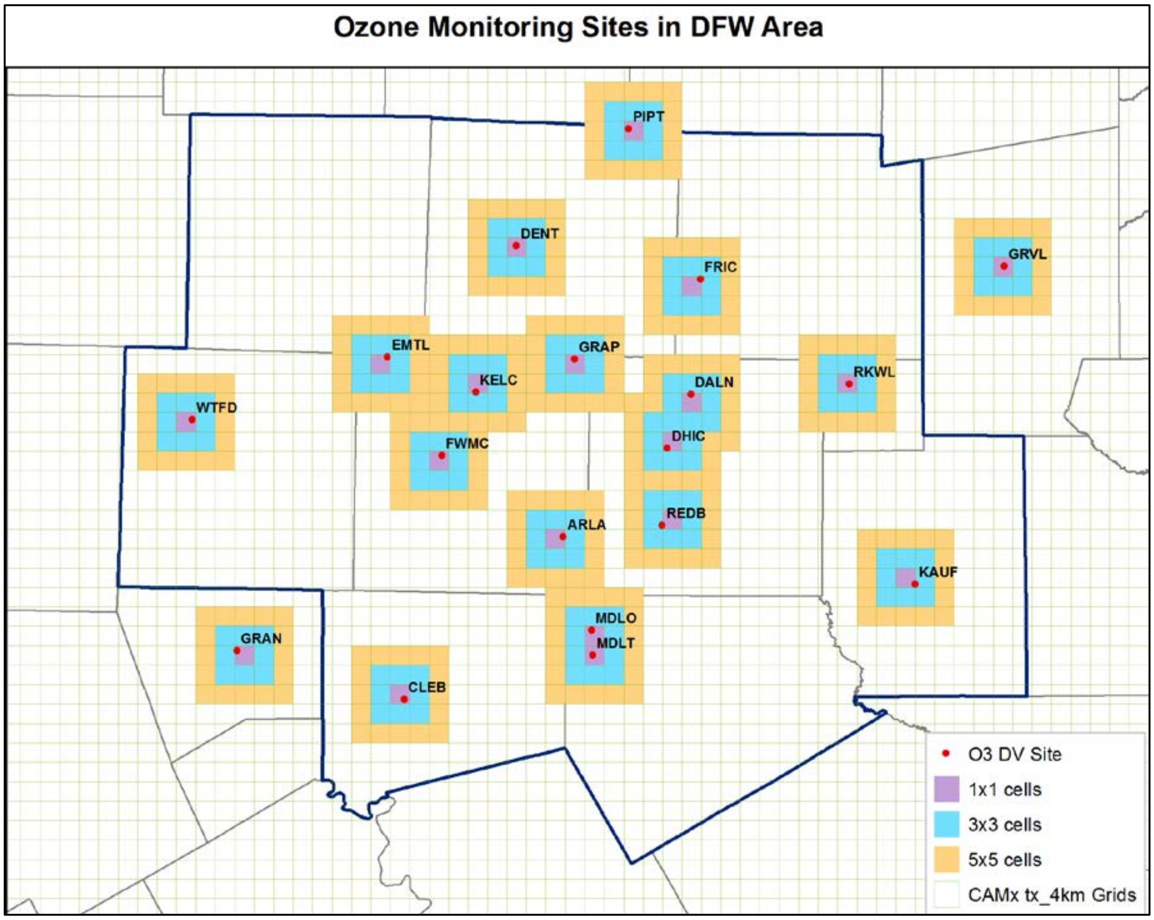



**Figure 3-29: Location of DFW Ozone Monitors with 4 km Grid Cell Array**

**Table 3-40: 2006 Baseline Design Value Summary for the All Days Attainment Test**

| 2006 DFW Area Monitor and CAMS Code | DFW Area Monitor Alpha Code | 2006 $DV_B$ (ppb) | Modeled Average of Days >75 ppb | Number of Modeled Days > 75ppb |
|---|---|---|---|---|
| Denton Airport South - C56 | DENT | 93.33 | 88.07 | 35 |
| Eagle Mountain Lake - C75 | EMTL | 93.33 | 87.50 | 28 |
| Grapevine Fairway - C70 | GRAP | 90.67 | 90.83 | 33 |
| Keller - C17 | KELC | 91.00 | 89.07 | 32 |
| Fort Worth Northwest - C13 | FWMC | 89.33 | 89.13 | 27 |
| Frisco - C31 | FRIC | 87.67 | 86.83 | 34 |
| Dallas North #2 - C63 | DALN | 85.00 | 85.65 | 31 |
| Dallas Executive Airport - C402 | REDB | 85.00 | 84.46 | 27 |
| Parker County - C76 | WTFD | 87.67 | 84.37 | 20 |
| Cleburne Airport - C77 | CLEB | 85.00 | 83.06 | 16 |
| Dallas Hinton Street - C401 | DHIC | 81.67 | 85.38 | 31 |
| Arlington Municipal Airport - C61 | ARLA | 83.33 | 85.20 | 30 |
| Granbury - C73* | GRAN | 83.00 | 82.86 | 17 |

| 2006 DFW Area Monitor and CAMS Code | DFW Area Monitor Alpha Code | 2006 $DV_B$ (ppb) | Modeled Average of Days >75 ppb | Number of Modeled Days > 75ppb |
|---|---|---|---|---|
| Midlothian Tower - C94† | MDLT | 80.50 | 83.74 | 19 |
| Pilot Point - C1032† | PIPT | 81.00 | 86.41 | 33 |
| Rockwall Heath - C69 | RKWL | 77.67 | 82.21 | 26 |
| Midlothian OFW - C52† | MDLO | 75.00 | 83.86 | 22 |
| Kaufman - C71 | KAUF | 74.67 | 79.28 | 16 |
| Greenville - C1006* | GRVL | 75.00 | 79.16 | 16 |

* Granbury and Greenville are located outside of the 10-County DFW nonattainment area.

† Midlothian OFW, Midlothian Tower, and Pilot Point did not measure enough data from 2004 through 2008 to calculate a complete $DV_B$. The $DV_B$ shown uses all available data.

### 3.7.2 Future Baseline Modeling

Similar to the 2006 baseline modeling, 2017 future case modeling was conducted for each of the 67 episode days using the anthropogenic emission inputs discussed in Section 3.5.4: *2017 Future Case Emissions*. Using the same days from the 2006 baseline where eight-hour ozone concentrations were modeled above 75 ppb, the RRF for each monitor was calculated by dividing the 2017 modeled peak eight-hour ozone average by the 2006 peak eight-hour modeled ozone average. For example, there were a total of 35 days in the 67-day episode where the Denton Airport South monitor was modeled above 75 ppb in the 2006 baseline. Table 3-40 shows that the 2006 baseline average of the maximum eight-hour modeled ozone for these 35 days is 88.07 ppb. The 2017 future case average for the same 35 days is 73.47 ppb. The Denton Airport South RRF is obtained by dividing the 73.47 ppb future year average by the 88.07 ppb baseline average to obtain 0.8342. A summary for all monitors is provided in Table 3-41: *RRF Calculations from the 2006 Baseline and 2017 Future Case for the All Days Attainment Test*.

**Table 3-41: RRF Calculations from the 2006 Baseline and 2017 Future Case for the All Days Attainment Test**

| 2006 DFW Area Monitor and CAMS Code | DFW Area Monitor Alpha Code | 2006 Average of Days >75 ppb | 2017 Average of Days >75 ppb | Relative Response Factor (RRF) |
|---|---|---|---|---|
| Denton Airport South - C56 | DENT | 88.07 | 73.47 | 0.8342 |
| Eagle Mountain Lake - C75 | EMTL | 87.50 | 72.68 | 0.8306 |
| Grapevine Fairway - C70 | GRAP | 90.83 | 77.33 | 0.8514 |
| Keller - C17 | KELC | 89.07 | 75.14 | 0.8436 |
| Fort Worth Northwest - C13 | FWMC | 89.13 | 75.77 | 0.8501 |
| Frisco - C31 | FRIC | 86.83 | 73.69 | 0.8487 |
| Dallas North #2 - C63 | DALN | 85.65 | 73.91 | 0.8629 |
| Dallas Executive Airport - C402 | REDB | 84.46 | 71.76 | 0.8496 |
| Parker County - C76 | WTFD | 84.37 | 69.45 | 0.8231 |
| Cleburne Airport - C77 | CLEB | 83.06 | 69.47 | 0.8364 |
| Dallas Hinton Street - C401 | DHIC | 85.38 | 74.18 | 0.8689 |
| Arlington Municipal Airport - C61 | ARLA | 85.20 | 72.15 | 0.8469 |

| 2006 DFW Area Monitor and CAMS Code | DFW Area Monitor Alpha Code | 2006 Average of Days >75 ppb | 2017 Average of Days >75 ppb | Relative Response Factor (RRF) |
|---|---|---|---|---|
| Granbury - C73 | GRAN | 82.86 | 68.61 | 0.8281 |
| Midlothian Tower - C94 | MDLT | 83.74 | 70.49 | 0.8418 |
| Pilot Point - C1032 | PIPT | 86.41 | 71.90 | 0.8321 |
| Rockwall Heath - C69 | RKWL | 82.21 | 69.49 | 0.8452 |
| Midlothian OFW - C52 | MDLO | 83.86 | 70.64 | 0.8423 |
| Kaufman - C71 | KAUF | 79.28 | 65.87 | 0.8309 |
| Greenville - C1006 | GRVL | 79.16 | 65.20 | 0.8237 |

The RRF is then multiplied by the 2006 $DV_B$ to obtain the 2017 $DV_F$ for each ozone monitor. In accordance with the 2007 guidance, the final $DV_F$ is obtained by rounding to the tenths digit and truncating to zero decimal places. These results are presented in Table 3-42: *Summary of 2017 Future Ozone Design Values for the All Days Attainment Test*. Application of the all days attainment test results in the Denton Airport South, Eagle Mountain Lake, Grapevine Fairway, and Keller monitors above the 2008 eight-hour ozone standard of 75 ppb. The 2007 guidance for the 84 ppb standard states that when the maximum future design value falls within 82 through 87 ppb, a WoE "demonstration should be conducted to determine if aggregate supplemental analyses support the modeled attainment test." Application of the 82 through 87 ppb WoE range to the 75 ppb standard indicates that the currently applicable WoE range would be 73 through 78 ppb. As the $DV_F$ for these four monitors falls within this range, a WoE demonstration is included in Chapter 5: *Weight of Evidence* of this 2017 DFW AD SIP revision.

**Table 3-42: Summary of 2017 Future Ozone Design Values for the All Days Attainment Test**

| 2006 DFW Area Monitor and CAMS Code | DFW Area Monitor Alpha Code | 2006 $DV_B$ (ppb) | 2017 $DV_F$ (ppb) | 2017 Truncated $DV_F$ (ppb) |
|---|---|---|---|---|
| Denton Airport South - C56 | DENT | 93.33 | 77.86 | 77 |
| Eagle Mountain Lake - C75 | EMTL | 93.33 | 77.52 | 77 |
| Grapevine Fairway - C70 | GRAP | 90.67 | 77.20 | 77 |
| Keller - C17 | KELC | 91.00 | 76.77 | 76 |
| Fort Worth Northwest - C13 | FWMC | 89.33 | 75.94 | 75 |
| Frisco - C31 | FRIC | 87.67 | 74.40 | 74 |
| Dallas North #2 - C63 | DALN | 85.00 | 73.35 | 73 |
| Dallas Executive Airport - C402 | REDB | 85.00 | 72.21 | 72 |
| Parker County - C76 | WTFD | 87.67 | 72.17 | 72 |
| Cleburne Airport - C77 | CLEB | 85.00 | 71.10 | 71 |
| Dallas Hinton Street - C401 | DHIC | 81.67 | 70.96 | 71 |
| Arlington Municipal Airport - C61 | ARLA | 83.33 | 70.57 | 70 |
| Granbury - C73 | GRAN | 83.00 | 68.73 | 68 |
| Midlothian Tower - C94 | MDLT | 80.50 | 67.77 | 67 |

| 2006 DFW Area Monitor and CAMS Code | DFW Area Monitor Alpha Code | 2006 $DV_B$ (ppb) | 2017 $DV_F$ (ppb) | 2017 Truncated $DV_F$ (ppb) |
|---|---|---|---|---|
| Pilot Point - C1032 | PIPT | 81.00 | 67.40 | 67 |
| Rockwall Heath - C69 | RKWL | 77.67 | 65.65 | 65 |
| Midlothian OFW - C52 | MDLO | 75.00 | 63.17 | 63 |
| Kaufman - C71 | KAUF | 74.67 | 62.04 | 62 |
| Greenville - C1006 | GRVL | 75.00 | 61.78 | 61 |

The EPA draft modeling guidance recommends the attainment test be performed for each monitor on the 10 episode days from the baseline with the highest modeled eight-hour ozone. A summary of how the RRF is obtained for each monitor using this approach is provided in Table 3-43: *RRF Calculations Using the 10 Highest Days*. Please note that the Denton Airport South RRF with the top 10 days test is 0.8171 instead of the 0.8342 value from the all days test referenced in Table 3-41.

**Table 3-43: RRF Calculations Using the 10 Highest Days**

| 2006 DFW Area Monitor and CAMS Code | DFW Area Monitor Alpha Code | 2006 Average of 10 Highest Days | 2017 Average of 10 Highest Days | Relative Response Factor (RRF) |
|---|---|---|---|---|
| Denton Airport South - C56 | DENT | 100.52 | 82.13 | 0.8171 |
| Eagle Mountain Lake - C75 | EMTL | 96.29 | 78.98 | 0.8202 |
| Grapevine Fairway - C70 | GRAP | 104.34 | 87.06 | 0.8344 |
| Keller - C17 | KELC | 100.68 | 83.36 | 0.8280 |
| Fort Worth Northwest - C13 | FWMC | 98.91 | 82.80 | 0.8371 |
| Frisco - C31 | FRIC | 97.57 | 82.19 | 0.8424 |
| Dallas North #2 - C63 | DALN | 95.68 | 81.30 | 0.8497 |
| Dallas Executive Airport - C402 | REDB | 94.52 | 80.13 | 0.8477 |
| Parker County - C76 | WTFD | 89.39 | 73.82 | 0.8258 |
| Cleburne Airport - C77 | CLEB | 87.26 | 71.71 | 0.8218 |
| Dallas Hinton Street - C401 | DHIC | 96.73 | 82.10 | 0.8487 |
| Arlington Municipal Airport - C61 | ARLA | 97.26 | 81.54 | 0.8384 |
| Granbury - C73 | GRAN | 87.02 | 71.73 | 0.8242 |
| Midlothian Tower - C94 | MDLT | 90.04 | 75.43 | 0.8378 |
| Pilot Point - C1032 | PIPT | 97.75 | 80.37 | 0.8222 |
| Rockwall Heath - C69 | RKWL | 88.46 | 74.95 | 0.8473 |
| Midlothian OFW - C52 | MDLO | 91.51 | 76.34 | 0.8342 |
| Kaufman - C71 | KAUF | 81.28 | 67.60 | 0.8318 |
| Greenville - C1006 | GRVL | 81.17 | 67.21 | 0.8279 |

The RRF from the top 10 days methodology is then multiplied by the 2006 $DV_B$ for each monitor to obtain the revised 2017 $DV_F$ figures presented in Table 3-44: *Summary of 2017 Future Ozone*

*Design Values for the Top 10 Days Attainment Test*. Similar to the 2007 guidance, the draft guidance recommends rounding the final $DV_F$ to the tenths digit and truncating to zero decimal places. The results from Tables 3-42 and 3-44 are graphically displayed in Figure 3-30: *2017 Future Design Values by DFW Monitoring Location for All Days Test (top) and Top 10 Days Test (bottom)*. The draft guidance from December 2014 also recommends inclusion of WoE in an attainment demonstration, but does not specify a numeric $DV_F$ range. Instead, the draft guidance requires that the $DV_F$ figures be "close to the NAAQS" for the purposes of demonstrating attainment.

**Table 3-44: Summary of 2017 Future Ozone Design Values for the Top 10 Days Attainment Test**

| **2006 DFW Area Monitor and CAMS Code** | **DFW Area Monitor Alpha Code** | 2006 **$DV_B$** (ppb) | 2017 **$DV_F$** (ppb) | **2017 Truncated $DV_F$** (ppb) |
|---|---|---|---|---|
| Denton Airport South - C56 | DENT | 93.33 | 76.26 | 76 |
| Eagle Mountain Lake - C75 | EMTL | 93.33 | 76.55 | 76 |
| Grapevine Fairway - C70 | GRAP | 90.67 | 75.65 | 75 |
| Keller - C17 | KELC | 91.00 | 75.35 | 75 |
| Fort Worth Northwest - C13 | FWMC | 89.33 | 74.78 | 74 |
| Frisco - C31 | FRIC | 87.67 | 73.85 | 73 |
| Dallas North #2 - C63 | DALN | 85.00 | 72.23 | 72 |
| Dallas Executive Airport - C402 | REDB | 85.00 | 72.05 | 72 |
| Parker County - C76 | WTFD | 87.67 | 72.40 | 72 |
| Cleburne Airport - C77 | CLEB | 85.00 | 69.86 | 69 |
| Dallas Hinton Street - C401 | DHIC | 81.67 | 69.31 | 69 |
| Arlington Municipal Airport - C61 | ARLA | 83.33 | 69.86 | 69 |
| Granbury - C73 | GRAN | 83.00 | 68.41 | 68 |
| Midlothian Tower - C94 | MDLT | 80.50 | 67.44 | 67 |
| Pilot Point - C1032 | PIPT | 81.00 | 66.60 | 66 |
| Rockwall Heath - C69 | RKWL | 77.67 | 65.81 | 65 |
| Midlothian OFW - C52 | MDLO | 75.00 | 62.57 | 62 |
| Kaufman - C71 | KAUF | 74.67 | 62.11 | 62 |
| Greenville - C1006 | GRVL | 75.00 | 62.09 | 62 |

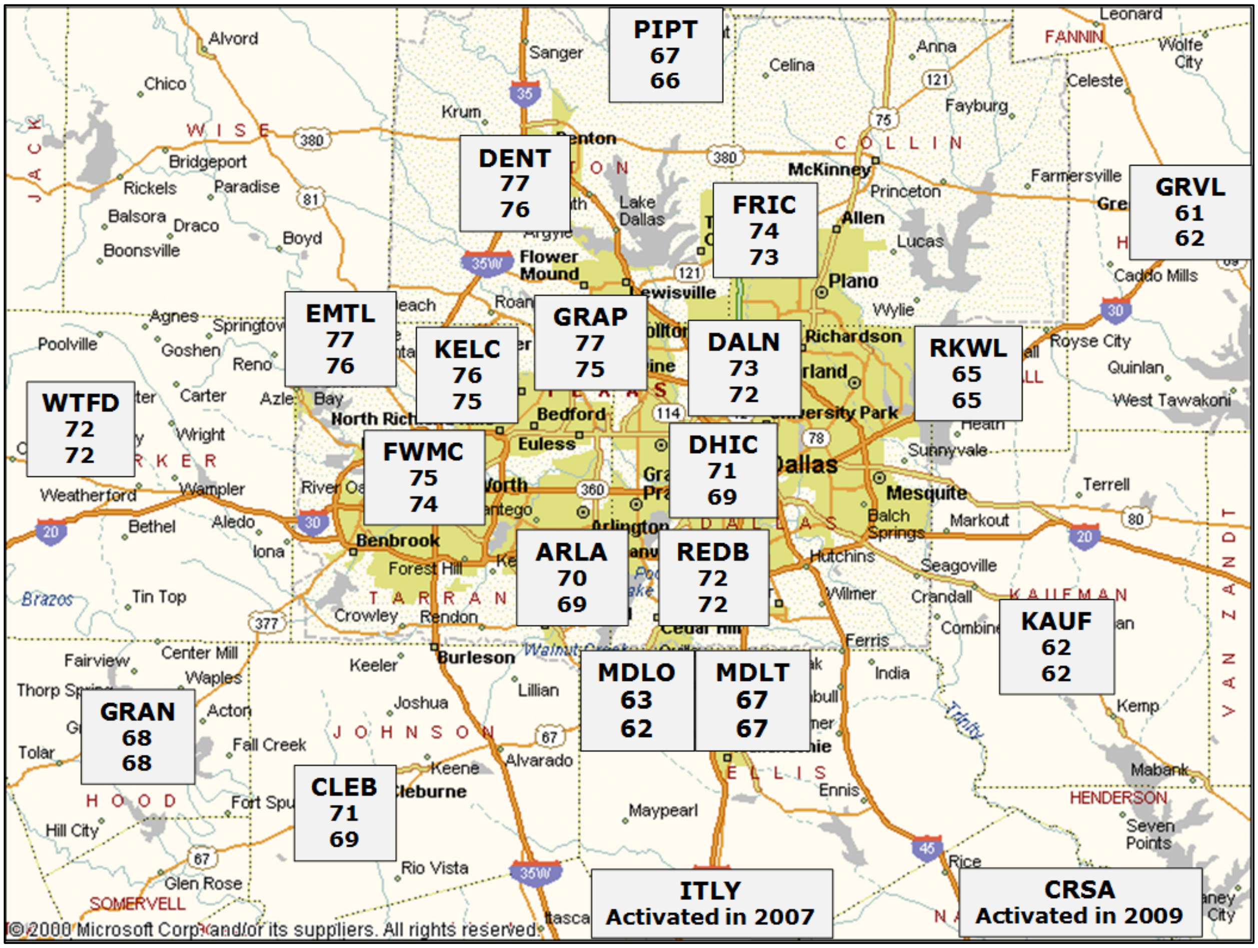



**Figure 3-30: 2017 Future Design Value by DFW Monitoring Location for All Days Test (top) and Top 10 Days Test (bottom)**

### 3.7.3 Ozone Source Apportionment Tool and Anthropogenic Precursor Culpability Analysis

A source apportionment analysis was conducted on the 2017 future case modeling. The two techniques of Anthropogenic Precursor Culpability Assessment (APCA) and Ozone Source Apportionment Technology (OSAT) were used to analyze contributions by different emission source categories in selected regions to the 2017 modeled ozone concentrations. Both APCA and OSAT keep track of the origin of the $NO_X$ and VOC precursors creating the ozone during the model run, which can then be apportioned to specific user-defined geographic regions and source categories. A key difference between APCA and OSAT is that APCA recognizes that the biogenic source category is not controllable. Where OSAT would apportion ozone production to biogenic emissions, APCA reallocates that ozone production to the controllable or anthropogenic emissions that combined with the biogenic emissions to create ozone. Only ozone created from both biogenic $NO_X$ and VOC precursors is apportioned to the biogenic emission source group by APCA.

For the APCA analysis, the three geographic regions of 10-county DFW, non-DFW Texas, and non-Texas were chosen. For display purposes, the anthropogenic emissions were divided into eight source categories for DFW, five for non-DFW Texas, and one aggregate category for non-Texas. The highest level of resolution in the anthropogenic emission categories that can be obtained for APCA analyses is driven by the number of separate EPS3 processing streams for

CAMx input. For example, the on-road emissions processing with EPS3 is not split between streams for passenger cars and heavy-duty diesel trucks, so an APCA analysis is not able to provide separate ozone contribution estimates for these categories. Use of APCA requires tracking of biogenic emissions, initial conditions, and boundary conditions, but these are not allocated to any specific geographic area. Table 3-45: *APCA Geographic Region and Source Category Combinations* summarizes these 17 groups.

**Table 3-45: APCA Geographic Region and Source Category Combinations**

| Geographic Region | Source Category |
|---|---|
| 10-County DFW | On-Road |
| 10-County DFW | Non-Road |
| 10-County DFW | Off-Road - Airports and Locomotives |
| 10-County DFW | Area Sources |
| 10-County DFW | Oil and Gas Drilling and Production |
| 10-County DFW | Point - Electric Utilities |
| 10-County DFW | Point - Cement Kilns |
| 10-County DFW | Point - Oil and Gas and Other * |
| Non-DFW Texas | On-Road |
| Non-DFW Texas | Non-Road, Off-Road, and Area Sources |
| Non-DFW Texas | Oil and Gas Drilling and Production |
| Non-DFW Texas | Point - Electric Utilities |
| Non-DFW Texas | Point - Cement Kilns, Oil and Gas, and Other |
| Non-Texas | All Anthropogenic |
| All Geographic Areas | Biogenic |
| NA | Boundary Conditions |
| NA | Initial Conditions |

* For the 2017 future year, oil and gas point source $NO_X$ is 16.50 tpd and the remaining "other" is 6.68 $NO_X$ tpd.

The full 67-day combined episode was run with APCA for the 2017 future case to estimate the geographic region and source category contributions to the ozone formed for each hour and day. The APCA output was processed to obtain these contributions for each monitor within the DFW area. Graphical results for the Denton Airport South monitor are presented in Figure 3-31: *2017 Ozone Contributions for Denton Airport South from May 31 through June 16* and Figure 3-32: *2017 Ozone Contributions for Denton Airport South from August 13 through 27*. These time periods represent the first half of the June and August-September episodes, respectively. The photochemical model must be run with initial conditions that become less important once the earlier part of the episode has finished. Each peak represents the higher mid-day levels of modeled ozone, while each valley represents the nighttime low. Differing amounts of ozone are formed each day, and the contribution from each geographic region and source category combination varies due to changing meteorological conditions by day and hour. The gray, green, and pink colors towards the bottom of the charts reflect the boundary conditions, biogenic, and non-Texas anthropogenic contributions, respectively.

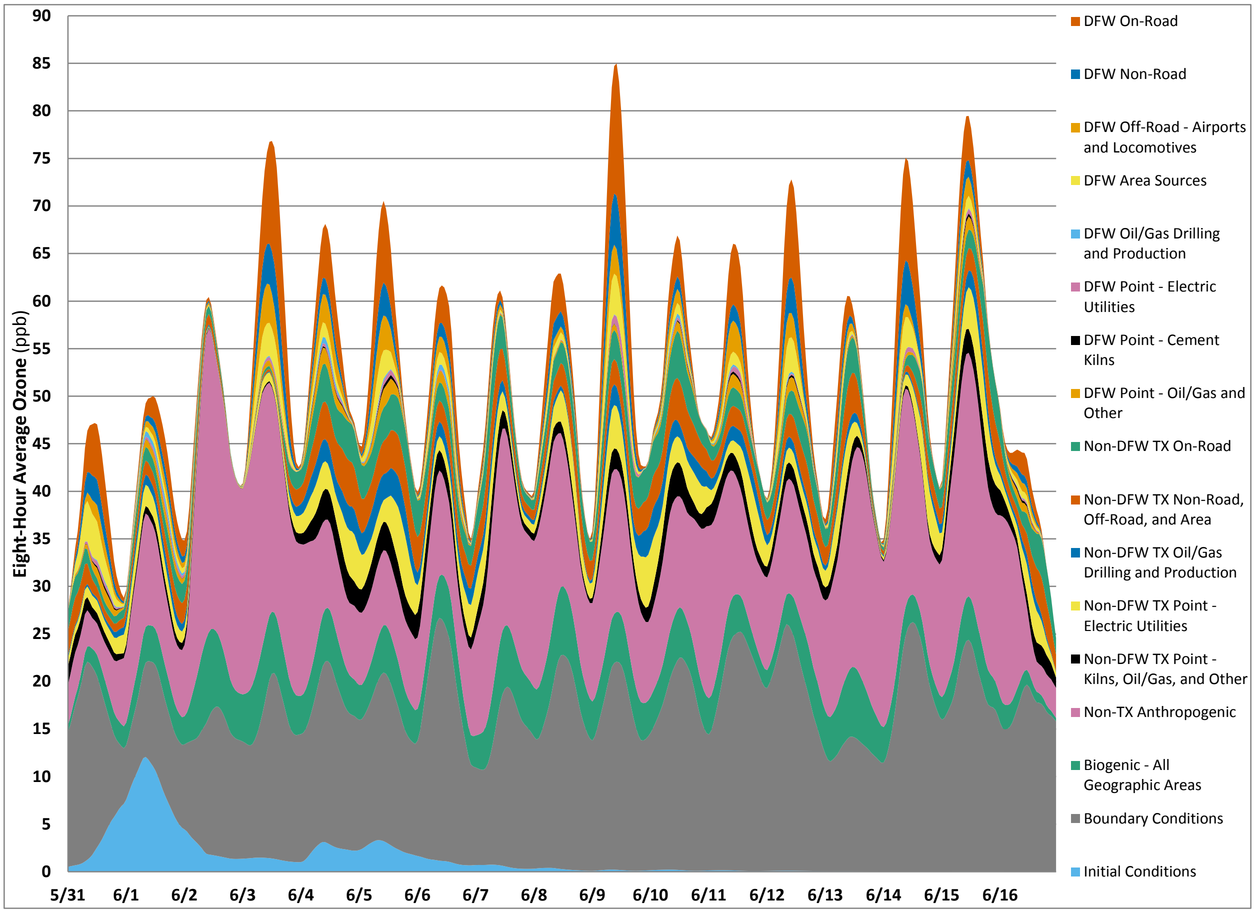



**Figure 3-31: 2017 Ozone Contributions for Denton Airport South from May 31 through June 16**

Figure 3-31 and Figure 3-32 present the ozone contributions for each day of the respective time periods, but not all of these days were used in the RRF calculations presented in Tables 3-40 through 3-44. For each monitor, the maximum eight-hour ozone contributions from the APCA output were aggregated for the episode days used in the RRF calculations. A distribution by geographic area and source type was obtained by averaging the ozone contributions across the RRF days, and that distribution was then applied to the 2017 $DV_F$ for each monitor. This approach was done separately for the all days attainment test and the top 10 days attainment test.

The results for the all days analysis are presented in Figure 3-33: *2017 Ozone Contributions for the Denton, Parker, and Kaufman Monitors Based on the All Days Design Values*. The Denton Airport South monitor was chosen for review because it has the highest 2017 $DV_F$ and is located in the far northwestern downwind portion of the DFW nonattainment area, so its APCA results represent the maximum total ozone contribution from DFW nonattainment area precursors. The Kaufman monitor was chosen for review because it has a low 2017 $DV_F$ and is located in the far southeastern upwind portion of the DFW nonattainment area, so its APCA results can best represent the background contribution. The Parker County monitor was chosen to evaluate ozone impacts of oil and gas operations because it is located in the far western portion of the DFW nonattainment area downwind of prevalent drilling and production activity.

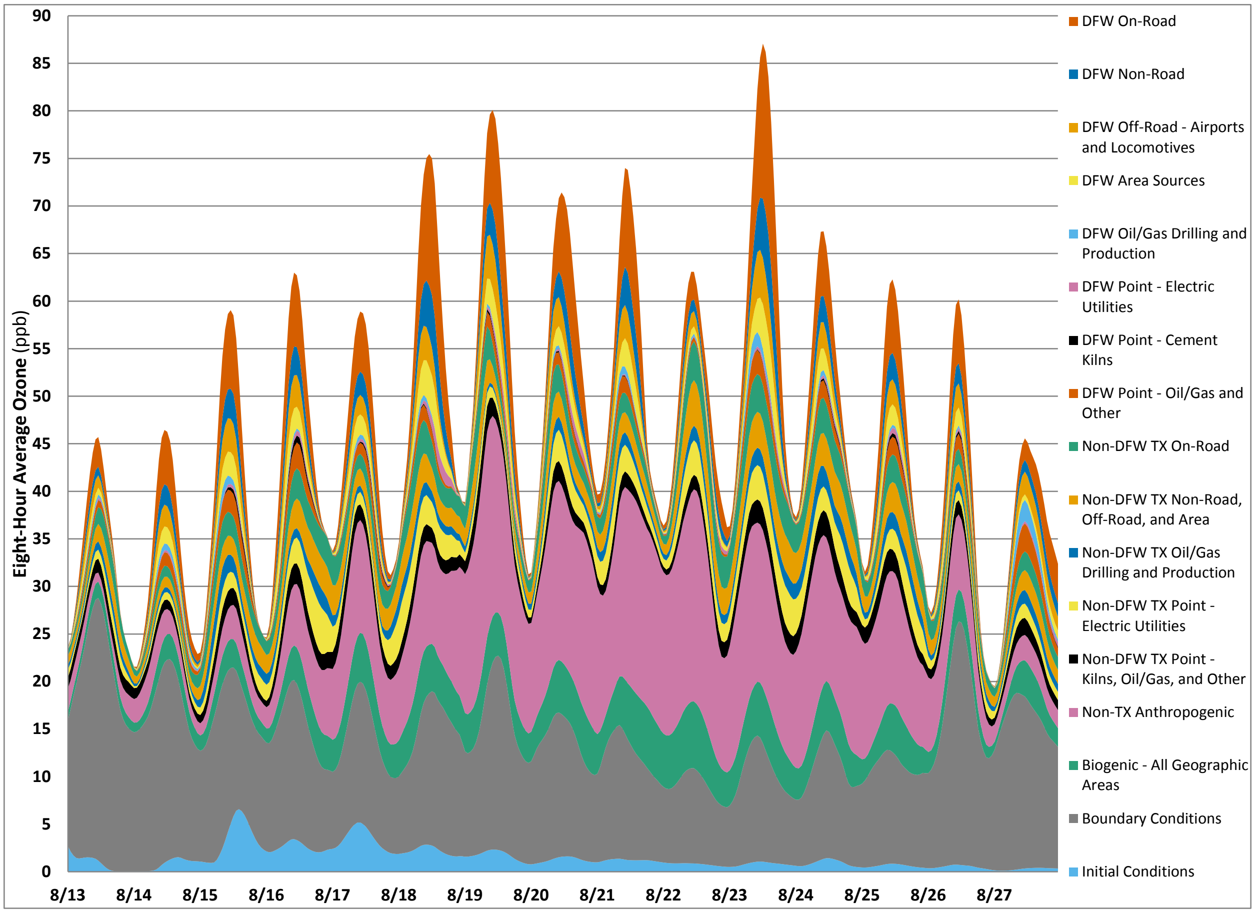



**Figure 3-32: 2017 Ozone Contributions for Denton Airport South from August 13 through 27**

Table 3-46: *2017 Ozone Contributions for the Denton, Parker, and Kaufman Monitors Based on the All Days Design Values* presents the numeric results for each of the geographic area and source categories referenced in Figure 3-33. Table 3-47: *2017 Aggregate Ozone Contributions for the Denton, Parker, and Kaufman Monitors Based on the All Days Design Values* groups the anthropogenic source category results from Table 3-46 into 10-County DFW, non-DFW Texas, and non-Texas areas. The southeastern upwind Kaufman monitor reflects the lowest DFW nonattainment area ozone contribution of 2.70 ppb to its $DV_F$, while the northwestern downwind Denton Airport South monitor reflects the highest DFW nonattainment area ozone contribution of 21.11 ppb. While the peak ozone at Kaufman is 15.81 ppb lower than at Denton Airport South, a greater portion of its ozone can be attributed to non-DFW Texas (16.38 ppb) and non-Texas (20.90 ppb) sources. The comparative non-DFW Texas and non-Texas anthropogenic contributions for Denton Airport South are 11.37 ppb and 18.61 ppb, respectively. As Tables 3-46 and 3-47 indicate, the remaining portions of the $DV_F$ for each monitor are from biogenic sources, initial conditions for the start of the episode, and boundary conditions assigned to the borders of the modeling domain.

As shown in Table 3-46, the Parker monitor reflects higher ozone contributions from oil and gas operations compared with other DFW nonattainment area monitors. This is to be expected due its location downwind of much of this activity during ozone season. As noted in Table 3-45, the DFW nonattainment area point source contributions are divided into electric utilities, cement kilns, and a remaining category that combines oil and gas operations with “other”. The 2017 figures in Table 3-22 and Table 3-32 show that the oil and gas portion is 16.50 $NO_X$ tpd with 6.68 $NO_X$ tpd comprising the remainder of the total 23.18 $NO_X$ tpd for non-cement kiln non-EGUs. Appendix C contains more detail on the APCA analyses presented here.

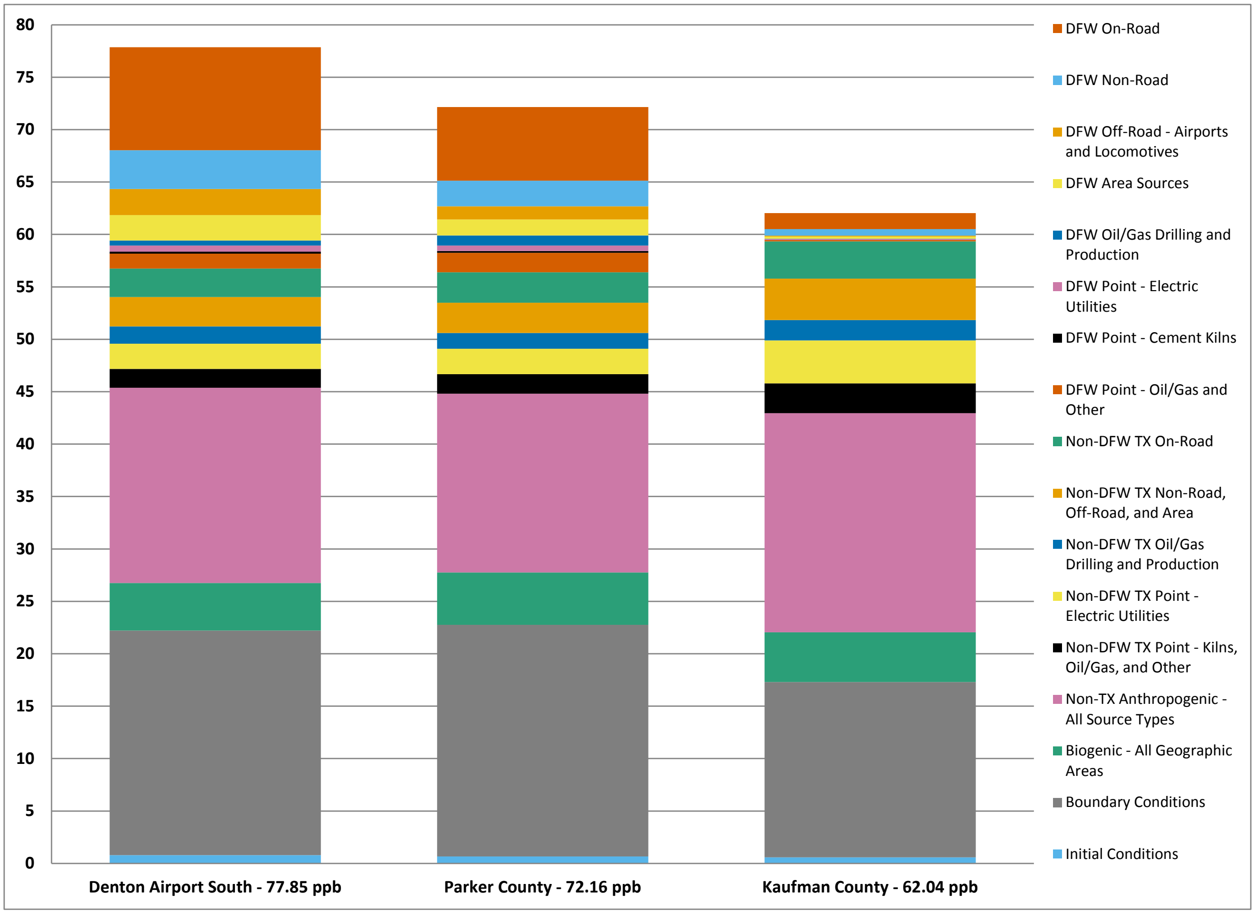



**Figure 3-33: 2017 Ozone Contributions for the Denton, Parker, and Kaufman Monitors Based on the All Days Design Values**

**Table 3-46: 2017 Ozone Contributions for the Denton, Parker, and Kaufman Monitors Based on the All Days Design Values**

| Geographic Area and Source Type | Denton Airport South (ppb) | Parker County (ppb) | Kaufman County (ppb) |
|---|---|---|---|
| DFW On-Road | 9.82 | 7.04 | 1.53 |
| DFW Non-Road | 3.69 | 2.44 | 0.63 |
| DFW Off-Road - Airports and Locomotives | 2.51 | 1.26 | 0.09 |
| DFW Area Sources | 2.43 | 1.52 | 0.20 |
| DFW Oil/Gas Drilling and Production | 0.47 | 0.95 | 0.02 |
| DFW Point - Electric Utilities | 0.58 | 0.53 | 0.10 |
| DFW Point - Cement Kilns | 0.19 | 0.16 | 0.01 |
| DFW Point - Oil/Gas and Other | 1.42 | 1.87 | 0.12 |

| Geographic Area and Source Type | Denton Airport South (ppb) | Parker County (ppb) | Kaufman County (ppb) |
|---|---|---|---|
| Non-DFW TX On-Road | 2.72 | 2.91 | 3.56 |
| Non-DFW TX Non-Road, Off-Road, and Area Sources | 2.80 | 2.87 | 3.94 |
| Non-DFW TX Oil/Gas Drilling and Production | 1.65 | 1.52 | 1.94 |
| Non-DFW TX Point - Electric Utilities | 2.40 | 2.43 | 4.10 |
| Non-DFW TX Point - Cement Kilns, Oil/Gas, and Other | 1.80 | 1.85 | 2.84 |
| Non-TX Anthropogenic - All Source Types | 18.61 | 17.05 | 20.90 |
| Biogenic - All Geographic Areas | 4.54 | 5.01 | 4.76 |
| Boundary Conditions | 21.43 | 22.10 | 16.71 |
| Initial Conditions | 0.80 | 0.66 | 0.59 |
| 2017 Future Design Value | 77.86 | 72.17 | 62.04 |

**Table 3-47: 2017 Aggregate Ozone Contributions for the Denton, Parker, and Kaufman Monitors Based on the All Days Design Values**

| Aggregated Geographic Area and Source Type | Denton Airport South (ppb) | Parker County (ppb) | Kaufman County (ppb) |
|---|---|---|---|
| DFW Anthropogenic - All Source Types | 21.11 | 15.77 | 2.70 |
| Non-DFW Texas Anthropogenic - All Source Types | 11.37 | 11.58 | 16.38 |
| Non-Texas Anthropogenic - All Source Types | 18.61 | 17.05 | 20.90 |
| Biogenic - All Geographic Areas | 4.54 | 5.01 | 4.76 |
| Boundary and Initial Conditions | 22.23 | 22.76 | 17.30 |
| 2017 Future Design Value | 77.86 | 72.17 | 62.04 |

Table 3-48: *2017 Ozone Contributions for the Denton, Parker, and Kaufman Monitors Based on the Top 10 Days Design Values* is similar to Table 3-46 but presents the results for the newer top 10 attainment test. Table 3-49: *2017 Aggregate Ozone Contributions for the Denton, Parker, and Kaufman Monitors Based on the Top 10 Days Design Values* presents similar information at Table 3-47 but for the newer top 10 attainment test. The bar charts presented above in Figure 3-33 for the all days attainment test are not repeated for the top 10 results because the numeric differences are not large enough to show much distinction in bar charts. For the Denton Airport South monitor, Table 3-49 shows that DFW anthropogenic sources contribute 24.98 ppb for the top 10 days $DV_F$, which is 3.87 ppb higher than the 21.11 ppb contribution for the all days $DV_F$ shown in Table 3-47. According to the EPA's draft guidance, this is expected because "on days with high ozone concentrations, there is a relatively higher percentage of locally generated ozone compared to days with low base concentrations. Days with low ozone concentrations are more likely to have a high percentage of ozone due to background and boundary conditions."

**Table 3-48: 2017 Ozone Contributions for the Denton, Parker, and Kaufman Monitors Based on the Top 10 Days Design Values**

| Geographic Area and Source Type | Denton Airport South (ppb) | Parker County (ppb) | Kaufman County (ppb) |
|---|---|---|---|
| DFW On-Road | 11.81 | 10.07 | 1.68 |
| DFW Non-Road | 4.68 | 3.49 | 0.66 |
| DFW Off-Road - Airports and Locomotives | 3.13 | 1.87 | 0.11 |
| DFW Area Sources | 2.93 | 2.40 | 0.22 |
| DFW Oil/Gas Drilling and Production | 0.39 | 0.96 | 0.02 |
| DFW Point - Electric Utilities | 0.58 | 0.77 | 0.14 |
| DFW Point - Cement Kilns | 0.17 | 0.23 | 0.02 |
| DFW Point - Oil/Gas and Other | 1.29 | 2.11 | 0.15 |
| Non-DFW TX On-Road | 2.24 | 1.92 | 3.43 |
| Non-DFW TX Non-Road, Off-Road, and Area Sources | 2.21 | 1.91 | 3.98 |
| Non-DFW TX Oil/Gas Drilling and Production | 1.36 | 1.21 | 1.86 |
| Non-DFW TX Point - Electric Utilities | 2.27 | 2.08 | 4.20 |
| Non-DFW TX Point - Cement Kilns, Oil/Gas, and Other | 1.45 | 1.21 | 3.06 |
| Non-TX Anthropogenic - All Source Types | 17.44 | 14.98 | 21.92 |
| Biogenic - All Geographic Areas | 4.52 | 4.49 | 4.67 |
| Boundary Conditions | 18.90 | 22.16 | 15.31 |
| Initial Conditions | 0.89 | 0.53 | 0.68 |
| 2017 Future Design Value | 76.26 | 72.40 | 62.11 |

**Table 3-49: 2017 Aggregate Ozone Contributions for the Denton, Parker, and Kaufman Monitors Based on the Top 10 Days Design Values**

| Aggregated Geographic Area and Source Type | Denton Airport South (ppb) | Parker County (ppb) | Kaufman County (ppb) |
|---|---|---|---|
| DFW Anthropogenic - All Source Types | 24.98 | 21.91 | 3.00 |
| Non-DFW Texas Anthropogenic - All Source Types | 9.53 | 8.33 | 16.53 |
| Non-Texas Anthropogenic - All Source Types | 17.44 | 14.98 | 21.92 |
| Biogenic - All Geographic Areas | 4.52 | 4.49 | 4.67 |
| Boundary and Initial Conditions | 19.79 | 22.69 | 15.99 |
| 2017 Future Design Value | 76.26 | 72.40 | 62.11 |

### 3.7.4 Future Case Modeling Sensitivities

Section 3.7.2 presented the 2017 future design values obtained from the running the photochemical model with the 2006 baseline and 2017 future case emission inventories discussed in Sections 3.5.3 and 3.5.4, respectively. When a future case sensitivity analysis is performed, the future year anthropogenic emission inventory inputs are modified while the baseline emission inventories are typically held constant. For each future case sensitivity test, the RRF analysis is performed and the revised future case design values for each monitor are compared to the future baseline levels.

#### 3.7.4.1 2017 Clean Air Interstate Rule (CAIR) Phase II Sensitivity

On July 28, 2015, the D.C. Circuit Court found that the CSAPR 2014 sulfur dioxide ($SO_2$) and ozone season $NO_X$ budgets for Texas and certain other states were invalid because the budgets required more emission reductions than were necessary. The court remanded the rule without vacatur to the EPA for reconsideration of the emission budgets. Therefore, while the current CSAPR budgets for Texas are still in effect, the budgets may be subject to change in the future after the EPA's reconsideration or changes resulting from further appeals.

As described in Section 3.5.4.1, the 2017 future case EGU emissions for this 2017 DFW AD SIP revision were projected based on the latest available CSAPR unit level allocations from the EPA. The TCEQ performed a 2017 sensitivity analysis that replaced the 2017 EGU emission estimates based on CSAPR with those that would apply if the CAIR Phase II allocations were still in effect. The modeled 2017 ozone impacts for the DFW area monitors are presented in Table 3-50: *2017 Future Design Value Changes from CAIR II Instead of CSAPR for the All Days Attainment Test*. The maximum modeled reduction of 0.45 ppb is at the Fort Worth Northwest monitor, while the maximum modeled increase of 0.43 ppb is at the Rockwall Heath monitor located northeast of Dallas.

**Table 3-50: 2017 Future Design Value Changes from CAIR II Instead of CSAPR for the All Days Attainment Test**

| 2006 DFW Area Monitor and CAMS Code | DFW Area Monitor Alpha Code | 2017 $DV_F$ for CSAPR (ppb) | 2017 $DV_F$ for CAIR II (ppb) | 2017 $DV_F$ Change (ppb) |
|---|---|---|---|---|
| Denton Airport South - C56 | DENT | 77.86 | 77.75 | -0.11 |
| Eagle Mountain Lake - C75 | EMTL | 77.52 | 77.29 | -0.23 |
| Grapevine Fairway - C70 | GRAP | 77.20 | 77.12 | -0.08 |
| Keller - C17 | KELC | 76.77 | 76.59 | -0.18 |
| Fort Worth Northwest - C13 | FWMC | 75.94 | 75.49 | -0.45 |
| Frisco - C31 | FRIC | 74.40 | 74.51 | +0.11 |
| Dallas North #2 - C63 | DALN | 73.35 | 73.49 | +0.14 |
| Dallas Executive Airport - C402 | REDB | 72.21 | 72.38 | +0.17 |
| Parker County - C76 | WTFD | 72.17 | 72.13 | -0.04 |
| Cleburne Airport - C77 | CLEB | 71.10 | 70.99 | -0.11 |
| Dallas Hinton Street - C401 | DHIC | 70.96 | 71.06 | +0.10 |
| Arlington Municipal Airport - C61 | ARLA | 70.57 | 70.59 | +0.02 |
| Granbury - C73 | GRAN | 68.73 | 68.78 | +0.05 |
| Midlothian Tower - C94 | MDLT | 67.77 | 67.95 | +0.18 |
| Pilot Point - C1032 | PIPT | 67.40 | 67.39 | -0.01 |
| Rockwall Heath - C69 | RKWL | 65.65 | 66.08 | +0.43 |
| Midlothian OFW - C52 | MDLO | 63.17 | 63.35 | +0.18 |
| Kaufman - C71 | KAUF | 62.04 | 62.39 | +0.35 |

| 2006 DFW Area Monitor and CAMS Code | DFW Area Monitor Alpha Code | 2017 $DV_F$ for CSAPR (ppb) | 2017 $DV_F$ for CAIR II (ppb) | 2017 $DV_F$ Change (ppb) |
|---|---|---|---|---|
| Greenville - C1006 | GRVL | 61.78 | 61.86 | +0.08 |

The modeled 2017 ozone impacts for this same scenario using the top 10 days test are included in Table 3-51: *2017 Future Design Value Changes from CAIR II Instead of CSAPR for the Top 10 Days Attainment Test*. This approach has the maximum modeled reduction of 0.33 ppb at the Fort Worth Northwest monitor, while the maximum modeled increase of 0.37 ppb is at the Kaufman monitor located southeast of Dallas.

**Table 3-51: 2017 Future Design Value Changes from CAIR II Instead of CSAPR for the Top 10 Days Attainment Test**

| 2006 DFW Area Monitor and CAMS Code | DFW Area Monitor Alpha Code | 2017 $DV_F$ for CSAPR (ppb) | 2017 $DV_F$ for CAIR II (ppb) | 2017 $DV_F$ Change (ppb) |
|---|---|---|---|---|
| Denton Airport South - C56 | DENT | 76.26 | 76.34 | +0.08 |
| Eagle Mountain Lake - C75 | EMTL | 76.55 | 76.34 | -0.21 |
| Grapevine Fairway - C70 | GRAP | 75.65 | 75.68 | +0.03 |
| Keller - C17 | KELC | 75.35 | 75.30 | -0.05 |
| Fort Worth Northwest - C13 | FWMC | 74.78 | 74.45 | -0.33 |
| Frisco - C31 | FRIC | 73.85 | 74.05 | +0.20 |
| Dallas North #2 - C63 | DALN | 72.23 | 72.45 | +0.22 |
| Dallas Executive Airport - C402 | REDB | 72.05 | 72.18 | +0.13 |
| Parker County - C76 | WTFD | 72.40 | 72.24 | -0.16 |
| Cleburne Airport - C77 | CLEB | 69.86 | 69.60 | -0.26 |
| Dallas Hinton Street - C401 | DHIC | 69.31 | 69.53 | +0.22 |
| Arlington Municipal Airport - C61 | ARLA | 69.86 | 69.73 | -0.13 |
| Granbury - C73 | GRAN | 68.41 | 68.47 | +0.06 |
| Midlothian Tower - C94 | MDLT | 67.44 | 67.66 | +0.22 |
| Pilot Point - C1032 | PIPT | 66.60 | 66.61 | +0.01 |
| Rockwall Heath - C69 | RKWL | 65.81 | 66.00 | +0.19 |
| Midlothian OFW - C52 | MDLO | 62.57 | 62.76 | +0.19 |
| Kaufman - C71 | KAUF | 62.11 | 62.48 | +0.37 |
| Greenville - C1006 | GRVL | 62.09 | 62.13 | +0.04 |

### 3.7.5 Unmonitored Area Analysis

The 2007 modeling guidance recommends that areas within or near nonattainment counties but not adjacent to monitoring locations (unmonitored areas (UMA)) be subjected to a UMA analysis to demonstrate that these areas are expected to reach attainment by the required future year. The standard attainment test is applied only at monitor locations, and the UMA analysis is intended to identify any areas not near a monitoring location that are at risk of not meeting the attainment date. Recently, the EPA provided Modeled Attainment Test Software (MATS), which can be used to conduct UMA analyses but has not specifically recommended using its software in the 2007 guidance, instead stating that "States will be able to use the EPA-provided software or are free to develop alternative techniques that may be appropriate for their areas or situations."

The TCEQ chose to use its own procedure to conduct the UMA analysis instead of MATS for several reasons. Both procedures incorporate modeled predictions into a spatial interpolation procedure. However, the TCEQ Attainment Test for Unmonitored areas (TATU) is already integrated into the TCEQ's model post-processing stream while MATS requires that modeled concentrations be exported to a personal computer-based platform. Additionally, MATS requires input in latitude/longitude, while TATU works directly off the LCC projection data used in TCEQ modeling applications. Finally, MATS uses the Voronoi Neighbor Averaging (VNA) technique for spatial interpolation, while TATU relies on the more familiar kriging geospatial interpolation technique. More information about TATU is provided in Appendix C.

Figure 3-34: *Spatially Interpolated Ozone Design Values for the 2006 Baseline and 2017 Future Case* shows two color contour maps of ozone concentrations produced by TATU, one for the 2006 baseline (bottom) and one for the 2017 future case (top). The 2006 plot shows that the maximum modeled baseline design value is in cell 78 in the X-direction and cell 191 in the Y-direction (78-X/191-Y) which is the same 4 km cell where the Denton Airport South monitor is located. The 2017 plot shows the extent and magnitude of the expected improvements in ozone design values compared with the 2006 baseline, with few grid cells at or above 76 ppb. The 2017 plot indicates that the maximum 2017 design value in the domain is 78.6 ppb, which is located in cell 79-X/186-Y between the Grapevine Fairway and Denton Airport South monitors. This value of 78.6 ppb is 0.7 ppb higher than the Denton Airport South future design value of 77.9 reported in Table 3-42.

Figure 3-29 shows the location of all ozone monitors within the entire 4 km grid cell array for DFW. The five monitors that typically record the highest ozone levels in DFW are located north and west of Fort Worth: Denton Airport South, Eagle Mountain Lake, Fort Worth Northwest, Grapevine Fairway, and Keller. Both the 2006 baseline and 2017 future case modeling for this 67-day episode are properly capturing the geographic locations of the monitored peaks.

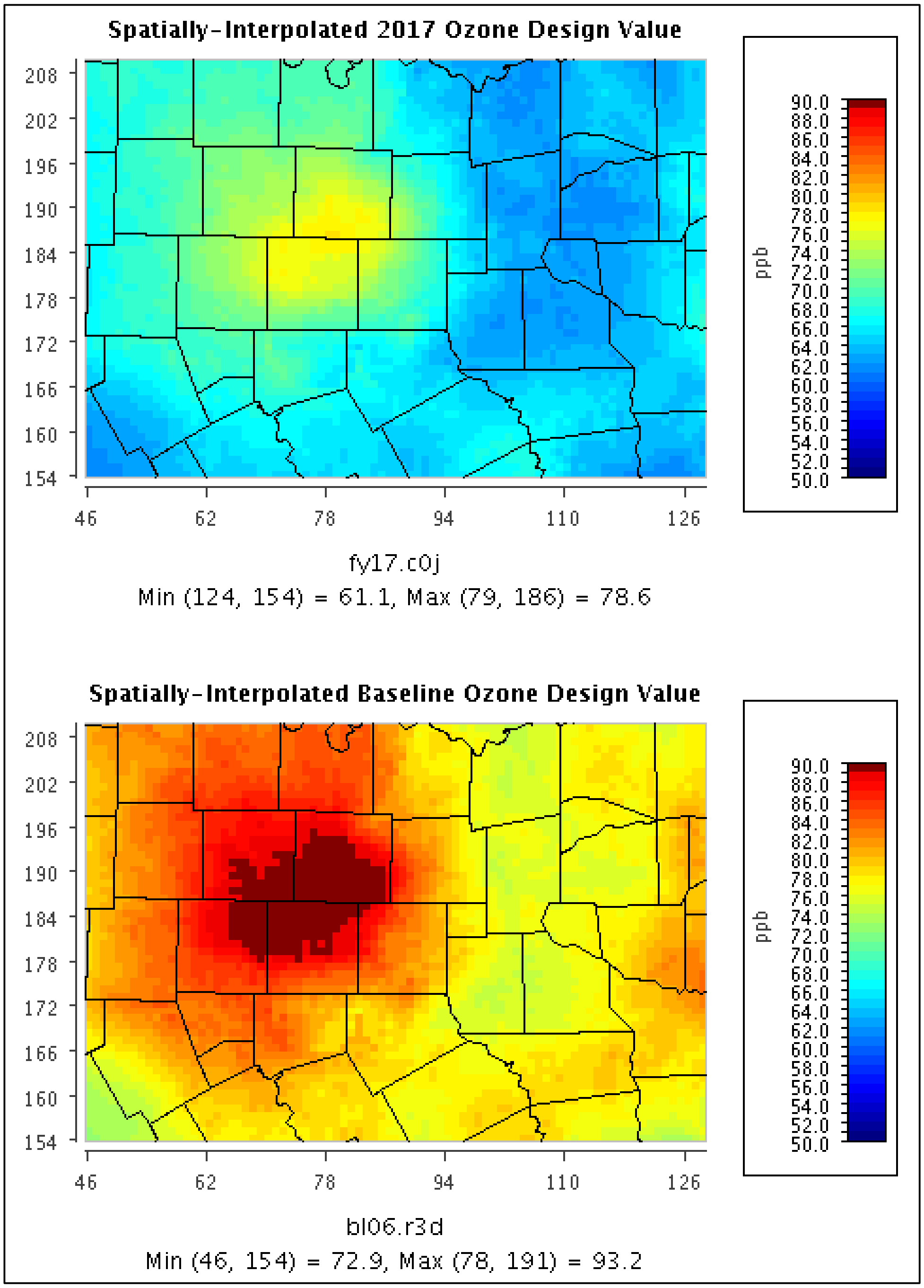



**Figure 3-34: Spatially Interpolated Ozone Design Values for the 2006 Baseline and 2017 Future Case**

## 3.8 MODELING ARCHIVE AND REFERENCES

### 3.8.1 Modeling Archive

The TCEQ has archived all modeling documentation and modeling input/output files generated as part of the 2017 DFW AD SIP revision modeling analysis. Interested parties can contact the TCEQ for information regarding data access or project documentation. Most modeling files and performance evaluation products may be found on the TCEQ modeling FTP site, (ftp://amdaftp.tceq.texas.gov/pub/TX/camx/).

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# CHAPTER 4: CONTROL STRATEGIES AND REQUIRED ELEMENTS

## 4.1 INTRODUCTION

The Dallas-Fort Worth (DFW) nonattainment area for the 2008 eight-hour ozone National Ambient Air Quality Standard (NAAQS), which consists of Collin, Dallas, Denton, Tarrant, Ellis, Johnson, Kaufman, Parker, Rockwall, and Wise Counties, includes a wide variety of major and minor industrial, commercial, and institutional entities. The Texas Commission on Environmental Quality (TCEQ) has implemented stringent and innovative regulations that address emissions of nitrogen oxides ($NO_X$) and volatile organic compounds (VOC) from these sources. This chapter describes existing ozone control measures for the DFW nonattainment area, as well as how Texas meets the following moderate ozone nonattainment area state implementation plan (SIP) requirements for the 2008 eight-hour ozone NAAQS: reasonably available control technology (RACT), reasonably available control measures (RACM), motor vehicle emissions budget (MVEB), and contingency measures.

## 4.2 EXISTING CONTROL MEASURES

Since the early 1990s, a broad range of control measures have been implemented for each emission source category for ozone planning in the DFW nonattainment area, formerly consisting of nine counties, Collin, Dallas, Denton, Tarrant, Ellis, Johnson, Kaufman, Parker, and Rockwall. Wise County was added to the nonattainment area for the 2008 eight-hour ozone NAAQS. Table 4-1: *Existing Ozone Control and Voluntary Measures Applicable to the DFW 10-County Nonattainment Area* lists the existing ozone control strategies that have been implemented for the one-hour and the 1997 and 2008 eight-hour ozone standards for all 10 counties comprising the DFW nonattainment area.

**Table 4-1: Existing Ozone Control and Voluntary Measures Applicable to the DFW 10-County Nonattainment Area**

| Measure | Description | Start Date(s) |
|---|---|---|
| Industrial, Commercial, and Institutional (ICI) Major Source Rule<br><br>30 Texas Administrative Code (TAC) Chapter 117, Subchapter B, Division 4 | Applies to all major sources (50 tons per year (tpy) of $NO_X$ or more) with affected units in Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, and Tarrant Counties<br><br>Applies to major sources (100 tpy of $NO_X$ or more) with affected units in Wise County<br><br>Affected source categories included in rule: boilers; process heaters; stationary gas turbines, and duct burners used in turbine exhaust ducts; lime kilns; heat treat and reheat metallurgical furnaces; stationary internal combustion engines; incinerators; glass, fiberglass, and mineral wool melting furnaces; fiberglass and mineral wool curing ovens; natural gas-fired ovens and heaters; brick and ceramic kilns; lead smelting reverberatory and blast furnaces; and natural gas-fired dryers used in organic solvent, printing ink, clay, brick, ceramic tile, calcining, and vitrifying processes | March 1, 2009 or March 1, 2010, depending on source category<br><br>Note: these $NO_X$ control requirements are in addition to the $NO_X$ control strategies previously implemented for ICI major sources in Collin, Dallas, Denton, and Tarrant Counties in March 2002 for the one-hour ozone NAAQS<br><br>January 1, 2017 for Wise County and for wood-fired boilers in all 10 counties of the DFW area |

| Measure | Description | Start Date(s) |
|---|---|---|
| ICI Minor Source Rule<br><br>30 TAC Chapter 117, Subchapter D, Division 2 | Applies to all minor sources (less than 50 tpy of $NO_X$) with stationary internal combustion engines in Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, and Tarrant Counties | March 1, 2009 for rich-burn gas-fired engines, diesel-fired engines, and dual-fuel engines<br><br>March 1, 2010 for lean-burn gas-fired engines |
| Stationary Diesel Engines<br><br>30 TAC Chapter 117, Subchapter B, Division 4 and Subchapter D, Division 2 | Prohibition on operating stationary diesel and dual-fuel engines for testing and maintenance purposes between 6:00 a.m. and noon in Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, and Tarrant Counties | March 1, 2009 |
| Major Utility Electric Generation Source Rule<br><br>30 TAC Chapter 117, Subchapter C, Division 4 | $NO_X$ control requirements for major source (50 tpy of $NO_X$ or more) utility electric generating facilities in Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, and Tarrant Counties<br><br>$NO_X$ control requirements for major source (100 tpy of $NO_X$ or more) utility electric generating facilities in Wise County<br><br>Applies to utility boilers, auxiliary steam boilers, stationary gas turbines, and duct burners used in turbine exhaust ducts used in electric power generating systems<br><br>Note: these $NO_X$ control requirements are in addition to the $NO_X$ control strategies implemented for utilities in Collin, Dallas, Denton, and Tarrant Counties in 2001 through 2005 for the one-hour ozone NAAQS | March 1, 2009 for Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, and Tarrant Counties<br><br>January 1, 2017 for Wise County |
| Utility Electric Generation in East and Central Texas<br><br>30 TAC Chapter 117, Subchapter E, Division 1 | $NO_X$ control requirements on utility boilers and stationary gas turbines (including duct burners used in turbine exhaust ducts) at utility electric generation sites in East and Central Texas, including Parker County | May 1, 2003 through May 1, 2005 |
| Cement Kiln Rule<br><br>30 TAC Chapter 117, Subchapter E, Division 2 | $NO_X$ control requirements for all Portland cement kilns located in Ellis County | March 1, 2009 |

| Measure | Description | Start Date(s) |
|---|---|---|
| Nitric Acid Manufacturing Rule – General<br><br>30 TAC Chapter 117, Subchapter F, Division 3 | $NO_X$ emission standards for nitric acid manufacturing facilities (state-wide rule – no nitric acid facilities in DFW) | November 15, 1999 |
| East Texas Combustion Sources Rule<br><br>30 TAC Chapter 117, Subchapter E, Division 4 | $NO_X$ control requirements for stationary rich-burn, gas-fired internal combustion engines (240 horsepower (hp) and greater)<br><br>Measure implemented to reduce ozone in the DFW nonattainment area although controls not applicable in the DFW nonattainment area | March 1, 2010 |
| Natural Gas-Fired Small Boilers, Process Heaters, and Water Heaters Rule<br><br>30 TAC Chapter 117, Subchapter E, Division 3 | $NO_X$ emission limits on small-scale residential and industrial boilers, process heaters, and water heaters equal to or less than 2.0 million British thermal units per hour in Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, and Tarrant Counties | May 11, 2000 |
| VOC Control Measures<br><br>30 TAC Chapter 115 | Control technology requirements for VOC sources for RACT and other SIP planning purposes including: storage, general vent gas, industrial wastewater, loading and unloading operations, general VOC leak detection and repair, solvent using processes, etc. | December 31, 2002 and earlier for Collin, Dallas, Denton, and Tarrant Counties<br><br>June 15, 2007 or March 1, 2009 for Ellis, Johnson, Kaufman, Parker, and Rockwall Counties<br><br>January 1, 2017 for Wise County |
| Degassing of Storage Tanks, Transport Vessels, and Marine Vessels Rule<br><br>30 TAC, Chapter 115, Subchapter F, Division 3 | VOC control requirements for degassing during, or in preparation of, cleaning any storage tanks and transport vessels | May 21, 2011 for Collin, Dallas, Denton, and Tarrant Counties |

| Measure | Description | Start Date(s) |
|---|---|---|
| Storage Tanks Rule<br><br>30 TAC Chapter 115, Subchapter B, Division 1 | Applies to major source storage tanks (50 tpy of VOC or more) in Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, and Tarrant Counties<br><br>Applies to major source storage tanks (100 tpy of VOC or more) in Wise County<br><br>Requires controls for slotted guidepoles and more stringent controls for other fittings on floating roof tanks, and control requirements or operational limitations on landing floating roof tanks<br><br>Eliminates exemption for storage tanks for crude oil or natural gas condensate and regulates flash emissions from these tanks | March 1, 2013<br><br>January 1, 2017 for major source storage tanks in Wise County and for new inspection requirements to control flashed gases from storage tanks and corresponding recordkeeping requirements for fixed roof storage tanks in all 10 counties of the DFW area |
| Solvent-Using Processes Rules<br><br>30 TAC Chapter 115, Subchapter E | Implements control, testing, monitoring and recordkeeping requirements for eight emission source categories in the DFW nonattainment area for degreasing, surface coating, solvent cleaning, printing, and adhesive application processes. Certain rules were updated based on the control techniques guidelines issued by the United States Environmental Protection Agency (EPA) between 2006 and 2008 (see Dallas-Fort Worth Attainment Demonstration SIP Revision for the 1997 Eight-Hour Ozone Standard Nonattainment Area (2010-022-SIP-NR)) | March 1, 2013 for Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, and Tarrant Counties<br><br>January 1, 2017 for Wise County<br><br>March 1, 2011 for major source offset lithographic printing lines and March 1, 2012 for minor source offset lithographic printing lines in Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, and Tarrant Counties |

| Measure | Description | Start Date(s) |
|---|---|---|
| Refueling – Stage I Rule<br><br>30 TAC, Chapter 115, Subchapter C, Division 2 | Captures gasoline vapors that are released when gasoline is delivered to a storage tank<br><br>Vapors returned to tank truck as storage tank is filled with fuel, rather than released into ambient air | 1990 for Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, and Tarrant Counties<br><br>January 1, 2017 for Wise County<br><br>A SIP revision related to Stage I regulations was approved by the EPA, effective June 29, 2015 |
| Refueling – Stage II Rule<br><br>30 TAC, Chapter 115, Subchapter C, Division 4 | Captures gasoline vapors when vehicle is fueled at pump<br><br>Vapors returned through pump hose to petroleum storage tank, rather than released into ambient air | 1992 (Collin, Dallas, Denton, and Tarrant Counties)<br><br>A SIP revision authorizing the decommissioning of Stage II vapor control equipment was approved by the EPA on March 17, 2014. Facilities may continue operating Stage II until August 31, 2018. |
| Texas Low Reid Vapor Pressure (RVP) Gasoline<br><br>30 TAC Chapter 114, Subchapter H, Division 1 | Requires all gasoline for both on-road and non-road use to have RVP of 7.8 pounds per square inch or less from May 1 through October 1 each year | April 2000 in Ellis, Johnson, Kaufman, Parker, Rockwall, and Wise Counties |
| Texas Low Emission Diesel (TxLED)<br><br>30 TAC Chapter 114, Subchapter H, Division 2 | Requires all diesel fuel for both on-road and non-road use to have a lower aromatic content and a higher cetane number | Phased in from October 31, 2005 through January 31, 2006 |
| Federal Area/Non-Road Measures | Series of emissions limits implemented by the EPA for area and non-road sources<br><br>Examples: diesel and gasoline engine standards for locomotives and leaf-blowers | Phase in through 2018 |

| Measure | Description | Start Date(s) |
|---|---|---|
| Texas Emissions Reduction Plan (TERP)<br><br>30 TAC Chapter 114, Subchapter K | Provides grant funds for on-road and non-road heavy-duty diesel engine replacement/retrofit. The first emissions reduction incentive grant projects funded under TERP were for fiscal years (FY) 2002-2003 (September 1, 2001, through August 31, 2003). To focus the emissions reduction benefits for the areas that needed them the most, applications were accepted only for projects in the Houston-Galveston-Brazoria (HGB) and DFW nonattainment areas for FY 2002-2003. An application period limited to DFW, HGB, and Beaumont-Port Arthur was done in 2006 and 2007. The allocation approach established by the commission for TERP included several grant programs for reducing emissions from mobile sources and encouraging the use of cleaner alternative fuels for transportation, including the Diesel Emissions Reduction Incentive Program providing grants to replace or upgrade heavy-duty on-road vehicles, non-road equipment, locomotives, marine vessels, and some stationary engines. | January 2002 |

| Measure | Description | Start Date(s) |
|---|---|---|
| Vehicle Inspection and Maintenance (I/M) Rule<br><br>30 TAC Chapter 114, Subchapter C | Yearly treadmill-type testing for pre-1996 vehicles and computer checks for 1996 and newer vehicles | May 1, 2002 in Collin, Dallas, Denton, and Tarrant Counties<br><br>May 1, 2003 in Ellis, Johnson, Kaufman, Parker, and Rockwall Counties<br><br>The DFW area meets the Federal Clean Air Act (FCAA), §182(b)(4) requirements to implement an I/M program, and according to 40 Code of Federal Regulations (CFR) §51.350(b)(2), an I/M program is required to cover the entire urbanized area based on the 1990 census. The current I/M program in the DFW ozone nonattainment area sufficiently covers a population equal to the DFW urbanized area, thus expansion of the I/M program to include Wise County is not required. |
| California Gasoline Engines | California standards for non-road gasoline engines 25 hp and larger | May 1, 2004 |
| Voluntary Mobile Emissions Reduction Program | Various pedestrian, bicycle, traffic, and mass transit voluntary measures administered by the North Central Texas Council of Governments (NCTCOG) (see Appendix H for more details) | 2007 |
| Voluntary Energy Efficiency/Renewable Energy (EE/RE) | EE/RE projects encouraged by the Texas Legislature are outlined in section 5.4.1.1 | See section 5.4.1.1 |

| Measure | Description | Start Date(s) |
|---|---|---|
| Federal On-Road Measures | Series of emissions limits implemented by the EPA for on-road vehicles<br><br>Included in measures: Tier 1, Tier 2, and Tier 3 light-duty and medium-duty passenger vehicle standards, heavy-duty vehicle standards, low sulfur diesel standards, National Low Emission Vehicle standards, and reformulated gasoline | Phase in through 2010<br><br>Tier 3 phase in from 2017 through 2025 |
| Transportation Control Measures | Various transportation-related, local measures implemented under the previous one-hour and 1997 eight-hour ozone NAAQS<br><br>NCTCOG has implemented all transportation control measure (TCM) commitments and provides an accounting of TCMs as part of the transportation conformity process.<br>TCMs are not required to be considered for a moderate nonattainment area. | May 2007 for TCM commitments under 1997 eight-hour ozone standard<br><br>August 1986 for TCM commitments under one-hour ozone standard |

## 4.3 UPDATES TO EXISTING CONTROL MEASURES (NO CHANGE)

### 4.3.1 Updates to $NO_X$ Control Measures (No change)

### 4.3.2 Updates to VOC Control Measures (No change)

### 4.3.3 Minor Source Stationary Diesel Engine Exemption (No change)

### 4.3.4 Decommissioning of Stage II Vapor Recovery (No change)

### 4.3.5 Updates to Stage I Vapor Recovery (No change)

## 4.4 NEW CONTROL MEASURES (NO CHANGE)

### 4.4.1 Stationary Sources (No change)

#### 4.4.1.1 $NO_X$ RACT Control Measures for Wise County (No change)

## 4.5 RACT ANALYSIS

### 4.5.1 General Discussion

Nonattainment areas classified as moderate and above are required to meet the mandates of the FCAA under §172(c)(1) and §182(b)(2) and (f). According to the EPA's 2008 eight-hour ozone SIP requirements rule (80 *Federal Register* [FR] 12264), states containing areas classified as moderate nonattainment or higher must submit a SIP revision to fulfill the RACT requirements for all control techniques guidelines (CTG) emission source categories and all non-CTG major sources of $NO_X$ and VOC. This SIP revision must also contain adopted RACT regulations, certifications where appropriate that existing provisions are RACT, and/or negative declarations that there are no sources in the nonattainment area covered by a specific CTG source category. The major source threshold for moderate nonattainment areas is a potential to emit 100 tpy or more of either $NO_X$ or VOC. The 100 tpy major source threshold applies in the newly designated Wise County. A 50 tpy major source threshold is retained for the remaining nine counties, which are currently classified as a serious nonattainment area under the 1997 eight-hour ozone NAAQS.

RACT is defined as the lowest emissions limitation that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility (44 FR 53762, September 17, 1979). RACT requirements for moderate and higher classification nonattainment areas are included in the FCAA to assure that significant source categories at major sources of ozone precursor emissions are controlled to a reasonable extent, but not necessarily to best available control technology (BACT) levels expected of new sources or to maximum achievable control technology (MACT) levels required for major sources of hazardous air pollutants.

While RACT and RACM have similar consideration factors like technological and economic feasibility, there is a significant distinction between RACT and RACM. A control measure must advance attainment of the area towards meeting the NAAQS for that measure to be considered RACM. Advancing attainment of the area is not a factor of consideration when evaluating RACT because the benefit of implementing RACT is presumed under the FCAA.

In 2008, the EPA approved the DFW $NO_X$ rules in 30 TAC Chapter 117 (73 FR 73562). In 2009, the EPA approved the DFW VOC rules in 30 TAC Chapter 115 and $NO_X$ rules for cement kilns in 30 TAC Chapter 117 as meeting the FCAA RACT requirements (74 FR 1903 and 74 FR 1927). In 2014, the EPA approved the 30 TAC Chapter 115 rules for VOC storage tanks as meeting the FCAA RACT requirements (79 FR 53299). State regulations in Chapter 115 that implement the controls recommended in CTG or alternative control techniques (ACT) documents or that implement equivalent or superior emission control strategies were determined to fulfill RACT requirements for any CTG or ACT documents issued prior to 2006 for the nine-county DFW 1997 eight-hour ozone nonattainment area.

The EPA issued 11 CTG documents between 2006 and 2008 with recommendations for VOC controls on a variety of consumer and commercial products. The RACT analysis included in the DFW Attainment Demonstration SIP revision for the 1997 Eight-Hour Ozone Standard adopted on March 10, 2010 addressed the following three CTG documents:

- Flat Wood Paneling Coatings, Group II issued in 2006;
- Offset Lithographic and Letterpress Printing, Group II issued in 2006; and
- Fiberglass Boat Manufacturing Materials, Group IV issued in 2008.

The RACT analysis included in the DFW Attainment Demonstration SIP Revision for the 1997 Eight-Hour Ozone Standard adopted on December 7, 2011 addressed the remaining eight CTG documents:

- Flexible Packaging Printing Materials, Group II issued in 2006;
- Industrial Cleaning Solvents, Group II issued in 2006;
- Large Appliance Coatings, Group III issued in 2007;
- Metal Furniture Coatings, Group III issued in 2007;
- Paper, Film, and Foil Coatings, Group III issued in 2007;
- Miscellaneous Industrial Adhesives, Group IV issued in 2008;
- Miscellaneous Metal and Plastic Parts Coatings, Group IV issued in 2008; and
- Auto and Light-Duty Truck Assembly Coatings, Group IV issued in 2008.

In 2014, the EPA approved the 30 TAC Chapter 115 rules for offset lithographic printing as meeting the FCAA RACT requirements (79 FR 45105). In 2015, the EPA approved the DFW VOC rules in 30 TAC Chapter 115 addressing the remaining CTGs issued between 2006 and 2008, in addition to approving the DFW RACT analysis as meeting the FCAA RACT requirements for all affected VOC and $NO_X$ sources under the 1997 eight-hour ozone NAAQS (80 FR 16291).

TCEQ rules that are consistent with or more stringent than controls implemented in other nonattainment areas were also determined to fulfill RACT requirements. Federally approved state rules and rule approval dates can be found in 40 CFR §52.2270(c), EPA Approved Regulations in the Texas SIP. Emission sources subject to the more stringent BACT or MACT requirements were determined to also fulfill RACT requirements.

The TCEQ fulfilled FCAA RACT requirements for the 2008 eight-hour ozone NAAQS as part of the 2018 DFW Attainment Demonstration (AD) SIP revision for the 2008 eight-hour ozone NAAQS submitted to the EPA on July 10, 2015. However, as part of this 2017 DFW AD SIP revision, the TCEQ reviewed the 2013 point source emissions inventory to verify that all CTG or ACT emission source categories and non-CTG or non-ACT major emission sources in the DFW nonattainment area were subject to requirements that meet or exceed the applicable RACT requirements, or that further emission controls on the sources were either not economically feasible or not technologically feasible. The TCEQ concluded that RACT is in place for all emission sources in the DFW area and that no additional rulemaking is necessary as part of this 2017 DFW AD SIP Revision.

### 4.5.2 $NO_X$ RACT Determination (No change)

### 4.5.3 VOC RACT Determination (No change)

## 4.6 RACM ANALYSIS

### 4.6.1 General Discussion

FCAA, §172(c)(1) requires states to provide for implementation of all RACM as expeditiously as practicable and to include RACM analyses in the SIP. In the general preamble for implementation of the FCAA Amendments published in the April 16, 1992 issue of the *Federal Register* (57 FR 13498), the EPA explains that it interprets FCAA, §172(c)(1) as a requirement that states incorporate into their SIP all RACM that would advance a region's attainment date; however, states are obligated to adopt only those measures that are reasonably available for implementation in light of local circumstances.

The TCEQ used a two-step process to develop the list of potential control strategies evaluated during the RACM analysis for the 2018 DFW AD SIP for the 2008 eight-hour ozone NAAQS submitted to the EPA on July 10, 2015. The same list was used for this 2017 DFW AD SIP revision. First, the TCEQ compiled a list of potential control strategy concepts based on an initial evaluation of the existing control strategies in the DFW nonattainment area and existing sources of VOC and $NO_X$ in the DFW nonattainment area. The EPA allows states the option to consider control measures outside the ozone nonattainment area that can be shown to advance attainment; however, consideration of these sources is not a requirement of the FCAA. A draft list of potential control strategy concepts was developed from this initial evaluation. The TCEQ also invited stakeholders to suggest any additional strategies that might help advance attainment of the DFW nonattainment area. The final list of potential control strategy concepts for RACM analysis includes the strategies on the initial draft list and the strategies suggested by stakeholders during the informal stakeholder comment process.

Each control measure identified through the control strategy development process was evaluated to determine if the measure would meet established criteria to be considered reasonably available. The TCEQ used the general criteria specified by the EPA in the proposed approval of the New Jersey RACM analysis published in the January 16, 2009 issue of the *Federal Register* (74 FR 2945):

> *RACM is defined by the EPA as any potential control measure for application to point, area, on-road and non-road emission source categories that meets the following criteria:*
>
> - *The control measure is technologically feasible;*
> - *The control measure is economically feasible;*
> - *The control measure does not cause "substantial widespread and long-term adverse impacts;"*
> - *The control measure is not "absurd, unenforceable, or impracticable;"*
> - *The control measure can advance the attainment date by at least one year.*

The EPA did not provide guidance in the *Federal Register* notice on how to interpret the criteria "advance the attainment date by at least one year." Considering the July 20, 2018 attainment date for this 2017 DFW AD SIP revision, the TCEQ evaluated this aspect of RACM based on advancing the deadline for implementing control measures by one year, to July 20, 2017. As a result of the December 23, 2014 court decision that vacated the previous December 31, 2018 attainment date, the commission reevaluated RACM as part of this 2017 DFW AD SIP revision based on the new attainment date of July 20, 2018, since the new attainment year is now 2017.

In order for a control measure to "advance attainment," it would need to be implemented prior to the beginning of ozone season in the attainment year, so suggested control measures that could not be implemented by March 1, 2017 could not be considered RACM because the measures would not advance attainment. To "advance the attainment date by at least one year" to July 20, 2017, suggested control measures would have to be fully implemented by March 1, 2016. In order to provide a reasonable amount of time to fully implement a control measure, the following must be considered: availability and acquisition of materials; the permitting process; installation time; and the time and resources necessary for implementation of testing and monitoring to demonstrate compliance.

The TCEQ also considered whether the control measure was similar or identical to control measures already in place in the DFW nonattainment area. If the suggested control measure would not provide substantive and quantifiable benefit over the existing control measure, then the suggested control measure was not considered RACM because reasonable controls were already in place. Tables G-1: *DFW Area Stationary Source RACM Analysis* and G-2: *DFW Area On-Road and Non-Road Mobile Source RACM Analysis* of Appendix G: *RACM Analysis* presents the final list of potential control measures as well as the RACM determination for each measure.

### 4.6.2 Results of the RACM Analysis

Based on the RACM analysis, the TCEQ determined that no potential control measures met the criteria to be considered RACM. All potential control measures evaluated for stationary sources were determined to not be RACM due to technological or economic feasibility, enforceability, adverse impacts, or ability of the measure to advance attainment of the NAAQS. In general, the inability to advance attainment is the primary determining factor in the RACM analyses. As discussed in Chapter 3: *Photochemical Modeling* and Chapter 5: *Weight of Evidence* of this 2017 DFW AD SIP revision, the current modeling results in conjunction with the weight of evidence analysis indicate that the DFW area will demonstrate attainment. Modeling results based on the April 2007 EPA modeling guidance project the future ozone design value to be 77 parts per billion (ppb). Use of the newer EPA draft guidance projects this 2018 future ozone design value to be 76 ppb. These 2018 design values and the weight of evidence analysis included in Chapter 5 of this 2017 DFW AD SIP revision demonstrate attainment of the 2008 eight-hour ozone NAAQS. Based on a July 20, 2018 attainment deadline, a control measure would have to be in place by March 1, 2017 (prior to the beginning of ozone season in the attainment year) to be considered RACM. Furthermore, a control measure would have to be in place by March 1, 2016 in order for the measure to advance the attainment date by one year; to July 20, 2017; and it is not possible for the TCEQ to reasonably implement any control measures that would provide for earlier attainment of the NAAQS. Specifically, there is not adequate time to adopt additional rule requirements and have these rules go into effect or for sources to acquire, install, permit, and/or begin operation prior to this date. Negative RACM determinations for potential control measures that were based on technological or economic feasibility, enforceability, or adverse impacts remain relevant, regardless of attainment year.

## 4.7 MVEB

The MVEB refers to the maximum allowable emissions from on-road mobile sources for each applicable criteria pollutant or precursor as defined in the SIP. The budget must be used in transportation conformity analyses. Areas must demonstrate that the estimated emissions from transportation plans, programs, and projects do not exceed the MVEB. The attainment budget represents the summer weekday on-road mobile source emissions that have been modeled for the AD, and includes all of the on-road control measures reflected in Chapter 4: *Control Strategies and Required Elements* of the demonstration. The on-road emission inventory establishing this MVEB was developed with the 2014 version of the Motor Vehicle Emission Simulator (MOVES2014) model, and is shown in Table 4-2: *2017 Attainment Demonstration MVEB for the 10-County DFW Area*. For additional detail, refer to Chapter 3 of Appendix B*: Emissions Modeling for the DFW Attainment Demonstration SIP Revision for the 2008 Eight-Hour Ozone Standard.*

**Table 4-2: 2017 Attainment Demonstration MVEB for the 10-County DFW Area**

| 10-County DFW Area On-Road Emissions Inventory Description | $NO_X$ tons per day (tpd) | VOC (tpd) |
|---|---|---|
| 2017 On-Road MVEB Based on MOVES2014 | 130.77 | 64.91 |

## 4.8 MONITORING NETWORK

The TCEQ operates a variety of monitors in support of assessing ambient air quality throughout the state of Texas. These monitors meet the requirements for several federally required networks including the State or Local Air Monitoring Stations network (SLAMS), Photochemical Assessment Monitoring Stations network, Chemical Speciation Network, National Air Toxics Trends Stations network, and National Core Multipollutant Monitoring Stations network.

The Texas annual monitoring network plan provides information on ambient air monitors established to meet federal ambient monitoring requirements including comparison to the NAAQS. Under 40 CFR §58.10, all states are required to submit an annual monitoring network plan to the EPA by July 1 of each year. The annual monitoring network plan is made available for public inspection for at least 30 days prior to submission to the EPA. The plan and any comments received during the 30 day inspection period are forwarded to the EPA for final review and approval. The TCEQ's 2015 plan presented the current Texas network, as well as proposed changes to the network from July 1, 2015, through December 31, 2016. The plan was posted for public comment from May 15, 2015, through June 14, 2015, and was submitted to the EPA on July 1, 2015.

The current DFW area monitoring network in 2015 includes 20 regulatory ozone monitors. There are 17 ozone monitors located in Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, and Tarrant Counties and an additional three ozone monitors in Navarro, Hood, and Hunt Counties. The TCEQ ensures compliance with monitoring siting criteria and data quality requirements for these and all other federally required monitors in accordance with 40 CFR Part 58. The TCEQ utilizes this data to support determinations regarding air quality in the DFW nonattainment area.

## 4.9 CONTINGENCY PLAN (NO CHANGE)

## 4.10 REFERENCES

EPA, 1993. $NO_X$ Substitution Guidance (https://www3.epa.gov/ttn/oarpg/t1/memoranda/noxsubst.pdf)

EPA, 2005. Clean-Fuel Vehicle Standards, no. CCD-05-1

# CHAPTER 5: WEIGHT OF EVIDENCE

## 5.1 INTRODUCTION

The corroborative analyses presented in this chapter demonstrate the progress that the Dallas-Fort Worth (DFW) nonattainment area is making towards attainment of the 2008 eight-hour ozone National Ambient Air Quality Standard (NAAQS) of 75 parts per billion (ppb). This corroborative information supplements the photochemical modeling analysis presented in Chapter 3: *Photochemical Modeling* to support a conclusion that the DFW nonattainment area will reach attainment of the 2008 eight-hour ozone standard by July 20, 2018. The United States Environmental Protection Agency's (EPA) *Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze* (EPA, 2007) states that all modeled attainment demonstrations (AD) should include supplemental evidence that the conclusions derived from the basic attainment modeling are supported by other independent sources of information. This chapter details the supplemental evidence, i.e., the corroborative analyses, for this AD.

This chapter describes analyses that corroborate the conclusions of Chapter 3. First, information regarding trends in ambient concentrations of ozone, ozone precursors, and reported emissions in the DFW nonattainment area is presented. Analyses of ambient data and reported emissions trends corroborate the modeling analyses and independently support the AD. An overview is provided of background ozone levels transported into the DFW nonattainment area. More detail on these ozone and emission trends is provided in Appendix D: *Conceptual Model for the DFW Attainment Demonstration SIP Revision for the 2008 Eight-Hour Ozone Standard*. Second, this chapter also discusses the results of additional air quality studies and their relevance to the DFW AD. Third, this chapter describes air quality control measures that are not quantified but are nonetheless expected to yield tangible air quality benefits, even though they were not included in the AD modeling discussed in Chapter 3. Finally, information is provided to inform the public regarding on-going initiatives that are expected to improve the scientific understanding of ozone formation in the DFW nonattainment area.

## 5.2 ANALYSIS OF AMBIENT TRENDS AND EMISSION TRENDS

When development work on this 2017 DFW AD state implementation plan (SIP) revision commenced in 2012, the EPA's April 2007 *Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze* (http://www3.epa.gov/ttn/scram/guidance/guide/final-03-pm-rh-guidance.pdf ) (EPA, 2007) was the latest modeling guidance available. The EPA released an update to this guidance in December 2014 entitled *Draft Modeling Guidance for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze* (http://www3.epa.gov/ttn/scram/guidance/guide/Draft_O3-PM-RH_Modeling_Guidance-2014.pdf) (EPA, 2014). The April 2007 document will be referred to as either the "2007 guidance" or "2007 modeling guidance," and the December 2014 one will be referred to as the "draft guidance" or "draft modeling guidance." Section 7.0: *How Can Additional Analyses Be Used to Support the Attainment Demonstration?* of the 2007 guidance states that a simple way to qualitatively assess progress toward attainment is to examine recently observed air quality and emissions trends. Downward trends in observed air quality and in emissions (past and projected) are consistent with progress toward attainment. The strength of evidence produced by emissions and air quality trends is increased if an extensive monitoring network exists, which is the case in an area like DFW that currently has 20 operational monitors for ozone, 15 for nitrogen oxides ($NO_X$), and 15 automated gas chromatographs (Auto-GC) for volatile organic compounds (VOC). More detail on these specific locations and pollutants measured per monitor can be found on the Texas Commission on Environmental Quality (TCEQ) Air Monitoring Sites

Web page. (https://www.tceq.texas.gov/airquality/monops/sites/mon_sites.html). This section examines the emissions and ambient trends from the extensive ozone and ozone precursor monitoring network in the DFW area. Despite a continuous increase in the population of the 10-county DFW nonattainment area, a strong economic development pattern, and growth in vehicle miles traveled (VMT), the observed emission trends are downward for ozone and its precursors of $NO_X$ and VOC. More details regarding ambient and emissions trends are included in Appendix D.

Appendix D provides an extensive set of graphics that detail ozone trends in the region from 1991 through 2014. The graphics and analyses also illustrate the wealth of monitoring data examined including regulatory ozone monitors and a network of Auto-GCs. The one-hour and the eight-hour ozone design values both have overall sustained decreasing trends over the past 18 years. The DFW area has monitored attainment of the revoked one-hour ozone standard since 2006. At the end of the 2014 ozone season, the eight-hour design value was 81 ppb, which is in attainment of the 1997 eight-hour ozone standard of 84 ppb. No monitor in the region had measured a fourth high in 2014 above the 1997 standard of 84 ppb, and only two had fourth highs in 2014 above the 2008 ozone standard of 75 ppb. These 2014 fourth high values of 77 ppb and 79 ppb were measured at the Denton Airport South and Fort Worth Northwest monitors, respectively. As of 2015, the Denton Airport South monitor has a design value of 83 ppb.

An analysis conducted by the TCEQ (https://www.tceq.texas.gov/assets/public/implementation/air/am/committees/pmt_dfw/20131105/20131105-DFW-Ozone-75ppb-Kite.pdf) and presented at a DFW area air quality technical meeting in November 2013 graphically shows changes in design value by monitor over the period 2003 through 2013 with the largest reduction of design values at the northwestern area monitors that historically have recorded the highest ozone levels. For example, the Keller monitor design value dropped 15 ppb in that period and Grapevine Fairway dropped 14 ppb. Additional analyses tracked the historic fourth highest eight-hour ozone levels at five northwest DFW monitors from 2001 to 2013. When 2012 and 2013 are examined, there is a strong suggestion that the 2011 fourth highest levels monitored may be outliers in the downward trend. These 2011 fourth-high values are included in the DFW nonattainment area design value calculations from 2011 through 2013, but are not part of the 2014 and 2015 design value determinations. The ozone measurements through 2015 combined with the overall historic ozone trends at all DFW area monitors suggest that the region will reach attainment of the 2008 standard by July 20, 2018.

As documented in Chapter 2: *Anthropogenic Emissions Inventory Description* of this 2017 DFW AD SIP revision, emissions trends examined through reported and developed inventories support the downward trends in ozone and ozone precursors observed through the measurements of pollutant concentrations at monitors. While $NO_X$ emissions are more significant in the formation of ozone in the DFW nonattainment area, VOC trends are examined as well. On-road mobile sources are the single largest contributors to $NO_X$ emissions in the DFW nonattainment area. According to the TCEQ emissions inventory (EI) estimates for 2011, on-road mobile represents 54% of the total $NO_X$ for the DFW nonattainment area, non-road and off-road mobile accounts for 26.3%, area sources account for 10.3%, and point sources account for 9.1%. The downward trend in total $NO_X$ emissions is in large part due to the downward trends in $NO_X$ emissions from on-road mobile sources. Even though human population and VMT in the DFW nonattainment area have both increased roughly 38% from 1999 to 2014, $NO_X$ emission trends from on-road mobile sources as well as total $NO_X$ emissions have decreased since 1999, due largely due to targeted emissions reductions strategies implemented by state rules, federal measures, and local initiatives. Mobile strategies are listed with all existing DFW emission reduction strategies in Table 4-1: *Existing Ozone Control and Voluntary Measures Applicable to the DFW Nine-County Nonattainment Area* of this 2017 DFW AD SIP revision. $NO_X$ emissions from point sources, over which the TCEQ does have more direct regulatory control compared with mobile sources, have shown decreases of 62% over the past 16 years. Ambient $NO_X$ monitoring data corroborate these trends in reported emissions, with decreases in ambient $NO_X$ monitoring concentrations observed in the DFW nonattainment area over the past 17 years.

Since the mid-1990s, the TCEQ has collected 40-minute measurements on an hourly basis of up to 58 VOC compounds using Auto-GC instruments. These instruments automatically measure and report chemical compounds resident in ambient air. The TCEQ has also employed two types of ambient monitoring canisters in the DFW nonattainment area, one that samples ambient air over a 24-hour period and another that samples ambient air for a single hour at a time, usually at four different times of day. Since 1999, peak VOC concentrations above the 90th percentile have generally trended downward. During the same time period, mean VOC concentrations trended downward until roughly 2005 and have been relatively constant since 2006. On-road VOC emission trends discussed later in this chapter show a more distinct downward trend for 1999-2005 than for 2006-and-later years. Ozone formation in DFW is much more sensitive to anthropogenic $NO_X$ than to anthropogenic VOC. This is due to the primarily $NO_X$-limited character of ozone formation in DFW, coupled with an abundance of naturally occurring reactive VOC from biogenic sources, such as isoprene emitted by oak trees. Much of the anthropogenic VOC emitted in the DFW nonattainment area is in the form of compounds with relatively low reactivity such as ethane and propane. Appendix D provides more detail on these VOC trend analyses and their impacts on ozone formation in DFW.

The Anthropogenic Precursor Culpability Assessment and Ozone Source Apportionment Technology (OSAT) analyses detailed in Chapter 3 and Appendix C: *Photochemical Modeling for the DFW Attainment Demonstration SIP Revision for the 2008 Eight-Hour Ozone Standard* indicate that emission sources outside of the 10-county DFW nonattainment area also contribute to the eight-hour ozone concentrations within the 10-county DFW nonattainment area. On average, the ozone produced outside of the DFW nonattainment area, in addition to the natural background ozone, accounts for a large portion of the maximum ozone concentrations within the DFW nonattainment area. Analyses (Berlin et al., 2013; Cooper et al., 2012) suggest that background ozone is trending downward across the United States (U.S.), which can reduce peak ozone in the DFW nonattainment area. The EPA Air Quality Trends Web page (http://www.epa.gov/airtrends/aqtrends.html) highlights the significant percent changes in $NO_X$ reductions between 2000 and 2013. Some of these $NO_X$ reductions can be attributed to strategies implemented in Texas. For example, electric generating units (EGU) in the counties east of the DFW nonattainment area, which is the area that is predominately upwind on high ozone days, have reduced emissions of $NO_X$ by about 58% over the past 16 years.

As part of the examination of emissions trends, it is also important to examine the variability of $NO_X$ concentrations by the day of the week. As discussed in Chapter 3, $NO_X$ concentrations are lower on Saturdays and Sundays compared to weekdays. The lower concentrations of ozone precursors on weekends are likely due to the absence of morning commuter traffic during that time. This finding further supports the conclusion that lowering $NO_X$ reduces ozone since $NO_X$ is the primary precursor in ozone formation when naturally occurring reactive VOC from biogenic sources is abundant.

The VOC or $NO_X$ limitation of an air mass is an important way to evaluate how immediate reductions in VOC and $NO_X$ concentrations affect ozone concentrations. A detailed analysis of the DFW nonattainment area's $NO_X$ or VOC limitation is included in Appendix D. Ozone responds best to VOC reductions in VOC-limited areas and to $NO_X$ reductions in $NO_X$-limited areas. In transitional areas, both VOC and $NO_X$ reductions should be effective. Analysis of VOC to $NO_X$ ratios indicates that the urban core of the DFW nonattainment area is transitional and trending towards $NO_X$-limitation, while the more rural parts of the DFW nonattainment area are $NO_X$-limited and are trending towards more strongly $NO_X$-limited. Because the DFW nonattainment area overall is trending towards $NO_X$-limited and the northwest locations of the design value setting monitors are $NO_X$-limited, this result also supports reducing $NO_X$ as a method to control ozone overall in the DFW nonattainment area.

It is more difficult to control ozone in the urban core because the emissions in that area, which is transitional and not strongly $NO_X$-limited, are primarily from on-road mobile sources, for which the TCEQ has limited authority to regulate. However, both state and federal regulation have resulted in estimated downward trends in $NO_X$ emission and VOC emissions since 1999 from on-road and non-road mobile emission inventories. These reductions have contributed to the downward trend in ozone levels monitored within the urban core during the same 15 year period. More detail regarding emissions trends can be found in Chapter 3 as well as in Section 5.2.2.1: *$NO_X$ Emission Trends* of this chapter. The ambient ozone and emissions trends briefly discussed above lead to the following conclusions:

- Emissions of $NO_X$, VOC, and their monitored ambient concentrations have been decreasing across the DFW nonattainment area, despite a rapidly expanding population and strong continued economic development over a sustained period as documented by the Federal Reserve Bank of Dallas Economic Indicators (http://www.dallasfed.org/research/update/dfw/index.cfm).
- Observed $NO_X$ concentrations and reported $NO_X$ emissions are both trending downward, which suggests lower ozone concentrations should follow in an area that is primarily $NO_X$-limited.
- The decrease in $NO_X$ emissions is largely due to reductions of on-road and non-road mobile sources, which are the largest source of $NO_X$ in the DFW nonattainment area. The reductions can be attributed to an increasingly modern and cleaner motor vehicle fleet, as well as implementation of on-road control programs such as inspection and maintenance, Texas Emission Reduction Plan (TERP), and Texas Low Emission Diesel. In addition, controls on point sources both in the DFW nonattainment area and statewide continue to contribute to these $NO_X$ reductions.
- Modeled emissions from on-road and non-road mobile sources as well as trend analyses indicate that $NO_X$ concentrations will continue trending downward out to the modeled attainment year of 2017 and beyond.
- The one-hour ozone design value has decreased from 140 ppb when the 1990 Clean Air Act Amendments were signed to 102 ppb in 2015. The eight-hour ozone design value decreased from 100 ppb in 2003 to 83 ppb in 2015.
- Given the currently implemented control programs, total DFW nonattainment area $NO_X$ in 2017 is expected to be reduced by roughly 49% from 2006 levels, with projected $NO_X$ reductions of 54% for both on-road sources and non-road sources. More detail is contained in Chapter 3 on these expected reductions from 2006 through 2017.

Accordingly, the strong and lasting historic downward trends in observed air quality and in emissions (past and projected) are consistent with progress toward attainment and are positive evidence supporting the results of the photochemical modeling documented in Chapter 3, indicating that the DFW nonattainment area will attain the 2008 ozone NAAQS by July 20, 2018.

### 5.2.1 Ozone Design Value and Background Ozone Trends

As noted above, eight-hour ozone design values have decreased over the past 18 years, as shown in Figure 5-1: *One-Hour and Eight-Hour Ozone Design Values in the DFW Area from 1997 through 2014*. The 2015 one-hour ozone design value is 102 ppb, which demonstrates continued attainment of the revoked one-hour ozone NAAQS, at levels substantially below the one-hour ozone standard. The 2015 eight-hour ozone design value for the DFW nonattainment area is 83 ppb at Denton Airport South, which is in attainment of the former 84 ppb standard and demonstrates progress toward the current 75 ppb standard. This monitor is located to the north-northwest of the DFW nonattainment area, which is downwind of the urban core considering prevailing winds.

The trend line for the one-hour ozone design value shows a decrease of about 2.1 ppb per year, but the trend line for the eight-hour ozone design value only shows a decrease of about 1.1 ppb per year. The one-hour ozone design values decreased about 27% from 1991 through 2015 and the eight-hour ozone design values decreased about 21% over that same time. The slower change in the eight-hour ozone design values compared to the one-hour ozone design values could relate to the background ozone, which appears to affect the eight-hour ozone much more than the one-hour ozone.

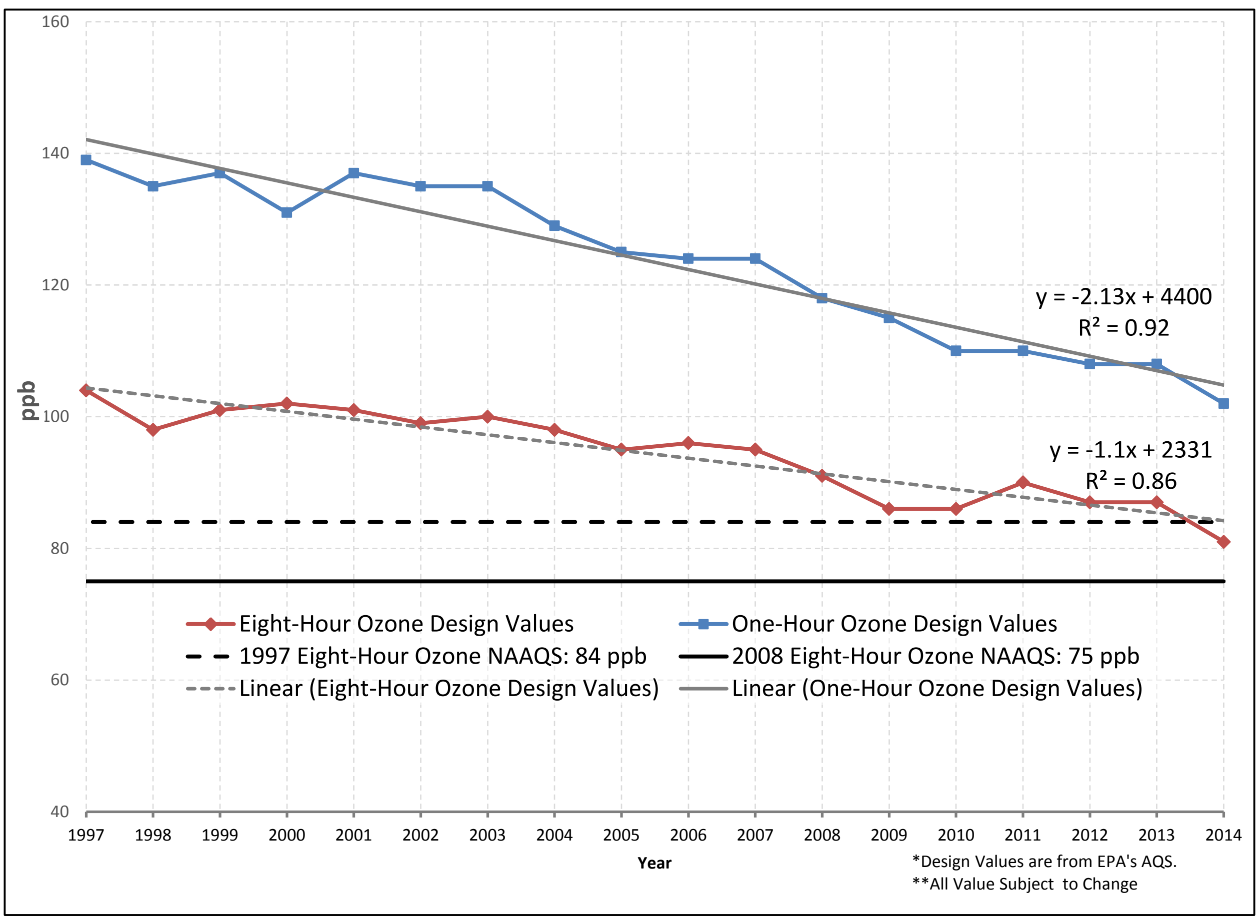


**Figure 5-1: One-Hour and Eight-Hour Ozone Design Values in the DFW Area from 1997 through 2014**

A background ozone trend analysis was conducted to define background ozone and the ozone concentration carried into the DFW nonattainment area. Background ozone reflects the ozone produced from all sources outside of the 10-county DFW nonattainment area. Continental and natural background ozone concentrations are generally assumed to be about 40 ppb. Ozone levels in the DFW nonattainment area are the sum of the background ozone entering the area and the locally produced ozone. The local ozone contribution is found by subtracting the background ozone concentration from the maximum ozone concentration.

To obtain the background ozone concentrations, monitors outside of the urban core were identified. Out of this subset of background ozone monitors, the minimum ozone concentration was identified during the time that the maximum ozone concentration was measured. This minimum eight-hour ozone concentration is considered the background ozone for the DFW nonattainment area. Figure 5-2: *Eight-Hour Ozone in the DFW area from 1997 through 2014* shows that in the DFW nonattainment area, the average background ozone contribution is a larger part of the maximum eight-hour ozone than the local ozone contribution. The inter-seasonal variability in the peak ozone concentrations seems to come from the seasonal variability in the background ozone concentrations as opposed to the local ozone contributions. Because background ozone contributes a large portion of the total eight-hour ozone in the DFW nonattainment area, it would be difficult to see large decreases in the eight-hour ozone concentration if the background ozone does not also decrease.

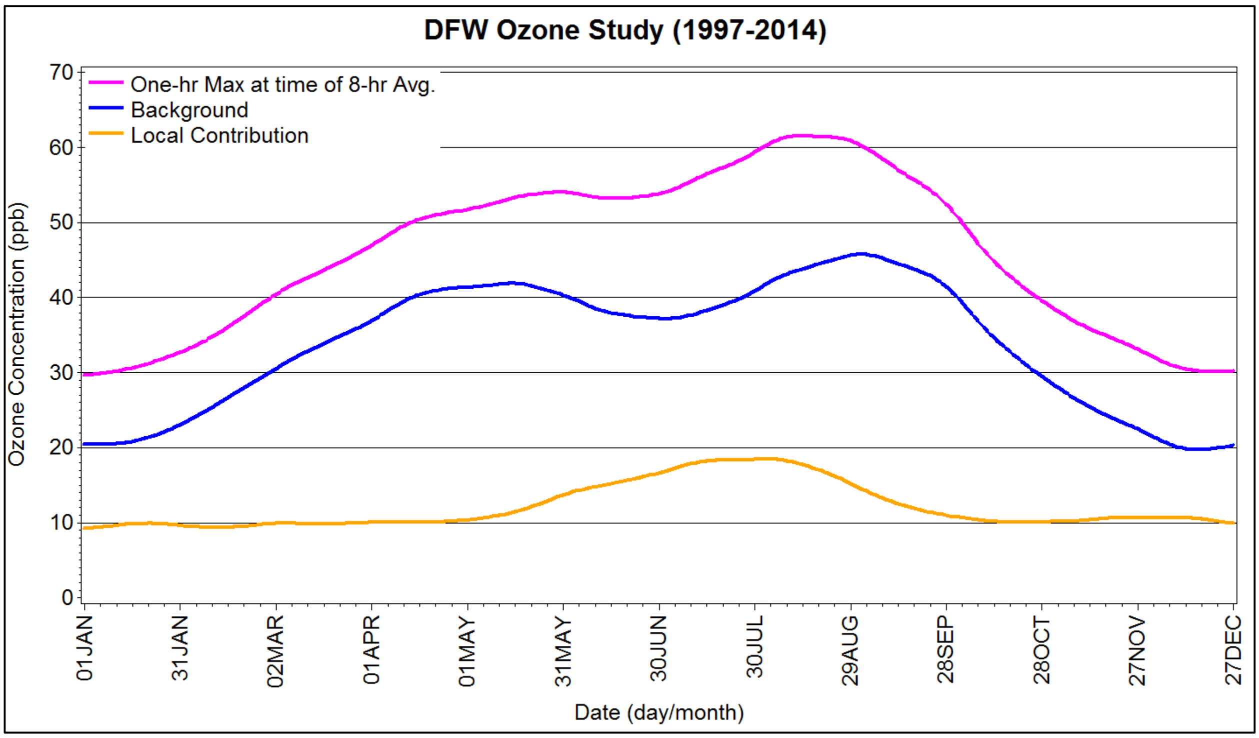


**Figure 5-2: Eight-Hour Ozone in the DFW Area from 1997 through 2014**

Using a similar method, the TCEQ conducted an analysis to determine the background trend in eight-hour ozone for the period from 1997 through 2014. Results from this analysis are shown in Figure 5-3: *DFW Background Ozone for 1997 through 2014*. The findings show that there is a slight downward trend in the background ozone. The percent change in average background ozone from the 1997 to 2014 ozone seasons is 4.51%, and the percent change in the 95th percentile average ozone concentrations is 5.67% over that same time. The current estimated average background ozone in the DFW nonattainment area is 52 ppb, but can vary greatly depending on the day of interest. Evidence of background eight-hour ozone in the DFW nonattainment area is another positive factor indicating support for the photochemical modeling results documented in Chapter 3.

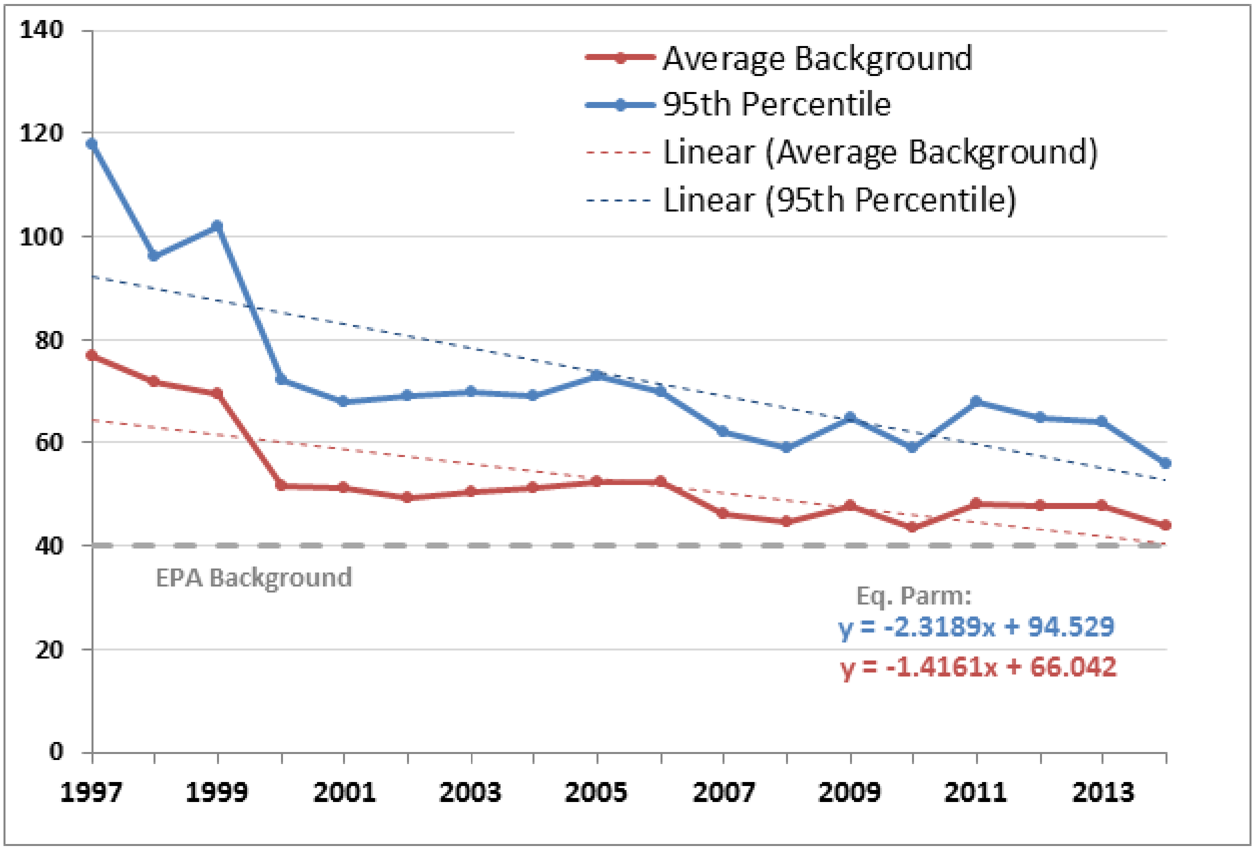


**Figure 5-3: DFW Background Ozone for 1997 through 2014**

### 5.2.2 $NO_X$ Trends

$NO_X$, a precursor to ozone formation, is a mixture of nitrogen oxide and nitrogen dioxide ($NO_2$). $NO_X$ is primarily emitted by fossil fuel combustion, lightning, biomass burning, and soil (Martin, et al., 2006). Examples of common $NO_X$ emission sources in urban areas are automobiles, diesel engines, other small engines, residential water heaters, industrial heaters, flares, and industrial and commercial boilers. Mobile, residential, and commercial $NO_X$ sources are usually numerous smaller sources distributed over a large geographic area, while industrial sources are usually large point sources, or numerous small sources, clustered in a small geographic area. Because of the large number of $NO_X$ sources, elevated ambient $NO_X$ concentrations can occur throughout the DFW nonattainment area. This section will discuss trends in both $NO_X$ emissions and ambient $NO_X$ concentrations. The overall downward trends in both $NO_X$ emissions and ambient $NO_X$ concentrations in the DFW nonattainment area are another positive factor indicating support for the photochemical modeling results documented in Chapter 3.

#### 5.2.2.1 $NO_X$ Emission Trends

DFW nonattainment area anthropogenic emissions are from the following four aggregate categories: point sources, on-road mobile sources, non-road mobile sources, and area sources. Specific industry types can be categorized under one or more of these aggregate groups. The data used in this trend analysis come from several sources. Companies in the DFW nonattainment area report annual point source EI data. The Texas Transportation Institute

(TTI) prepared the on-road mobile source emission inventories for the TCEQ. The TCEQ prepared the area and the non-road mobile source data for 2006 and 2017 using EPA-approved models and techniques.

The annually reported point source $NO_X$ emissions from 1997 through 2012 are shown in Figure 5-4: *Reported Point Source $NO_X$ Emissions for the 10-County DFW Area*. The emissions are reported in tons per year (tpy) and are aggregated by year. The aggregation is of all $NO_X$ sources located within the 10 counties of the DFW nonattainment area. The graph shows an overall downward trend in $NO_X$ emissions and the pattern closely matches that of the observed $NO_X$ concentrations at the DFW nonattainment area monitors, which will be shown later in this document.

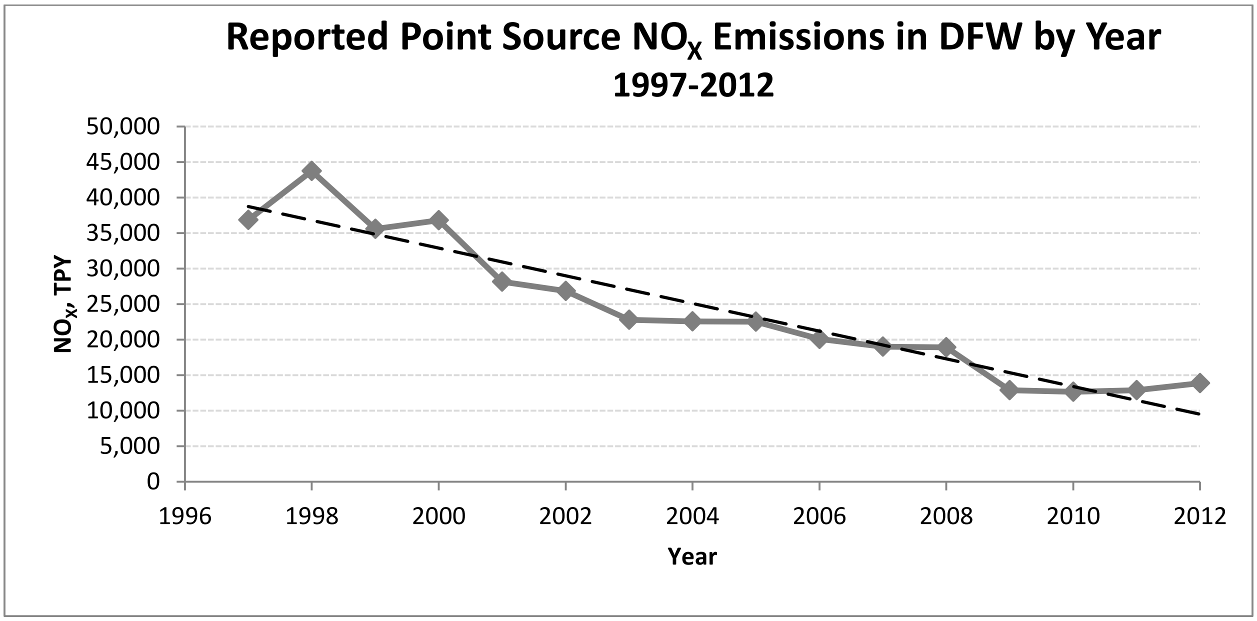


**Figure 5-4: Reported Point Source $NO_X$ Emissions for the 10-County DFW Area**

Historically, much of the point source $NO_X$ emission reductions have come from cement kilns located within Ellis County. In 2007, a source cap for cement kilns in Ellis County was adopted (30 Texas Administrative Code §117.3123). In 2008, 2010, and 2011, further reductions were achieved with changes in cement kiln operations and shutdown of certain processes and kilns. In large part, the downward trends in reported emissions are attributable to the reductions and facility shutdowns in Ellis County.

The decrease in point source $NO_X$ emissions from 1997 through 2012 is seen more clearly in Figure 5-5: *Reported Point Source $NO_X$ Emissions by DFW County*. Ellis County reports the greatest amounts of point source $NO_X$ emissions as well as the greatest reductions in point source $NO_X$ emissions. A large portion of these reductions took place from 2006 to 2009. Other large reductions in point source $NO_X$ emissions can be seen in Dallas and Tarrant Counties due to the implementation of many of the point source rules summarized in Table 4-1. The remaining counties consistently report substantially lower point source $NO_X$ emissions, with no appreciable trend over the 2006 to 2009 period. Since Wise County was designated nonattainment in 2012, some facilities have only recently started to report as point sources because they exceed the 25 $NO_X$ tpy and/or 10 VOC tpy thresholds applicable to nonattainment counties. Newly reported $NO_X$ sources in Wise County are reflected by a small increase in the point source $NO_X$ emission totals for the 2011 and 2012 periods.

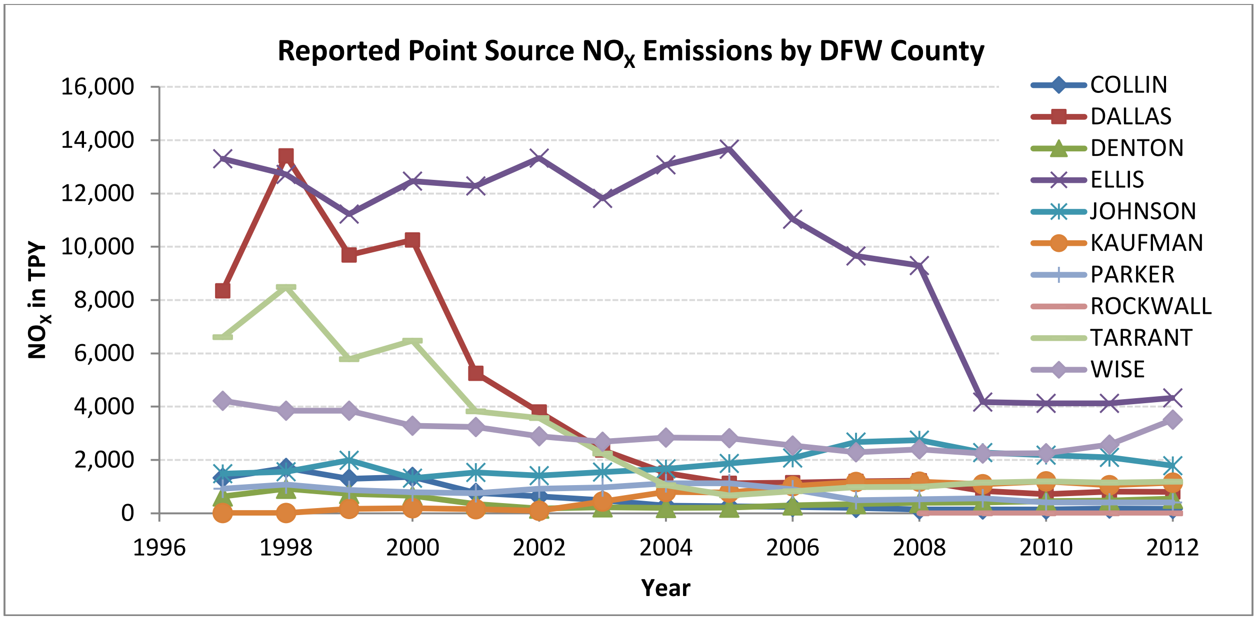


**Figure 5-5: Reported Point Source $NO_X$ Emissions by DFW County**

Other point sources of $NO_X$ are EGUs located within and outside of the DFW nonattainment area. $NO_X$ emissions from EGUs are displayed in Figure 5-6: *Trends in EGU $NO_X$ Emissions in the DFW 10-County Area* and show a downward trend due to the implementation of EGU rules described in Table 4-1. $NO_X$ emissions from EGUs in the 10-county DFW nonattainment area have decreased by 88.9% from 1997 through 2012.

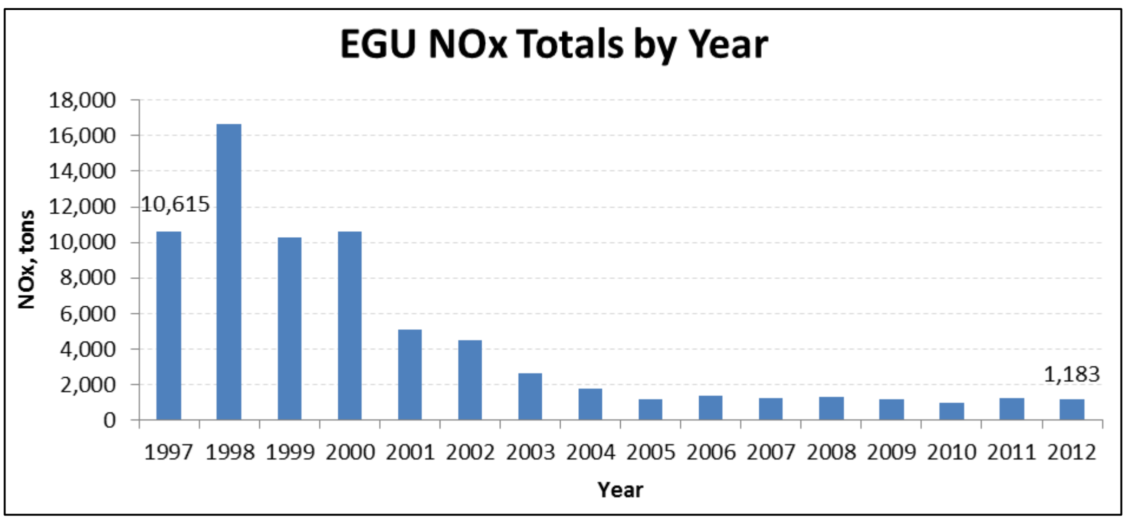


**Figure 5-6: Trends in EGU $NO_X$ Emissions in the DFW 10-County Area**

On-road mobile sources are the biggest contributor to $NO_X$ emissions in the DFW nonattainment area. With on-road mobile $NO_X$ sources accounting for over half of the total $NO_X$ emissions in the DFW nonattainment area, it is important to discuss the trends in $NO_X$ emissions for this source category. TTI has estimated the emissions of $NO_X$, VOC, carbon monoxide, and VMT from 1999 through 2050 using the 2014 version of the EPA's Motor Vehicle Emission Simulator (MOVES2014) model. Figure 5-7: *MOVES2014 10-County DFW Area On-Road Emission Trends for 1999 through 2050* shows the results of this work from TTI. The estimates show that $NO_X$ emissions have and will continue to decrease through to year 2037, though at different rates over time. These emission decreases occur even though VMT is projected to increase out to 2050 because cleaner newer vehicles will continuously replace higher-emitting older ones. The downward trend in $NO_X$ emissions from on-road sources mirrors the trends in ambient $NO_X$ concentrations observed at urban monitors, which will be discussed in the following section. If the downward trend in on-road $NO_X$ emissions continues as projected, observed $NO_X$ concentrations would be expected to decrease as well, thus reducing ozone-producing precursors in the DFW airshed.

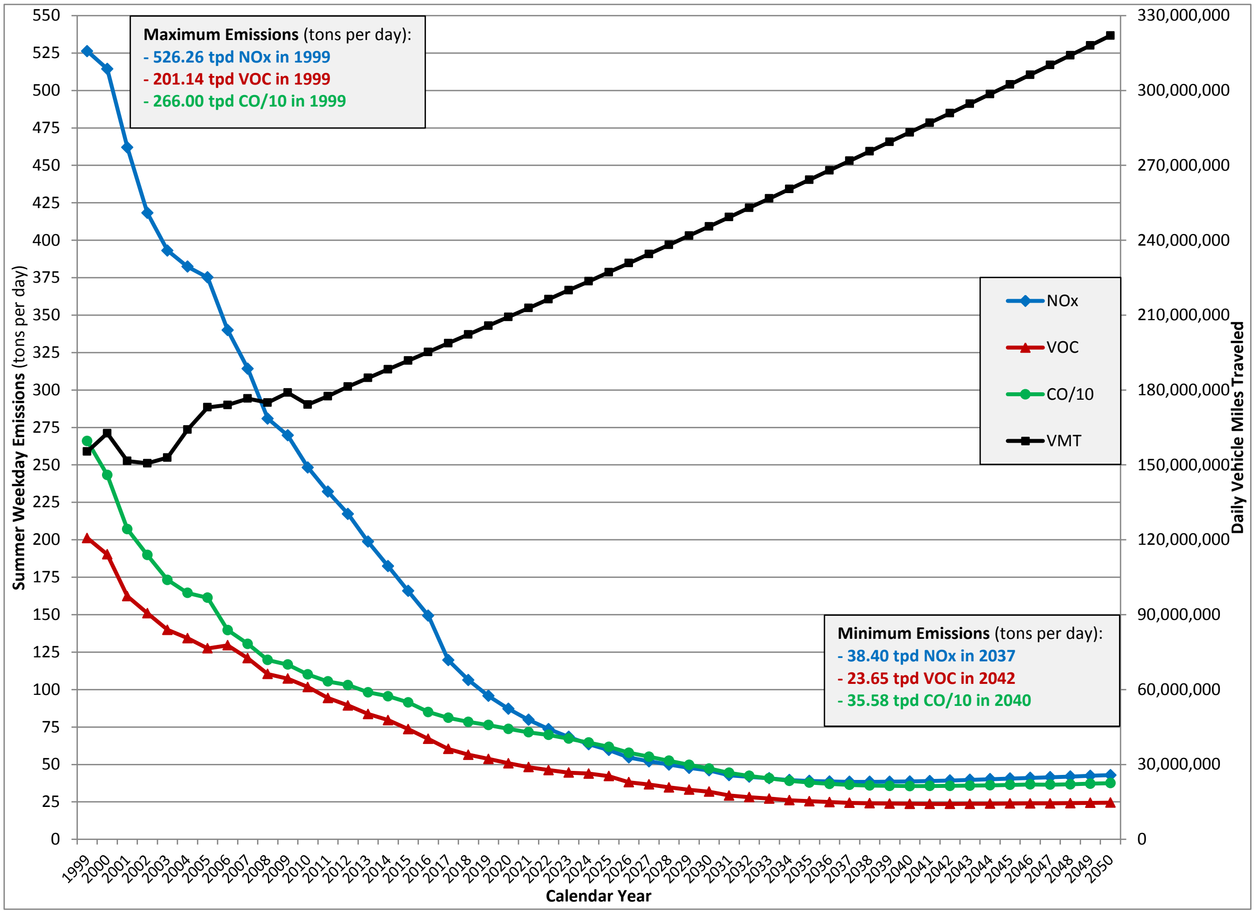


**Figure 5-7: MOVES2014 10-County DFW Area On-Road Emission Trends for 1999 through 2050**

Similar to on-road, the non-road source category contributes a significant amount to total $NO_X$ emissions in the DFW nonattainment area. Emission projections of non-road $NO_X$ emissions were estimated using the Texas NONROAD (TexN) model, and are shown in Figure 5-8: *TexN DFW Area Non-Road Emission Trends for 2000 through 2050*. The results show that $NO_X$ emissions from non-road sources will decrease through year 2031, though at different rates over time. Since on-road and non-road $NO_X$ sources account for the vast majority of $NO_X$ emissions in the DFW nonattainment area, and since these two source categories are projected to have continuously lower emissions over the next several years, and because ozone production is dependent on $NO_X$ emissions, it is expected that future ozone concentrations will also be reduced.

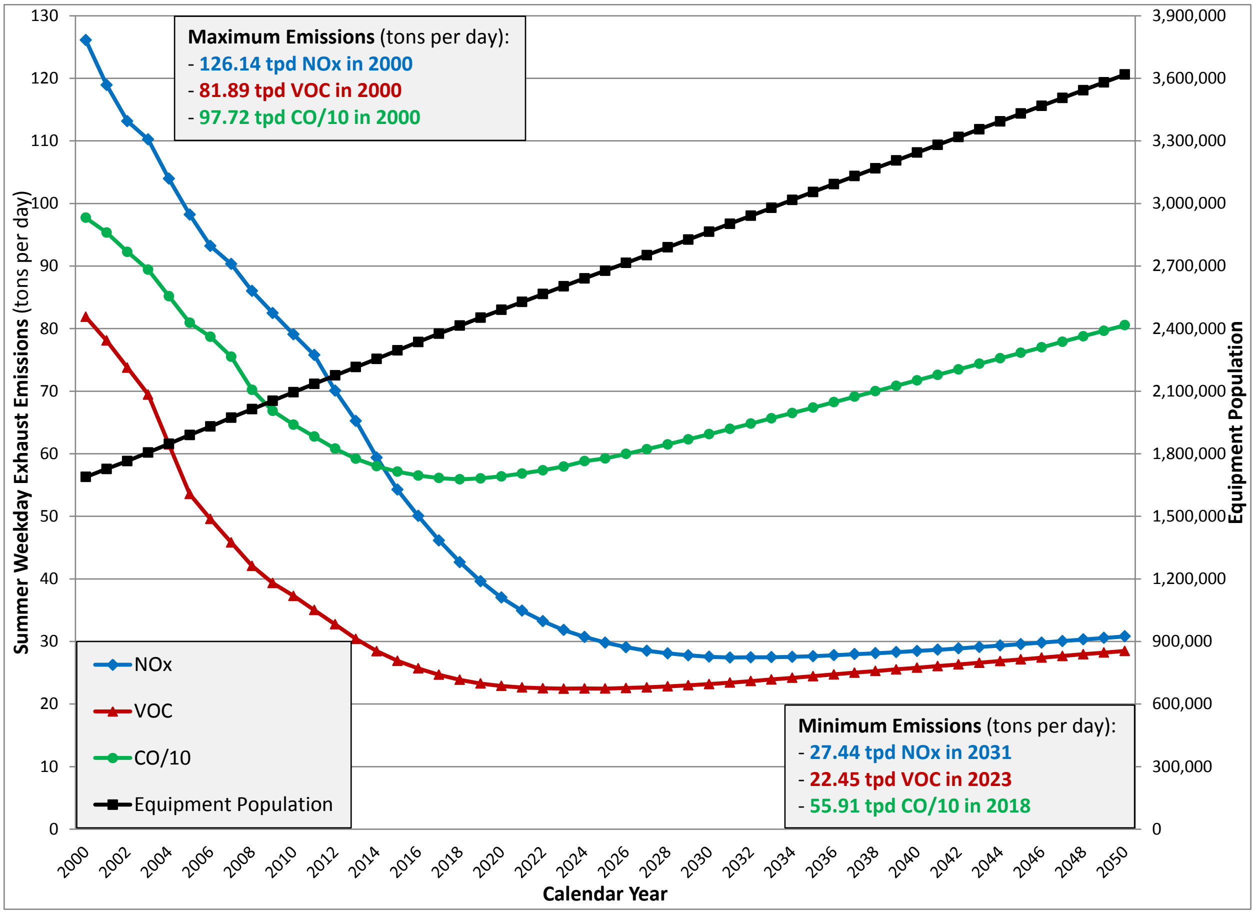


**Figure 5-8: TexN DFW Area Non-Road Emission Trends for 2000 through 2050**

### 5.2.2.2 Ambient $NO_X$ Trends

Trends for ambient $NO_X$ concentrations are presented in Figure 5-9: *Ozone Season (March through October) Daily Peak $NO_X$ Trends in the DFW Area*. Trends are for the ozone season (March through October) and represent the 90th percentile, the 50th percentile, and the 10th percentile of daily peak $NO_X$ concentrations in the DFW nonattainment area. The largest $NO_X$ concentrations and the median $NO_X$ concentrations in the DFW nonattainment area appear to be decreasing over time, while the 10th percentile concentrations have remained flat. A dotted line is provided to highlight the trend in ambient $NO_X$ concentrations.

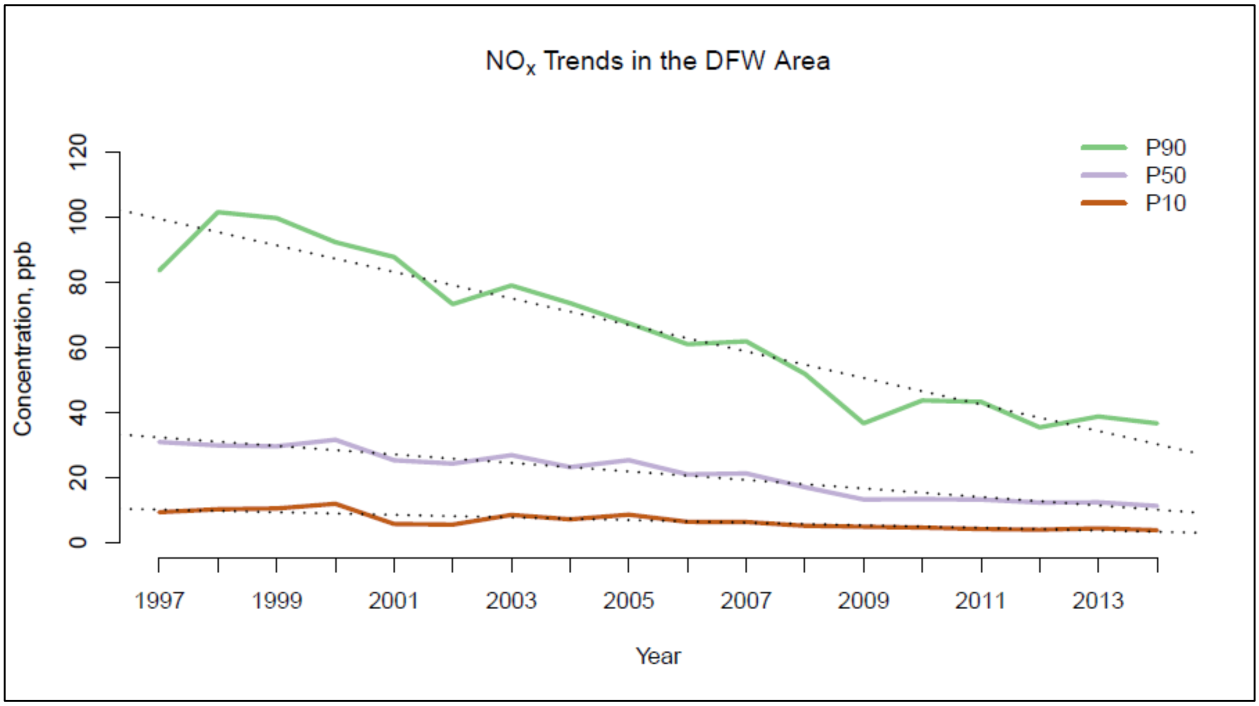


**Figure 5-9: Ozone Season (March through October) Daily Peak $NO_X$ Trends in the DFW Area**

The $NO_X$ trends in the DFW nonattainment area are more pronounced at urban monitors as seen in Figure 5-10: *90th Percentile Daily Peak $NO_X$ Concentrations in the DFW Area*. The downward trends in ambient $NO_X$ concentrations are observed at all monitors except at the Parker County monitor, for which the trend is flat. The Parker County monitor measures the lowest $NO_X$ concentrations because it is located in a rural area 34 miles west of the Fort Worth area with very little on-road activity or nearby $NO_X$ sources. All other monitors, however, demonstrate downward $NO_X$ trends. The monitors with smaller downward trends do not record high $NO_X$ concentrations, mostly because they are rural monitors with little on-road activity. The typical ozone design value setting monitors (Denton Airport South, Keller, and Grapevine Fairway) show downward trends in ambient $NO_X$ concentrations. Because of the prevailing winds during ozone season, these monitors also observe transported $NO_X$ from the DFW urban areas and benefit from lower transported $NO_X$ emissions.

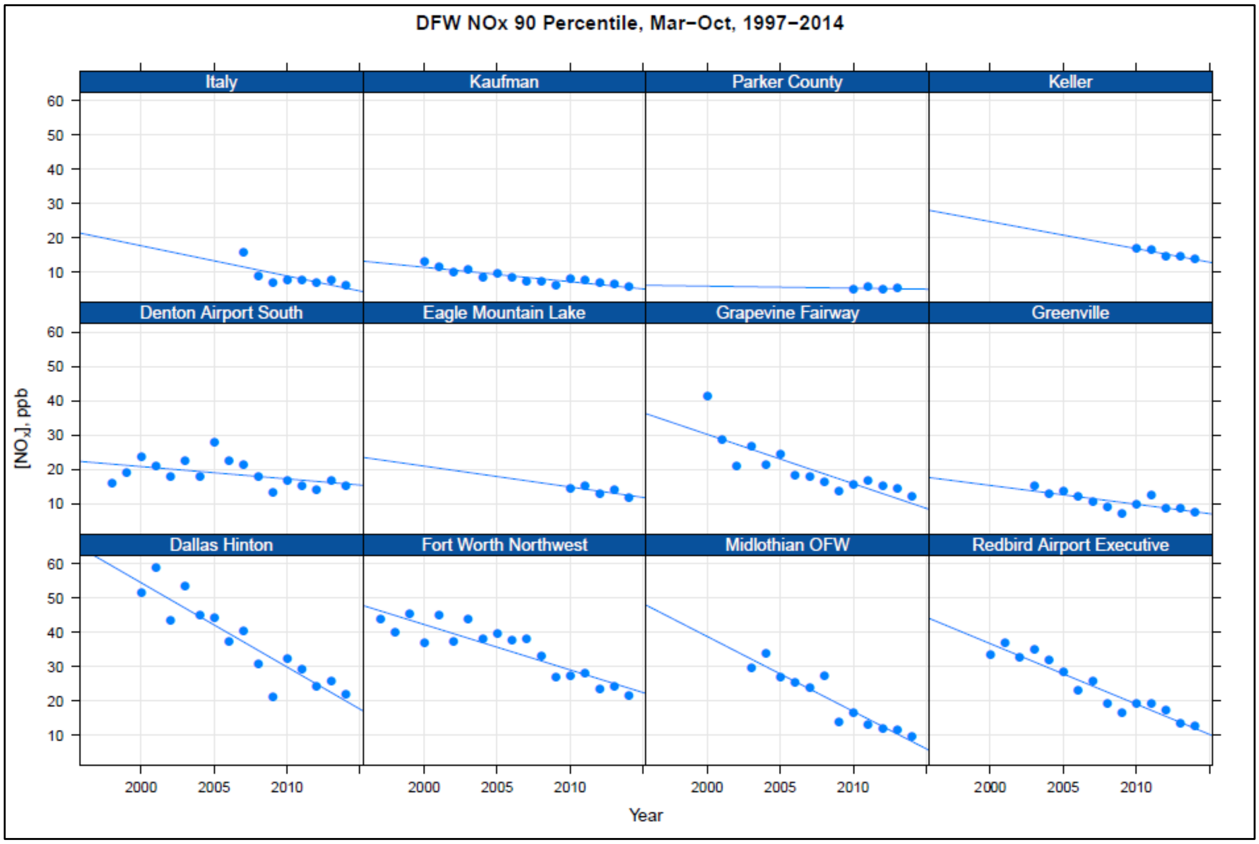


**Figure 5-10: 90th Percentile Daily Peak $NO_X$ Concentrations in the DFW Area**

Ambient $NO_X$ concentrations in the overall DFW nonattainment area are trending downward, especially in the DFW urban areas. This downward trend results from the state controls placed on point sources, along with the federal standards implemented for on-road vehicles and non-road equipment.

### 5.2.3 VOC and $NO_X$ Limitations

The VOC and $NO_X$ limitation of an air mass can help determine how immediate reductions in VOC and $NO_X$ concentrations might affect ozone concentrations. A $NO_X$-limited region occurs where the radicals from VOC oxidation are abundant, and therefore the ozone formation is more sensitive to the amount of $NO_X$ present in the atmosphere. In these regions, controlling $NO_X$ would be more effective in reducing the ozone concentrations. In VOC-limited regions, $NO_X$ is abundant, and therefore the ozone formation is more sensitive to the amount of radicals from VOC oxidation present in the atmosphere. In VOC-limited regions, controlling VOC emissions would be more effective in reducing the ozone concentrations. Areas where ozone formation is not strongly limited by either VOC or $NO_X$ are considered transitional, and controlling either VOC or $NO_X$ emissions would reduce ozone concentrations in these regions.

The annual median VOC to $NO_X$ ratios at the Dallas Hinton Street, Eagle Mountain Lake, and Fort Worth Northwest Auto-GC monitors are shown in Figure 5-11: *Trend in VOC to $NO_X$ ratios using AutoGC Data*. VOC to $NO_X$ ratios at the three AutoGC monitors show that the DFW nonattainment area is becoming more $NO_X$-limited over time. The Dallas Hinton Street and Fort Worth Northwest monitors were VOC-limited, but have begun to trend towards $NO_X$-limited, and are currently showing transitional conditions. This result can be attributed to the lower ambient $NO_X$ concentrations due to $NO_X$ reductions taking place in the urban DFW nonattainment area.

The more rural Eagle Mountain Lake monitor is $NO_X$-limited and shows a trend towards even more $NO_X$-limited conditions. This monitor not only observes biogenic emissions and oil and gas emissions, but also observes emissions from the urban DFW nonattainment area because it is located downwind of the urban core. Because total VOC emissions at this monitor are not increasing, the increase in the VOC to $NO_X$ ratio can be attributed to decreasing $NO_X$ emissions from the urban DFW nonattainment area.

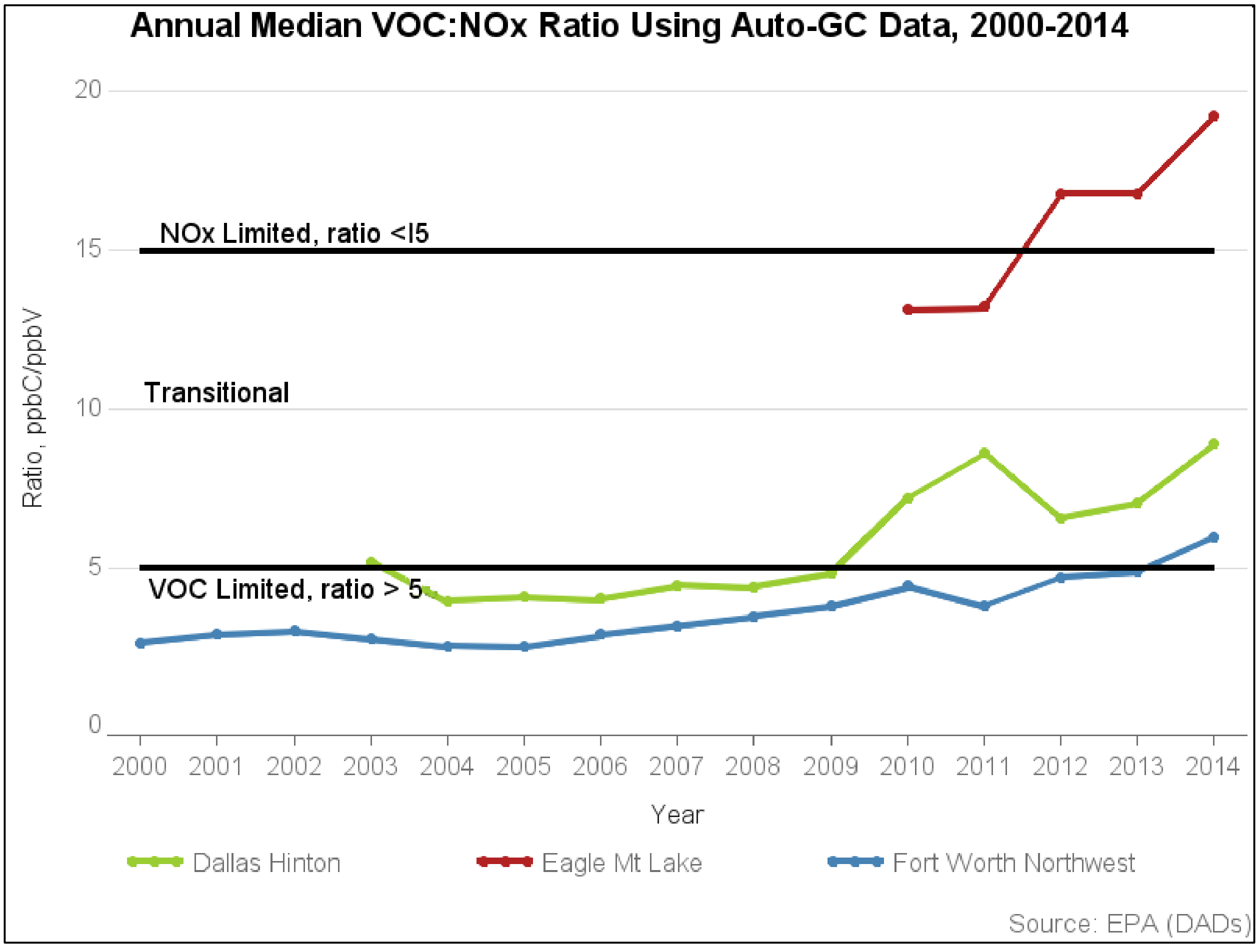


**Figure 5-11: Trend in VOC to $NO_X$ Ratios Using AutoGC Data**

This evidence of continued $NO_X$-limitation in the DFW nonattainment area is another positive factor indicating support for the photochemical modeling results which also indicate the $NO_X$-limited nature of the DFW nonattainment area, as documented in Chapter 3.

### 5.2.4 Weekday/Weekend Effect

The trends in $NO_X$ concentrations by day of the week show how local control strategies might affect the ozone concentrations. Examining the way ozone behaves on days with lower $NO_X$ concentrations will help demonstrate how ozone might behave if there were overall reductions in $NO_X$. To investigate if there is a day of the week effect in the DFW nonattainment area, $NO_X$ concentrations were calculated by the day of the week from 1997 through 2014. The $NO_X$ data at Fort Worth Northwest are from 2003 and 2004 only.

Results displayed in Figure 5-12: *Day of Week $NO_X$ Concentrations* show that at urban monitors, weekends observe lower $NO_X$ than most weekdays. This implies that there is less $NO_X$ generated on weekends, most likely due to less on-road activity as discussed in Chapter 3 and Appendix C. Since $NO_X$ is a precursor to ozone formation, controlling $NO_X$ should in turn reduce ozone concentrations.

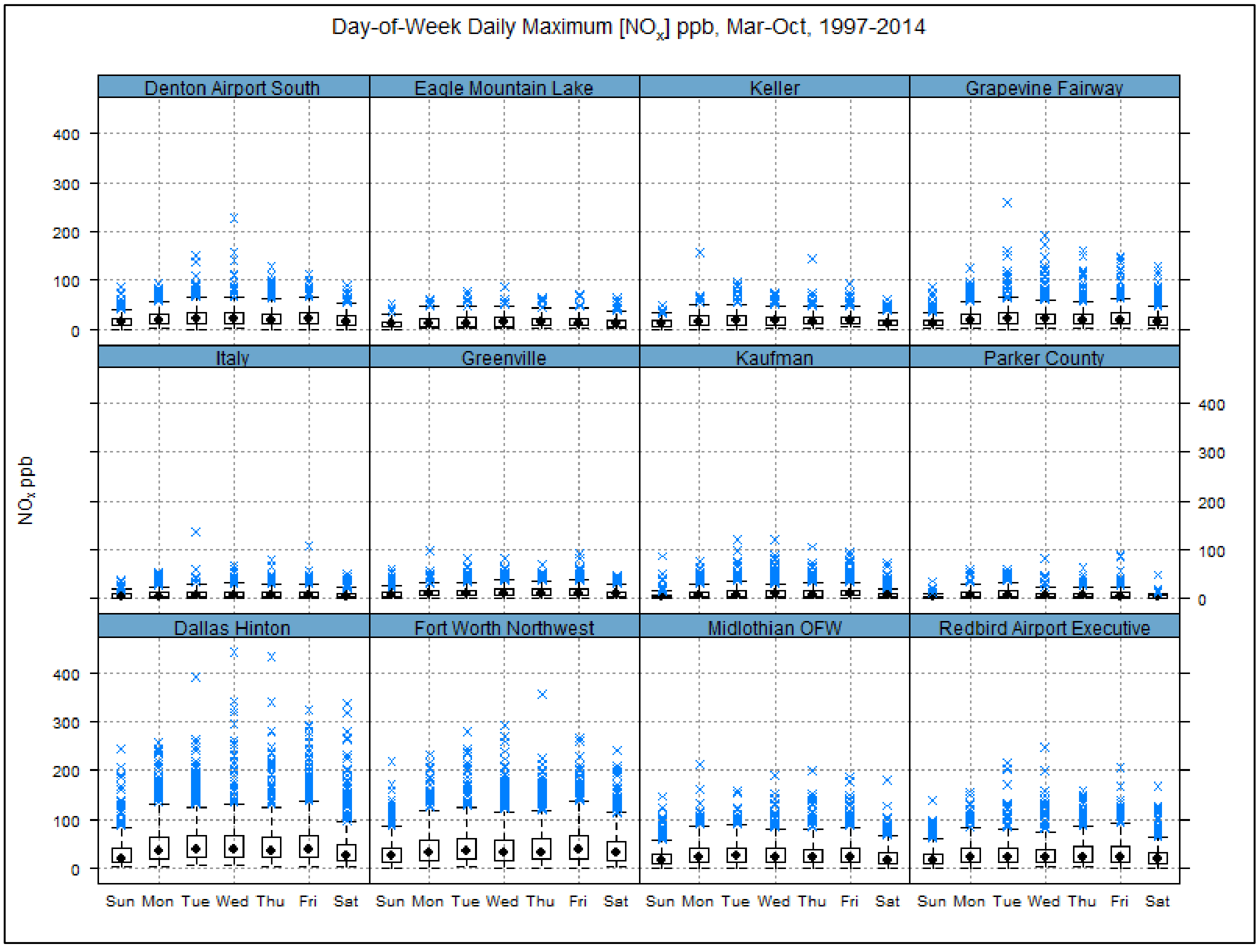


**Figure 5-12: Day of Week $NO_X$ Concentrations**

Given that there is less $NO_X$ generated on weekends, there accordingly should be fewer high ozone days on weekends. To determine the number of days with high eight-hour ozone on weekends, days with eight-hour ozone over 75 ppb were counted using all DFW area monitors.

Figure 5-13: *Weekday/Weekend Effect for Ozone in the DFW Area* shows that the total number of days with eight-hour ozone concentrations greater than 75 ppb is greater on weekdays compared to weekends. Fewer high eight-hour ozone days occur on Sundays (85 days) compared to other days of the week. Sunday had 18 fewer high eight-hour ozone days than Mondays, which had the second lowest amount of high eight-hour ozone days (103 days). High eight-hour ozone days occur most often on Fridays, with 137 days. It appears that high ozone occurs less frequently on Sunday, when there are also lower amounts of $NO_X$ from on-road sources. By the end of the week, the DFW nonattainment area begins to experience higher ozone as well as higher $NO_X$ emissions. This result corroborates the hypothesis that local $NO_X$ reductions will lead to lower ozone concentrations, and this weekday/weekend analysis using monitoring data corroborates the weekday/weekend modeling analysis summarized in Chapter 3.

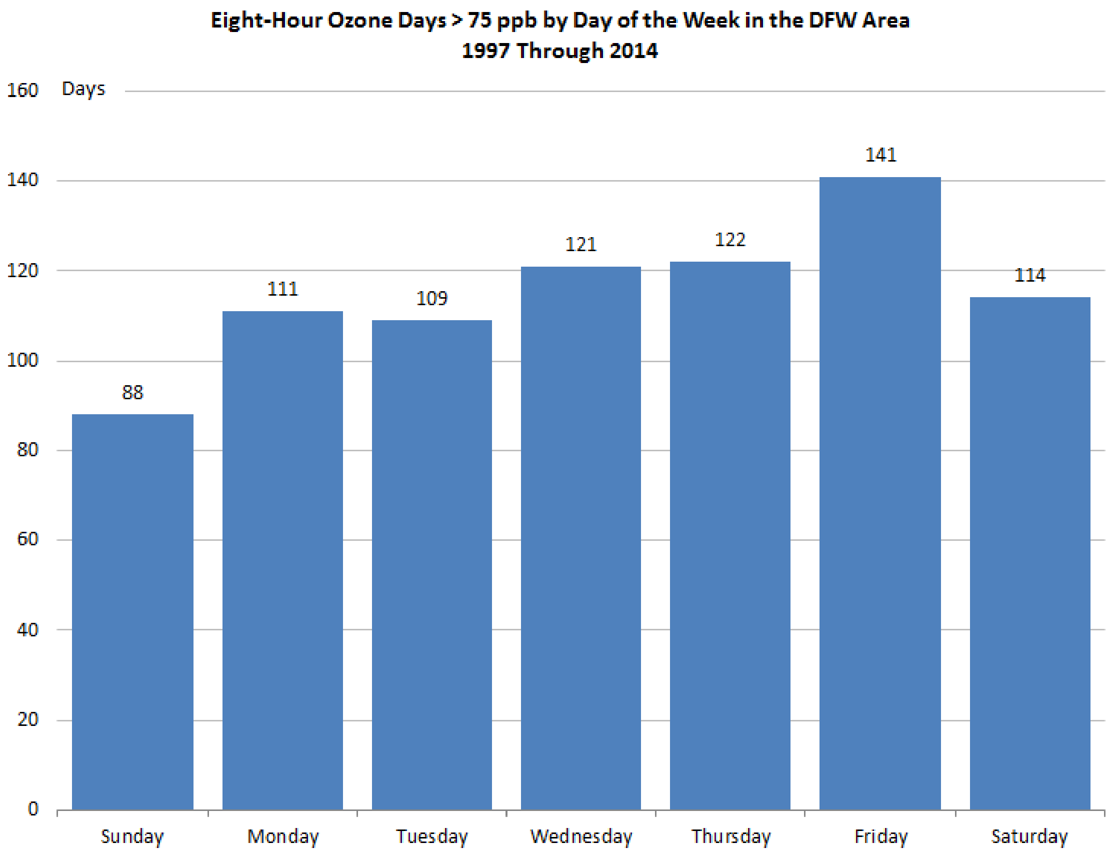


**Figure 5-13: Weekday/Weekend Effect for Ozone in the DFW Area**

### 5.2.5 VOC Trends

Total non-methane organic carbon (TNMOC), which is used to represent VOC concentrations, can enhance ozone production in combination with $NO_X$ and sunlight. TNMOC is an important precursor to ozone formation. However, because the DFW air shed is more $NO_X$-limited, controlling TNMOC is not as effective as controlling $NO_X$ to reduce ozone concentrations. Nevertheless, these precursors to ozone formation are discussed below.

Two types of monitors record TNMOC data in the DFW nonattainment area: AutoGCs, which record hourly data, and canisters, which collect 24-hour data. Because the canisters have more long-term data than the AutoGCs, they can provide more long-term trend information. The annual geometric mean TNMOC concentrations collected using the seven canisters in the DFW nonattainment area are presented in Figure 5-14: *Annual Geometric Mean TNMOC Concentrations*. The chart shows that annual geometric mean TNMOC concentrations in the DFW nonattainment area are declining, although there appear to be fewer decreases occurring after 2006. Due to the $NO_X$-limited nature of the DFW nonattainment area, controlling TNMOC is not as effective at controlling $NO_X$ to reduce ozone concentrations. Since the rate of decline in TNMOC concentrations since 2006 is much less pronounced than that for $NO_X$, we would expect TNMOC controls to have a much smaller effect for reducing ozone. This information also supports the photochemical modeling results documented in Chapter 3.

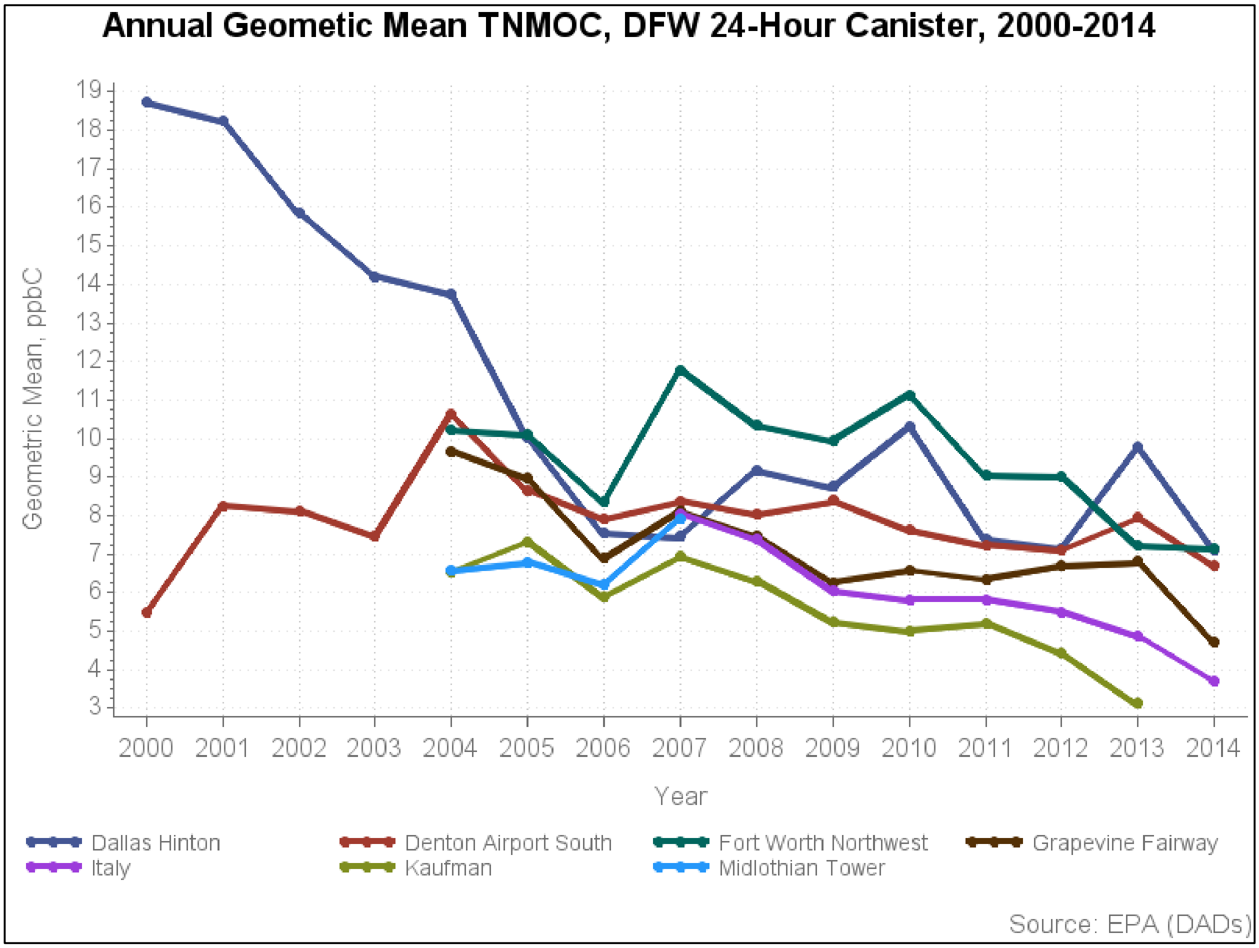


**Figure 5-14: Annual Geometric Mean TNMOC Concentrations**

## 5.3 STUDIES OF OZONE FORMATION, ACCUMULATION, AND TRANSPORT RELATED TO DFW

A number of peer-reviewed studies have been performed that relate to air quality in the DFW nonattainment area and ozone ADs in general. These studies are an important component of the Weight of Evidence (WoE) analyses in that in several cases they corroborate the conclusion that there are downward trends in ozone, $NO_X$, and VOC. Additional research also provides support of the improvements in the use of photochemical modeling as a predictive tool. Several of the studies summarized below relate to the effects of precipitation on biogenic emissions, VOC profiles for oil and gas production, and the effects of oil and gas operations on ozone formation. Each study is fully referenced in the bibliography.

One study by Sather and Cavender (2012) examined trends in ozone and its precursors at several cities in the south central U.S., including DFW. Several parameters associated with meteorology conducive to high ozone were also examined, including days with temperatures ≥90 degrees Fahrenheit, days with resultant wind speeds ≤4 miles per hour, and the number of days with precipitation. They evaluated five five-year periods from 1986 through 1990 and continuing from 2006 through 2010. They found that ozone-conducive days were lowest from 2001 through 2005, and highest during 1991 through 1995 and 2006 through 2010. In spite of the increase in ozone-conducive days during 2006 through 2010, the number of hours above 75 ppb at four DFW monitoring sites decreased by more than 70 hours per site compared to 2001 through 2005. The downward trends observed by Sather and Cavender for $NO_X$ and VOC matched those calculated by the TCEQ.

Another study by Tang et al. (2013) relating to emissions inventories used two advanced numerical techniques to estimate a top-down $NO_X$ EI based upon the $NO_2$ column density measurements from the Ozone Monitoring Instrument (OMI) satellite. These two techniques, the discrete Kalman filter and the decoupled direct method, allowed the Comprehensive Air Quality Model with Extensions (CAMx) to adjust the original bottom-up TCEQ inventory for 2006 ozone episodes iteratively until it matched the satellite-derived $NO_2$ column observations. A second top-down adjustment was calculated based upon ground-based $NO_X$ measurements. The two methods gave widely diverging results, with the OMI measurement pushing the inventory slightly higher, and the ground monitoring pushing the inventory much lower. The original TCEQ 2006 inventory included emissions of $NO_X$ from lightning and other sources often not included in standard emissions inventories, but the two top-down inventories were still different.

Each of the top-down inventories was substituted into the CAMx modeling to see if ozone model performance was improved. Neither alternative inventory showed substantial improvements over the original inventory. The tendency of the Tang et al. modeling to overestimate ground $NO_2$ concentrations and underestimate column densities could not be corrected by the techniques used in this study. Other model weaknesses aside from potential emission inventory error could explain this discrepancy, particularly the simulation of planetary boundary layer dynamics. Another explanation is that different data retrieval techniques used for OMI data have shown large variations, even though they are supposed to match each other. Revisions to the retrieval algorithms are being implemented to try to correct the problem. The results of this study did not compel any changes in the SIP modeling for DFW.

A third emissions/modeling related study evaluated by TCEQ staff was by Lamsal et al. (2008), which attempted to infer the ground-based $NO_2$ concentrations based upon the OMI satellite data. Since the ground-based $NO_2$ monitors have a known high bias, due to their inability to distinguish between $NO_2$ and other oxidized nitrogen compounds, the authors developed a correction for the ground-based $NO_2$ data. They found that OMI $NO_2$ column analysis was able to predict ground $NO_2$ concentrations reasonably well, which may allow these data to fill gaps in the $NO_2$ measurement network across the country. Tarrant County was an area that they specifically examined to see how well OMI $NO_2$ column analysis could predict ground $NO_2$. However, the OMI $NO_2$ results for Tarrant County did not include sufficient resolution that could be used to alter the $NO_X$ emission estimates by source category for the 2006 and 2017 SIP modeling performed for DFW.

A fourth study related to emissions evaluated by the TCEQ was by Huang et al. (2014), which examined drought effects on biogenic emissions during two drought years (2006 and 2011) and one “wet” year (2007) to elucidate the relationship between leaf area index (LAI) and emissions. Drought severity was evaluated using the Standard Precipitation Index and the Palmer Drought Severity Index. Monthly average LAI was estimated from the Moderate Resolution Imaging Spectroradiometer (MODIS) satellite data for four different regions in eastern Texas; DFW was included in the “North Central” region. The study found large differences in LAI between the wet year and the drought years, with up to 50% decreases during the drought years relative to 2007. Isoprene and monoterpene emissions estimated with the Model of Emissions of Gases and Aerosols from Nature (MEGAN) and Texas-specific land cover categories were lower during drought years by 25-30%. The authors also looked at which month showed the largest inter-annual variations, and determined which factor was most important (i.e., inter-annual meteorological variations or LAI). September showed the greatest emission variation due to LAI variations. April showed the largest emission variation due to meteorological conditions, and to the combination of meteorology and LAI. These results may ultimately help improve biogenic emissions modeling by taking into account drought conditions when modeling the emissions from vegetation.

A fifth modeling support study evaluated by the TCEQ was Lefohn et al. (2014), which modeled background ozone using the Goddard Earth Observing System with Chemistry (GEOS-Chem) global model and CAMx for 2006. The source apportionment tools in CAMx were invoked to track the sources of background ozone simulated throughout the country. Many sites were examined in detail, including the Dallas Executive Airport monitoring site, which was used to assess the impact of background ozone on DFW. Twelve kilometer (km) CAMx modeling yielded decent mean fractional bias of hourly ozone in DFW during April, May, September, and October, but biased by about +20% during June and July, and by about -20% for the other months. For April, May, and October, the estimated global average background was about 58-63% of the total ozone for the Dallas Executive Airport site. During June through September, the global average background was only about 43-48% of the total ozone. Overall, the percentage of total ozone attributed to background tended to decrease at higher concentrations of total ozone. Using their estimation method, they found indications of stratospheric contributions to background in March and June 2006, though the contributions were not quantified or focused upon specific days. Because the contributions were not quantified, there is no quantification of the uncertainty of this assessment. The results presented in this paper are consistent with DFW regional background ozone assessments developed by the TCEQ using an upwind-downwind method.

A sixth study evaluated by the TCEQ was Pacsi et al. (2013), which carried out CAMx modeling for eastern Texas at 12 km after making adjustments to the 2012 future case inventory used by the TCEQ for the June 2006 ozone episode that was included with the DFW AD SIP adopted in December 2011. The study estimated how regional $NO_X$ emissions and consequent ozone formation would vary based on four natural gas price scenarios of $1.89, $2.88, $3.87, and $7.74 per Million British Thermal Units (MMBTU). Using the $2.88 scenario as a baseline, the $1.89 scenario resulted in lower $NO_X$ at EGUs since more natural gas was being used instead of coal. However, $NO_X$ emissions from natural gas production were increased to account for the increase in demand from EGUs. The regional ozone decrease was 0.2-0.5 ppb for this $1.89 scenario, but some localized ozone increases were seen downwind of natural gas production areas. Conversely, the $3.87 and $7.74 scenarios resulted in regional ozone increases of 0.2-0.7 ppb because the use of higher $NO_X$ emitting coal for EGUs was favored over natural gas.

Overall, the studies evaluated by the TCEQ are supportive of the use of photochemical modeling as a predictive tool in determining attainment.

## 5.4 QUALITATIVE CORROBORATIVE ANALYSIS

This section outlines additional measures, not included in the photochemical modeling, that are expected to further reduce ozone levels in the DFW nonattainment area. Various federal, state, and local control measures exist that are anticipated to provide real emissions reductions; however, these measures are not included in the photochemical model because they may not meet all of the EPA's criteria for modeled reductions. While the modeling analysis described in Chapter 3 shows an estimated future ozone design value of 76 or 77 ppb, emissions reductions from these measures, in addition to those from the measures included in the photochemical model, support the conclusion that the DFW area will attain the 2008 ozone NAAQS by the end of 2017.

### 5.4.1 Additional Measures

5.4.1.1 Energy Efficiency and Renewable Energy (EE/RE) Measures

Energy efficiency (EE) measures are typically programs that reduce the amount of electricity and natural gas consumed by residential, commercial, industrial, and municipal energy consumers. Examples of EE measures include increasing insulation in homes, installing compact fluorescent light bulbs, and replacing motors and pumps with high efficiency units. Renewable energy (RE) measures include programs that generate energy from resources that are replenished or are otherwise not consumed as with traditional fuel-based energy production. Examples of renewable energy include wind energy and solar energy projects.

Local government programs frequently implement EE/RE measures. An example of a locally initiated RE measure is the Solar Ready II (SRII) project launched by the North Central Texas Council of Governments (NCTCOG). The purpose of the SRII project was to identify and implement best management practices to support the growth of solar installations in the region. The SRII project ended in March 2016. However, while not a commitment, the NCTCOG has indicated to the TCEQ that NCTCOG staff will continue to promote the best management practices of the SRII project through ongoing efforts.

Additionally, Texas leads the nation in RE generation from wind. As of December 2014, Texas has 14,098 megawatts (MW) of installed wind generation capacity[3]; more than double that of California, the state with the next highest amount of installed wind generation capacity. Texas' total net electrical generation from renewable wind generators for 2014 is estimated to be approximately 39 million megawatt-hours (MWh)[4], approximately 22% of the total wind net electrical generation for the U.S. As of December 31, 2015, Texas' installed wind generation capacity increased to 17,713 MW, approximately a 25% increase in just one year.

While EE/RE measures are beneficial and do result in lower overall emissions from fossil fuel-fired power plants in Texas, emission reductions resulting from these programs are not explicitly included in photochemical modeling for SIP purposes because local efficiency efforts may not result in local emissions reductions or may be offset by increased demand in electricity. The complex nature of the electrical grid makes accurately quantifying emission reductions from EE/RE measures difficult. At any given time, it is impossible to determine exactly where a specific user's electricity was produced. The electricity for users in a nonattainment area may not necessarily be generated solely within that nonattainment area. For example, some of the electricity used within a nonattainment area in East Texas could be generated by a power plant in a nearby attainment county or even in West Texas. If electrical demand is reduced in a nonattainment area due to local efficiency measures, the resulting emission reductions from power generation facilities may occur in any number of locations around the state. Similarly, increased RE generation may not necessarily replace electrical generation from local fossil fuel-fired power plants within a particular nonattainment area.

While specific emission reductions from EE/RE measures are not provided in the SIP, persons interested in estimates of energy savings and emission reductions from EE/RE measures can access additional information and reports from the Energy Systems Laboratory, Texas A&M

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[3] U.S. Department of Energy, National Renewable Energy Laboratory, http://apps2.eere.energy.gov/wind/windexchange/wind_installed_capacity.asp

[4] U.S. Department of Energy, Energy Information Administration, Form EIA-923 data, http://www.eia.gov/electricity/data/eia923/

Engineering Experiment Station, at http://esl.tamu.edu/. The reports submitted to the TCEQ regarding EE/RE measures are available under TERP Letters and Reports.

Finally, the Texas Legislature has enacted a number of EE/RE measures and programs. The following is a summary of Texas EE/RE legislation since 1999.

76th Texas Legislature, 1999

- Senate Bill (SB) 7
- House Bill (HB) 2492
- HB 2960

77th Texas Legislature, 2001

- SB 5
- HB 2277
- HB 2278
- HB 2845

78th Texas Legislature, 2003

- HB 1365 (Regular Session)

79th Texas Legislature, 2005

- SB 20 (First Called Session)
- HB 2129 (Regular Session)
- HB 2481 (Regular Session)

80th Texas Legislature, 2007

- HB 66
- HB 3070
- HB 3693
- SB 12

81st Texas Legislature, 2009

- None

82nd Texas Legislature, 2011

- SB 898 (Regular Session)
- SB 924 (Regular Session)
- SB 981 (Regular Session)
- SB 1125 (Regular Session)
- SB 1150 (Regular Session)
- HB 51 (Regular Session)

83rd Texas Legislature, 2013

- None

84th Texas Legislature, 2015

- SB 1626
- HB 1736

*Renewable Energy*

SB 5, 77th Texas Legislature, 2001, set goals for political subdivisions in affected counties to implement measures to reduce energy consumption from existing facilities by 5% each year for five years from January 1, 2002 through January 1, 2006. In 2007, the 80th Texas Legislature passed SB 12, which extended the timeline set in SB 5 through 2007 and made the annual 5% reduction a goal instead of a requirement. The State Energy Conservation Office (SECO) is charged with tracking the implementation of SB 5 and SB 12. Also during the 77th Texas Legislature, the Energy Systems Laboratory (ESL), part of the Texas Engineering Experiment Station, Texas A&M University System, was mandated to provide an annual report on EE/RE efforts in the state as part of the TERP under Texas Health and Safety Code (THSC), §388.003(e).

The 79th Texas Legislature, 2005, Regular and First Called Sessions, amended SB 5 through SB 20, HB 2129, and HB 2481 to add, among other initiatives, renewable energy initiatives that require: 5,880 MW of generating capacity from renewable energy by 2015; the TCEQ to develop a methodology for calculating emission reductions from renewable energy initiatives and associated credits; the ESL to assist the TCEQ in quantifying emissions reductions from EE/RE programs; and the Public Utility Commission of Texas (PUCT) to establish a target of 10,000 MW of installed renewable technologies by 2025. Wind power producers in Texas exceeded the renewable energy generation target by installing over 10,000 MW of wind electric generating capacity by 2010.

HB 2129, 79th Texas Legislature, 2005, Regular Session, directed the ESL to collaborate with the TCEQ to develop a methodology for computing emission reductions attributable to use of renewable energy and for the ESL to annually quantify such emission reductions. HB 2129 directed the Texas Environmental Research Consortium to use the Texas Engineering Experiment Station to develop this methodology. With the TCEQ's guidance, the ESL produces an annual report, Statewide Air Emissions Calculations from Energy Efficiency, Wind and Renewables, detailing these efforts.

In addition to the programs discussed and analyzed in the ESL report, local governments may have enacted measures beyond what has been reported to SECO and the PUCT. The TCEQ encourages local political subdivisions to promote EE/RE measures in their respective communities and to ensure these measures are fully reported to SECO and the PUCT.

SB 981, 82nd Texas Legislature, 2011, Regular Session, allows a retail electric customer to contract with a third party to finance, install, or maintain a distributed renewable generation system on the customer's side of the electric meter, regardless of whether the customer owns the installed system. SB 981 also prohibits the PUCT from requiring registration of the system as an electric utility if the system is not projected to send power to the grid.

HB 362, 82nd Texas Legislature, 2011, Regular Session, helps property owners install solar energy devices such as electric generating solar panels by establishing requirements for property owners associations' approval of installation of solar energy devices. HB 362 specifies the conditions that property owners associations may and may not deny approval of installing solar energy devices.

SB 1626, 84th Texas Legislature, 2015, modifies the provisions established by HB 362 from the 82nd Texas Legislature, 2011, Regular Session, regarding property owners associations' authority to approve and deny installations of solar energy devices such as electric generating solar panels. HB 362 included an exception that allowed developers to prohibit installation of solar energy devices during the development period. SB 1626 limits the exception during the development period to developments with 50 or fewer units.

*Residential and Commercial Building Codes and Programs*

THSC, Chapter 388, Texas Building Energy Performance Standards, as adopted in SB 5 of the 77th Texas Legislature, 2001, states in §388.003(a) that single-family residential construction must meet the energy efficiency performance standards established in the energy efficiency chapter of the International Residential Code. The Furnace Pilot Light Program includes energy savings accomplished by retrofitting existing furnaces. Also included is a January 2006 federal mandate raising the minimum Seasonal Energy Efficiency Ratio SEER for air conditioners in single-family and multi-family buildings from 10 to 13.

THSC, Chapter 388, as adopted in SB 5 of the 77th Texas Legislature, 2001, states in §388.003(b) that non-single-family residential, commercial, and industrial construction must meet the energy efficiency performance standards established in the energy efficiency chapter of the International Energy Conservation Code.

HB 51, 82nd Legislature, 2011, Regular Session, requires municipalities to report implementation of residential and commercial building codes to SECO.

HB 1736, 84th Texas Legislature, 2015, update THSC §388.003 to adopt, effective September 1, 2016, the energy efficiency chapter of the International Residential Code as it existed on May 1, 2015. HB 1736 also established a schedule by which SECO could adopt updated editions of the International Residential Code in the future, not more often than once every six years.

*Federal Facility EE/RE Projects*

Federal facilities are required to reduce energy use by Presidential Executive Order 13123 and the Energy Policy Act of 2005 (Public Law 109-58 EPACT20065). The Energy Systems Laboratory compiled energy reductions data for the federal EE/RE projects in Texas.

*Political Subdivisions Projects*

SECO funds loans for energy efficiency projects for state agencies, institutions of higher education, school districts, county hospitals, and local governments. Political subdivisions in nonattainment and affected counties are required by SB 5, 77th Texas Legislature, 2001, to report EE/RE projects to SECO. These projects are typically building systems retrofits, non-building lighting projects, and other mechanical and electrical systems retrofits such as municipal water and waste water treatment systems.

*Electric Utility Sponsored Programs*

Utilities are required by SB 7, 76th Texas Legislature, 1999, and SB 5, 77th Texas Legislature, 2001, to report demand-reducing energy efficiency projects to the PUCT (see THSC, §386.205 and Texas Utilities Code (TUC), §39.905). These projects are typically air conditioner replacements, ventilation duct tightening, and commercial and industrial equipment replacement.

SB 1125, 82nd Texas Legislature, 2011, Regular Session, amended the TUC, §39.905 to require energy efficiency goals to be at least 30% of annual growth beginning in 2013. The metric for the energy efficiency goal remains at 0.4% of peak summer demand when a utility program accrues that amount of energy efficiency. SB 1150, 82nd Texas Legislature, 2011, Regular Session, extended the energy efficiency goal requirements to utilities outside the Electric Reliability Council of Texas area.

*State Energy Efficiency Programs*

HB 3693, 80th Texas Legislature, 2007, amended the Texas Education Code, Texas Government Code, THSC, and TUC. The bill:

- requires state agencies, universities and local governments to adopt energy efficiency programs;
- provides additional incentives for electric utilities to expand energy conservation and efficiency programs;
- includes municipal-owned utilities and cooperatives in efficiency programs;
- increases incentives and provides consumer education to improve efficiency programs; and
- supports other programs such as revision of building codes and research into alternative technology and renewable energy.

HB 51, 82nd Texas Legislature, 2011, Regular Session, requires new state buildings and major renovations to be constructed to achieve certification under an approved high-performance design evaluation system.

HB 51 also requires, if practical, that certain new and renovated state-funded university buildings comply with approved high-performance building standards.

SB 898, 82nd Texas Legislature, 2011, Regular Session, extended the existing requirement for state agencies, state-funded universities, local governments, and school districts to adopt energy efficiency programs with a goal of reducing energy consumption by at least 5% per state fiscal year (FY) for 10 state FYs from September 1, 2011 through August 31, 2021.

SB 924, 82nd Texas Legislature, 2011, Regular Session, requires all municipally owned utilities and electric cooperatives that had retail sales of more than 500,000 MWh in 2005 to report each year to SECO information regarding the combined effects of the energy efficiency activities of the utility from the previous calendar year, including the utility's annual goals, programs enacted to achieve those goals, and any achieved energy demand or savings goals.

5.4.1.2 Cement Kiln Consent Decree (No change)

5.4.1.3 Clean Air Interstate Rule (CAIR) and Cross-State Air Pollution Rule (CSAPR)

In March 2005, the EPA issued CAIR to address EGU emissions that transport from one state to another. The rule incorporated the use of three cap and trade programs to reduce sulfur dioxide ($SO_2$) and $NO_X$: the ozone-season $NO_X$ trading program, the annual $NO_X$ trading program, and the annual $SO_2$ trading program.

Texas was not included in the ozone season $NO_X$ program but was included for the annual $NO_X$ and $SO_2$ programs. As such, Texas was required to make necessary reductions in annual $SO_2$ and $NO_X$ emissions from new and existing EGUs to demonstrate that emissions from Texas do not contribute to nonattainment or interfere with maintenance of the 1997 particulate matter with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers ($PM_{2.5}$) NAAQS in another state. CAIR consisted of two phases for implementing necessary $NO_X$ and $SO_2$

reductions. Phase I addressed required reductions from 2009 through 2014. Phase II was intended to address reductions in 2015 and thereafter.

In July 2006, the commission adopted a SIP revision to address how the state would meet emissions allowance allocation budgets for $NO_X$ and $SO_2$ established by the EPA to meet the federal obligations under CAIR. The commission adopted a second CAIR-related SIP revision in February 2010. This revision incorporated various federal rule revisions that the EPA had promulgated since the TCEQ's initial submittal. It also incorporated revisions to 30 Texas Administrative Code Chapter 101 resulting from legislation during the 80th Texas Legislature, 2007.

A December 2008 court decision found flaws in CAIR but kept CAIR requirements in place temporarily while directing the EPA to issue a replacement rule. In July 2011, the EPA finalized CSAPR to meet Federal Clean Air Act (FCAA) requirements and respond to the court's order to issue a replacement program. Texas was included in CSAPR for ozone season $NO_X$, annual $NO_X$, and annual $SO_2$ due to the EPA's determination that Texas significantly contributes to nonattainment or interferes with maintenance of the 1997 eight-hour ozone NAAQS and the 1997 $PM_{2.5}$ NAAQS in other states. As a result of numerous EGU emission reduction strategies already in place in Texas, the annual and ozone season $NO_X$ reduction requirements from CSAPR were relatively small but still significant. CSAPR required an approximate 7% reduction in annual $NO_X$ emissions and less than 5% reduction in ozone season $NO_X$ emissions.

On August 21, 2012, the U.S. Court of Appeals for the District of Columbia (D.C.) Circuit vacated CSAPR. Under the D.C. Circuit Court's ruling, CAIR remained in place until the EPA developed a valid replacement.

The EPA and various environmental groups petitioned the Supreme Court of the United States to review the D.C. Circuit Court's decision on CSAPR. On April 29, 2014, a decision by the Supreme Court reversed the D.C. Circuit and remanded the case. On October 23, 2014, the D.C. Circuit lifted the CSAPR stay and on November 21, 2014, the EPA issued rulemaking, which shifted the effective dates of the CSAPR requirements to account for the time that had passed after the rule was stayed in 2011. Phase 1 of CSAPR took effect January 1, 2015 and Phase 2 is scheduled to begin January 1, 2017. On July 28, 2015, the D.C. Circuit Court ruled that the 2014 annual $SO_2$ budgets and the 2014 ozone season $NO_X$ budgets for Texas were invalid because they required over control of Texas emissions, and remanded these budgets back to the EPA without vacatur.

On January 22, 2015, the EPA issued a memorandum to provide information on how it intends to implement FCAA interstate transport requirements for the 2008 ozone NAAQS. The EPA provided preliminary modeling results for 2018, which show contribution to nonattainment of the 2008 ozone NAAQS in the DFW area from sources outside of Texas. On July 23, 2015, the EPA issued a notice of data availability regarding updated ozone transport modeling results for a 2017 attainment year.

On December 3, 2015, the EPA published a proposed update to the CSAPR ozone season program by issuing the CSAPR Update Rule for the 2008 eight-hour ozone standard (80 *Federal Register* 75706). As part of this rule, the EPA is also proposing to promulgate FIPs for nine states, including Texas, that incorporate revised emissions budgets to replace the ozone season $NO_X$ budgets remanded by the D.C. Circuit on July 28, 2015. These proposed budgets would be effective for the 2017 ozone season, the same period in which the phase 2 budgets that were invalidated by the court are to become effective. Therefore, this proposed action, if finalized, would replace the remanded budgets promulgated in CSAPR to address the 1997 ozone NAAQS with budgets developed to address the more stringent 2008 ozone NAAQS. Remanded $SO_2$ budgets are still to be resolved. Therefore, while the current CSAPR budgets for Texas are still in effect, the budgets may be subject to change in the future after the EPA's reconsideration, finalization of the CSAPR Update Rule, or changes resulting from further appeals.

As discussed in Section 3.5.4, *2017 Future Case Emissions*, the TCEQ used CSAPR as the basis for allocating EGU emission caps in the 2017 future year. Section 3.7.4.1, *CAIR Phase II Sensitivity*, presents the results of a sensitivity analysis where the CSAPR caps were replaced with those that would apply under Phase II of the CAIR program.

#### 5.4.1.4 TERP

The TERP program was created in 2001 by the 77th Texas Legislature to provide grants to offset the incremental costs associated with reducing $NO_X$ emissions from high-emitting heavy-duty internal combustion engines on heavy-duty vehicles, non-road equipment, marine vessels, locomotives, and some stationary equipment.

The primary emissions reduction incentives are awarded under the Diesel Emissions Reduction Incentive Program (DERI). The DERI incentives are awarded to projects to replace, repower, or retrofit eligible vehicles and equipment to achieve $NO_X$ emission reductions in Texas ozone nonattainment areas and other counties identified as affected counties under the TERP where ground-level ozone is a concern.

From 2001 through August 2015, $968 million in DERI grants were awarded for projects projected to help reduce 168,289 tons of $NO_X$. Over $327 million in DERI grants were awarded to projects in the DFW area, with a projected 58,062 tons of $NO_X$ reduced. These projects are estimated to reduce up to 18.7 tons per day of $NO_X$ in the DFW area in 2015. The emissions reduction estimates will change yearly as older projects reach the end of the project life and new projects begin achieving emissions reductions.

Also, of the $327 million awarded in the DFW area, $22 million were awarded to North Central Texas Council of Governments (NCTCOG) through third-party grants to administer subgrants in the DFW area.

Three other incentive programs under the TERP will result in the reduction in $NO_X$ emissions in the DFW area, as discussed below.

The Drayage Truck Incentive Program was established in 2013 to provide grants for the replacement of drayage trucks operating in and from seaports and rail yards located in the nonattainment areas. Nine projects to replace 36 vehicles were awarded grants in FY 2015 totaling $3.95 million. One of these projects was in the DFW area and totaled $501,524. The project will result in a reduction of approximately 25 tons of $NO_X$, representing 0.02 tons per day of $NO_X$ reduced starting in 2017.

The Texas Clean Fleet Program (TCFP) was established in 2009 to provide grants for the replacement of light-duty and heavy-duty diesel vehicles with vehicles powered by alternative fuels, including: natural gas, liquefied petroleum gas, hydrogen, methanol (85% by volume), or electricity. This program is for larger fleets, with a requirement that an applicant apply for replacement of at least 20 vehicles at a time. From 2009 through August 2015, over $31.4 million in TCFP grants were awarded for projects to help reduce over 400 tons of $NO_X$. Over $9.1 million in TCFP grants were awarded to projects in the DFW area, with a projected 181.6

tons of $NO_X$ reduced. The projects are projected to reduce up to 0.07 tons per day of $NO_X$ in the DFW area starting in 2015.

The Texas Natural Gas Vehicle Grant Program (TNGVGP) was established in 2011 to provide grants for the replacement of medium-duty and heavy-duty diesel vehicles with vehicles powered by natural gas. This program may include grants for individual vehicles or multiple vehicles. The majority of the vehicle's operation must occur in the Texas nonattainment areas, other counties designated as affected counties under the TERP, and the counties in and between the triangular area between Houston, San Antonio, Dallas, and Fort Worth. From 2011 through August 2015 over $46.3 million in TNGVGP grants were awarded for projects to help reduce a projected 1,646 tons of $NO_X$. Over $18.5 million in TNGVGP grants were awarded to projects in the DFW area, with a projected 769 tons of $NO_X$ reduced. These projects are estimated to reduce up to 0.4 tons per day of $NO_X$ in the DFW area starting in 2015.

HB 1, General Appropriations Bill, 84th Texas Legislature, 2015, appropriated $118.1 million per year for implementation of the TERP in FYs 2016 and 2017. This represents an increase of $40.5 million per year over the appropriation amount in FYs 2014 and 2015. The additional funding will result in more grant projects that result in $NO_X$ reductions in the eligible TERP areas, including the DFW area.

5.4.1.5 Low-Income Vehicle Repair Assistance, Retrofit, and Accelerated Vehicle Retirement Program (LIRAP)

The TCEQ established a financial assistance program for qualified owners of vehicles that fail the emissions test. The purpose of this voluntary program is to repair or remove older, higher emitting vehicles from use in certain counties with high ozone. The LIRAP provisions of House Bill (HB) 2134, 77th Texas Legislature 2001, created the program. In 2005, HB 1611, 79th Texas Legislature, modified the program to apply only to counties that implement a vehicle inspection and maintenance program and have elected to implement LIRAP fee provisions. The counties currently participating in the LIRAP are Brazoria, Fort Bend, Galveston, Harris, Montgomery, Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, Tarrant, Travis, and Williamson Counties.

SB 12, 80th Texas Legislature 2007, expanded the LIRAP participation criteria by increasing the income eligibility to 300% of the federal poverty rate and increasing the amount of assistance toward the replacement of a retired vehicle. HB 3272, 82nd Texas Legislature 2011, Regular Session, expanded the class of vehicles eligible for a $3,500 voucher to include hybrid, electric, natural gas, and federal Tier 2, Bin 3 or cleaner Bin certification vehicles. The program provides $3,500 for a replacement hybrid, electric, natural gas, and federal Tier 2, Bin 3 or cleaner Bin certification vehicle of the current model year or the previous three model years; $3,000 for cars of the current or three model years; and $3,000 for trucks of the current or previous two model years. The retired vehicle must be 10 years old or older or must have failed an emissions test. From December 12, 2007 through February 29, 2016, the program has retired and replaced 55, 807 vehicles at a cost of $167,629,312.80. During the same period, an additional 39,379 vehicles have had emissions-related repairs at a cost of $20,894,123.66. The total retirement/replacement and repair expenditure from December 12, 2007 through February 29, 2016 is $188,523,436.46.

In the DFW nonattainment area, the LIRAP is currently available to vehicle owners in nine counties: Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall and Tarrant. Between December 12, 2007 and February 29, 2016, the program has repaired 17,433 vehicles and retired and replaced 29,344 vehicles at a cost of $96,873,835.61. HB 1, General

Appropriations Bill, 84th Texas Legislature 2015, appropriated $43.5 million per year for FY 2016 and FY 2017 to continue this clean air strategy in the 16 participating counties. Participating DFW area counties were allocated approximately $21.6 million per year for the LIRAP for FYs 2016 and 2017. This is an increase of approximately $18.8 million per year over the previous biennium.

5.4.1.6 Local Initiative Projects (LIP)

Funds are provided to counties participating in the LIRAP for implementation of air quality improvement strategies through local projects and initiatives. In the DFW area, LIP funding is available to the nine counties currently participating in the LIRAP: Collin, Dallas, Denton, Ellis, Johnson, Kaufman, Parker, Rockwall, and Tarrant. HB 1, General Appropriations Bill, 84th Texas Legislature 2015, appropriated $4.8 million per year for FY 2016 and FY 2017 to continue this clean air strategy. The nine DFW area counties were allocated approximately $2.4 million per year for FYs 2016 and 2017. This is an increase of approximately $2.1 million per year over the previous biennium.

Dallas County used LIP funds in 2008 to establish the Dallas County Clean Air Emissions Task Force. For its first seven years, the task force targeted high-emitting vehicles, smoking vehicles, and suspicious vehicles to verify that the state safety and emissions inspection windshield certificates on these vehicles were legitimate and in compliance with air quality standards. The task force's objective is to reduce the number of fraudulent, fictitious, or improperly issued safety and emissions inspection windshield certificates.

Following the success of Dallas County's emissions enforcement project, Denton (2008-2016), Ellis (2008-2014), Johnson (2010-2014), Kaufman (2012-2016), and Tarrant (2010-2016) Counties established similar task forces. Beginning in March 2015, the emission enforcement task forces adjusted their objectives to concentrate on the identification of vehicles with counterfeit registration insignia and the reduction of fraudulent vehicle inspection reports. These programs have partnered with local and state agencies to enforce state laws, codes, rules, and regulations regarding air quality and mobile emissions in the DFW area. The citizens of the entire north Texas region benefit from these programs as a result of the reduction in $NO_X$ emissions from each vehicle brought into emissions compliance.

The City of Plano, through Interlocal Agreements with Collin County, used LIP funding in 2012 and 2014 for Local Initiative Projects. In 2012, LIP funding was used by the City of Plano to install auxiliary power units in Police Department vehicles to reduce vehicle emissions during the daily activities of traffic enforcement. This idle reduction technology powers equipment such as lights, radio, and computers so that law enforcement officers can shut-off their vehicles to perform traffic control, traffic accident investigations, lunch breaks, and other activities where the enforcement officer is outside their vehicle. In 2014, the City of Plano used LIP funding to install wireless communications technology at 20 intersections and additional pan/tilt cameras at 19 of those intersections. The project allows signal management from a traffic management center to reduce traffic congestion and idling in an effort to reduce emissions. The project reduces idling by improving traffic flow and decreasing the number of times vehicles must stop at traffic lights. The "Exhaust Phase" of an engine emits the most emissions during starting, idling, and breaking stationary inertia. The project increases the emissions reduction benefits by allowing real-time traffic management instead of a stagnate model to better manage peak-hour congestion, while minimizing cross-traffic congestion, and reducing emissions.

#### 5.4.1.7 Local Initiatives

The NCTCOG submitted an assortment of locally implemented strategies in the DFW nonattainment area including pilot programs, new programs, or programs with pending methodologies. These programs are expected to be implemented in the ten-county nonattainment area by 2017. Due to the continued progress of these measures, additional air quality benefits will be gained and will further reduce precursors to ground level ozone formation. A summary of each strategy is included in Appendix H: *Local Initiatives Submitted by the North Central Texas Council of Governments.*

#### 5.4.1.8 Voluntary Measures

While the oil and natural gas industry is required to install controls either due to state or federal requirements, the oil and natural gas industry has in some instances voluntarily implemented additional controls and practices to reduce VOC emissions from oil and natural gas operations in the DFW nonattainment area as well as other areas of the state. Examples of these voluntary efforts include: installing vapor recovery units on condensate storage tanks; using low-bleed natural gas actuated pneumatic devices; installing plunger lift systems in gas wells to reduce gas well blowdown emissions; and implementing practices to reduce VOC emissions during well completions (i.e., "Green Completions"). The EPA's Natural Gas STAR Program provides details on these and other practices recommended by the EPA as voluntary measures to reduce emissions from oil and natural gas operations and improve efficiency. Additional information on the EPA Natural Gas STAR Program may be found on the EPA's Natural Gas STAR Program Web page (http://www.epa.gov/gasstar/).

The TCEQ continues to attempt to quantify the extent and impacts of these voluntary measures through area source emissions inventory improvement projects, such as the projects detailed in Chapter 6: *Ongoing Initiatives.*

## 5.5 CONCLUSIONS

The TCEQ has used several sophisticated technical tools to evaluate the past and present causes of high ozone in the DFW nonattainment area in an effort to predict the area's future air quality. Photochemical grid modeling performance has been rigorously evaluated, and 2006 ozone episodes from both June and August-September have been used to match the times of year when the highest ozone levels have historically been measured in the DFW nonattainment area. Historical trends in ozone and ozone precursor concentrations and their causes have been investigated extensively. The following conclusions can be reached from these evaluations.

First, as documented in Chapter 3 and Appendix C, the photochemical grid modeling performs relatively well, with one weakness being an overproduction of ozone primarily during night-time hours and days when lower ozone concentrations are measured. Problems observed with the base case ozone modeling are those that are known to exist in all photochemical modeling exercises, particularly when multiple consecutive weeks are modeled rather than short time periods of just one or two weeks. The model can be used with confidence to project future ozone design values because the EPA's 2007 and draft guidance documents both recommend applying the relative response in modeled ozone to monitored design values. Under the all days attainment test from the EPA's 2007 guidance, the photochemical grid modeling predicts that the 2017 future year ozone design value at four monitors located in the northwest portion of the DFW area will be above the 75 ppb standard: 77 ppb for Denton Airport South, Eagle Mountain Lake, and Grapevine Fairway monitors, and 76 ppb for the Keller monitor. The remaining 15 ozone monitors that were operational in 2006 have 2017 future design values ranging from 62-75 ppb. Use of the all days test results in the 2017 future design values for all DFW area monitors either below or within the 73-78 ppb WoE range inferred for the 75 ppb standard from the 82-87 ppb WoE range that is specified in the 2007 modeling guidance for the 84 ppb standard.

Application of the top 10 days attainment test recommended by the draft EPA modeling guidance from December 2014 projects a 76 ppb future design value at the Denton Airport South and Eagle Mountain Lake monitors, with the remaining 17 monitors ranging from 62-75 ppb. The draft guidance recommends the newer top 10 days test over the older all days test because "model response to decreasing emissions is generally most stable when the base ozone predictions are highest. The greater model response at higher concentrations is likely due to more 'controllable' ozone at higher concentrations." The TCEQ concurs with this assessment, and feels that the top 10 days test is a superior predictor of future ozone design values for this AD. The draft guidance no longer specifies a WoE range for future year design values, and instead requires "a fully-evaluated, high-quality modeling analysis that projects future values that are close to the NAAQS." With inclusion of the superior top 10 days test, this 2017 DFW AD SIP revision and all of its appendices document a fully-evaluated high-quality modeling analysis with future year design values that are close to or below the 75 ppb eight-hour ozone standard for all DFW area ozone monitors.

The prospective and weekday-weekend evaluations presented in Chapter 3 show that the model response to emission decreases is similar to the response observed in the atmosphere, suggesting that the $NO_X$ and VOC emission levels projected for 2017 will lead to lower ozone concentrations recorded at the DFW area monitors. The prospective analysis presented in Chapter 3 and Appendix C showed that applying 2012 emission estimates to the 2006 base case meteorology did a satisfactory job of estimating the 2012 eight-hour ozone design values at various DFW area monitors. This is particularly significant because this 2012 modeling performed significantly better than that submitted in the 2011 AD SIP revision. As summarized in Table 3-37: *Summary of Ozone Modeling Platform Changes*, the current modeling platform relies on improved tools and methodologies that were not available when the 2011 AD SIP revision work was performed: updated version of the photochemical model; improved meteorological model; improved chemical mechanism for VOC speciation; superior biogenic emissions model; updated anthropogenic emission inventories; and larger fine and coarse grid modeling domains.

For the cement kiln and electric utility sources within DFW, the required emission caps are modeled in the future year even if historical operational levels have only been roughly 50% of these caps. For example, the cement kilns operated at an average ozone season day level of 9.03 $NO_X$ tons per day (tpd) in 2012, but the 2017 future year is still modeled at the 17.64 $NO_X$ tpd cap. In a similar fashion, the EGUs emitted an average of 8.25 $NO_X$ tpd in 2012, but the 2017 future year is modeled at the CSAPR caps of 13.98 $NO_X$ tpd. This conservative approach of modeling the maximum allowable emission levels ensures that future estimates are not underestimated for these large $NO_X$ sources on high ozone days.

Second, trend analyses show that ozone has decreased significantly since 2000 when the eight-hour ozone design value at the Denton Airport South monitor was 102 ppb. As of 2015, the Denton Airport South monitor has an eight-hour ozone design value of 83 ppb. $NO_X$ and VOC precursor trends also show significant decreases, which has led to this reduced ozone formation. These reductions in precursors in the DFW nonattainment area are due to a combination of federal, state, and local emission controls. As shown in this chapter, Chapter 3, and Appendix B, the on-road and non-road mobile source categories are the primary sources of $NO_X$ emissions in the DFW nonattainment area, and are expected to continue their downward decline due to fleet turnover where older high-emitting sources are replaced with newer low-emitting ones. The current TERP program managed by the TCEQ continues to accelerate the mobile source fleet turnover effect by providing financial incentives for purchases of lower-emitting vehicles and equipment. Ozone formation is expected to decline through the 2017 modeled attainment year as lower amounts of $NO_X$ are emitted from these sources. Based on the photochemical grid modeling results and these corroborative analyses, the WoE indicates that the DFW nonattainment area will attain the 2008 eight-hour ozone standard by July 20, 2018.

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# CHAPTER 6: ONGOING INITIATIVES

## 6.1 INTRODUCTION (NO CHANGE)

## 6.2 ONGOING WORK

### 6.2.1 Oil and Gas Well Drilling Activities

There have been significant variations in drilling activity in certain regions of Texas over the past ten years, in particular for unconventional horizontal wells in shale formations such as the Barnett Shale, which overlaps the western portion of the 2008 Dallas-Fort Worth (DFW) ozone nonattainment area.

The Texas Commission on Environmental Quality (TCEQ) has contracted with Eastern Research Group, Inc. (ERG) to complete a study to develop 2014 periodic emissions inventory estimates as well as improve forecasted emissions for drilling rigs using Texas-specific data. The TCEQ has expedited finalizing this data and portions of it have been included in the area source oil and gas emissions inventory used in this 2017 DFW Attainment Demonstration (AD) state implementation plan (SIP) revision; see Chapter 3: *Photochemical Modeling,* Section 3.5.4.4: *Area Sources* for details. The TCEQ will evaluate using these data in other future attainment AD and reasonable further progress (RFP) SIP revisions as appropriate, as well as evaluate potential opportunities for follow-up research. The final report can be accessed on the TCEQ's Air Quality Research and Contract Reports: Emissions Inventory Web page (http://www.tceq.state.tx.us/airquality/airmod/project/pj_report_ei.html)

### 6.2.2 Upstream Oil and Condensate Storage Tanks and Loading Activities

The TCEQ has contracted with ERG to complete a study to evaluate the extent and types of controls on upstream oil and condensate storage tanks as well as loading activities. This study focused on shale formations producing hydrocarbon liquids in Texas, including the Barnett Shale. The results of this project will be used to improve upstream area source oil and gas volatile organic compounds (VOC) emissions estimates.

The TCEQ has expedited finalizing this data so that portions of it have been included in the area source oil and gas emissions inventory used in this SIP revision; see Chapter 3, Section 3.5.4.4 for details. The TCEQ will evaluate using these data in other future AD and RFP SIP revisions as appropriate, as well as evaluate potential opportunities for follow-up research.

### 6.2.3 Biogenic Emissions Projects

There are four ongoing Air Quality Research Program (AQRP) projects dedicated to improving the estimates of biogenic emissions throughout Texas.

- AQRP 14-008: Investigation of input parameters for biogenic emissions modeling in Texas during drought years (University of Texas).
- AQRP 14-016: Improved land cover and emission factor inputs for estimating biogenic isoprene and monoterpene emissions for Texas air quality simulations (Environ, National Oceanic and Atmospheric Administration, and Pacific Northwest National Laboratory).
- AQRP 14-017: Incorporating space-borne observations to improve biogenic emission estimates in Texas (University of Alabama-Huntsville, Rice University).
- AQRP 14-030: Improving modeled biogenic isoprene emissions under drought conditions and evaluating their impact on ozone formation (Texas A&M University).

These four projects will investigate biogenic emissions using modeling, aircraft-measured concentration data, satellite-estimated solar radiation and temperature data, and field study data from a forest research site, respectively. The wide-ranging efforts of these projects will benefit SIP modeling for the DFW nonattainment area by expanding our understanding of biogenic emissions and the factors that drive them.

Appendices available upon request.

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**RESPONSE TO COMMENTS RECEIVED CONCERNING THE DALLAS-FORT WORTH (DFW) 2008 EIGHT-HOUR OZONE STANDARD NONATTAINMENT AREA ATTAINMENT DEMONSTRATION (AD) STATE IMPLEMENTATION PLAN (SIP) REVISION FOR THE 2017 ATTAINMENT YEAR**

**PROPOSED DECEMBER 9, 2015**

The commission conducted public hearings in Arlington on January 21, 2016, at 6:30 p.m., and in Austin on January 26, 2016, at 10:00 a.m. During the comment period, which closed on January 29, 2016, the commission received comments from Amanda Crowe for United States Congresswoman Eddie Bernice Johnson (Congresswoman Johnson), the DFW Chapter of System Change Not Climate Change, Dallas City Councilmember Sandy Greyson (Councilmember Greyson), the Dallas County Medical Society, the Denton Drilling Awareness Group, Downwinders at Risk (Downwinders), Empowering Oak Cliff, Erin Moore for Dallas County Commissioner Dr. Theresa Daniel (Commissioner Daniel), the Fort Worth League of Neighborhood Associations, Frack Free Denton, Keep America Moving, the League of Women Voters of Dallas, the League of Women Voters of Irving, Liveable Arlington, the Lone Star Chapter of the Sierra Club, the North Texas Renewable Energy Group, Public Citizen, the Regional Transportation Council (RTC), the Sierra Club, the Sierra Club of Dallas, the Texas Campaign for the Environment, the Texas Medical Association, the United States Environmental Protection Agency (EPA), and 51 individuals.

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## GENERAL COMMENTS

### General Support

Congresswoman Johnson acknowledged the effort of the Texas Commission on Environmental Quality (TCEQ or agency) staff in developing the proposal and expressed support of the collaboration between federal and state agencies to develop a successful strategy for preserving the environment and improving the health of the DFW region. The RTC commended the TCEQ for quickly turning around this 2017 DFW AD SIP revision for the 2017 attainment year. The EPA expressed appreciation for the TCEQ's consideration of the numerous measures to reduce emissions of ozone precursors, and noted that the TCEQ analysis indicates that a number of the measures would require local action to implement. The EPA encouraged the TCEQ to support local, voluntary implementation of the most cost effective measures, to the extent possible.

**The TCEQ appreciates the support and is committed to working with local entities and interested parties to keep them updated on SIP developments and informed about technical issues related to air quality. No changes were made in response to these comments.**

### Public Participation

The Sierra Club and Downwinders appreciated the opportunity to submit comments on the TCEQ's Attainment Demonstration SIP for the 2008 eight-hour ozone National Ambient Air Quality Standard (NAAQS). The RTC expressed appreciation for the staff who held a public hearing in the DFW region. An individual expressed concern that the TCEQ does not act in the interest of citizens and that the TCEQ's rules are not designed to provide easy points of information access for citizens. An individual commented that public hearings are a total exercise in futility and are ineffective.

The League of Women Voters of Dallas noted appreciation for the TCEQ's public hearing to allow the democratic process of citizens' participation in critical decisions affecting the air that all North Texans breathe and submitted the following:

> The League of Women Voters of Dallas support the preservation of the physical, chemical, and biological integrity of the ecosystem and maximum protection of public health and the environment. We support regulation of pollution sources by control and penalties, inspection and monitoring, full disclosure of pollution data, incentives to accelerate pollution control. We support vigorous enforcement mechanisms including sanctions for states and localities that do not comply with federal standards and substantial fines for noncompliance. We support measures to reduce vehicular pollution, including inspection and maintenance of emission controls, changes in engine design, fuel types, and the development of more energy-efficient transportation systems. We support regulation and reduction of pollution from stationary sources, regulation and reduction of ambient toxic air pollutants, and measures to reduce transboundary air pollutants such as ozone and those that cause acid deposition.

**The TCEQ encourages public participation in the SIP development process and appreciates the efforts of those who took the time to evaluate the proposed DFW AD SIP revision and provide oral and written comments. The TCEQ takes its duties very seriously and has reviewed and analyzed all testimony related to this 2017 DFW AD SIP revision, provided responses to comments, and made changes as**

**appropriate. All public comments received have been included in this 2017 DFW AD SIP revision package for submission to the EPA.**

**The TCEQ also strives to provide information on agency activities to the public. To get e-mail or text updates on your choice of topics from the TCEQ, go to https://service.govdelivery.com/accounts/TXTCEQ/subscriber/new. No changes were made in response to these comments.**

**Incorporation of Previous Comments**

The Sierra Club and Downwinders requested that the comments they submitted to the TCEQ in February 2015 on the 2018 Proposed *DFW 2008 Eight-Hour Ozone Nonattainment Area Attainment Demonstration SIP Revision* be incorporated by reference, except to the extent those comments explicitly address issues unique to attainment in 2018 rather than to the current attainment year of 2017.

**The 2018 DFW 2008 Eight-Hour Ozone Standard Nonattainment Area AD SIP Revision and the Response to Comments adopted by the commission on June 3, 2015 (2018 DFW AD SIP revision), Non-rule Project 2013-015-SIP-NR) that address the comments submitted by the Sierra Club and Downwinders are incorporated by reference and can be found on the TCEQ's Web page at: https://www.tceq.texas.gov/assets/public/implementation/air/sip/dfw/dfw_ad_sip_2015/AD/Adoption/DFWAD_13015SIP_ado_all.pdf. No changes were made in response to these comments.**

**General Air Quality Concerns**

Congresswoman Johnson expressed sensitivity to the problems arising from poor air quality and the damaging impact it can have on the health of Texans, and indicated more must be done to protect sensitive populations from the negative health effects of ozone. The DFW Chapter of System Change Not Climate Change expressed concern that many more thousands will die and more should be done to save children and the planet.

Liveable Arlington was concerned about the intense drilling in Arlington and its neighboring cities; as residents, they spend time always surrounded by drilling emissions and the children are constantly exposed to emissions. The Denton Drilling Awareness Group and Frack Free Denton were concerned about the contributions of oil and gas development to the degradation of the air quality in North Texas and endorsed many of the comments made at the public hearing regarding the SIP and modeling.

Keep America Moving stated that they have seen the air turn black in Fort Worth. Empowering Oak Cliff commented that the poor air quality limits time outside and was concerned that after it rains, a brown haze rolls into Dallas. An individual commented that the pollution is actually visible, a purplish-gray shroud that hangs over the area.

An individual expressed concern that the most recent evidence shows the smog pollution increasing from 81 parts per billion (ppb) in 2014 to 83 ppb in 2015 and that the TCEQ has failed to take sufficient steps to mitigate this problem. An individual was concerned that others will not move to Dallas because of the poor air quality. An individual urged the TCEQ to take care of the air, the children, this country, and environment. An individual expressed concern that the TCEQ does not responsibly monitor or require that businesses not pollute the air and water. An individual was concerned that the urban smog feeds upon itself as people create a dome of trapped pollution. An individual was concerned about bad air quality and commented that key decision makers should make changes.

An individual was concerned about the haze coming into downtown Dallas and having to stay inside on an ozone day due to respiratory problems. An individual was concerned about the adverse health effects experienced during ozone alert days and noted that a family member can feel when there's an ozone alert day and takes medications to deal with it. An individual commented that it's time to stop having red alert days, bad air days, and stay-inside days. An individual commented that citizens have been attending meetings for years and describing to various officials how the air around the DFW area has negatively affected their health.

**The TCEQ takes its responsibilities very seriously and endeavors to protect the public interest in every action it takes, including those intended to reduce air pollution. The TCEQ strives to protect Texas' human and natural resources, including those in the DFW area, consistent with sustainable economic development, as required by state and federal laws. Information regarding air quality and health effects is provided in the Health Benefits section in this response to comments. No changes were made in response to these comments.**

**TCEQ Failure to Meet Clean Air Standards**

Councilmember Greyson commented that after 20 years of plans that have not met clean air standards, the TCEQ needs to put a better plan in place than the one currently proposed. The Sierra Club and Downwinders commented that although the measures required to ensure compliance with ozone standards in the DFW area raise difficult political issues, the TCEQ has failed to fulfill its obligation to protect the public from the deleterious human health and economic impacts of ozone pollution for more than 45 years. Empowering Oak Cliff commented that it is no longer standing idle but demanding action. Public Citizen commented that for over 20 years it has been working with the TCEQ to come up with a clean air plan to reduce air pollution in the DFW area, and the TCEQ and the State of Texas have failed to protect the people who live and breathe in the DFW area from the impacts of air pollution.

The Texas Campaign for the Environment commented that after 20 years there is still not a plan that meets the Federal Clean Air Act (FCAA) requirements. The DFW Chapter of System Change Not Climate Change commented that the TCEQ has failed repeatedly. The League of Women Voters of Dallas commented that the DFW area has been in continual violation of the Federal Clean Air Act for ozone pollution since 1991, and is currently classified as a nonattainment area for the current federal eight-hour ozone standard of 75 ppb, which is now considered to be inadequate and soon to be replaced by lower 70 ppb standard. The Lone Star Chapter of the Sierra Club commented that over the last 20 years the State of Texas has never succeeded in bringing the DFW area into compliance with the FCAA. Further commenting that North Texas has waited too long, and it's time for the TCEQ to address the regional air problems and devise a successful air plan.

Two individuals commented that the DFW area has been in nonattainment since 1991. An individual commented that for 20 years the region has waited for more than marginal kind of SIPs. An individual commented that if the area hasn't been in attainment since 1991, the whole organization is a failure. An individual is concerned that the TCEQ gives contentious responses to the EPA, doesn't answer its questions, and refuses to do what the EPA asks the TCEQ to do.

An individual commented that there's pressure from the polluters' side, and there is no way the TCEQ will move forward with implementing any of these strategies that are well-known and have been implemented all over the place to clean up the air.

An individual commented that state government has failed thousands of Texans for the last 20 years and that's not close enough, that's long enough. Two individuals commented that they are putting their energy toward pleading with the EPA and that 20 years of illegal air sounds criminal. An individual commented that based on a systemic statewide disregard for environmental concerns, the commenter has no confidence in this state's willingness or ability to adequately address air quality standards. An individual commented that previous SIPs have failed, decades have passed, and this SIP is the latest in a sad procession of SIPs supposedly researched and then designed to bring the North Texas region into compliance with federally mandated ozone levels. An individual commented that he attended the public hearing for one reason, to inspire long overdue action to reduce ozone in North Texas.

**The TCEQ does not agree that it has failed in carrying out its duties. As discussed further elsewhere in this response to comments, air quality in the DFW area has improved dramatically as a result of state, local, and federal air pollution control measures. The TCEQ remains committed to working with area stakeholders to attain the 2008 eight-hour ozone standard as expeditiously as practicable in accordance with EPA rules and guidance and the FCAA. As discussed in this SIP revision, assessment and evaluation of ozone formation is complex, involving hundreds of chemical compounds and chemical reactions, since ozone is not emitted directly. The TCEQ follows EPA rules and guidance in the development of required attainment demonstrations to determine the appropriate mix of control strategies best targeted to address ozone formation in a particular airshed. As shown in Chapter 3, and Appendix B, of this AD SIP revision, the on-road and non-road mobile source categories are the primary sources of $NO_X$ emissions in the DFW nonattainment area, and the FCAA generally preempts state authority to adopt or enforce emissions standards for mobile sources. No changes were made in response to these comments.**

**Reevaluate the SIP and Add Controls**

Congresswoman Johnson expressed concern that the TCEQ's current SIP falls short of complying with federal standards and that additional steps may be needed to protect the health of the citizens. Commissioner Daniel commented that the EPA finds the TCEQ SIP to be inadequate. Further, leading medical experts have asked the EPA to reject the plan for health reasons; Dallas County citizens need the TCEQ to provide a plan that can meet or exceed the current standard of 75 ppb. Commissioner Daniel noted that only attainment should be considered close enough. Councilmember Greyson commented that an effective plan is needed with measures that will get the area to the clean air goal. Councilmember Greyson also referenced the EPA’s comment that with the shorter attainment date, the EPA remains concerned that there are no new measures beyond federal measures and fleet turnover and that additional local and regional ozone precursor emission reductions will be necessary to reach attainment by 2017.

The Sierra Club and Downwinders commented that the TCEQ’s proposed 2017 AD SIP revision is significantly flawed and cannot be approved by the EPA. Liveable Arlington commented that if the SIP revision that's been submitted by the TCEQ did a good job of reducing pollution, one would see significant drops in ozone in this area. These reductions in ozone would be sufficient to bring most parts of the metroplex into compliance with the current 75 ppb standard. The Texas Campaign for the Environment noted that close enough is not good enough and the TCEQ should not expect EPA approval.

The League of Women Voters of Dallas commented that the official EPA comments have stated that the TCEQ's newly proposed DFW clean air plan will not be effective without additional reductions in smog-forming pollution and warn that the state's refusal to comply with certain Clean Air Act requirements make the plan unacceptable. They urged the TCEQ to seriously reevaluate the SIP that it presented and develop a plan to clean the air and protect public health and the environment.

Public Citizen commented that the SIP once again fails to make any significant reduction in power plants, the kilns, or the emissions from the Barnett Shale. Liveable Arlington commented that a plan that cannot take the area to 75 ppb in a timely way and takes no steps to reduce smog-forming pollution from the oil and gas industry does not protect residents of the area. The Lone Star Chapter of the Sierra Club commented that there is a need for meaningful pollution standards on oil and gas equipment, coal plants, cement kilns, and other major pollution sources.

The Fort Worth League of Neighborhood Associations commented that at the 2015 convention in November, the Texas Medical Association passed a resolution to reject the TCEQ's 2015 SIP and advocate for development of a new SIP report that conforms to the scientific peer-reviewed modeling methods developed by the University of Texas (UT) Southwestern Medical School and the University of North Texas experts. The Texas Campaign for the Environment commented that this plan is supposed to provide clean, healthy, safe, and legal air and it does not. The Sierra Club of Dallas stated that it is absolutely horrified at the complete disregard for human health and safety by the State of Texas, which has never taken a single step to make the oil and gas industry the least bit safe to Texas residents.

An individual commented that the TCEQ should take this seriously and reevaluate the SIP that’s been presented and come up with something that works for everybody. An individual commented that people are angry about all the ineffective air SIPs. An individual noted that the so-called clean air plans, including this update to the DFW eight-hour ozone SIP, have never brought the area into compliance with EPA standards. Three individuals expressed concern that the TCEQ holds hearings and appears to listen, but then another meaningless plan is thrown out to the public. An individual commented that the people of DFW have suffered for many years under inadequate clean air plans and the proposed SIP plan will not help to achieve cleaner air, but keeps the public imprisoned in polluted air by a state agency that does not consider the health and welfare of the public when formulating so-called SIP plans. An individual commented that the Texas air has been getting dirtier since the 1990s and the last five times Texas has done a SIP it has failed to implement a plan that makes meaningful cuts in the emissions to get the air clean, yet the TCEQ considers it close enough; the individual’s granddaughter commented that this may not make a dent, but all kids need clean air to breathe. An individual disagrees with the proposed rulemaking because it is not aggressive enough to result in meeting the proposed ozone limits, much less the lower limits arguably required to prevent adverse health effects.

An individual commented that the State of Texas is the Flint, Michigan of air quality; they breathe in illegal air and smog. An individual asked that the TCEQ consider with all seriousness the significance of the resolution passed by the 40,000+ membership of the Texas Medical Association to reject the current version of the SIP. Further, the commenter was concerned that all of North Texas is at great risk for a host of ailments, including death, as a result of the toxicity in the air and for which the TCEQ bears the burden of responsibility.

Twenty individuals commented that they are opposed to the awful State air plan for DFW because it doesn't include any cuts in pollution from major sources and doesn't cut smog enough to comply with the current smog standard. An individual implored the EPA to hold to the regulations that are available to it to impose on industries. An individual commented that this new SIP, fully in the spirit of regulatory make-believe, advocates no new strategies for ozone reduction. An individual commented that it's disgusting and unacceptable that the TCEQ would propose a plan with no new cuts in emissions whatsoever.

An individual commented that it's maddening and extremely frustrating that this SIP doesn't deal with drilling emissions.

**The purpose of this DFW AD SIP revision is to demonstrate attainment of the 2008 eight-hour ozone standard in accordance with the EPA's guidance and FCAA requirements. The DFW area has made considerable improvement in air quality, as evidenced by the information provided in this DFW AD SIP revision. For example, between 2000 and 2014 the eight-hour ozone design value has trended downward 21 ppb, as a result of both state and federal rules. The number of days with at least one DFW eight-hour ozone monitored value day over 75 ppb has also decreased from 63 to 12 over the same period. The DFW area design values by monitor ranged from 88-102 ppb in 2000, but ranged from 67-81 ppb as of 2014 with 45% of these monitors either at or below the 75 ppb standard. Progress toward attainment of the ozone standard from 2000 through 2014 has been significant, even in light of DFW area human population increasing by 32% during this period and vehicle miles traveled increasing by 16%, which largely influences mobile emissions. All emissions in the nonattainment area (on-road mobile, non-road mobile, stationary point sources, and area sources) were reviewed in this DFW AD SIP revision. For more information on power plants, cement kilns, or the emissions from the Barnett Shale, see the Control Strategy and Technical Analysis sections in this document.**

**The TCEQ has evaluated all relevant information documented in this SIP revision in addition to public comment in reaching its decision regarding the appropriate control strategies for the DFW nonattainment area.**

**No changes were made in response to these comments.**

**<u>The DFW SIP Revision Should Be Replaced With a Federal Implementation Plan</u>**

Congresswoman Johnson was hopeful that the TCEQ is up to the challenge and would call on the EPA to ensure that the right of Texans to clean air is protected. Councilmember Greyson commented that the state needs to adopt the EPA's suggestions for this plan, or the EPA should formulate the plan.

Public Citizen announced it doesn’t believe the TCEQ anymore, and is asking the federal government and the EPA to come in and do a federal implementation (FIP) plan to finally clean up the air in Texas. The League of Women Voters of Irving urged the TCEQ to revise the plan and meet the requirements, if not, the EPA needs to do the job that the TCEQ seems to lack the will to do. The Sierra Club of Dallas stated that clean air is a basic human right, not something that the State of Texas should be allowed to take away and give to the oil and gas companies to use as a sewer and further commented that it's time for this tragedy of justice to stop; the EPA needs to take over the SIP and bring some sanity and morality to the state. Liveable Arlington strongly urged the EPA to reject and implement a better plan that deals with the harmful effects of pollution from oil and gas drilling. The Lone Star Chapter of the Sierra Club commented that it's time for the EPA to take over the air planning process with a FIP plan and reject allowing the TCEQ to continue the planning process any further; the TCEQ has failed to clean up the air in the DFW region for more than two decades and action and results are needed.

The North Texas Renewable Energy Group commented that it is going to continue its war on coal and the TCEQ and further stated that the EPA needs to step in and declare this new SIP a failure. The Texas Campaign for the Environment commented that if the TCEQ doesn’t take responsibility to clean up industry, the EPA needs to do a FIP. The Dallas County Medical Society and the Texas Medical Association commented that the physicians of the Dallas County Medical Society and the 45,000 physicians of Texas are dismayed by the TCEQ's rejection of their petition for rule change and failing an immediate revision, urges the EPA to respond to the problem with a FIP. The FW League of Neighborhoods urged the EPA to reject the proposed clean air plan of the TCEQ.

An individual asked the EPA to please take over the Texas SIP. An individual commented that people are beyond frustrated that they have been working on this issue for years, written the powers that be, gone to meetings and hearings, and their pleas are always met by deaf ears. Further, the individual urged the EPA to please get involved in this process and take over for the TCEQ in this matter. An individual commented that Texas needs a good smog plan for DFW and the EPA is the only hope to breathing cleaner air; the State of Texas does not have the citizen’s best interest when it comes to air including frackquakes from the oil and gas industry. An individual commented that in the event the TCEQ can't do what it should, EPA, Region 6 is the only hope.

An individual noted that the Clean Air Act requires the EPA to implement a FIP if a SIP fails to include measurements that will assure attainment of the NAAQS. An individual requested an EPA intervention to ensure the air quality in DFW so the seven million people it affects get the attention they deserve. Two individuals commented that after 20 years, they are done asking the TCEQ to do much of anything, and hope that at this point the EPA steps in. An individual pleaded with the EPA to take the area into the 21st century with a FIP, not a SIP. An individual urged the staff to solve the issues or resign and requested that the EPA take over. An individual commented that the EPA is the last hope in this state, in this region, to get this done. Further commenting that enough is enough, and it's time that the EPA take this region over with a FIP. An individual commented that the only way that the citizens of the area will ever begin to enjoy reasonably healthy air is if the EPA institutes a plan capable of bringing the DFW area into compliance with a new 70 ppb standard. An individual urged the EPA to please take over the problem and that the TCEQ commissioners need to be fired. An individual commented that the state needs to do its job or the EPA is going to do it for the state. An individual commented that it is the duty of the people to nurture the world and protect it and pled with the EPA to take over the management of air quality from the TCEQ, establish severe, meaningful, and enforceable regulations on polluters to give citizens the clean and safe air they deserve to breathe.

**The DFW area has seen considerable improvement in air quality since the time of the area's initial nonattainment designation under the one-hour ozone standard in 1991. In 2008, the EPA issued a determination that the DFW four-county one-hour ozone nonattainment area (Collin, Dallas, Denton, and Tarrant Counties) had attained the one-hour NAAQS based on certified 2004 through 2006 monitoring data and was further supported by 2007 through 2008 monitoring data. The DFW area continues to monitor attainment of the one-hour ozone standard. In addition, the eight-hour ozone design values in the DFW area have been trending downward since 2000, and the area is now monitoring attainment of the 1997 eight-hour ozone standard based on certified 2012 through 2014 monitoring data. On February 24, 2015, the TCEQ submitted early certification of 2014 ozone air monitoring data to the EPA, along with a request for a determination of attainment for the 1997 eight-hour ozone standard (85 ppb) for the DFW area. On September 1, 2015, the EPA finalized a clean data determination for the DFW 1997 eight-hour ozone nonattainment area (80 *Federal Register* [FR] 52630). The DFW area continues to monitor attainment of the 1997 eight-hour ozone standard with preliminary monitoring data for 2013 through 2015.**

**This SIP revision satisfies the FCAA, §182 requirements and EPA guidance for the DFW nonattainment area under the 2008 eight-hour ozone standard by demonstrating attainment of the 2008 eight-hour ozone NAAQS by July 20, 2018 based on a photochemical modeling analysis of reductions in nitrogen oxides ($NO_X$) and volatile organic compounds (VOC) emissions from existing control strategies and a WoE analysis. Once a SIP revision is adopted by the commission, the SIP package is submitted to the EPA. Once submitted, the EPA will review this SIP revision and either approve or disapprove it.**

**Since the modeling cannot provide an absolute prediction of future-year ozone design values, additional information from corroborative analyses are used in assessing whether the area will attain the ozone standard by July 20, 2018. The 2017 future-year design value ($DV_F$) calculations are provided using both the "all days" and "top 10 days" attainment tests discussed below. A WoE range of 73-78 ppb is inferred from the EPA official modeling guidance from April 2007 entitled *Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, PM2.5, and Regional Haze* (https://www3.epa.gov/ttn/scram/guidance/guide/final-03-pm-rh-guidance.pdf). Use of the "all days" attainment test from this official modeling guidance results in a peak ozone design value of 77 ppb that falls within this 73-78 ppb range. The EPA released a draft update to this modeling guidance in December 2014 entitled *Draft Modeling Guidance for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze* (https://www3.epa.gov/ttn/scram/guidance/guide/Draft_O3-PM-RH_Modeling_Guidance-2014.pdf) which does not specify a WoE range, and instead requires that the $DV_F$ figures be "close to the NAAQS." The newer "top 10 days" attainment test results in a peak ozone design value of 76 ppb that meets this requirement. Differences in the application of these two tests are more thoroughly**

**described in Chapter 3: *Photochemical Modeling*, Section 3.7.2: *Future Baseline Modeling*.**

**The WoE includes supplemental evidence that the conclusions derived from the basic attainment modeling are supported by other independent sources of information including: emission trends, additional air quality studies, air quality control measures that are not quantified but are nonetheless expected to yield tangible air quality benefits, and on-going initiatives that are expected to improve the scientific understanding of ozone formation in the DFW nonattainment area. No changes were made in response to these comments.**

Texas Campaign for the Environment stated that the EPA has said that the proposed plan is not adequate, that this plan does not follow the law, and that it is not an option to not follow the FCAA.

**The commission disagrees with the commenter that it has not followed the law in preparing this SIP revision. At the time of the public hearing on the 2017 DFW AD SIP revision in Arlington, Texas on June 21, 2016, the EPA had not yet offered formal comments on this 2017 DFW AD SIP revision but had commented on a previous demonstration using a different attainment date. The commission has considered all comments, including the comments that the EPA has submitted on the current 2017 DFW AD SIP revision. The commission has followed all relevant EPA guidance on how to develop an AD SIP revision, and is submitting an DFW 2017 AD SIP revision with all required elements. The commission agrees that it is necessary to follow the FCAA, and this AD SIP revision contains all elements required by the FCAA and EPA guidance. No changes were made in response to this comment.**

An individual commented that he is concerned about recent news stories about the Environmental Defense Fund petitioning the EPA to revoke the TCEQ's authority to develop clean air implementation plans because of recent Texas legislative actions. The individual is also concerned about lawsuits brought by Texas to prevent EPA enforcement of the Clean Air Act and is concerned about the TCEQ's implementation plan.

**These comments are beyond the scope of this action. The TCEQ continues to meet its obligations under the FCAA, including the obligation to develop a plan to bring any ozone nonattainment areas, including the DFW area, into attainment as expeditiously as practicable. That is the purpose of the current 2017 DFW AD SIP revision. Any current lawsuits between the EPA and the TCEQ have no direct relation to the purpose of this AD SIP revision. No changes were made in response to these comments.**

**<u>Environmental Justice</u>**

Congresswoman Johnson commented that working together, greater strides can be made for environmental justice and cleaner air for all. An individual stated that West Dallas is the poster child for environmental racism due to the poverty in the area, which has existed since he was a child.

**The TCEQ has made a strong commitment to address such issues by creating the Environmental Equity Program within the Office of the Chief Clerk. The goals of the Environmental Equity Program are to: help citizens and neighborhood groups participate in regulatory processes; serve as the agency contact to address allegations of environmental injustice; serve as a link for communications between the community, industries, and the government; and thoroughly consider all citizens' concerns and handle them fairly. Additional information can be found on the TCEQ's Environmental Equity Program Web page (http://www.tceq.texas.gov/agency/hearings/envequ.html). No changes were made in response to this comment.**

**TCEQ Leadership Needed**

Keep America Moving and one individual expressed general frustration that the commissioners do not attend public hearings. The Denton Drilling Awareness Group and Frack Free Denton commented that the state and federal government need to protect the public and not create conditions that make the public sick. The League of Women Voters of Irving and an individual commented that Texas government makes the public sick and that people are being harmed by bad politics and bad public policy, and further stated that all that matters to the TCEQ is adhering to the rigid party line no matter how much science is denied in the process; TCEQ leadership has no political will to make hard decisions and yet the state government is taking credit for federal gains in clean air that were done despite the state's resistance. Public Citizen commented that the commissioners and the governor have failed and failure should never be rewarded, and it's time for somebody who will actually do the job to step in and take over.

An individual commented that the TCEQ does not have the political will nor the fortitude to implement a SIP that would enable the area to attain compliance with the Clean Air Act. An individual commented that the public should come first and leaders should protect the people and not industry. An individual expressed dissatisfaction that the commissioners will not take the public's side but rather, the polluters when it comes to decisions regarding air quality. Five individuals were concerned that the TCEQ doesn't listen when citizens warn of toxic air in DFW that is making children sick and challenged the TCEQ to protect citizens and not repeat what happened in Flint, Michigan when state government ignored the problem.

**The TCEQ appreciates and understands the concerns and frustrations expressed by the commenters. The commission is kept apprised of comments and approve these responses, as well as the SIP revision. In making decisions regarding proposed and final SIP revisions, the commission carefully considers public comments and concerns, which are a valued part of the SIP revision process. As discussed elsewhere in this response, air quality has improved dramatically as a result of state, local, and federal air pollution control measures. Additionally, specific health effects associated with air quality are discussed further elsewhere in this response to comments document. No changes were made in response to these comments.**

**Economic Effects and Profits Over Public Health**

Congresswoman Johnson commented that effective regulations will have a positive economic impact by promoting job creation, encouraging scientific innovation, and promoting the creation of new technologies. The Sierra Club and Downwinders commented that reductions in ozone levels from the curtailment of emissions at the five largest coal plants in East Texas would not only result in significant improvement in public health but would yield substantial economic development and the creation of jobs.

**The TCEQ agrees generally that effective regulations should minimize negative economic impact. Whether the curtailment of emissions at the five largest coal plants in East Texas would yield substantial economic development and creation of jobs is outside the scope of this DFW nonattainment area SIP revision. For general information on ozone impact on public health, see the Health Benefits section on page 14 of this response to comments document. No changes were made in response to this comment.**

An individual commented that the TCEQ's proposed SIP is outrageous and unacceptable and proves once again that the TCEQ sadly cares more about polluters' profits than about the public health. The Sierra Club of Dallas was concerned that the State of Texas only cares about corporations that give campaign contributions to legislators; clean air is a basic human right, not something that the State of Texas should be allowed to take away from the people and give to the oil and gas companies. The Texas Campaign for the Environment commented that often times a state environmental agency acts as a rubber stamp for polluting companies.

The DFW Chapter of System Change Not Climate Change commented that the bad air quality in this state is due to leaders who are on the side of industry and polluters. Keep America Moving was very concerned that if oil and gas companies go bankrupt, there will be hundreds of injection wells full of contaminated fracking fluid and frack ponds that will need to be cleaned up. Further, the concern is that the state budget will lose income from the same oil and gas companies and may not be able to provide funding for the TCEQ to do the cleanup. Two individuals were concerned about corporate greed and people not having the will to enforce policy.

An individual was concerned about chronic air pollution in DFW and compared it to a time in 19th century England when the government backed the smoke-producing monopolists rather than the public health. An individual was concerned that leaders protect industry over people. An individual is concerned that the State of Texas prioritizes financial gain in the oil and gas industry ahead of public health concerns. An individual was very concerned that big oil's profits are worth more than health to the government. An individual commented that state and local policy leaders only respond to those representing industry profits, the economy, and jobs, so it's senseless to have repeated hearings on how to protect clean air and water, better health and quality of life, and reduction in premature death.

An individual was concerned that big government says that any type of control will cause a weak economy and loss of jobs, but employers lose about 14 million workdays every year when asthma keeps an adult out of work and $650 million a year in productivity is lost. An individual commented that the State of Texas clean air plan is a shellgame influenced by elected officials who protect the oil and gas industry and profits. The commenter also stated that people put trust in the EPA and the TCEQ to protect the air for kids with respiratory issues who suffer and die under regulatory capture.

**The TCEQ appreciates the concerns expressed by the commenters but does not agree that it is only concerned with industry profits or the economy. As discussed elsewhere in this response, the TCEQ takes its responsibilities seriously and**

**strives to protect the state's human and natural resources consistent with sustainable economic development, as required by the general powers and duties granted to the commission by the Texas Legislature. The DFW area has made considerable improvement in air quality while steadily increasing in population and gross metropolitan product.**

**For example, between 2000 and 2014, the eight-hour ozone design value has trended downward 21 ppb. The number of days in the DFW area where the daily eight-hour ozone peak exceeded 75 ppb has also decreased from 63 to 12 over the same period. The DFW area design values by monitor ranged from 88-102 ppb in 2000, but ranged from 67-81 ppb as of 2014 with 45% of these monitors either at or below the 75 ppb standard. According to the most recent data from the United States (U.S.) Bureau of Economic Analysis website (http://bea.gov), from 2000 to 2014, the DFW metropolitan area's economy grew from $254.5 billion to $504.4 billion while the Combined Statistical Area population increased by 37.5% according to the Census Bureau website (http://census.gov). No changes were made in response to these comments.**

An individual expressed general dissatisfaction with TCEQ permitting, TCEQ SIP planning, and alleged inadequate TCEQ responses to past EPA requests.

**The TCEQ is aware of the general dissatisfaction with SIP planning noted by several commenters. SIP planning is a detailed and highly technical process that involves both technical and policy objectives. As discussed further elsewhere in this response to comment document, the TCEQ takes its responsibility in SIP planning extremely seriously and values public input in this process. There were no specific issues mentioned in the comments, therefore, the TCEQ cannot further address this comment. No changes were made in response to this comment.**

**State of Texas Usurping Local Control**

The Denton Drilling Awareness Group and Frack Free Denton commented that the people of Denton voted by an overwhelming margin to take measures to clean up the air in Denton, and the State of Texas saw fit, at the urging of the oil and gas industry, to "swat down" Denton's effort to protect itself and to breathe clean air. An individual commented that Denton citizens tried to correct negative impacts of fracking in their community but legislators on the side of the energy industry took away local control. An individual expressed concern that an oil and gas CEO once verified for a group of folks at a homeowner's association meeting that talk of peaceful protesting in Denton has people on a Homeland Security watch list and if they can't buy policymakers, they resort to open intimidation.

An individual commented that local elections curbing drilling and fracking are just nullified at the state level. An individual commented that even if the city council were to deny future drilling, the state's going to sue them, so there is nobody to turn to. An individual commented that Texas law turns a blind eye to the dangers of fracking showing more concern for oil and gas production than for protecting the land upon which they live and work and play and breathe. The commenter further stated that even if the majority of property owners in an urban area vote to disallow fracking in their neighborhoods, they essentially have no say in the matter as per Texas' new laws unless they can prove that fracking is not commercially beneficial to the state.

**Comments regarding legislative support for local and regional governments or legislative funding priorities are outside the scope of the commission's authority. No changes were made in response to these comments.**

## HEALTH EFFECTS

Congresswoman Johnson, Commissioner Daniel, Public Citizen, the Sierra Club of Dallas, the Dallas County Medical Society, the Texas Medical Association, Liveable Arlington, the Sierra Club and Downwinders, the Fort Worth League of Neighborhood Associations, Empowering Oak Cliff, and 40 individuals expressed concern for the DFW area's air quality and its impact on human health. One individual expressed concern about getting nosebleeds upon moving to the area. Congresswoman Johnson, Public Citizen, Liveable Arlington, and one individual noted concern that the American Lung Association has given the DFW area air quality a failing grade. One individual stated that she couldn't encourage someone to move to the area because the air is worse in the Dallas area than it is in New York City, Boston, and Providence and it would endanger her friend's infant's health.

Several individuals and organizations expressed concern about area asthma. The Sierra Club and Downwinders and 24 individuals expressed concern about the incidence and prevalence of asthma and other respiratory and cardiovascular diseases in North Texas. The Sierra Club of Dallas, Empowering Oak Cliff, and five individuals expressed that they or their loved one(s) are suffering with asthma. One individual commented that, as a former teacher, she has seen an increase in childhood asthma and autism in her school. Liveable Arlington, the Fort Worth League of Neighborhood Associations, and 25 individuals commented that the DFW area has an asthma rate that is three times higher than the national average. The Sierra Club and Downwinders stated that 14% of adults in the DFW area have asthma, which is the highest prevalence rate in Texas, and more than 13% of Texas children will have asthma over the course of their childhood. The Sierra Club and Downwinders, and three individuals expressed concern that asthma disproportionately affects minorities. Three individuals described the difficulties of living with asthma. The Sierra Club and Downwinders, stated that ozone both exacerbates existing asthma and increases the risk of developing asthma with every 10 ppb increase in annual mean or eight-hour average ozone concentration.

The Sierra Club and Downwinders and seven individuals expressed that they or their loved one(s) have been diagnosed with pulmonary disease, such as bronchiectasis, bronchitis, or pulmonary fibrosis. Public Citizen noted the story of a member who had asthma and blamed upwind power plants for the lung cancer that she developed later in life.

The Sierra Club and Downwinders state that epidemiology studies consistently demonstrate that ozone is linked with various respiratory impacts, such as "lung function decrements, increases in respiratory symptoms, pulmonary inflammation in children with asthma, increases in respiratory-related hospital admissions and emergency department visits." The commenters also state that there is evidence that "repeated exposure over time causes additional health impacts which may even be more severe and less reversible."

In addition to respiratory morbidity, the Sierra Club and Downwinders stated that ozone exposure can lead to health impacts in the central nervous, cardiovascular, and reproductive systems, as well as perinatal and developmental impacts. Examples of cardiovascular impacts include increased risk of hospitalization for acute myocardial infarction, coronary atherosclerosis, stroke, and heart disease, as well as increased risk of children developing cardiovascular disease later in life. The commenters also expressed concern that ozone exposure caused reduced birth weight, premature delivery, and birth defects.

Commenters also expressed concern over ozone-mediated mortality. The Sierra Club and Downwinders and four individuals expressed concern that ozone levels in the DFW area caused the deaths of area residents and children. The Sierra Club and Downwinders stated that a 10 ppb increase in peak ozone concentration was associated with a 0.52% increase in mortality the following week and that ozone concentrations below 60 ppb were still associated with increased mortality. One individual stated that 76 to 100 people a year die needlessly in the area and that the TCEQ's "toxicologists of ill-refute" [sic] claim that "smog doesn't kill people, and they can claim there's no down side."

The Dallas County Medical Society, the Texas Medical Association, and three individuals expressed concern over comments from the TCEQ regarding ozone-induced health effects. The Dallas County Medical Society and the Texas Medical Association expressed surprise that the TCEQ stated that 70 to 80 ppb ozone does not hurt humans and is "actually beneficial to humans' lungs." One individual suggested that the TCEQ mistakenly believes that ozone does not destroy human lung tissue. Another individual expressed alarm that the TCEQ used taxpayer money to contract with Gradient Corporation to challenge the science behind the ozone standard and argue that health benefits are not worth the cost of regulation. A third individual expressed frustration that the TCEQ's chief toxicologist tells residents to stay inside on high ozone days.

Congresswoman Johnson, Commissioner Daniel, the Dallas County Medical Society, the Texas Medical Association, Liveable Arlington, the Sierra Club and Downwinders, and two individuals noted the economic savings of attaining a lower ozone standard. Specifically, Congresswoman Johnson noted poor air quality leads to higher healthcare costs and lost productivity. Commissioner Daniel, the Sierra Club and Downwinders, the Dallas County Medical Society, the Texas Medical Association, and two individuals referenced a study by Dr. Robert Haley showing a savings to northeast Texas of $650 million a year and prevention of 95 to 100 deaths annually for a 5 ppb reduction in ozone. The Dallas County Medical Society used the EPA's benefits-mapping computer model to estimate that a 5 ppb reduction in ozone would "prevent 165 hospital admissions, 350 emergency room visits, 150,000 restricted activity days, ... 120,000 school absences, and 77 deaths per year from lung and heart disease catastrophes, with an economic valuation to the area of over $500 million" per year in the DFW nonattainment area. Liveable Arlington stated that decreasing benzene emissions would lower smog and improve "other public health situations."

**The FCAA requires the EPA to set the primary ozone NAAQS at levels that protect the health of the public, including infants, children, the elderly, and those with pre-existing conditions, such as asthma. The TCEQ takes the health and concerns of Texans seriously and, through regulatory and voluntary efforts with area industry, communities, and individuals, concentrations of ozone and ozone precursors have steadily decreased in Texas and in the DFW area over the last 15 years. Specifically, between 2000 and 2014, the eight-hour ozone design value in the DFW area has decreased 21 ppb.**

**Concern was raised about general air quality in light of the failing grade the American Lung Association gave Texas. The grading system used by the American**

**Lung Association in its annual State of the Air report has drawn public criticism from a variety of organizations, including the EPA, Colorado Department of Public Health and Environment, Indiana Department of Environmental Management, Maryland Department of the Environment, and Hamilton County Department of Environmental Services (Kerrigan 2015). Among many issues, the report authors do not take into consideration the varying ambient concentrations within an area or an individual's actual exposure, which would be necessary to conduct an assessment of health risk in urban areas.**

**Ambient ozone concentrations have decreased considerably from 2000 to 2014 in the DFW area despite the population increasing by 32%. For more information, see the air monitoring data available on the TCEQ's Air Web page (http://www.tceq.state.tx.us/agency/air_main.html).**

**As noted by commenters and the media, the TCEQ has invested staff resources and state allocated funds in the analysis of ozone health effect data in an effort to provide a scientific peer review of an important ambient chemical that has many far-reaching regulatory implications. The TCEQ has never stated that ozone is beneficial to human lungs. In fact, the TCEQ has repeatedly agreed with the EPA that ozone is an irritating chemical that can cause acute respiratory symptoms at high enough doses, as described more fully in the sections below. The TCEQ's analysis, however, did note many inconsistent results, biases, and errors in both the ozone health data and how it was analyzed, as well as uncertainties in modeling and extrapolation of the data to real-world exposure scenarios. The TCEQ's work and official comments to the EPA highlighted these shortcomings and filled in some gaps in the EPA's analysis that were important to understanding the health effects of ozone.**

**The TCEQ's choice to analyze the ozone literature is consistent with its mission to protect our state's public health and natural resources consistent with sustainable economic development. The ozone analyses suggest additional scientific dialogue and evaluation are necessary to determine the point at which further lowering of ozone concentrations will have negligible benefits for human health. The TCEQ looks forward to additional collegial work with the EPA, ozone scientists, and public health experts to ensure regulatory standards are necessary and provide meaningful protection to Texans.**

**With respect to concerns about reducing time outdoors, the TCEQ encourages a broader understanding of pollutant exposure when determining whether to spend time indoors or outdoors. As detailed more fully in the section below, human subjects exposed to ambient-relevant ozone concentrations only experienced statistically significant health effects when they both vigorously exercised and were exposed over 6.6 hours. Vigorous outdoor exercise conducted over several hours during a day with ozone concentrations greater than 70 ppb is not a common combination, which makes the public less likely to experience adverse health effects. Conversely, the EPA has identified and characterized significant risks to public health from indoor environmental contaminants that are commonly found in homes, schools, offices, and other buildings, such as radon, tobacco smoke, molds, irritants in cleaning supplies, and combustion by-products.**

According to the Texas Department of State Health Services, it is possible for indoor levels of air pollutants to reach up to two to five times higher, and occasionally even 1,000 times higher, than outdoor levels (TDSHS 2012). The TCEQ encourages individuals to consider more than ozone levels, such as the risk of extreme heat and exposure to indoor air pollutants, when making choices about whether to limit outdoor activities and stay indoors when ambient ozone concentrations are elevated above 75 ppb.

Responses to specific health-related concerns expressed by commenters are provided below.

<u>Asthma</u>

Current scientific literature does not provide a definitive link between ambient ozone levels and asthma development. Although earlier studies indicated asthma diagnosis was increasing, the 2010 Texas Asthma Burden Report noted that lifetime or current asthma prevalence in either Texas adults or children did not change significantly from 2005 to 2009, and the 2014 Texas Asthma Burden Report noted a similar plateau effect for the 2011 to 2013 period (TDSHS 2010, TDSHS 2014). , Figure 1: *2011 Asthma Prevalence Rates in the U.S., Texas has one of the lowest prevalence rates of asthma in the country (CDC 2013a)* in this response to comments document, page 22, overall, Texas has one of the lowest adult lifetime asthma prevalence rates in the country. According to 2013 Behavioral Risk Factor Surveillance System (BRFSS) survey, 17 states had higher childhood asthma prevalence rates than Texas (CDC 2013b). Furthermore, the 2013 prevalence of parents reporting that their child has been diagnosed with asthma and still has asthma in Health Service Region (HSR) 3, which includes the DFW nonattainment area, was lower than the prevalence rate in HSR 4, which includes Tyler, and HSR 10, which includes El Paso (TDSHS 2014). The 2014 eight-hour ozone design values in these areas were 71 ppb (Tyler) and 72 ppb (El Paso), well below the DFW design value of 81 ppb. This suggests that ozone concentrations do not readily predict asthma prevalence for these areas in Texas. In addition, contrary to comments received, the asthma rates for the region including DFW (HSR 3) are *not* three times higher than national averages (HSR 3: 8% for adults and 11% for children versus national averages of 7.4% for adults and 8.6% for children) (CDC 2014). These data suggest that childhood asthma rates in the DFW area are actually *lower* than some areas of the state and are only slightly elevated above national averages.

The trends in asthma prevalence and the lack of a definitive link between ambient ozone concentrations and asthma rates is consistent on the national scale. Abinkami et al. (2016) recently reported a plateau effect in nationwide childhood asthma prevalence. Large, multi-city studies, which have included Dallas, have not indicated a correlation between current ambient concentrations of ozone and increased incidence of asthma symptoms (O'Connor et al. 2008, Schildcrout et al. 2006). In addition, a more recent study has shown that the most important factors affecting asthma incidence are ethnicity and poverty (Keet et al. 2015). Finally, the EPA's analysis completed as part of the 2015 ozone NAAQS does not anticipate a statistically significant reduction in asthma exacerbations as a result of the lower standard (Table 6-20, USEPA 2015). Therefore, because asthma rates have

**remained steady while ambient levels of both ozone and ozone precursors have been steadily decreasing and asthma rates can be higher in areas with lower ozone, it does not appear that ambient ozone concentrations are a significant contributing factor to asthma rates. Further, if ozone does not contribute to asthma incidence, then additional decreases in ambient ozone concentrations would not be expected to reduce the cost of illness nor would the reduction offer greater protection of children's health from new-onset asthma.**

**Although the causes of asthma are not fully understood, there are many factors that influence the development and exacerbation of asthma. According to the World Health Organization, one of the strongest risk factors for developing asthma is genetic predisposition. In addition, indoor allergens (dust mites, pet dander, and presence of pests such as rodents or cockroaches) together with outdoor allergens (pollen and mold), tobacco smoke, or other triggers such as cold air, extreme emotions (anger or fear), and physical exercise can all provoke symptoms in those with asthma. Some scientists have also suggested that changes in exposure to microorganisms (hygiene hypothesis) or the rise in sedentary lifestyle (affecting lung health) and obesity, which results in inflammation, may be to blame.**

**Again, the TCEQ agrees that breathing ground-level ozone at higher than typical ambient concentrations for hours while vigorously exercising may cause acute respiratory problems like cough and respiratory irritation and may aggravate the symptoms of asthma. Clinical studies in humans exposed to ozone verify this result and indicate that health effects can generally resolve quickly once an individual is no longer exposed to high ozone levels. The TCEQ uses this information to discuss and encourage meaningful regulatory policy and remains committed to ensuring the air is safe to breathe in all areas of Texas.**

**<u>Ozone-Induced Mortality</u>**

**The TCEQ does not support the assertion that ambient concentrations of ozone are causing death because the scientific data do not support it.**

**Clinical studies on hundreds of human subjects have shown only a range of mild, reversible respiratory effects in people that were exposed to between 60 ppb and 120 ppb ozone (representative of ambient concentrations) for up to eight hours while exercising vigorously (Adams 2006, Schelegle et al. 2009). Ethical standards preclude scientists from giving human subjects potentially lethal doses of chemicals, and none of the human subjects in these studies died as a result of their exposure to ozone. Basic toxicological principles indicate that concentrations of ozone (or any other chemical) that only cause a mild, reversible effect cannot also increase the incidence of all causes of death, even in a very sensitive individual. The dose of ozone that is lethal to experimental animals is orders of magnitude higher than ambient levels of ozone (Stokinger et al. 1957) and the National Institute for Occupational Safety and Health (NIOSH) Immediately Dangerous to Life or Health value for ozone is 5,000 ppb (NIOSH 2005). Therefore, the available information does not support assertions that there is a mechanism for ambient ozone to contribute to mortality. Epidemiology studies suggesting the possibility of ozone-mortality associations make the crucial error of not considering the actual**

**exposure of the people in the study. Rather, these studies assume that people are exposed to the level of ozone measured at the ambient monitor (sometimes to the highest ambient monitor in the entire metropolitan area), which could be up to 10-times higher than their actual exposure (Lee et al. 2004) and may not correlate at all with the person's actual exposure (Sarnat et al. 2001, Sarnat et al. 2005).**

**Furthermore, the epidemiology studies that are the basis for the conclusions about long-term exposure to ozone affecting mortality are, in fact, not consistent. The relationship between long-term ozone exposure and mortality has been investigated in at least 12 epidemiology studies. Rather than build its position on the entirety of available data, the EPA concludes that there is a likely causal relationship between ozone and long-term respiratory mortality based on a single epidemiology study (Jerrett et al. 2009). Only Jerrett et al. (2009) showed a statistically significant (but very small) correlation between ozone and respiratory mortality. Interestingly, the effect was only observed at temperatures above 82°F. Paradoxically, the effect was not observed in U.S. regions with the highest ozone concentrations (southern California) nor in areas with the highest number of respiratory deaths (the Northeastern U.S. and the industrial Midwest). Other studies that looked at the same population of people as Jerrett et al. (2009) did not find an association between long-term ozone exposure and cardiopulmonary mortality (Pope et al. 2002, Jerrett et al. 2005, Atkinson et al. 2016). Most recently, a study analyzing 14 publications from eight cohorts determined that there was "no evidence of associations between long-term annual $O_3$ [ozone] concentrations and the risk of death from all causes, cardiovascular or respiratory diseases, or lung cancer" (Atkinson et al. 2016).**

**<u>Respiratory Effects of Ozone</u>**

**The lowest concentration of ozone tested in human-controlled exposure studies that caused both a decrease in lung function and symptoms (the American Thoracic Society's definition of an adverse respiratory health effect; ATS 2000) was 72 ppb. These effects were mild and reversible, and the study subjects had to be exposed for 6.6 hours while vigorously exercising to show those mild effects (Schelegle et al. 2009). As stated above, this is a relatively uncommon combination of events (the person would also have to be outdoors), and in addition, these lung function effects may or may not even be detectable to the person experiencing them. Interestingly, rather than being more sensitive, children and asthmatics have been shown to have similar lung function effects after ozone exposure as healthy adults (McDonnell et al. 1985, Koenig et al. 1987, Holz et al. 1999, Stenfors et al. 2002). In addition, clinical studies have not shown increased lung function responses to ozone in people with chronic obstructive pulmonary disease (COPD), which includes chronic bronchitis, compared to healthy individuals (Gong et al. 1997). Indeed, there is little consistent data from epidemiology studies showing lung function effects of ozone on individuals with COPD (Peacock et al. 2011, Lagorio et al. 2006). There is also little evidence to suggest that ozone negatively impacts lung development. A recent study of children in the Los Angeles area, which has much higher levels of ozone than the DFW area (the 2014 eight-hour ozone design value was 102 ppb in Los Angeles versus 81 ppb in DFW) has shown that ozone has no effect on lung development (Gauderman et al. 2015).**

**Cardiovascular Effects of Ozone**

**Several recent studies have integrated all of the evidence for both short-term and long-term ozone exposure effects on cardiovascular disease and mortality. For both short-term and long-term exposure, the study authors found that the evidence was “below equipoise,” meaning that the evidence was not enough to conclude that either short-term or long-term exposure to ambient concentrations of ozone causes cardiovascular health effects (Goodman et al. 2014, Prueitt et al. 2014).**

**Other Health Effects**

**None of the available literature indicates that repeated exposure to ozone causes additional or more severe health impacts. In fact, two studies specifically noted an adaptive lung function response (that is, a decrease in response when exposure occurs constantly or repeatedly) to ozone exposure. Zanobetti and Schwartz (2008) noted that ozone mortality effects diminished in the later parts of the ozone season when individuals are presumed to have experienced repeated or prolonged potential for ozone exposure. In addition, Hackney et al. (1977) noted that lung function decrements (forced vital capacity, forced expiratory volume in one second, delta nitrogen, total respiratory resistance, and symptom scores) in study individuals who were “unusually” responsive to ozone had almost returned to control values by the fourth successive day of exposure.**

**Many different health effects have been investigated after ozone exposure. However, because data from minimal or inconsistent studies do not provide the WoE necessary to substantiate the association between pollutant exposure and the health outcome, only those health outcomes with consistent, robust data should be considered in the TCEQ’s and the EPA’s health risk assessments. Those that do not have robust datasets, and therefore are not included in the risk assessment, include: nose bleeds, autism, cancer, and perinatal, reproductive, and central nervous system impacts.**

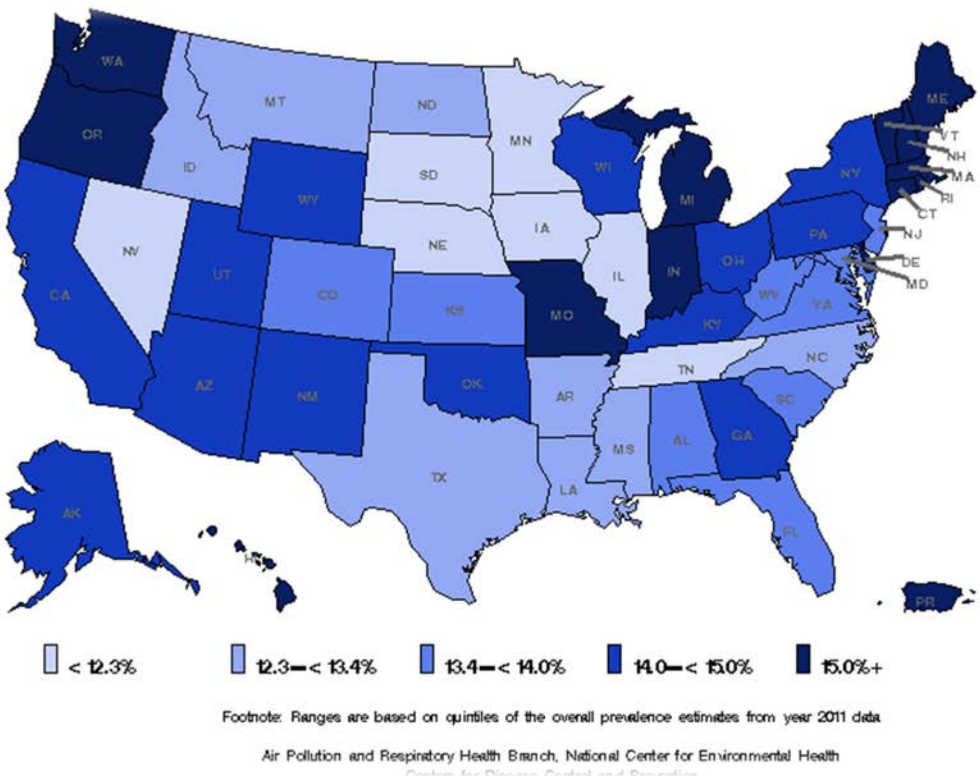


**Figure 1: 2011 Asthma Prevalence Rates in the U.S., Texas has one of the lowest prevalence rates of asthma in the country (CDC 2013a).**

**<u>Benefits of ozone reduction</u>**

**The analysis provided by Dr. Robert Haley used the EPA's Benefits Mapping and Analysis Program (BenMAP) to calculate the health impacts of a 5 ppb reduction in ambient ozone concentrations in the DFW area. Most (over 90%) of the monetary benefits of reducing ozone in BenMAP are derived from a reduction in premature mortality. However, as explained above, the scientific data suggesting an association between ozone exposure and premature death are tenuous at best. The EPA also expressed a lack of confidence in the mortality data saying that "the PA [Policy Assessment] places relatively less weight on epidemiologic-based risk estimates", (USEPA 2014), and that "The determination to attach less weight to the epidemiologic-based estimates reflects the uncertainties associated with mortality and morbidity risk estimates, including the heterogeneity in effect estimates between epidemiologic study areas, the potential for epidemiologic-based exposure measurement error, and uncertainty in the interpretation of the shape of the concentration-response functions at lower ozone concentrations." Therefore, the projected prevention of up to 100 deaths per year is highly suspect. In addition, the EPA's own modeling analysis conducted as part of the 2015 ozone NAAQS indicates that, statistically, no fewer asthma attacks or respiratory hospital admissions are anticipated as a result of lowering ambient design values from 75 ppb to 70 ppb (USEPA 2015).**

**No changes were made in response to these comments. References for all studies are provided at the end of the document.**

**Oil and Gas Health Effects**

Liveable Arlington, the Sierra Club of Dallas, and five individuals expressed concern over the health effects related to emissions from oil and gas activity. The Sierra Club of Dallas expressed concern about methane, propane, benzene, xylene, propargyl alcohol, dichloromethane, trichloroethylene, and cyclohexane leaking from fracking operations. Liveable Arlington expressed concern about methane, nitric oxide, nitrogen dioxide, and VOCs, including benzene, toluene, ethyl benzene, and xylene, as well as the impact these compounds have on ozone formation. The Sierra Club of Dallas further stated that Texas doesn't care about the people in the Metroplex and that the TCEQ's chief toxicologist tells people to stay inside and not to think about the people repairing streets and building buildings. Two individuals stated concern about health effects, including rashes, sneezing, nosebleeds, and bronchitis, experienced by themselves and family members. One individual expressed concern over her husband's exposure to ambient pollutants as an outdoor construction worker. One individual stated that the "TCEQ lowered its own acceptable amount of benzene exposure 40% and weakened protections for a slew of other chemicals" following the shale boom. Liveable Arlington expressed concern for the potential health effects of long-term exposure to drilling emissions and the costs of medication, lost wages, and emotional costs of a chronically ill child. Liveable Arlington and one individual asked for a change in allowable levels of pollutant emissions.

**The TCEQ takes its mission of protecting our state's public health and natural resources seriously and has, therefore, heavily invested in conducting extensive air monitoring for chemicals associated with oil and gas operations in the DFW area. Since 2009, staff have collected over 1,700 individual air samples that have been analyzed for 84 individual VOCs, including propane, benzene, ethyl benzene, toluene, xylenes, dichloromethane, trichloroethylene, and cyclohexane. In addition to individual canisters collected by staff, the TCEQ receives hourly concentration data from 16 nitrogen dioxide monitors and 15 VOC monitors, as well as 24-hour air samples collected once every six days from 13 sampling sites in the DFW region alone.**

**The TCEQ uses a peer-reviewed process to derive air monitoring comparison values (AMCVs) that are used to evaluate this ambient air monitoring data, and criteria air pollutants such as ozone and nitrogen dioxide are compared to the NAAQS. The TCEQ first derives a conservative interim AMCV, then follows up with a more in-depth evaluation of available toxicity data and, if necessary, revises the AMCV through a transparent process. The public is encouraged to provide the TCEQ with scientific data on chemical toxicity at any time, as well as to provide comments on draft documents during the public comment period. The benzene AMCVs were revised in this manner separate and apart from the activities in the Barnett Shale area. Short-term AMCVs are based on potential effects following short-term exposures of one hour and, in the case of some chemicals, 24 hours and are compared to measured 1-hour or 24-hour concentrations. Long-term AMCVs are protective of chronic adverse cancer and non-cancer health effects following a lifetime of exposure and are compared to annual averages of chemical concentrations. The TCEQ's revised unit risk factor, which is used to derive the**

**long-term benzene AMCV (TCEQ 2015), is consistent with the unit risk factor the EPA derived for benzene (USEPA 2003).**

**None of these stationary monitoring data indicates ambient concentrations of pollutants are at levels that would be expected to cause adverse health effects after long-term (i.e., lifetime) exposure. In some instances, short-term concentrations of some VOCs were monitored at levels that would be expected to cause odors, which is consistent with citizen odor complaints and staff investigator reports. None of these air samples have indicated any off-site, short-term concentrations that would be expected to cause adverse health effects after short-term exposure. Finally, the DFW area has always been in attainment of both the one-hour and annual nitrogen dioxide standards.**

**Air monitoring data and associated toxicological evaluations addressing oil and gas-related air quality issues in the DFW area are publicly available on the [TCEQ's Barnett Shale](https://www.tceq.texas.gov/airquality/barnettshale) Web page (https://www.tceq.texas.gov/airquality/barnettshale). Toxicological evaluations of Region 4 ambient air network monitoring data are publicly available on the [TCEQ's Toxicology Division](http://www.tceq.texas.gov/toxicology/regmemo/AirMain.html) Web page (http://www.tceq.texas.gov/toxicology/regmemo/AirMain.html).**

**As stated previously, the TCEQ encourages a broader understanding of pollutant exposure when determining whether to spend time indoors or outdoors. The TCEQ provides information about monitored levels of pollutants and toxicological evaluations of the monitoring data to the public and has consistently noted that concentrations are not at levels that pose potential short- or long-term health risks. Indoor pollutant exposures are often times higher and unmonitored, so individuals must consider the benefits of outdoor air quality and physical exercise when making choices about whether to limit outdoor activity. No changes were made in response to these comments.**

## CONTROL STRATEGY COMMENTS

### Stationary Sources

#### East Texas Electric Generating Units (EGU)

Public Citizen commented that installing pollution controls on the coal-fired power plants located to the southeast of the DFW ozone nonattainment area would dramatically decrease the ozone levels in the DFW ozone nonattainment area. Public Citizen cited a 2007 Environ study that indicated installing pollution controls on three East Texas coal-fired power plants would decrease the emissions that cause air pollution in the DFW nonattainment area. Public Citizen further stated that three years prior to the date of this proposed DFW AD SIP revision, the Texas Medical Association and the Dallas County Medical Society released a study indicating the DFW area would likely come close to or perhaps attain the ozone standard if selective catalytic reduction (SCR) technology was installed on the same three East Texas coal-fired power plants.

**As part of the reasonably available control measures (RACM) analysis conducted for the 2017 DFW AD SIP revision, the TCEQ considered the potential impact of increasing the stringency of the existing East and Central Texas EGU rules located in 30 Texas Administrative Code (TAC) Chapter 117, Subchapter E, Division 1. The TCEQ previously implemented these rules in attainment counties in East and**

**Central Texas to address $NO_X$ emissions and ozone transport from EGUs, including the three East Texas coal-fired power plants referenced by the commenter and the subject of the Texas Medical Association and the Dallas County Medical Society study. The total capital costs of achieving SCR control on the eight affected units located at the three East Texas coal-fired power plants are estimated to be $1,878,585,000.**

**As discussed on page 61 of the response to comments for the 2018 DFW AD SIP revision adopted in June 2015 (Non-Rule Project No. 2013-015-SIP-NR) regarding the June 2006 Environ study on East Texas EGU controls, the impact of SCR as the suggested $NO_X$ controls on East Texas EGUs is not expected to have a substantive impact on the Denton Airport South monitor, nor the other monitors, in the DFW area.**

**The 2017 DFW AD SIP revision demonstrates attainment of the 2008 eight-hour ozone NAAQS by July 20, 2018 based on a photochemical modeling analysis of reductions in $NO_X$ emissions from existing control strategies and a WoE analysis. The peak ozone design value in 2017 for the DFW nonattainment area is projected to be 77 ppb using EPA official modeling guidance from April 2007 and 76 ppb using draft modeling guidance released by the EPA in December 2014. Given the substantial costs associated with the suggested control measure cited in previous studies, the insufficient time available to implement controls in time to advance attainment, the limited ozone reduction benefit to the DFW area from these sources outside the DFW area, and the current modeling results and WoE indicating that the DFW area will demonstrate attainment, the TCEQ has determined that imposing additional controls on these attainment county EGUs is not justified at this time and is not RACM. No changes were made in response to these comments.**

The Dallas County Medical Society and the Texas Medical Association commented that the TCEQ should require the incorporation of reasonably available control technology (RACT) on three East Texas coal-fired power plants. The Dallas County Medical Society and the Texas Medical Association further commented that their previously submitted petition for rule change asking the TCEQ to control emissions from the three East Texas coal-fired power plants was rejected on the basis that it was premature in light of an upcoming SIP revision. The commenters stated that the 2018 DFW AD SIP revision adopted in June 2015 (Non-Rule Project No. 2013-015-SIP-NR) ignored their concerns and contained no effort to control the emissions from the three coal-fired power plants. The Dallas County Medical Society and the Texas Medical Association commented that computer modeling of DFW air quality data performed by the University of North Texas showed that an average of 5 ppb of ozone to the DFW nonattainment area could be eliminated by controls on the three East Texas coal-fired power plants.

**In the petition for rule change mentioned by the commenters, a request was made for the three East Texas coal-fired power plants to either install and operate SCR or convert to natural gas. Considering the SIP modeling and the RACM analysis, the TCEQ has determined that the controls requested in the petition are not necessary to demonstrate attainment of the 2008 eight-hour ozone NAAQS.**

**The three East Texas coal-fired power plants would not be subject to a RACT analysis given their location outside the ozone nonattainment area and that RACT requirements cannot be extended to emission sources located outside an ozone nonattainment area. RACM is evaluated based on multiple criteria, and although the EPA allows states the option to consider control measures outside the ozone nonattainment area that can be shown to advance attainment, such as the existing requirements for East and Central Texas EGUs, states are not required to exercise this option under the FCAA. The TCEQ does not agree that the University of North Texas (UNT) modeling shows a reduction of 5 ppb to the eight-hour ozone design value in the DFW area. This is explained more fully in a separate comment response below under the heading of *UNT Modeling* on page 71.**

**As discussed in the response to the previous comment, the TCEQ considered the potential impact of increasing the stringency of the existing East and Central Texas EGU rules, and has determined that imposing additional controls on these attainment county EGUs is not justified at this time and is not RACM.**

**The TCEQ appreciates stakeholder technical input relating to control strategy development and may be able to use valid information for future air quality planning purposes. No changes were made in response to these comments.**

The Sierra Club and Downwinders suggested three RACM strategy options to decrease ozone season $NO_X$ emissions from five East Texas coal-fired power plants. The first option would implement staggered $NO_X$ mass emission limits based on reductions from the 2015 ozone season average $NO_X$ tons per day (tpd) rate: a 40% mass emissions reduction commencing on March 1, 2017, increasing to a 60% reduction commencing on March 1, 2018, and a final increase to an 80% reduction commencing on March 1, 2019, with the goal to install and commence operation of SCR on all units at the five East Texas coal-fired power plants by March 1, 2019. Each unit's 2015 $NO_X$ tpd baseline rate excluded reductions achieved by selective non-catalytic reduction (SNCR), but included reductions achieved by combustion modifications, where applicable. The Sierra Club and Downwinders provided information that other states have taken a similar approach, and provided an example from Georgia.

The second option would impose a mass-based, tons per hour emission limit on each boiler located at the five East Texas coal-fired power plants. The third option would create mass-based caps for all units owned and operated by Luminant, NRG, and American Electric Power.

The Sierra Club and Downwinders commented that in the 2018 DFW AD SIP revision adopted in June 2015 (Non-Rule Project No. 2013-015-SIP-NR) the TCEQ dismissed emission limits on the referenced five East Texas coal-fired power plants and other EGUs as RACM based on substantial cost, limited ozone reduction benefits, and modeling results indicating that the DFW area would demonstrate attainment. However, according to the Sierra Club and Downwinders, the TCEQ's modeling for the 2017 DFW AD SIP revision demonstrated that the DFW area will not attain by its attainment date. The Sierra Club and Downwinders stated that other, independent modeling results showed that there would be substantial ozone reduction benefits if the TCEQ required post-combustion control technology to reduce $NO_X$ emissions from the five East Texas coal-fired power plants.

The commenters assert that the accepted metric to justify the cost effectiveness of control is dollar per ton ($/ton), and that the commenters' previous discussion of the $/ton costs of $NO_X$ controls on coal-fired power plants confirmed the well-established point that SCR on coal-fired power plants is a highly cost-effective $NO_X$ control technology. The Sierra Club and Downwinders cited other research showing capital costs for SCR on the units located at the five East Texas coal-fired power plants ranging from $1.4 billion to $2.5 billion, a fraction of the TCEQ's alleged unsupported claim of $8 billion to install SCR on 69 EGUs.

Commissioner Daniel commented that the TCEQ should require the East Texas coal-fired power plants to use reasonably available pollution controls, as defined in the FCAA, to control pollution from these plants drifting toward North Texas. An individual commented that it was time to immediately stop coal-fired power plants from spewing filth and respiratory irritants as well as carcinogens into the air of the DFW area.

**The purpose of the 2017 DFW AD SIP revision is to demonstrate attainment of the 2008 eight-hour ozone standard in accordance with the EPA's guidance and FCAA requirements. Other existing regulations, such as the Mercury and Air Toxics Standards and National Emission Standards for Hazardous Air Pollutants address other pollutants, and these regulations are beyond the scope of this SIP revision.**

**For a state's RACM analysis, the EPA allows states the option to consider control measures outside the ozone nonattainment area that can be shown to advance attainment; however, the state does not have to exercise this option to maintain consistency with the FCAA. As discussed in the responses to the previous two comments, the TCEQ researched the potential impact of increasing the stringency of the existing East and Central Texas EGU rules and East Texas combustion rules for sources of $NO_X$ located outside the DFW nonattainment area. Given the change in attainment date for the DFW moderate ozone nonattainment area to July 20, 2018 with a 2017 attainment year, the TCEQ is considering only those control strategies for the 2017 DFW AD SIP revision that can be implemented by March 1, 2017. Therefore, control strategies implemented after this time are not pertinent to the RACM analysis for the 2017 DFW AD SIP revision. The TCEQ has previously implemented controls in attainment counties in East and Central Texas to address $NO_X$ emissions and ozone transport from stationary sources outside the DFW area, including East Texas coal-fired power plants, at a time when these measures were determined to meet RACM criteria. These measures were included as part of the DFW AD SIP revision for the 1997 eight-hour ozone NAAQS adopted in April 2000 (Project No. 1999-055-SIP-AI). However, the TCEQ has determined that imposing additional controls, such as SCR, or imposing mass-based emission caps, on EGUs or on the companies that own or operate EGUs in East Texas attainment counties is not justified at this time.**

**The TCEQ disagrees with the commenters that $/ton is the only accepted metric for determining cost effectiveness of a control measure. While $/ton is one factor to consider in an economic analysis, it is not the only factor. Overall capital costs, annual operating costs, $/ton, who is impacted (e.g., small businesses), even secondary costs, such as impacts to cost of electricity, may be relevant in determining the economic feasibility of a potential RACM measure.**

**The TCEQ disagrees with the commenters' assertions that the TCEQ's reported number of $8 billion to install SCR on 69 EGUs is unsupported. As discussed in the response to comments for the 2018 DFW AD SIP revision adopted in June 2015 (Non-Rule Project No. 2013-015-SIP-NR), the TCEQ evaluated EGU emissions and process rate data for reporting year 2012 from the EPA's Air Markets Program Database. The TCEQ also evaluated available literature cost data for SCR control on coal-fired power plants from Sargent and Lundy and the Edison Electric Institute. Cost information was based on either 2008 or 2009 U.S. dollars. The commenters cite $2.5 billion as a possible maximum for SCR capital costs for five East Texas coal-fired power plants, 10 EGUs in total. The TCEQ's analysis of these 10 units, using the emission and process rate data and literature cost data for SCR control that was used in the 2018 DFW AD SIP revision adopted in June 2015, results in SCR capital costs of approximately $2.3 billion as a possible maximum for the same 10 EGUs, which is very close to the $2.5 billion estimated by the commenters. While the TCEQ agrees that the cost of installing SCR for those 10 EGUs would be less than the $8 billion estimated for all 69 EGUs, this substantial capital cost is still not justified because, as discussed above, the resulting $NO_X$ reductions would not advance attainment, nor would there be sufficient time to implement SCR by March 1, 2017.**

**No changes were made in response to these comments.**

The Sierra Club and Downwinders commented that implementing RACM for coal fired power plants in east Texas would assist in meeting its interstate transport obligation for the 2008 ozone NAAQS as well as the next regional haze submittal, due in 2018. The commenters further assert that RACM on these sources is mandated by Section 110(l) of the FCAA because it would interfere with the DFW area's ability to attain the NAAQS as expeditiously as practicable.

**The obligation for states to implement RACM has no connection to the independent obligations regarding interstate transport and regional haze. Additionally, the coal-fired power plants in East Texas are not within the DFW ozone nonattainment area, and thus, there is no obligation for states to implement RACM for them. The TCEQ does not agree that FCAA, Section 110(l) requires RACM on east Texas coal plants or any other emissions source. Section 110(l) is intended to prevent the EPA from approving a SIP revision that would allow a relaxation of SIP regulations already approved by the EPA that would interfere with the state's ability to meet an applicable requirement of the FCAA; this is known as anti-backsliding. No changes were made in response to these comments.**

Commissioner Daniel commented that either new pollution controls should be required on coal plants to the east of the area or the coal plants should be included in the larger DFW nonattainment area since pollution from the plants drifts into the DFW area.

**As discussed in the previous response to comment, the TCEQ determined that imposing additional controls on EGUs or on the companies that own or operate EGUs in East Texas attainment counties is not justified at this time.**

**While states may make recommendations on nonattainment areas to the EPA during the designations process, establishment of nonattainment area boundaries,**

**as described in Section 107(d)(B) of the FCAA, is the duty of the EPA Administrator. One of the criteria the EPA considers in determining the boundaries of an ozone nonattainment area is emissions and emissions-related data. The EPA evaluates whether monitors that do not meet the NAAQS are significantly impacted by emissions sources in nearby counties. The EPA's 2012 designation of the 10-county DFW nonattainment area for the 2008 ozone NAAQS contemplated the impact of emissions from outside the nine-county ozone nonattainment area for the 1997 eight-hour ozone NAAQS. No changes were made in response to this comment.**

The Sierra Club and Downwinders commented that the five East Texas coal-fired power plants could choose to comply with a mass-based cap by decreasing generation at these units and that decreased generation could be temporarily offset by increased generation from other fossil fuel-fired units, energy storage, and from solar and wind power, noting that Texas added over 2.5 gigawatts (GW) of wind power and over one GW of combined cycle natural gas power plants in 2015. The commenters suggested that electricity demand could also be reduced by energy efficiency and demand response measures, including air conditioning efficiency improvements. The Sierra Club and Downwinders commented that the DFW area and Texas ranked low in energy efficiency (EE) relative to other locations and that efficiency measures exist that can be installed quickly. The commenters further suggested that Texas adopt "net metering" to compensate customer-side solar electricity generators for energy sent to the electric grid.

**The commenters' suggested net metering changes are beyond the scope of the 2017 DFW AD SIP revision. Regulating electric markets or requiring renewable energy (RE) generation, as suggested by the commenter, extends beyond the TCEQ's direct authority. The TCEQ's authority is limited to setting standards of performance for emissions of air pollutants from stationary sources, which the TCEQ has done in its RACM analysis regarding East Texas coal-fired power plants. The assumption that decreased generation from certain targeted coal-fired units would be offset by increased generation from other gas-fired combustion turbines and RE generating resources does not account for possible changes to existing transmission infrastructure and grid reliability, potential loss of load, or significant interruption to the power grid. Further, the complex nature of the electrical grid makes accurately quantifying emission reductions from EE/RE measures difficult. If electrical demand is reduced in a nonattainment area due to local EE measures, the resulting emission reductions from power generation facilities may occur in any number of locations around the state, not necessarily these specific coal-fired units.**

**The TCEQ supports EE/RE energy programs and it recognizes the air quality benefits of these programs. The Texas Legislature has implemented many EE/RE programs, including mandates for installation of new capacity of wind and other renewable energy generation. As discussed in Chapter 5: *Weight of Evidence*, Section 5.4.1.1: Energy Efficiency and Renewable Energy (EE/RE) Measures, Senate Bill (SB) 5, 77th Texas Legislature, 2001, which established the Texas Emissions Reduction Plan (TERP), set goals for political subdivisions in affected counties to implement measures to reduce energy consumption from existing facilities by 5% each year for five years from January 1, 2002 through January 1, 2006. In 2007, the 80th Texas Legislature passed SB 12, which extended the**

**timeline set in SB 5 and made the annual 5% reduction a goal instead of a requirement. The State Energy Conservation Office (SECO) is charged with tracking the implementation of SB 5 and SB 12. Also during the 77th Texas Legislature, the Energy Systems Laboratory (ESL), part of the Texas Engineering Experiment Station, Texas A&M University System, was mandated to provide an annual report on EE/RE efforts in the state as part of the TERP under THSC, §388.003(e).**

**Texas is a leader in RE such as wind energy. Installation of new wind generation facilities has greatly exceeded the milestones mandated by the legislature. Texas' current installed wind power capacity, as of December 31, 2015, is approximately 17,713 Megawatts, which is more than 2.5 times the current installed wind power capacity of the state with the next highest capacity. Texas is also seventh in the nation in terms of installed solar photovoltaic system capacity and tenth in terms of average cost of solar systems on a dollar per watt basis. The effects of existing EE and demand response measures are included in the WoE analysis in Chapter 5 of the 2017 DFW AD SIP revision. No changes were made in response to these comments.**

**Natural Gas**

An individual requested that the TCEQ stop hydraulic fracturing.

**This comment is beyond the scope of the 2017 AD SIP revision. Additionally, the TCEQ does not have the regulatory authority to stop hydraulic fracturing. As noted in Appendix G, drilling activity is under the jurisdiction of the Railroad Commission of Texas (RRC). The TCEQ notes however, that oil and gas activities are not unregulated; requirements exist under TCEQ rules in 30 TAC Chapters 115 and 117, and are prescribed under the air permitting program and in federal rules at 40 Code of Federal Regulations (CFR) Part 60 Subpart OOOO. No changes were made in response to this comment.**

**Cement Kilns**

The Sierra Club and Downwinders commented that an SCR system is operating on a long dry cement kiln in Joppa, Illinois, and has demonstrated 80% $NO_X$ control. The commenters further noted that the EPA commented in February 2015 that a new RACT evaluation is needed for Ellis County cement kilns, that the ozone impact of potential $NO_X$ reductions appear significant, and speculated that the EPA would not be able to approve this 2017 DFW AD SIP revision without it.

**The commission acknowledges that an SCR system has been successfully demonstrated on a long dry cement kiln in Joppa, Illinois. However, the TCEQ does not consider SCR on Portland cement kilns to be adequately demonstrated with regard to technological or economic feasibility and, therefore, is not RACT for the existing Ellis County cement kilns. As further discussed in Appendix G: *RACM Analysis* of this DFW AD SIP revision, the publically available version of the SCR demonstration report for the Joppa kiln does not include detailed design information, total cost numbers, or operational data, so it is insufficient for evaluating the feasibility of applying the technology to the Ellis County cement kilns or to establish an emission limit for the purposes of this AD.**

**The TCEQ also acknowledges that the EPA submitted comment regarding the TCEQ's cement kiln RACT analysis included with the 2018 DFW AD SIP revision adopted in June 2015 (Non-Rule Project No. 2013-015-SIP-NR). These comments were addressed in the Response to Comments section of the 2018 DFW AD SIP revision. The 2017 DFW AD SIP revision does not include a RACT analysis because the change to the 2017 attainment year did not impact the RACT analysis adopted by the commission in June 2015. As discussed in Appendix F: *RACT Analysis* of the 2018 DFW AD SIP revision, the EPA has previously approved the current Ellis County ozone season $NO_X$ source cap in 30 TAC Chapter 117, Subchapter E, Division 2 as meeting the RACT requirements for these sources, and the three companies subject to the cap, Ash Grove Cement Company (Ash Grove), Holcim U.S., Inc. (Holcim), and Martin Marietta (formerly TXI) have been operating well under their source caps due to low product demand and replacement of higher-emitting wet kilns with dry kilns.**

**The RACT analysis included discussion of the reconstruction of kiln #3 at Ash Grove, which is subject to the 1.5 lb $NO_X$/ton of clinker emission standard in the New Source Performance Standards (NSPS) for Portland Cement Plants. The NSPS therefore satisfies RACT for Ash Grove. The RACT analysis also asserted that the current source cap of 5.3 tpd $NO_X$ for Holcim satisfies RACT. As further discussed in Appendix G: *RACM Analysis* of the 2017 DFW AD SIP revision, Holcim currently has two dry preheater/precalciner (PH/PC) kilns equipped with SNCR. During the 2009 through 2011 ozone seasons, Holcim ran both kilns with SNCR at reduced output at or below 1.6 lb $NO_X$/ton of clinker. In the 2012 through 2014 ozone seasons, for economic reasons, Holcim ran only one kiln with SNCR and reported less than 1.5 lb $NO_X$/ton of clinker. Thus, although Holcim's $NO_X$ emissions have been lower in recent years, this is due to decreased production resulting from lower demand for Portland cement. Additionally, while Holcim's emission rate of less than 1.5 lb/ton of clinker is less than the 1.7 lb/ton of clinker factor used for dry PH/PC kilns in calculating the source cap, this emission rate for Holcim's kilns is an average rate over the ozone season whereas the cap is enforced on a 30-day rolling average basis. Given the inherent variability in $NO_X$ emissions from Portland cement kilns on a short-term basis and the 30-day enforcement period of the standard in the rule Chapter 117, the 1.7 lb/ton of clinker factor in the cap equation is still appropriate. Therefore, the 5.3 tpd source cap for Holcim continues to satisfy RACT.**

**As part of the SIP planning process, the TCEQ evaluates available technologies for potentially affected sources or emission source categories and, in accordance with EPA RACT guidance and the FCAA, implements those technologies when necessary. The compliance date for potential control measures used in the 2017 DFW AD SIP revision precludes consideration of technologies such as SCR that cannot be installed and made operational on cement kilns prior to March 1, 2017. No changes were made in response to these comments.**

### Compressor Emissions

The Sierra Club and Downwinders commented that replacement of either the largest or all natural gas-fired engines powering natural gas compressors with electric motors is a RACT measure, as indicated by cost data in the industry's literature.

**The TCEQ is aware of several electric motor-driven large compressors in the DFW area and recognizes that powering compressors with electric motors supplied by grid electricity is technologically feasible for some affected sources. However, this is not an appropriate RACT measure because it would require replacement of some or all of the engines powering natural gas compressors with electric motors, which is not economically or logistically feasible at this time. Published articles indicate logistical concerns with this strategy, as described in Appendix G, Section 4.2.2: *Engines* of the 2017 DFW AD SIP revision. Concerns include the need for additional equipment beyond just the electric motor at the compressor station, potential electric service upgrades, and potential replacement of the compressor, all of which need to be considered in addition to the cost of the electric motor itself. Published information also indicates that delivery time for necessary equipment and time required to install additional equipment at all affected sites renders a strategy of complete replacement unreasonable to accomplish by the regulatory deadline. No changes were made in response to this comment.**

An individual expressed concern because sites with less than 25 tons per year (tpy) of VOC emissions are not required to use catalytic converters on their lift compressors or vapor recovery systems on their storage tanks. The individual further commented that lift compressors do not have to be controlled by vapor recovery during blowdown. Another individual questioned the reason emission controls on compressor stations in urban areas are not required.

**Emissions from all compressor stations are regulated by the TCEQ. Minor sources of air pollutants are required to obtain authorization to emit air pollutants, either through a case-by-case NSR authorization, or an NSR permit by rule (PBR). The requirements for PBRs limit total actual emissions of various pollutants, for example, 25 tpy VOC. Individual sources that use a PBR must meet the requirements of the appropriate PBR. Each PBR holder shall establish, implement, and update, as appropriate, a maintenance program for all facilities that is consistent with good air pollution control practices, or alternatively, manufacturer's specifications and recommended programs applicable to facility performance and the effect on emissions. These PBR requirements apply to all facilities regardless of their location, rural or urban.**

**In addition to NSR permitting requirements, the TCEQ implements RACT and RACM rules based on EPA-designated nonattainment areas classified moderate nonattainment and higher, and does not distinguish between urban areas and rural areas. The rules in 30 TAC Chapters 115 and 117 for VOC and $NO_X$, respectively, specify control requirements for certain compressor station fugitive VOC emissions and compressor engine $NO_X$ emissions. The VOC compressor station rules were implemented in the DFW nonattainment area to satisfy RACT requirements and the $NO_X$ compressor engine rules were implemented to satisfy both RACT and RACM obligations. All compressor engines subject to the NOx compressor engine rules, including those at sites with less than 25 tpy of VOC emissions, must meet the specified emission limits. Companies typically install catalytic converters on the compressor engines to meet the specified emission limits.**

**No additional controls on catalytic converters on compressors have been determined to be necessary for compressors at this time. When compressor units are shut down, typically the high pressure gas remaining within the compressors and associated piping is vented to the atmosphere (blowdown) or controlled by a flare. Routing the blowdown to a storage tank is not an effective control option because storage tanks are not designed to contain or process gases at the pressures and volumes associated with compressor blowdowns. No changes are made in response to these comments.**

One individual commented that the blowdown emissions from oil and gas drilling caused more warming, exacerbating ozone.

**Both the draft and official versions of EPA modeling guidance require the TCEQ to model baseline year meteorology (which is 2006 for the DFW 2017 AD SIP revision), including temperature, and predict the effect of changed emissions in the attainment year, in this case 2017. Discussion of the photochemical modeling conducted for this SIP revision is located in Chapter 3. Any warming effect of methane emissions from compressor blowdowns in the DFW area on temperatures and ozone formation from the 2006 baseline year to 2017 is likely to be imperceptible. No changes are made in response to this comment.**

**General Reasonably Available Control Technology (RACT) Demonstration and Reasonably Available Control Measure (RACM) Demonstration**

The North Texas Renewable Energy Group commented that Governor Rick Perry ordered expedited permit approvals of eight Texas Utilities (TXU) coal-burning power plants justified by the governor's forecast of an increase in natural gas and the capability of coal-burning power plants to generate power at a low cost. The individual further commented that in spite of the governor's claim, every new coal-burning power plant would have cost approximately a billion dollars and the money to pay for these plants would have been recouped through electric rates. The commenter stated that as a result of litigation surrounding the eight coal-burning power plant permits finding the governor overstepped his constitutional authority, TXU withdrew the permits. The commenter asserted that the governor's goal was to get the permits approved prior to effective dates of EPA air quality standards. The commenter estimated the governor collected around $325,000 beginning in 2000 from TXU executives associated with the proposed permits.

**These comments are beyond the scope of this 2017 DFW AD SIP revision. No changes were made in response to this comment.**

The Sierra Club and Downwinders commented that the TCEQ must include additional RACM in the DFW area, such as previously recommended $NO_X$ emission reduction strategies for East Texas power plants, cement kilns, and electrification of compressors, to provide for attainment in a timely manner, sooner than will be attained with this proposed SIP, providing Texans and the TCEQ with numerous other benefits. An individual commented that Appendix G identified some viable control measures that could be incorporated into the SIP but disagreed with the TCEQ's response that the potential control measures would not advance attainment. The commenter further stated that the DFW area could reach attainment with the 2008 ozone NAAQS if enough of the potential control strategies were incorporated into the SIP.

**The TCEQ disagrees that the 2017 DFW AD SIP revision must include additional control measures as RACM. The TCEQ acknowledges its obligation to conduct a RACM analysis consistent with FCAA requirements and EPA RACM guidance, and provides its analysis and determination in Appendix G of the 2017 DFW AD SIP revision. During a RACM analysis, the TCEQ considers several factors and bases its determination on technical merit that does not always support adopting new controls. In addition, any public comment received on a TCEQ-proposed SIP revision or rulemaking is evaluated for RACT or RACM viability, as necessary, and summarized and responded to.**

**As detailed in Appendix G: *RACM Analysis*, implementing additional controls at this time is not justified, partially due to modeling results and WoE indicating the DFW area will attain the 2008 eight-hour ozone NAAQS by the July 20, 2018 attainment date.**

**The TCEQ further disagrees with the commenter's assertion that that RACM controls must be adopted for East Texas power plants, which are beyond the DFW nonattainment area boundaries. Further discussion is included in the responses to comment on those specific control measures in the above sections of this RTC document: *East Texas Electric Generating Units (EGU)*, *Cement Kilns*, and *Compressor Emissions*. No changes were made in response to these comments.**

The Sierra Club and Downwinders commented that RACM cannot be retroactively implemented. The commenters disagreed with the March 1, 2016 date as a RACM implementation deadline because this SIP revision will not be final and approved by then.

**The TCEQ acknowledges that in order for a control measure to meet the criteria of advancing attainment by at least a year, potential control measures would need to be in place no later than March 1, 2016. However, as explained in Appendix G, the TCEQ also evaluated March 1, 2017 as a RACM compliance deadline consistent with §172 of the FCAA. Neither of these impending deadlines provide a sufficient amount of time for an affected source to employ any of the control measures evaluated. Based on this, in addition to other factors discussed in Appendix G and in the responses to comments above, the TCEQ concluded that no potential control measures met the criteria to be considered RACM. The deadlines evaluated in this RACM analysis are in accordance with EPA-accepted RACM guidance and the FCAA.**

**The TCEQ agrees with the commenters' statement that a RACM regulation cannot possess a retroactive compliance date. The TCEQ notes that while a rulemaking must be adopted by the commission prior to the compliance deadline, it does not have to be approved by the EPA prior to the compliance deadline. No changes were made in response to these comments.**

The Sierra Club and Downwinders claimed that there is no evidence in this 2017 DFW AD SIP revision demonstrating the DFW area will attain the ozone NAAQS by July 20, 2018. The Sierra Club and Downwinders asserted the modeling and WoE does not support attainment as the TCEQ claims. The Sierra Club and Downwinders stated that control measures that advance attainment to before 2021 should be considered RACM based on the TCEQ's monitoring data and trend analysis. The commenters further stated that measures reducing ozone and meeting the RACM criteria, other than the ability to advance attainment of the NAAQS, should be considered RACM strategies.

**The TCEQ disagrees that its modeling and WoE do not support attainment by July 20, 2018 in the DFW nonattainment area as further discussed in the *Technical Analysis* section of this RTC.**

**The TCEQ further disagrees with the commenter's interpretation that the compliance deadlines should be ignored for the RACM analysis. Control measures considered to be RACM would need to be able to be implemented no later than March 1, 2017. Advancing the attainment date by one year to July 20, 2017 would require controls to be installed and in operation no later than March 1, 2016. This compliance deadline would allow time to realize the emissions reduction benefit from implementing the control measures. The TCEQ anticipates that without requiring operation of a control a year prior to the attainment year, the full benefit/effect of a control measure would not be realized in monitoring data and may not, in reality, actually advance attainment of the NAAQS by at least a year. If a control measure does not meet this criteria point, it is not a valid RACM control.**

**As explained in Appendix G of the 2017 DFW AD SIP revision, the implementation deadlines for RACM are established by the EPA's interpretation of FCAA, §172(c)(1) that states incorporate into their SIP all RACM that would advance a region's attainment date after determination that such measures are reasonably available for implementation in light of local circumstances (57 FR 13498). This interpretation was subsequently upheld by several courts. The use of 2021 as an evaluation date for RACM is inappropriate, since that date is beyond the July 20, 2018 attainment date. No changes were made in response to these comments.**

**<u>RACT Demonstration</u>**

An individual questioned the use of 2011 emissions inventory data instead of relying on more current data for the RACT analysis.

**The TCEQ bases policy decision-making on the most complete, comprehensive, and quality-assured data available for any given project, including the RACT analysis for the 2018 DFW AD SIP revision adopted in June 2015 (Non-Rule Project No. 2013-015-SIP-NR). The 2011 emissions inventory data year met these standards making it the best selection at the time the RACT analysis commenced in 2013 for the 2018 DFW AD SIP revision adopted in June 2015. A new RACT analysis is not required to be conducted as part of the 2017 DFW AD SIP revision and thus the RACT analysis remains unchanged.**

**The TCEQ performed a RACT analysis during the 2018 DFW AD SIP revision adopted in June 2015 and determined that the VOC and $NO_X$ rulemakings that were adopted concurrently (Rule Project Nos. 2013-048-115-AI and 2013-049-117-AI) and the rules already in place satisfied RACT for all existing sources in the DFW area. The 2017 DFW AD SIP revision does not include a RACT analysis because the change to the 2017 attainment year did not impact the RACT analysis**

**adopted by the commission in June 2015. No changes were made in response to this comment.**

An individual commented that Appendix F lacks the information necessary for vendors to identify permitted point sources needing help with emission control. The individual further commented that this lack of information also impedes the ability for the public to make purchase decisions based on emission controls installed. The commenter suggested that if the TCEQ has this information from permitting and air sampling, that it be added as an appendix in the SIP. The commenter indicated that without information specifying businesses doing well and businesses needing help from pollution-reducing competitors, the free market cannot function as it should.

**The TCEQ disagrees with the commenter's suggestion. Providing the type of information suggested by the commenter is not the purpose of the RACT analysis and determination in Appendix F: *RACT Analysis*. Appendix F of the 2018 DFW AD SIP revision adopted in June 2015 (Non-Rule Project No. 2013-015-SIP-NR), serves to demonstrate that RACT is in place for source categories addressed in an EPA control techniques guideline (CTG) and for non-CTG major sources as required by FCAA, §172(c)(1) and §182(b)(2) and (f). The TCEQ RACT analyses are conducted in accordance with FCAA requirements and consistent with EPA RACTguidance.**

**RACT rules are adopted to prescribe emission limits but are prohibited from mandating specific types of emission control technology. Sources subject to a RACT rule are required to comply with such rules but are free to meet those rules by installing emissions controls it chooses or modify operations in the manner it chooses. Supplying information to support consumer decisions is beyond the scope of Appendix F and would not contribute to fulfilling the objective of the RACT requirements under the FCAA.**

**Although separate from Appendix F, the Texas SIP contains EPA-approved TCEQ air permitting rules, eliminating the need to submit each air permit and air permit revision as an individual revision to the SIP. All air permits are available to the public, as is the monitoring data acquired throughout the state. Therefore, codifying each and every permit and air sampling data is redundant and unnecessary to continue providing quality information to the public. No changes were made in response to these comments.**

An individual commented that polluting sources are grandfathered-in and only need to meet RACT standards instead of best available control technology (BACT) standards. The commenter expressed skepticism that none of the point sources in the SIP have made substantial revisions or repairs warranting the application of BACT standards instead of RACT standards. The individual further commented that by not differentiating between BACT and RACT in Appendix F, the TCEQ misses an opportunity for the free market to solve the nonattainment problem. The commenter suggested the TCEQ rely on crowd sourcing to help the DFW area meet attainment. In addition, the commenter expressed disappointment that there are also no point sources identified in the SIP as needing to meet maximum achievable control technology (MACT) or lowest achievable emission rate (LAER) standards.

**RACT requirements for moderate and higher ozone nonattainment areas are included in the FCAA to assure that source categories covered by a CTG and significant source categories at major sources of ozone precursor emissions are controlled to a reasonable extent but not necessarily to BACT or MACT levels. Because the FCAA requires RACT apply to all existing sources addressed in a CTG and all existing non-CTG major sources, there is no grandfathering of sources as claimed by the commenter. At the time of the effective date, any source meeting the applicability criteria for an adopted RACT rule would be subject to such rule regardless of operation commencement date, or repairs or revisions made to the source.**

**BACT and LAER are permitting requirements that apply to new sources and modified sources meeting certain criteria and are implemented in the DFW nonattainment area through the TCEQ's air permitting process. Similarly, MACT is a requirement of 40 Code of Federal Regulations (CFR) Part 63 regulations and is separate from SIP requirements. Sources in the DFW area subject to MACT regulations are required to meet those standards. MACT, BACT, and LAER fulfill different FCAA obligations for programs outside of those included in the 2017 DFW AD SIP revision. For these reasons, these standards are not contemplated as part of this plan.**

**RACT requirements contemplated as part of an AD SIP revision apply to sources independent and regardless of BACT, LAER, and MACT control levels prescribed to a source through federal rules or air permitting means. However, the state can conclude that BACT controls prescribed in a source's permit are at least as stringent as RACT-level controls determined for the source, eliminating the need to replicate such control requirements as a SIP rule. Accordingly, as noted by the commenter, the TCEQ determined that the BACT level of control was at least as stringent as RACT level of control for the source listed in Appendix F.**

**Differentiating between RACT and BACT for each source is not a requirement for the RACT analysis. Access to additional information on control technologies is available at the EPA's RACT/BACT/LAER Clearinghouse Web page (https://cfpub.epa.gov/rblc/).**

**As detailed in Appendix F, the TCEQ conducted a RACT analysis and determined the level of RACT for various sources of VOC and $NO_X$ in the DFW 2008 eight-hour ozone nonattainment area. This RACT determination resulted in the DFW VOC and $NO_X$ RACT rulemakings (Rule Project Nos. 2013-048-115-AI and 2013-049-117-AI, respectively), which were submitted concurrently with the 2018 DFW AD SIP revision adopted in June 2015 (Non-Rule Project No. 2013-015-SIP-NR). No changes were made in response to these comments.**

An individual disagreed with the TCEQ's finding that additional control for RACT is not economically feasible given the lack of information in the SIP to make such a claim.

**The TCEQ disagrees with the commenter's claim that the RACT determination is not supported. In accordance with the FCAA and EPA RACT guidance, the TCEQ performed a RACT analysis as part of the 2018 DFW AD SIP revision adopted in**

**June 2015 (Non-Rule Project No. 2013-015-SIP-NR) to identify existing sources within the nonattainment area and to implement controls determined to be economically and technologically feasible for all sources addressed in a CTG and all non-CTG major sources. As part of the RACT analysis, the TCEQ is required to consider the economic and technological feasibility of potential control options. If, after this review, the TCEQ finds that a potential control option is not economically and technologically feasible, then the control option does not meet the requisite RACT criteria and cannot be considered RACT. As explained in the RACT analysis in the 2018 DFW AD SIP revision adopted in June 2015, the TCEQ determined that RACT was already in place or was being implemented through the concurrent $NO_X$ and VOC rulemakings (Rule Project Nos. 2013-048-115-AI and 2013-049-117-AI) and provided justification that no additional controls identified met both the technological and economic feasibility components to be considered RACT. No changes were made in response to this comment.**

**RACM Demonstration**

Four individuals expressed concern about the social health costs that they accrue and whether or not those costs are considered by the TCEQ. The individuals posed questions regarding pollution control technology and how the health benefits of adding those controls were considered when establishing the RACM analysis.

**The primary NAAQS are established by the EPA as necessary to protect public health, including sensitive members of the population such as children, the elderly, and those with pre-existing conditions. These standards are health-based standards that take into account health-related costs of ozone. The TCEQ bases its RACM analysis on the ability for these measures to advance attainment of the ozone NAAQS as well as other criteria established by EPA RACM guidance, e.g., technological and economic feasibility, enforceability, etc. No changes were made in response to these comments.**

The Denton Drilling Awareness Group and Frack Free Denton commented that the TCEQ consistently determined potential VOC RACM, including leak detection and repair requirements, would not help reduce ozone in the North Texas area. The groups disagreed with the TCEQ's conclusion that modeling indicated additional VOC control measures will not advance attainment of the ozone standard. One individual commented that Appendix G: *RACM Analysis* identified some viable control measures that could be incorporated into the SIP but disagreed with the TCEQ's response that the potential control measures would not advance attainment. The individual further stated that the DFW area could reach attainment with the 2008 ozone NAAQS if enough of the potential control strategies were incorporated into the SIP.

**As discussed in responses to comments above and as further detailed in Appendix G, none of the measures suggested met the multiple criteria to be considered RACM. VOC control measures have been determined to not meet RACM criteria in the DFW area because photochemical modeling indicates VOC reductions will not advance attainment. As also discussed in responses to comment above, implementing additional $NO_X$ controls at this time is not justified. No changes were made in response to these comments.**

The Sierra Club and Downwinders commented that the TCEQ relied on control measures beyond the DFW nonattainment area, including the utility electric generation in East and Central Texas and East Texas combustion sources rules in 30 Texas Administrative Code Chapter 117, in the past as strategies to reduce ozone for the DFW area.

**The TCEQ acknowledges that it has adopted rules in the past implementing RACM strategies for sources outside of the DFW nonattainment area to address ozone transport from coal-fired power plants and other sources of $NO_X$ emissions as a result of modeling indicating $NO_X$ emission reductions were needed to demonstrate attainment of the ozone NAAQS. For the 2017 DFW AD SIP revision, however, modeling results and WoE indicate that the DFW ozone nonattainment area will demonstrate attainment, rendering additional RACM unnecessary. No changes were made in response to these comments.**

The Texas Campaign for the Environment commented that ignoring the EPA's direction to make changes with this SIP revision that result in pollution reduction from major industries like coal plants, cement kilns, and oil and gas, means the EPA will have to make such changes. Fort Worth League of Neighborhood Associations and Texas Campaign for the Environment commented that the TCEQ lacks emission control requirements on major polluters, including power plants, Midlothian cement kilns, and oil and gas sources. The Fort Worth League of Neighborhood Associations further supported the Texas Medical Association's resolution for the state to implement RACM capable of meeting the ozone NAAQS, based on the UT Southwestern Medical School and UNT validated models. Councilmember Grayson commented that the SIP needs to be more proactive in cutting pollution from every source, especially sources that are outside the DFW area.

**The EPA-directed changes claimed by the commenter are not specifically identified and therefore the underlying issues cannot be individually addressed. The TCEQ acknowledges its obligation to perform RACT and RACM analyses and to consider the EPA's comments on the 2017 DFW AD SIP revision. The TCEQ adopts rules based on technical merits and reasoned decision-making in accordance with the FCAA and EPA RACT/RACM guidance.**

**The TCEQ disagrees with the commenter indicating pollution reduction is needed from every source, including those outside the DFW area. RACT and RACM are FCAA obligations and the state's means to impose control requirements as a result of thorough technical analyses supporting either the need for additional control or demonstrating no additional controls are necessary. RACT requirements are only required to be evaluated for major sources of $NO_X$ and VOC and certain non-major sources of VOC in a nonattainment area classified as moderate and higher, such as the 2008 DFW area, but not beyond the boundaries of such a nonattainment area.**

**The EPA's RACT guidance provides states the option to either make a demonstration that RACT is in place with existing control requirements and that additional controls are not necessary, make a negative declaration, or adopt new requirements implementing RACT for major sources of $NO_X$ and other FCAA-specified sources of VOC, including major sources. Consistent with this RACT guidance, the TCEQ conducted rulemaking to assure RACT was satisfied (Rule Project Nos. 2013-048-115-AI and 2013-049-117-AI) concurrent with the 2018 DFW**

**AD SIP revision adopted in June 2015 (Non-Rule Project No. 2013-015-SIP-NR). For all other emission source categories not addressed in those rulemakings, the existing RACT regulations or negative declarations provided continue to satisfy VOC and $NO_X$ RACT for the 2008 ozone DFW nonattainment area. The 2017 DFW AD SIP revision does not include a RACT analysis because the change to the 2017 attainment year did not impact the RACT analysis adopted by the commission in June 2015.**

**As discussed in responses to comment above, the TCEQ includes a RACM evaluation as part of the 2017 DFW AD SIP revision and provides its analysis of potential control measures, including controls contemplated for the source categories mentioned by the commenters, and its determination that there are none that met the criteria to be considered RACM.**

**Section 172 of the FCAA requires RACM only for sources in nonattainment areas although the EPA allows states the option to consider control measures outside the nonattainment area that can be shown to advance attainment. States are not required to exercise this option under the FCAA. Further, the TCEQ has determined that imposing additional controls is not justified at this time. No changes were made in response to these comments.**

## TECHNICAL ANALYSIS

### Monitoring Data and Trends

The EPA, the Sierra Club, and Downwinders commented that the DFW area's peak eight-hour ozone design value using 2013-2015 monitoring data is 83 ppb and questioned how the 75 ppb eight-hour ozone standard would be achieved by the end of the 2017 ozone season. The commenters reference Figure 5-1: *One-Hour and Eight-Hour Ozone Design Values in the DFW Area from 1997 through 2014* of the SIP narrative showing a historical linear relationship indicating that the design value has dropped at an average rate of 1.1 ppb per year in DFW since 1997. The Sierra Club and Downwinders state the 2010 and 2014 were low ozone years in DFW and that the 75 ppb standard is not likely to be met until 2021. Commissioner Daniel commented that ozone levels increased from 2014 to 2015. The EPA notes that the fourth highest ozone levels at various monitors in 2014 were lower than those in 2012 and 2013. The EPA mentions the meteorology in those years with 2012 having "higher winds than average most of the time, so ozone exceedances were not overly severe or frequent," and that 2013, 2014, and 2015 were all years that had meteorology that was not conducive for ozone formation.

**The TCEQ acknowledges that the DFW area's peak eight-hour ozone design value at Denton Airport South increased from 81 ppb in 2014 to 83 ppb in 2015. The Denton Airport South monitor has often measured the highest average ozone levels in the DFW area since it began operating in 1997. Denton Airport South had an eight-hour design value of 102 ppb in 2000, which is based on the first full three seasons of ozone measurements available for this monitor. Table 1: *Denton Airport South Eight-Hour Design Values from 2000 through 2015* shows the annual change in the eight-hour ozone design value at this monitor from 2000 through 2015.**

**Table 1: Denton Airport South Eight-Hour Design Values from 2000 through 2015**

| Calendar Year | Eight-Hour Design Value (ppb) | Change from Previous Year (ppb) |
|---|---|---|
| 2000 | 102 | N/A |
| 2001 | 101 | -1 |
| 2002 | 99 | -2 |
| 2003 | 97 | -2 |
| 2004 | 96 | -1 |
| 2005 | 93 | -3 |
| 2006 | 95 | 2 |
| 2007 | 94 | -1 |
| 2008 | 91 | -3 |
| 2009 | 85 | -6 |
| 2010 | 80 | -5 |
| 2011 | 83 | 3 |
| 2012 | 83 | 0 |
| 2013 | 87 | 4 |
| 2014 | 81 | -6 |
| 2015 | 83 | 2 |

**Achieving the 75 ppb standard by the end of the 2017 ozone season will require a reduction of 8 ppb in two years. As Table 1 shows, the Denton Airport South design value dropped by 6 ppb from both 2008 to 2009 and, most recently, from 2013 to 2014. It also dropped by 5 ppb from 2009 to 2010. The largest two-year reduction in the Denton Airport South design value was 11 ppb from 2008 to 2010. Due to meteorological variation from year to year, constant incremental reductions in a monitor's design value are not expected. Nonetheless, there is a precedent at the Denton Airport South monitor for design value reductions exceeding 4 ppb in one year, and over 8 ppb in two years.**

**The TCEQ does not concur with the EPA's statement that the four successive years of 2012 through 2015 all had meteorological patterns that were not conducive to high ozone formation. The EPA does not provide any analytical support for this statement.**

**The EPA only referenced the DFW area meteorology from 2012 through 2015 in its comments but did not reference the significant reductions in both $NO_X$ emissions and monitored $NO_X$ concentrations, which are documented in Section 5.2.2, *$NO_X$ Trends*, in the 2017 DFW AD SIP revision. Section 5.2.2.1, *$NO_X$ Emission Trends*, summarizes the reductions in point, on-road, and non-road emission reductions that have occurred in the DFW area since 1997. Section 5.2.2.2, *Ambient $NO_X$ Trends*, demonstrates how these reduced $NO_X$ emissions over time are reflected in**

**downward trends in $NO_X$ concentrations at various DFW area monitors. The TCEQ disagrees that reductions in ozone are simply related to meteorology, but does recognize the impact of meteorology on ozone formation and that meteorology in future years is not directly controllable or known. No changes were made in response to these comments.**

The Sierra Club and Downwinders commented that the number of days that ozone was measured above the 75 ppb level is higher in 2015 than in 2007, 2010, and 2014, and conclude that there is not a downward trend in ozone levels after 2007. The Sierra Club and Downwinders cited the following three-year periods where a downward trend was not evident: 2009-2011, 2010-2012, and 2011-2013.

**The TCEQ disagrees that a downward trend in ozone is not evident after 2007. A trend in monitored ozone levels is not based simply on the number of days per year that levels above 75 ppb are measured but is rather driven more by the magnitude of the ozone measured. For example, if one year had 10 days monitored at 76 ppb and another year had five days monitored at 80 ppb, the fourth high of the latter year would be greater than that from the former.**

**In 2007, none of the DFW area monitors had eight-hour ozone design values at or below 75 ppb. The 2007 values ranged from a low of 76 ppb at Greenville and Kaufman to a high of 95 ppb at Eagle Mountain Lake. As of 2015, 13 of the 20 DFW area monitors have eight-hour ozone design values at or below 75 ppb. These 2015 values range from a low of 64 ppb at Kaufman to a high of 83 ppb at Denton Airport South. The lowest and highest eight-hour ozone design values among all DFW area monitors were both reduced by 12 ppb from 2007 to 2015. Such a reduction represents an unmistakable downward trend.**

**In accordance with EPA requirements, each monitor's design value is based on a three-year average of the fourth-highest measurement per year. While it is true that meteorological variation can cause the fourth-highest level to fluctuate from one year to the next, peak ozone levels have fluctuated in a downward direction over the span of several years as shown in Figure 1-1: *One-Hour and Eight-Hour Ozone Design Value and DFW Population*, in the 2017 DFW AD SIP revision. This decline in ozone levels is a direct result of the decline in monitored $NO_X$ concentrations discussed in Section 5.2.2.2, *Ambient $NO_X$ Trends*, of the 2017 DFW AD SIP revision. No changes were made in response to this comment.**

The Sierra Club and Downwinders reference an EPA comment from February 2015 about how $NO_X$ concentrations have been relatively flat at several western area monitors where growth in oil and gas have been prevalent, compared with the more steep $NO_X$ declines at urban area monitors where on-road sources are prevalent. The Sierra Club and Downwinders state that the lack of control on gas industry pollution is linked to these flat trends.

**The TCEQ disagrees with this comment. As noted in Section 3.5.4.4, *Area Sources*, of the 2017 DFW AD SIP revision, the TCEQ promulgated rules in Chapter 117 in 2007 that effectively reduced compressor engine $NO_X$ by 93%. The issue of $NO_X$ trends is addressed more fully in Figure 5-10: 90*th Percentile Daily Peak $NO_X$ Concentrations in the DFW Area*, of the 2017 DFW AD SIP revision, which shows**

**that almost all of the 12 $NO_X$ monitors throughout DFW show an ongoing decline in concentrations in the 18-year period from 1997 through 2014. As expected, the trends are particularly steep at the most urbanized locations such as Hinton where 90th percentile daily peak $NO_X$ declined from over 60 ppb in 1997 to roughly 20 ppb in 2014. The TCEQ acknowledges that more rural monitors such as Parker show relatively flat profiles, but that is because levels of only 5-10 ppb have historically been monitored in such locations far away from major $NO_X$ sources. The TCEQ response to this February 2015 EPA comment is included under the Emission Trends section on page 66 of the response to comments from the 2018 DFW AD SIP revision adopted in June 2015 (Non-Rule Project No. 2013-015-SIP-NR). No changes were made in response to this comment.**

The Sierra Club and Downwinders commented that the TCEQ may try to dismiss ozone monitoring data from 2015 because it is not yet certified. The Sierra Club and Downwinders note that the TCEQ references ozone measurements through September 2015 in the SIP narrative and that the 2015 data will be certified by the time the EPA takes final action on this 2017 DFW AD SIP revision.

**The TCEQ does not agree that it will "dismiss" ozone monitoring data from 2015 because it is not yet certified. The TCEQ reports ozone measurements in real time on its air monitoring Web page (https://www.tceq.texas.gov/cgi-bin/compliance/monops/aqi_rpt.pl). In accordance with EPA requirements, these measurements are quality assured and reported on a quarterly basis to the EPA's Air Quality System (AQS) three months after each quarter has ended. For example, measurements from October through December 2015 are reported to EPA's AQS by the end of March 2016. The final TCEQ certification for an entire calendar year is due by May 1 of the subsequent year, and the TCEQ has always met this requirement. The 2015 TCEQ certification data was sent to the EPA on April 27, 2015. No changes were made in response to this comment.**

Commissioner Daniel, the League of Women Voters of Dallas, and the Lonestar Chapter of the Sierra Club commented that the peak ozone level in the DFW area was higher than that for Houston. The Denton Drilling Awareness Group and Frack Free Denton stated that the Denton area has some of the worst air in Texas and probably within the entire U.S.

**The dominant wind direction during the DFW ozone season is southeasterly, which has resulted in the highest DFW area ozone levels historically being monitored north and west of the urban core. Due to its downwind location, the Denton Airport South monitor has had the highest eight-hour ozone design values in seven of the 16 years from 2000 through 2015. During the other nine years, the following four other monitors also located north and west of DFW have had the highest eight-hour ozone design values: Eagle Mountain Lake, Fort Worth Northwest, Grapevine Fairway, and Keller.**

**As of 2015, the Denton Airport South monitor has the highest eight-hour ozone design value in Texas at 83 ppb, which represents a reduction of 19 ppb from the 102 ppb design value that Denton Airport South had in 2000 when it first had three full years of ozone measurements. The current highest eight-hour ozone design value in the Houston-Galveston-Brazoria (HGB) area is 80 ppb at the**

**Manvel Croix Park monitor, which had a design value of 91 ppb in 2003 when it first had three full years of ozone measurements. Denton Airport South had a design value of 97 ppb in 2003, so it has been reduced by 14 ppb to its current level of 83 ppb during that time, while Manvel Croix Park has been reduced by 11 ppb.**

**For the entire U.S., the EPA currently only has ozone data through 2014 posted to its [Design Values](https://www3.epa.gov/airtrends/values.html) Web page (https://www3.epa.gov/airtrends/values.html). The detailed ozone information spreadsheet available at the EPA website indicates that 45 monitors located in 14 counties throughout the U.S. have eight-hour ozone design values higher than Denton Airport South. These monitors are located in California, Colorado, Connecticut, and Michigan. No changes were made in response to these comments.**

**<u>Future Design Values and Attainment Test Methodologies</u>**

The EPA commented that the model is overestimating the amount of ozone reduction occurring between the 2006 base year and 2017 future year, which leads to modeling projections that are unrealistic. The EPA's basis for this claim is the over-prediction of modeled ozone from the base case on the episode days used in the relative response factor (RRF) attainment test calculations. The EPA notes that some of the episode days used in the RRF test had over-prediction in the range of 15-20 ppb or more. The EPA states that this over-prediction on RRF days seems to occur more at the "downwind" DFW area monitors that typically measure higher ozone rather than the "upwind" DFW area monitors that typically measure lower ozone. The EPA postulates that this over-prediction may make the downwind monitors overly sensitive to changes in local emissions, which in turn underestimates future projected design values. The EPA states that the cause of over-prediction should be further investigated.

**The TCEQ acknowledges that over-prediction of modeled ozone is more common in the base case than under-prediction over the 67 total episode days. However, the TCEQ disagrees with the EPA's statement that this over-prediction in the base case leads to unrealistic future design values. In both its draft and official modeling guidance, the EPA acknowledges the unavoidable error and uncertainty associated with all photochemical modeling efforts. The EPA appropriately discourages the use of "absolute" attainment test methods, and instead recommends applying relative changes in modeled ozone to monitored design values.**

**Section 4.1, *Overview of model attainment test*, on page 96 of the EPA's draft modeling guidance states: "While good model performance remains a prerequisite for use of a model in an AD, problems posed by imperfect model performance on individual days are expected to be reduced when using the relative approach. An internal EPA analysis (USEPA, 2014b) considered whether daily ratios of model future/current maximum daily 8-hour ozone averages (MDA8) varied strongly as a function of site-specific base case model performance. The analysis determined that when modeled MDA8 ozone bias was relatively small (e.g., less than +/- 20 ppb), the average response ratios were not a strong function of the model MDA8 bias. This provides confidence that the model can detect the air quality response in the midst of reasonable levels of absolute bias and error."**

**In its comments on the 2017 DFW AD SIP revision, the EPA did not provide a quantitative analysis to accompany the claim that inclusion of episode days in the**

**attainment test with over-prediction of 15-20 ppb were having a significant impact on future design values. The TCEQ performed such an analysis by filtering out episode days in the RRF attainment tests where peak modeled eight-hour ozone exceeded monitored levels at separate thresholds of 15 ppb and 20 ppb. An aggregate summary across all monitors is provided in Table 2: *Changes in 2017 Future Design Values from Filtering Over-Predicted Days* showing the minimum, maximum, and average changes across all monitors in the 2017 future design values associated with the specific filtering scenarios.**

**Table 2: Changes in 2017 Future Design Values from Filtering Over-Predicted Days**

| Attainment Test Type and Over-Prediction Filtering Scenario | Minimum Change (ppb) | Maximum Change (ppb) | Average Change (ppb) |
|---|---|---|---|
| All Days Test with 15 ppb Filtering | -0.25 | 0.58 | 0.12 |
| All Days Test with 20 ppb Filtering | -0.47 | 0.24 | 0.00 |
| Top 10 Days Test with 15 ppb Filtering | -0.57 | 1.02 | 0.15 |
| Top 10 Days Test with 20 ppb Filtering | -1.03 | 0.75 | -0.05 |

**As shown, there is relatively little average change for over-prediction thresholds of 15 ppb and 20 ppb when applied to both the all days and top 10 days attainment tests. More detailed tables are provided below showing the net changes for each monitor. For the all days attainment test, the number of episode days included in the RRF calculations was reduced after filtering occurred. For example, the Denton Airport South monitor had 35 episode days included in the RRF test. The 15 ppb threshold scenario filtered out four of these days, while the 20 ppb threshold scenario filtered out two of these days. Although the EPA states that this over-prediction would be more of a problem with downwind monitors, there is no clear pattern that filtering out over-prediction days impacts the "higher" downwind monitors more than the "lower" upwind ones. As shown, filtering out at thresholds of 15 ppb and 20 ppb actually reduces the Denton Airport South future design value for the all days test by 0.03 ppb and 0.07 ppb, respectively.**

**Table 3: Changes in 2017 Design Values in All Days Test for 15 ppb Filtering**

| 2006 DFW Area Operational Monitor and Continuous Ambient Monitoring Station (CAMS) Code | RRF Days | Filtered Days | Change in Days | 2017 $DV_F$ (ppb) | Filtered $DV_F$ (ppb) | $DV_F$ Change (ppb) |
|---|---|---|---|---|---|---|
| Denton Airport South - C56 | 35 | 31 | -4 | 77.85 | 77.82 | -0.03 |
| Eagle Mountain Lake - C75 | 28 | 24 | -4 | 77.52 | 77.81 | 0.29 |
| Grapevine Fairway - C70 | 33 | 23 | -10 | 77.19 | 77.50 | 0.31 |
| Keller - C17 | 32 | 27 | -5 | 76.76 | 76.95 | 0.19 |
| Fort Worth Northwest - C13 | 27 | 20 | -7 | 75.94 | 76.52 | 0.58 |
| Frisco - C31 | 34 | 26 | -8 | 74.40 | 74.57 | 0.17 |
| Dallas North #2 - C63 | 31 | 24 | -7 | 73.34 | 73.14 | -0.20 |
| Dallas Executive Airport - C402 | 27 | 21 | -6 | 72.21 | 72.25 | 0.04 |

| 2006 DFW Area Operational Monitor and Continuous Ambient Monitoring Station (CAMS) Code | RRF Days | Filtered Days | Change in Days | 2017 $DV_F$ (ppb) | Filtered $DV_F$ (ppb) | $DV_F$ Change (ppb) |
|---|---|---|---|---|---|---|
| Parker County - C76 | 20 | 17 | -3 | 72.16 | 72.16 | 0.00 |
| Cleburne Airport - C77 | 16 | 12 | -4 | 71.10 | 71.33 | 0.24 |
| Dallas Hinton Street - C401 | 31 | 24 | -7 | 70.96 | 70.97 | 0.01 |
| Arlington Municipal Airport - C61 | 30 | 18 | -12 | 70.56 | 70.73 | 0.17 |
| Granbury - C73 | 17 | 14 | -3 | 68.73 | 69.17 | 0.45 |
| Midlothian Tower - C94 | 19 | 11 | -8 | 67.76 | 67.76 | 0.00 |
| Pilot Point - C1032 | 33 | 26 | -7 | 67.39 | 67.49 | 0.10 |
| Rockwall Heath - C69 | 26 | 21 | -5 | 65.65 | 65.40 | -0.25 |
| Midlothian OFW - C52 | 22 | 17 | -5 | 63.17 | 63.56 | 0.39 |
| Kaufman - C71 | 16 | 12 | -4 | 62.04 | 61.84 | -0.20 |
| Greenville - C1006 | 16 | 13 | -3 | 61.78 | 61.81 | 0.03 |

**Table 4: Changes in 2017 Design Values in All Days Test for 20 ppb Filtering**

| 2006 DFW Area Operational Monitor and CAMS Code | RRF Days | Filtered Days | Change in Days | 2017 $DV_F$ (ppb) | Filtered $DV_F$ (ppb) | $DV_F$ Change (ppb) |
|---|---|---|---|---|---|---|
| Denton Airport South - C56 | 35 | 33 | -2 | 77.85 | 77.78 | -0.07 |
| Eagle Mountain Lake - C75 | 28 | 26 | -2 | 77.52 | 77.53 | 0.02 |
| Grapevine Fairway - C70 | 33 | 28 | -5 | 77.19 | 77.27 | 0.08 |
| Keller - C17 | 32 | 29 | -3 | 76.76 | 76.90 | 0.14 |
| Fort Worth Northwest - C13 | 27 | 24 | -3 | 75.94 | 76.10 | 0.16 |
| Frisco - C31 | 34 | 29 | -5 | 74.40 | 74.42 | 0.03 |
| Dallas North #2 - C63 | 31 | 26 | -5 | 73.34 | 72.88 | -0.47 |
| Dallas Executive Airport - C402 | 27 | 23 | -4 | 72.21 | 72.14 | -0.07 |
| Parker County - C76 | 20 | 18 | -2 | 72.16 | 72.18 | 0.01 |
| Cleburne Airport - C77 | 16 | 14 | -2 | 71.10 | 71.28 | 0.19 |
| Dallas Hinton Street - C401 | 31 | 27 | -4 | 70.96 | 70.97 | 0.01 |
| Arlington Municipal Airport - C61 | 30 | 23 | -7 | 70.56 | 70.71 | 0.15 |
| Granbury - C73 | 17 | 16 | -1 | 68.73 | 68.88 | 0.16 |
| Midlothian Tower - C94 | 19 | 15 | -4 | 67.76 | 68.00 | 0.24 |
| Pilot Point - C1032 | 33 | 29 | -4 | 67.39 | 67.28 | -0.11 |
| Rockwall Heath - C69 | 26 | 21 | -5 | 65.65 | 65.40 | -0.25 |
| Midlothian OFW - C52 | 22 | 20 | -2 | 63.17 | 63.33 | 0.16 |
| Kaufman - C71 | 16 | 13 | -3 | 62.04 | 61.58 | -0.45 |
| Greenville - C1006 | 16 | 14 | -2 | 61.78 | 61.87 | 0.09 |

**In the case of the top 10 days attainment test, an episode day that exceeded the designated threshold would be filtered out, and then the next highest day would be**

**included to be sure that 10 episode days were still used. For example, the eight-hour ozone peak at the Denton Airport South monitor was over-predicted by 16.1 ppb on August 19, which was the fifth highest episode day in the 67-day episode for Denton Airport South, and was included in the original top 10 test days attainment calculation. It was removed and then the 11th highest day of June 28 was incorporated to ensure that the filtered results were still based on 10 total days. Since none of the 10 highest days for Denton Airport South were over-predicted by more than 20 ppb, there is no change in the 2017 future design value for this monitor when the 20 ppb filtering threshold was applied.**

**Table 5: Changes in 2017 Design Values in Top 10 Days Test for 15 ppb Filtering**

| 2006 DFW Area Operational Monitor and CAMS Code | RRF Days | Filtered Days | Change in Days | 2017 $DV_F$ (ppb) | Filtered $DV_F$ (ppb) | $DV_F$ Change (ppb) |
|---|---|---|---|---|---|---|
| Denton Airport South - C56 | 10 | 10 | 0 | 76.25 | 76.52 | 0.27 |
| Eagle Mountain Lake - C75 | 10 | 10 | 0 | 76.55 | 76.55 | 0.00 |
| Grapevine Fairway - C70 | 10 | 10 | 0 | 75.65 | 76.22 | 0.57 |
| Keller - C17 | 10 | 10 | 0 | 75.34 | 75.54 | 0.20 |
| Fort Worth Northwest - C13 | 10 | 10 | 0 | 74.78 | 75.48 | 0.70 |
| Frisco - C31 | 10 | 10 | 0 | 73.85 | 73.76 | -0.09 |
| Dallas North #2 - C63 | 10 | 10 | 0 | 72.22 | 71.72 | -0.50 |
| Dallas Executive Airport - C402 | 10 | 10 | 0 | 72.04 | 71.79 | -0.25 |
| Parker County - C76 | 10 | 10 | 0 | 72.39 | 72.25 | -0.15 |
| Cleburne Airport - C77 | 10 | 10 | 0 | 69.85 | 70.87 | 1.02 |
| Dallas Hinton Street - C401 | 10 | 10 | 0 | 69.31 | 69.68 | 0.37 |
| Arlington Municipal Airport - C61 | 10 | 10 | 0 | 69.85 | 70.46 | 0.60 |
| Granbury - C73 | 10 | 10 | 0 | 68.41 | 69.25 | 0.85 |
| Midlothian Tower - C94 | 10 | 10 | 0 | 67.43 | 67.51 | 0.08 |
| Pilot Point - C1032 | 10 | 10 | 0 | 66.59 | 66.89 | 0.30 |
| Rockwall Heath - C69 | 10 | 10 | 0 | 65.81 | 65.24 | -0.57 |
| Midlothian OFW - C52 | 10 | 10 | 0 | 62.56 | 63.02 | 0.46 |
| Kaufman - C71 | 10 | 10 | 0 | 62.10 | 61.60 | -0.50 |
| Greenville - C1006 | 10 | 10 | 0 | 62.09 | 61.67 | -0.42 |

**Table 6: Changes in 2017 Design Values in Top 10 Days Test for 20 ppb Filtering**

| 2006 DFW Area Operational Monitor and CAMS Code | RRF Days | Filtered Days | Change in Days | 2017 $DV_F$ (ppb) | Filtered $DV_F$ (ppb) | $DV_F$ Change (ppb) |
|---|---|---|---|---|---|---|
| Denton Airport South - C56 | 10 | 10 | 0 | 76.25 | 76.25 | 0.00 |
| Eagle Mountain Lake - C75 | 10 | 10 | 0 | 76.55 | 76.55 | 0.00 |
| Grapevine Fairway - C70 | 10 | 10 | 0 | 75.65 | 75.91 | 0.26 |

| 2006 DFW Area Operational Monitor and CAMS Code | RRF Days | Filtered Days | Change in Days | 2017 $DV_F$ (ppb) | Filtered $DV_F$ (ppb) | $DV_F$ Change (ppb) |
|---|---|---|---|---|---|---|
| Keller - C17 | 10 | 10 | 0 | 75.34 | 75.54 | 0.20 |
| Fort Worth Northwest - C13 | 10 | 10 | 0 | 74.78 | 74.64 | -0.13 |
| Frisco - C31 | 10 | 10 | 0 | 73.85 | 73.76 | -0.09 |
| Dallas North #2 - C63 | 10 | 10 | 0 | 72.22 | 71.19 | -1.03 |
| Dallas Executive Airport - C402 | 10 | 10 | 0 | 72.04 | 71.79 | -0.25 |
| Parker County - C76 | 10 | 10 | 0 | 72.39 | 72.39 | 0.00 |
| Cleburne Airport - C77 | 10 | 10 | 0 | 69.85 | 70.60 | 0.75 |
| Dallas Hinton Street - C401 | 10 | 10 | 0 | 69.31 | 69.23 | -0.08 |
| Arlington Municipal Airport - C61 | 10 | 10 | 0 | 69.85 | 70.01 | 0.16 |
| Granbury - C73 | 10 | 10 | 0 | 68.41 | 68.84 | 0.43 |
| Midlothian Tower - C94 | 10 | 10 | 0 | 67.43 | 67.39 | -0.05 |
| Pilot Point - C1032 | 10 | 10 | 0 | 66.59 | 66.69 | 0.09 |
| Rockwall Heath - C69 | 10 | 10 | 0 | 65.81 | 65.24 | -0.57 |
| Midlothian OFW - C52 | 10 | 10 | 0 | 62.56 | 62.56 | 0.00 |
| Kaufman - C71 | 10 | 10 | 0 | 62.10 | 61.55 | -0.55 |
| Greenville - C1006 | 10 | 10 | 0 | 62.09 | 61.99 | -0.10 |

**The base case over-prediction referenced by the EPA is documented in Section 3.6.4, *Model Performance Evaluation*, of the 2017 DFW AD SIP revision and more fully in Appendix C, *Photochemical Modeling for the DFW Attainment Demonstration SIP Revision for the 2008 Eight-Hour Ozone Standard*. As explained in the 2017 DFW AD SIP revision, the over-prediction is more pronounced on lower ozone days, which by definition are not included in attainment test calculations. No changes were made in response to these comments.**

The EPA commented that the TCEQ's use of 2006 baseline modeled ozone instead of 2006 base case modeled ozone in the attainment tests was leading to differences in the future design value projections. The EPA states that the baseline days used in the RRF calculations were typically 1-4 ppb higher than those for the base case, "thus biasing and increasing the uncertainty of the attainment demonstration results." The EPA uses the August 21 episode day as an example where the base case modeled value was 93.70 ppb, but the baseline value was 98.23 ppb. The EPA further states that use of the baseline values in the RRF calculations seems to overestimate the amount of ozone reduction from 2006 to 2017. The EPA commented that the TCEQ should investigate the differences in the meteorology and emission inventories between the base case and baseline modeling to determine what is driving the overestimation issue for days used in the RRF calculations.

**The TCEQ disagrees with the assessment that base case modeled values should have been used for RRF calculations instead of baseline ones. Such an approach would contradict the EPA's modeling guidance. The use of baseline emissions instead of base case ones for RRF calculations is clearly recommended in the EPA's**

**official modeling guidance from April 2007, and the EPA provided no justification for departing from this guidance. Provided below are relevant excerpts:**

- **Section 3.3, *Choosing model predictions to calculate a relative response factor (RRF) near a monitor*, on page 26: "The relative response factor (RRF) used in the modeled attainment test is computed by taking the ratio of the mean of the 8-hour daily maximum predictions in the future to the mean of the 8-hour daily maximum predictions with baseline emissions, over all relevant days."**

- **Section 3.5, *Which base year emissions inventory should be projected to the future for the purpose of calculating RRFs?*, on page 33: "One is the base case inventory which represents the emissions for the meteorology that is being modeled. These are the emissions that are used for model performance evaluations…Once the model has been shown to perform adequately, it is no longer necessary to model the base case emissions…The baseline emissions inventory is the inventory that is ultimately projected to a future year."**

**For the DFW area, the 2006 base case and 2006 baseline emissions are identical for all source categories with the exception of wildfires and electric generating units (EGUs) based on Air Markets Program Data (AMPD). All other modeling inputs (e.g., non-EGU anthropogenic emissions, biogenic emissions, meteorological files, etc.) are identical between the 2006 base case and 2006 baseline. This is more fully explained in Section 3.5.2, *2006 Base Case*, and 3.5.3, *2006 Baseline*, of the 2017 DFW AD SIP revision. Much more detail about the differences in base case versus baseline emissions is provided in the following portions of Appendix B, *Emissions Modeling for the DFW Attainment Demonstration SIP Revision for the 2008 Eight-Hour Ozone Standard*: Section 2.1, *2006 Base Case Point Source Modeling Emissions Development*; and Section 2.2, *2006 Baseline Point Source Modeling Emissions Development*. The approach taken by the TCEQ complies with EPA modeling guidance to develop base case emissions specific to each episode day, but to take an averaging approach for developing representative baseline emissions for projection purposes. Such an averaging approach for the baseline reduces bias and uncertainty in the AD calculations, rather than increasing bias and uncertainty as the EPA states in its comment. Provided below are relevant excerpts from the EPA's official modeling guidance from April 2007:**

- **Section 3.5, *Which base year emissions inventory should be projected to the future for the purpose of calculating RRFs?*, on page 34: "The base case inventory may include day specific information (e.g. wildfires, CEM data) that is not appropriate for using in future year projections. Therefore the baseline inventory may need to replace the day specific emissions with average or 'typical' emissions (for certain types of sources)."**

- **Section 17.3, *What Other Data are Needed to Support Emissions Modeling?*, on pages 172-173: "For point sources, hourly CEM data are recommended for use in model-evaluation runs. For future-year runs, we recommend**

**creating an "average-year" or "typical year" temporal allocation approach that creates representative emissions for the "baseline inventory" but that also includes similar daily temporal variability as could be expected for any given year. Care should be taken to not reduce or increase day-to-day variability in the averaging approach, with the exception of eliminating year-specific outages or other year-specific anomalies within the years used for the model-attainment test."**

**For the future year, the TCEQ models EGU emissions at their Cross-State Air Pollution Rule (CSAPR) cap levels, even though these units historically operate at roughly half of their operating caps on a typical ozone season day. This is discussed more fully in Section 3.5.4, *2017 Future Case Emissions*, of the 2017 DFW AD SIP revision. This conservative approach of modeling the maximum allowable emission levels ensures that future estimates are not underestimated for these $NO_X$ sources on high ozone days.**

**The TCEQ disagrees with the EPA's claim that future year modeled ozone reductions are overestimated simply because baseline values used in the attainment test are higher than base case ones. In a hypothetical situation where there would be no difference between base case and baseline emission inventories, both the official and draft versions of the EPA's modeling guidance ensure that the baseline modeled value for the attainment test will always be higher than the base case value used for performance evaluation. EPA modeling guidance recommends that the denominator of the RRF calculation for a single episode day be based on the maximum modeled value of the nine grid cells comprising the 3x3 array around the monitor of interest. The base case value used for the performance evaluation is a bi-linear interpolation of the four modeled values from the cell containing the monitor plus the three closest ones. Based on how the modeling guidance is structured, the maximum of nine values from the 3x3 array will always be higher than an interpolation of any four values within that same 3x3 array.**

**In the example of the August 21 episode day mentioned by the EPA, the 93.70 ppb base case value is the bi-linear interpolation from four cells, while the maximum in the 3x3 array surrounding the Denton Airport South monitor is 99.51 ppb modeled for cell 77-X/190-Y. The EGU emissions specific to August 21 are 16.13 $NO_X$ tpd, while the baseline average emissions are 9.63 $NO_X$ tpd. Use of the lower EGU emissions in the baseline inventory results in the maximum modeled value in the 3x3 array of 98.23 ppb, which is also in cell 77-X/190-Y. In this instance, use of the base case inventory suggested by the EPA would actually result in a higher modeled value of 99.51 ppb instead of the 98.23 ppb from the baseline inventory. No changes were made in response to these comments.**

The EPA commented that the TCEQ modeling utilized the two RRF approaches based on the all days test and the top 10 days attainment tests. The EPA noted that under the all days test, four monitors have 2017 future design values above the 75 ppb standard: Denton Airport South (77), Eagle Mountain Lake (77), Grapevine Fairway (77), and Keller (76). The EPA also noted that under the top 10 days test, two of these monitors have 2017 future design values above the 75 ppb standard: Denton Airport South (76) and Eagle Mountain Lake (76). The EPA states that the future design values are likely underestimated by using the top 10 days test.

**The TCEQ is reporting the results of both attainment tests because the EPA requested that this be done in a February 11, 2015 set of comments on the 2018 DFW AD SIP revision that was proposed in December 2014. In these comments, the EPA stated that its "current plan is to review comments and finalize the revised modeling guidance by the end of the year (2015). The guidance may change further based on comments. In this transitional period, we recommend that TCEQ continue to provide the attainment test analysis using both the existing 2007 modeling guidance approach and the new approach recommended in the December 2014 draft modeling guidance." Since the EPA has not yet finalized the draft modeling guidance, the TCEQ is continuing to report results for both the all days and top 10 days attainment tests.**

**Within the *Executive Summary* plus Sections 3.7.2, *Future Baseline Modeling*, and 5.5, *Conclusions*, of the 2017 DFW AD SIP revision, the TCEQ states that the 2017 design values for all four monitors above 75 ppb fall within the 73-78 ppb WoE range that applies for the all days test under EPA's official modeling guidance. Within these same portions of the 2017 DFW AD SIP revision, the TCEQ states that the peak 2017 design value of 76 ppb for two monitors under the top 10 days test meets the draft modeling guidance requirement of being "close to the NAAQS."**

**The EPA's statement that use of the top 10 days attainment test is underestimating the modeled future design values is inconsistent with the EPA's own modeling guidance. The EPA's preference in this comment for the all days test contradicts the draft EPA modeling guidance that recommends use of the newer top 10 days test instead of the older all days test. Following are excerpts from Section 4.2.1, *Model values to use in the RRF calculation*, on page 101 of the draft modeling guidance: "Since the form of the standard is also focused on the highest days of an ozone season (i.e., the fourth highest MDA8), the RRF calculation should also focus on days when the model predicts the highest ozone concentrations...Using the highest modeled days at each monitor is most likely to represent the response of the observed design value at a monitor...We therefore recommend calculating the RRF based on the highest 10 modeled days in the simulated period...Use of the highest 10 days in the mean RRF calculation yields a slightly better estimate of the actual observed ozone change than the previous guidance approach."**

**Further, in its recent 2017 future year modeling efforts based on a 2011 base case episode, the EPA uses the top 10 days attainment test instead of the older all days one, as noted in Section 3.2, *Approach for Projection 2017 Ozone Design Values*, on page 14 of the November 2015 *Air Quality Modeling Technical Support Document for the 2008 Ozone NAAQS Cross-State Air Pollution Rule Proposal*. No changes were made in response to these comments.**

The Sierra Club and Downwinders commented that the EPA's 2017 future year modeling in support of the transport rule showed the highest DFW area monitor with an average design value of 79.6 and a maximum design value of 82.1 ppb. The Sierra Club and Downwinders state that since these EPA values are higher than the 76 ppb value claimed by the TCEQ, a WoE analysis cannot be used.

**The TCEQ disagrees with this comment. The modeled design values referenced by the commenter are in Appendix B of the EPA's [Air Quality Modeling Technical Support Document for the 2008 Ozone NAAQS Cross-State Air Pollution Rule Proposal](https://www.epa.gov/sites/production/files/2015-11/documents/air_quality_modeling_tsd_proposed_rule.pdf), November 2015, (https://www.epa.gov/sites/production/files/2015-11/documents/air_quality_modeling_tsd_proposed_rule.pdf). The average design values reported by the EPA in Appendix B are consistent with the recommendations included in its draft modeling guidance where a baseline design value ($DV_B$) from five years of monitoring data is multiplied by an RRF based on the 10 highest modeled days for that monitor. For the purposes of addressing "maintenance sites," the EPA introduced the "maximum design value" approach, which uses a maximum value based on three consecutive years instead of five. This maximum design value approach is not referenced or recommended by the EPA in its draft or official modeling guidance for ADs and is used only in its transport rule modeling. In the 2017 DFW AD SIP revision, the TCEQ provides future design values based on both the all days and top 10 tests consistent with the official modeling guidance and draft modeling guidance, respectively, so any comparison with the maximum design values using other approaches is not consistent with EPA guidance.**

**The 79.6 average design value reported by the EPA in Appendix B has a monitor identification code of 484392003, which is the Keller monitor located in Tarrant County roughly 12 miles north of central Fort Worth. As of 2015, Keller has an eight-hour monitored design value of 76 ppb, based on a three-year average of fourth-high readings of 80 ppb (2013), 74 ppb (2014), and 76 ppb (2015). Keller is already very close to meeting the 75 ppb standard, and the fourth-high measurement of 80 ppb from 2013 will be removed from its design value calculation once the 2016 ozone season has completed.**

**Denton Airport South is located roughly 21 miles north of Keller and is the monitor with the current highest design value of 83 ppb. Since it began operation in February 1998, Denton Airport South has, on average, measured higher ozone values than the other monitors in the DFW area. The TCEQ modeling in the 2017 DFW AD SIP revision projects that Denton Airport South will have the highest 2017 design value of 76.25 ppb when the top 10 days attainment test is employed. Denton Airport South has a monitor identification code of 481210034, and the EPA's ozone transport modeling projects its 2017 design value to be 76.9 ppb. After applying the final truncation step outlined in the EPA's attainment test, both the TCEQ and EPA modeling predicts Denton Airport South to have a final 2017 design value of 76 ppb.**

**The EPA's transport rule modeling is not the only 2017 future case work it has done in the recent past. Appendix B of *Air Quality Modeling Technical Support Document: Proposed Tier 3 Emission Standards*, March 2013, provides DFW area design values by county rather than by individual monitor. These results report 2017 design values for Denton County at 74.73 ppb and Tarrant County at 76.25 ppb. No changes were made in response to these comments.**

The Sierra Club and Downwinders state that use of the official EPA modeling guidance results in four monitors with 2017 future design values above 75 ppb, and that use of the draft EPA modeling guidance results in two monitors with 2017 future design values above 75 ppb. The Sierra Club and Downwinders also reference the unmonitored area peak of 78.6 ppb, and state that "there is no rational reason to truncate" these modeled design values.

**The TCEQ disagrees with the statement that "there is no rational reason to truncate" modeled design values. Section 3.1 on page 24 of the EPA's official modeling guidance from April 2007 states: "For 8-hour ozone, it is recommended to round to the tenths digit until the last step in the calculation when the final future design value is truncated." Section 4.1.1 on page 99 of the draft modeling guidance from December 2014 makes the same statement. A footnote on page 100 of the draft modeling guidance emphasizes that this truncation approach to the modeled attainment test is recommended to be consistent with how monitoring data are used for determination of attainment. Both modeling guidance versions provide example future design value calculations that show how this truncation is to be performed as the final step in the attainment test. No changes were made in response to this comment.**

The Sierra Club and Downwinders commented that the 2018 DFW AD SIP revision adopted in June 2015 showed a peak future design value at Denton Airport South of 76.7 ppb, but that this 2017 DFW AD SIP revision shows the same monitor at 77.8 ppb, which is roughly 1 ppb higher.

**The TCEQ acknowledges that the 2018 DFW AD SIP revision had a future design value that is roughly 1 ppb lower than this 2017 DFW AD SIP revision. The June 2015 DFW AD SIP revision was based on a 2018 future year in accordance with EPA direction from 2012, while this revision is based on a 2017 future year in response to an EPA-required change in the modeled attainment year for moderate areas. Due to ongoing fleet turnover effects that result in lower emissions over time, it is expected that 2018 will have lower $NO_X$ emissions than 2017, and therefore lower ozone formation as well. For example, the source apportionment results in Section 3.7.3, *Ozone Source Apportionment Tool and Anthropogenic Precursor Culpability Analysis*, show that the on-road source category is the largest local contributor to Denton Airport South ozone at 10-12 ppb depending on the type of attainment test used. The on-road emissions reported in these SIP revisions estimate 2017 at 130.77 $NO_X$ tpd and 2018 at 119.69 $NO_X$ tpd, which is a reduction of 11.08 $NO_X$ tpd. No changes were made in response to this comment.**

## Ozone Episode Selection

The Sierra Club and Downwinders commented that the TCEQ should not have used a 67-day ozone episode from 2006 but instead should have first focused on the entire 2011 ozone season or, at worst, the 2012 ozone season. The Sierra Club and Downwinders referenced the case of *Mississippi Commission on Environmental Quality vs. EPA*, and noted that the EPA criticized the TCEQ for using only a June 2006 episode in its analysis. The Sierra Club and Downwinders stated that the addition of the August-September 2006 episode to the June 2006 one is not sufficient because westerly winds were not included, which would be necessary to cover a variety of meteorological conditions. The Sierra Club and Downwinders stated that the TCEQ does not demonstrate that its base modeling period is representative of a variety of meteorological conditions. They specifically disagreed with the TCEQ's position that 2011 is not a satisfactory year to model because it is not representative of historic norms, citing the EPA's modeling guidance that calls for a variety of meteorological conditions to model.

**The TCEQ does not agree with these comments. Both the EPA official and draft modeling guidance documents do not require a full ozone season for AD modeling purposes. Section 2.3.1, *Choosing Time Periods to Model*, of the draft modeling guidance specifically says to "model time periods both before and following elevated pollution concentration episodes to ensure the modeling system appropriately characterizes low pollution periods, development of elevated periods, and transition back to low pollution periods through synoptic cycles." Figure 3-4: *Maximum Eight-Hour Ozone by Monitor from May 31 through July 2, 2006* of the 2017 DFW AD SIP revision shows how the 33-day June portion of the episode has three full synoptic cycles of low-high-low ozone periods. Figure 3-5: *Maximum Eight-Hour Ozone by Monitor from August 13 through September 15, 2006* of the 2017 DFW AD SIP revision shows how the 34-day August-September portion of the 2006 episode has four full synoptic cycles of low-high-low periods.**

**The TCEQ disagrees with the commenter's interpretation of the EPA's guidance on modeling a variety of meteorological conditions. In both the EPA's official modeling guidance and the more recent draft version, the EPA does not simply say to include all possible types of meteorological conditions when selecting an episode. The following excerpt from Section 2.3.1, *Choosing Time Periods to Model*, on page 16 of the draft version addresses this issue: "Choose time periods which reflect a variety of meteorological conditions that frequently correspond with observed 8-hour daily maxima concentrations greater than the level of the NAAQS at monitoring sites in the nonattainment area." Section 14.0, *How are the Meteorological Time Periods (Episodes) Selected?*, from the official version contains very similar direction about focusing on meteorological conditions that frequently occur at times when high ozone is measured, rather than all possible meteorological conditions that may occur within a given year.**

**Appendix D, *Conceptual Model for the DFW Attainment Demonstration SIP Revision for the 2008 Eight-Hour Ozone Standard*, of the 2017 DFW AD SIP revision provides an extensive discussion of meteorological conditions associated with high ozone levels in the DFW area. Section 1.2, *Ozone in the Dallas-Fort Worth Area*, discusses the dominance of south and southeasterly winds during ozone season rather than winds originating from the north and west. Section 3.6, *Meteorological Characterization and Trends*, provides analyses of the correlation of wind speed, wind direction, and ozone levels based on monitoring data collected from 1997 through 2013. The wind rose plots per monitor in Figure 3-21: *Wind Speeds by Wind Direction on High Ozone Days* substantiate that high ozone occurs in the DFW area when the dominant wind directions are south and southeasterly, while the westerly contribution is negligible. If winds from the west and northwest were correlated to high ozone days, there would be detectable patterns when the DFW area ozone monitors in the west and northwest (e.g., Denton Airport South and Grapevine Fairway) would have the lowest ozone measured and those to the east and southeast (e.g., Rockwall Heath and Kaufman) would have the highest ozone measured.**

**There are some days during the 2006 episode when micro-scale wind direction is westerly, and this tends to occur due to stagnation and/or flow reversal. This is shown in the 2017 DFW AD SIP revision in Figure 3-6: *Eagle Mountain Lake***

***Monitor Back Trajectories for May 31 through July 2, 2006*** **and Figure 3-7:** ***Denton Airport South Monitor Back Trajectories for August 13 through September 15, 2006*****, which show the 48-hour wind back trajectories for each of the 67 episode days. When the primary wind direction over a 48-hour period is viewed per day, the macro-scale origin is dominantly south and east with some occasional north and northeastern contribution. Micro-scale westerly flow is detected on certain days of the 2006 episode such as June 1, June 23, and August 15 where the "parcel" of air begins its 48-hour trajectory southeast of DFW (such as in the Gulf of Mexico), travels to the west of the DFW area where its speed is lowered, and then reverses direction traveling east towards DFW at a slow rate. However, as shown in Figures 3-4 and 3-5, these all happen to be days in the episode when no DFW area monitors measured above 75 ppb. This further corroborates the conceptual model's statements in Appendix D that westerly winds are not a frequent occurrence when high ozone is measured in the DFW area.**

**The TCEQ disagrees with the commenter's statement that the EPA "criticized TCEQ before for failing to use an entire ozone season it its modeling" in the case of** ***Mississippi Commission on Environmental Quality vs. EPA*****. In that case, the TCEQ was petitioning the court to review the EPA's designation of Wise County as nonattainment and used source apportionment modeling from the June 2006 episode. The EPA's comment on the TCEQ source apportionment work was that the historical high ozone pattern in the DFW area is bimodal with peaks occurring in June and August/September. The inclusion of the 34-day August/September period in this AD with the 33-day June one covers the bimodal high ozone distribution that the EPA discussed. Figure 3-2:** ***DFW Eight-Hour Ozone Days Above 75 ppb by Month from 1991 through 2014*** **in the 2017 DFW AD SIP revision presents this bimodal distribution of June and August/September peaks using historical monitoring data.**

**The TCEQ disagrees that the 2011 ozone season would be more representative than 2006 for attainment modeling purposes. Table 3-1:** ***DFW Days with Ozone Above 75 ppb by Month from 2006 through 2014*** **of the 2017 DFW AD SIP revision shows that 2006 not only had more days above 75 ppb than any other subsequent year, but it also has them occurring during the peak times of June, August, and early September, which matches the historical pattern. Compared to this historical bimodal pattern in DFW, 2011 had a very skewed distribution towards the latter portion of the ozone season with relatively few high ozone days in June, and the bulk occurring in late August and September. In addition, 2011 was an atypical year for meteorology because it was the highest drought year on record for Texas.**

**Under the EPA's official modeling guidance from April 2007, the attainment test is based on all days modeled above the 75 ppb standard. Under the draft modeling guidance, from December 2014, only the 10 highest modeled days are included in the attainment test. In both modeling guidance documents, the EPA recommends choosing episodes that have at least 10 days per monitor above the relevant standard to be included in these tests. Simply adding more weeks and months with low ozone in a base case episode does not necessarily help. For example, Table 7:** ***Episode Days Modeled Above 75 ppb in 2006 TCEQ Episode and 2011 EPA Episode*** **compares the number of days modeled above 75 ppb by DFW area monitors in the**

**TCEQ's 67-day episode from 2006 and the EPA's 153-day May-September episode from 2011. Even though the 2011 EPA episode is more than twice as long as the 2006 TCEQ one, only five of the monitors in the 2011 case reach the minimum of 10 recommended days above 75 ppb for the attainment test calculations. In the case of the 2006 TCEQ episode, even the "lowest" monitors of Cleburne Airport, Greenville, and Kaufman have 16 days out of the 67 with modeled ozone above 75 ppb. For the "highest" ozone monitor of Denton Airport South, the 67-day 2006 episode from the TCEQ has 35 days modeled above 75 ppb, while the 153-day 2011 episode from the EPA has only 12.**

**Table 7: Episode Days Modeled Above 75 ppb in 2006 TCEQ Episode and 2011 EPA Episode**

| DFW Area Monitor and CAMS Code | 67-Day TCEQ 2006 Episode | 153-Day EPA 2011 Episode | Difference in Days |
|---|---|---|---|
| Denton Airport South - C56 | 35 | 12 | 23 |
| Eagle Mountain Lake - C75 | 28 | 9 | 19 |
| Grapevine Fairway - C70 | 33 | 13 | 20 |
| Keller - C17 | 32 | 11 | 21 |
| Fort Worth Northwest - C13 | 27 | 5 | 22 |
| Frisco - C31 | 34 | 12 | 22 |
| Dallas North #2 - C63 | 31 | 8 | 23 |
| Dallas Executive Airport - C402 | 27 | 3 | 24 |
| Parker County - C76 | 20 | 3 | 17 |
| Cleburne Airport - C77 | 16 | 2 | 14 |
| Dallas Hinton Street - C401 | 31 | 3 | 28 |
| Arlington Municipal Airport - C61 | 30 | 4 | 26 |
| Granbury - C73 | 17 | 3 | 14 |
| Pilot Point - C1032 | 33 | 10 | 23 |
| Rockwall Heath - C69 | 26 | 4 | 22 |
| Midlothian OFW - C52 | 22 | 5 | 17 |
| Kaufman - C71 | 16 | 0 | 16 |
| Greenville - C1006 | 16 | 3 | 13 |

**In selecting a new episode for future SIP development, the TCEQ has chosen the 2012 ozone season because it is a far better match than 2011 and other recent years for reflecting the historical pattern of meteorological conditions that frequently correspond with eight-hour daily maximum concentrations, as required by both the draft and official versions of EPA's modeling guidance. To date, the TCEQ has completed a preliminary set of photochemical modeling inputs for the June 2012 period, and these are available via the TCEQ's [Texas Air Quality Modeling - Files and Information (2012 Episodes)](https://www.tceq.texas.gov/airquality/airmod/data/tx2012) Web page (https://www.tceq.texas.gov/airquality/airmod/data/tx2012). The TCEQ is currently improving these June 2012 inputs along with developing ones for additional months from May through September in the 2012 ozone season. When**

**these are complete, they will be posted to the 2012 modeling page for public access. No changes were made in response to these comments.**

The Sierra Club and Downwinders stated that the TCEQ modeling is unreliable and that the EPA has already rejected it "at face value, that is without adjustments, because it significantly underestimates ozone values." The Sierra Club and Downwinders provide an excerpt from a June 2, 2015 decision by the U.S. District of Columbia (D.C.) Circuit Court of Appeals in the case of *Mississippi Commission on Environmental Quality versus EPA*.

**The TCEQ disagrees both that the modeling is unreliable and that the EPA has already rejected it at face value. As discussed in a response above about this court case, the court decision excerpt referenced by the commenter simply says that the EPA should fully evaluate a modeling submission and not accept it at face value. The TCEQ concurs that all modeling work should be fully evaluated, whether that modeling is performed by the TCEQ, the EPA, or any other organization that does this type of complex work.**

**In referencing the June 2, 2015 court decision, the commenter did not note that AD modeling was not the subject of this case. The TCEQ joined other Texas petitioners in challenging the EPA's designation of Wise County as nonattainment under the 2008 eight-hour ozone standard. The court rejected the Texas petitioners and upheld the EPA's nonattainment designation for Wise County. Photochemical modeling for the DFW nonattainment area to support an AD was not an issue in this case and was not rejected by either the court or the EPA as unsuitable.**

**The excerpt mentioned by the commenter is from Section III.F.2.ii of the decision (http://caselaw.findlaw.com/us-dc-circuit/1702787.html) where the court addresses the EPA's review of the source apportionment modeling submitted by the TCEQ in support of excluding Wise County from the DFW nonattainment area. The court was addressing the EPA's observation that the DFW ozone season is bimodal, but that the TCEQ source apportionment modeling submitted was only for June 2006. At the time the TCEQ submitted this source apportionment modeling, it was relying on the best available information, which was modeling that was included in the December 2011 DFW AD SIP revision for the 1997 eight-hour ozone standard of 84 ppb.**

**The bimodal distribution referenced by the EPA is summarized in Figure 3-2: *DFW Eight-Hour Ozone Days Above 75 ppb by Month from 1991 through 2014* of the 2017 DFW AD SIP revision, showing DFW area ozone peaks typically occurring in both June and August/September. Section 3.3, *Episode Selection*, of the 2017 DFW AD SIP revision discusses how the 33-day June 2006 episode previously used was combined with a 34-day portion from August and September 2006 to better reflect this bimodal distribution pattern for the DFW area. In addition to extending the 2006 episode, multiple modeling improvements were made by the TCEQ with respect to emissions, meteorological, and photochemistry inputs as detailed in Section 3.6.4.3, *Diagnostic Evaluations*, of the 2017 DFW AD SIP revision. No changes were made in response to these comments.**

**Emissions Inventory Development**

The Sierra Club and Downwinders commented that the 2017 oil and gas emissions estimated by the TCEQ are 27.5 $NO_X$ tpd and 50.4 VOC tpd for a total of roughly 78 precursor tpd, which makes it the fourth largest total of any major source category. One individual also commented that oil and gas emissions were the fourth largest major source category, while another individual commented that oil and gas emissions were a leading cause of air pollution. The Sierra Club and Downwinders stated that projected $NO_X$ levels have increased over 50% from the 2018 estimates included in the June 2015 DFW AD SIP revision. They stated that this increase makes it more important to control compressor engine $NO_X$ emissions.

**The TCEQ does not agree with the oil and gas emission figures referenced by one of the commenters. The emission summary tables for 2017 are included within the *Executive Summary* and several locations in Chapter 3. These tables show that the combined oil and gas categories for production, drilling, and point total 30.37 $NO_X$ tpd and 57.98 VOC tpd for 2017. The 2018 DFW AD SIP revision adopted in June 2015 shows that the 2018 estimates for these same categories total 27.50 $NO_X$ tpd and 50.47 VOC tpd. The net increases from 2018 to 2017 of 2.87 $NO_X$ tpd and 7.51 VOC tpd reflect changes of 10% and 15%, respectively, instead of the 50% level referenced by the commenter. As shown in the trends from Figure 3-13: *Barnett Shale Drilling and Natural Gas Production from 1993-2015*, it is expected that 2018 oil and gas emission estimates would be slightly lower than those for 2017. The Barnett Shale drilling boom peak in 2008 led to a subsequent production peak in 2012, which has been steadily declining due to the significant reduction in drilling of new wells that started in 2009.**

**The TCEQ concurs that unregulated compressor engines could be a significant $NO_X$ source, and this is why the TCEQ adopted rules in Chapter 117 in 2007 that effectively reduced DFW area compressor engine $NO_X$ by 93%. This is explained in more detail in Section 3.5.4.4, *Area Sources*, of the 2017 DFW AD SIP revision. These effects are also evident by comparing the various summary tables containing 2006 and 2017 emission estimates. The oil and gas production category was estimated to emit 61.84 $NO_X$ tpd in 2006 prior to implementation of the Chapter 117 rules, and is expected to emit 10.80 $NO_X$ tpd in 2017.**

**When comparing ozone precursor totals in a $NO_X$-limited environment such as DFW, it is misleading to combine $NO_X$ and VOC for ranking purposes. When relatively large amounts of reactive biogenic VOC are present (e.g., isoprene from oak trees), small changes in relatively non-reactive anthropogenic VOC emissions have a negligible impact on ozone formation. Numerous summary tables included in the 2017 DFW AD SIP revision show that the on-road source category is the primary source of both $NO_X$ emissions and ozone formation at critical monitors such as Denton Airport South. No changes were made in response to this comment.**

The Sierra Club and Downwinders stated that the TCEQ overestimates 2006 on-road emissions, which in turn leads to an overestimate of the ozone reductions that will be achieved by 2017. The Sierra Club and Downwinders stated that the 2006 gasoline passenger truck emission rate of 1.508 grams/mile of $NO_X$ used by the TCEQ is too high. The Sierra Club and Downwinders cited an EPA document that indicates light-duty truck $NO_X$ emission rates for 2008 are 0.95

grams/mile. The name of this document is *Average Annual Emissions and Fuel Consumption for Gasoline-Fueled Passenger Cars and Light Trucks*, EPA420-F-08-024, October 2008.

**The TCEQ disagrees with this comment. The October 2008 EPA document states that the emission rate figures listed are based on the MOBILE6.2 model, which was initially released by the EPA in 2002 and last updated in 2004. The EPA replaced MOBILE6.2 with the 2010 version of the Motor Vehicle Emission Simulator (MOVES2010) model back in March of 2010. Upon its release, MOVES became the required on-road emission model for SIP development by states. The EPA's typical policy is to require that the latest version available at the time SIP development work commences of their on-road emission model be used. The 2017 DFW AD SIP revision makes multiple references to use of the MOVES2014 version of the model, which was first released in July 2014.**

**Texas does not arbitrarily choose its own emission rates for on-road inventory development but rather, uses output from MOVES2014. When developing and/or revising their on-road models, the EPA incorporates the effects of vehicle emission standards required of manufacturers. When developing an on-road emissions inventory for a specific calendar year to be used in a SIP (e.g., 2006 or 2017), states input local data that characterize the age distribution, composition, and overall activity from the fleet. The model then reports separate emission rates for each vehicle type based on all the data sets and algorithms incorporated by the EPA. No changes were made in response to this comment.**

The Sierra Club and Downwinders stated that the TCEQ "2017 modeling underestimates mobile source on-road emissions because TCEQ used the 2018 mobile source on-road emission estimate for the 2017 modeling."

**The TCEQ disagrees with this statement. Compared to the 2018 future year, the 2017 on-road emission estimates for the DFW area are higher by 11.08 $NO_X$ tpd and 2.71 VOC tpd. The *Executive Summary* of the 2018 DFW AD SIP revision reports 2018 on-road emission estimates for DFW at 119.69 $NO_X$ tpd and 62.20 VOC tpd. The *Executive Summary* of the current 2017 DFW AD SIP revision reports 2017 on-road emission estimates for the DFW area at 130.77 $NO_X$ tpd and 64.91 VOC tpd. Within both of these DFW AD SIP revisions, these on-road emission estimates are referenced multiple times in Chapter 3, Chapter 4, and Appendix B. All of the DFW area on-road emission inventory development files for these AD SIP revisions are available in the following FTP directories:**

- **ftp://amdaftp.tceq.texas.gov/pub/Mobile_EI/DFW/mvs/2006/ for 2006;**
- **ftp://amdaftp.tceq.texas.gov/pub/Mobile_EI/DFW/mvs/2017/ for 2017; and**
- **ftp://amdaftp.tceq.texas.gov/pub/Mobile_EI/DFW/mvs/2018/ for 2018.**

**No changes were made in response to this comment.**

The Sierra Club and Downwinders commented that there is no evidence that Tier 3 regulations will improve ozone levels in DFW in 2017. The Sierra Club and Downwinders stated that the number of Tier 3 compliant vehicles in 2017 will be a negligible portion of the on-road fleet. To demonstrate that Tier 3 reduction emission estimates exist in 2018 but not 2017, the Sierra Club and Downwinders provided a fact sheet entitled *EPA Sets Tier 3 Motor Vehicle Emission and Fuel Standards*, EPA-420-F-14-009, March 2014. Table 1 of this fact sheet provides the EPA's estimated annual emission reductions for the entire U.S. for both 2018 and 2030. The Sierra Club and Downwinders disputed the use of the annual average gasoline sulfur caps associated with the Tier 3 rule as inputs for on-road emission inventory development. They stated that "if EPA believed that sulfur levels would definitely be lower on any given day during 2017 in DFW, it would have lowered the refinery gate and downstream caps." The Sierra Club and Downwinders also claimed that the on-road emission inventory is underestimated since gasoline at the pump can have up to 15% ethanol (E15), which will lead to higher emission of ozone precursors.

**The TCEQ disagrees with these comments. The second sentence of the EPA fact sheet referenced states "Starting in 2017, Tier 3 sets new vehicle emissions standards and lowers the sulfur content of gasoline..." This fact sheet is available along with several other detailed documents through the EPA's Tier 3 Vehicle Emission and Fuel Standards Program Web page (http://www3.epa.gov/otaq/tier3.htm). The following reports prepared by the EPA are available on this site:**

- ***Air Quality Modeling Technical Support Document: Proposed Tier 3 Emission Standards*, EPA-454/R-13-006, March 2013, http://www3.epa.gov/otaq/documents/tier3/454r13006.pdf; and**

- ***Air Quality Modeling Technical Support Document: Tier 3 Motor Vehicle Emission and Standards*, EPA-454/R-14-002, February 2014, http://www3.epa.gov/otaq/documents/tier3/454r14002.pdf.**

**The EPA's March 2013 document summarizes the 2017 benefits that EPA modeled for the proposed Tier 3 rule. Page 12 of this document states: "The maximum projected decrease in an 8-hour ozone design value in 2017 is 1.09 ppb in Tarrant County, Texas." Appendix B of the March 2013 document includes the eight-hour ozone design value changes modeled by the EPA for the 2017 calendar year for various U.S. counties from Tier 3. Appendix B of the February 2014 document includes similar information by U.S. county for the 2018 calendar year. Table 8: *Tier 3 Ozone Reductions Modeled by EPA for 2017 and 2018* summarizes these results for DFW area counties.**

**Table 8: Tier 3 Ozone Reductions Modeled by EPA for 2017 and 2018**

| Texas County | 2017 Ozone Reduction (ppb) | 2018 Ozone Reduction (ppb) |
|---|---|---|
| Collin | 0.89 | 0.92 |
| Dallas | 0.90 | 0.81 |
| Denton | 1.07 | 0.79 |
| Ellis | 0.86 | 0.58 |
| Hood | 1.02 | 0.50 |

| Texas County | 2017 Ozone Reduction (ppb) | 2018 Ozone Reduction (ppb) |
|---|---|---|
| Hunt | 0.46 | 0.42 |
| Johnson | 0.88 | 0.51 |
| Kaufman | 0.45 | 0.46 |
| Rockwall | 0.54 | 0.58 |
| Tarrant | 1.09 | 0.73 |

**It is true that the penetration of Tier 3 compliant vehicles will be minimal in the 2017 calendar year because 2017 is the first model year for Tier 3 vehicles to start entering the fleet, and the full phase-in of these standards is not complete until the 2025 model year. However, the largest immediate benefit from the Tier 3 program comes from reducing the gasoline sulfur levels from 30 parts per million (ppm) to 10 ppm, which makes the catalytic converters from in-use vehicles more effective, and therefore reduces their emissions. The first page of the fact sheet referenced by the commenter states that "the Tier 3 gasoline sulfur standard will make emission control systems more effective for both existing and new vehicles..." This is fully documented in an EPA report entitled *The Effects of Ultra-Low Sulfur Gasoline on Emissions from Tier 2 Vehicles in the In-Use Fleet*, EPA-420-R-14-002, March 2014, (http://www3.epa.gov/otaq/models/moves/documents/420r14002.pdf). This study was conducted by the EPA and its results were incorporated into the MOVES2014 model that was used to develop 2017 on-road emission inventories for this 2017 DFW AD SIP revision.**

**The EPA appropriately incorporated the effects of both Tier 3 standards and 10 ppm sulfur gasoline into the MOVES2014 model, which it requires states to use for SIP emissions inventory development. The TCEQ disagrees that the EPA intended for states to model the refinery gate and downstream sulfur caps instead of the annual average sulfur cap of 10 ppm. The EPA provides direction to states on this issue in Section 4.9.1, *Fuel Formulation and Fuel Supply Guidance*, of their *MOVES2014 and MOVES2014a Technical Guidance: Using MOVES to Prepare Emission Inventories for State Implementation Plans and Transportation Conformity*, EPA-420-B-15-093, November 2015, (http://www3.epa.gov/otaq/models/moves/documents/420b15093.pdf). The following excerpt is from pages 46 and 47: "The Tier 3 rule establishes a national average of 10 ppm sulfur beginning in 2017...MOVES2014 assumes a sulfur level of 10 ppm for all regions. MOVES2014 can provide benefits of sulfur reduction down to 5 ppm. Do not use values for gasoline sulfur below 5 ppm." In accordance with EPA MOVES technical guidance on how to model Tier 3, the TCEQ specified a gasoline sulfur input of 10 ppm for the 2017 calendar year.**

**The EPA Tier 3 regulations require an annual average of 10 ppm sulfur content, but do allow a refinery gate cap of 80 ppm to account for occasional equipment problems that can occur at an individual refinery. However, for each day of a given year that a refinery would provide 80 ppm sulfur gasoline, 5 ppm sulfur gasoline would have to be provided for a total of 14 days to still meet the 10 ppm annual average.**

**According to the EPA's [E15](https://www.epa.gov/fuels-registration-reporting-and-compliance-help/e15-fuel-registration) Web page (https://www.epa.gov/fuels-registration-reporting-and-compliance-help/e15-fuel-registration), E15 can be sold for use in 2001-and-newer model year light-duty motor vehicles, subject to certain conditions. E15 cannot be sold for use in 2000-and-older model year light-duty vehicles, motorcycles, heavy-duty vehicles (e.g., buses and delivery trucks), non-road vehicles and equipment (e.g., boats, lawnmowers, and chain saws). Since many vehicles and types of equipment cannot use E15, it has very limited availability nationwide. According to the [Ethanol Retailer](http://www.ethanolretailer.com/e15-resource-center/whitepaper-e15) website (http://www.ethanolretailer.com/e15-resource-center/whitepaper-e15), "E15 has been available for three years and by the end of 2015 will be available at more than 300 major retail locations in 20 states." According to the American Petroleum Institute's [Service Station FAQs](http://www.api.org/Oil-and-Natural-Gas-Overview/Consumer-Information/Service-Station-FAQs) Web page, there are 152,995 locations nationwide selling gasoline (http://www.api.org/Oil-and-Natural-Gas-Overview/Consumer-Information/Service-Station-FAQs). These 300 retail locations selling E15 represent 0.2% of the nationwide total, and are heavily concentrated in the Midwestern states of Illinois, Iowa, Kansas, Minnesota, Nebraska, North Dakota, and Wisconsin with only three known locations in Texas.**

**The TCEQ typically contracts out surveys in three-year increments to obtain fuel properties throughout various Texas regions. The last such study was done for 2014 and is entitled *2014 Summer Fuel Field Study*, Eastern Research Group, January 2015 (http://www.tceq.state.tx.us/assets/public/implementation/air/am/contracts/reports/mob/5821199776FY1420-20140815-ergi-summer_2014_fuels.pdf). The survey shows that 10% is the maximum ethanol content in gasoline sold throughout Texas. If future fuel survey work shows that this ethanol content starts increasing to 15%, the TCEQ will revise its on-road modeling inputs accordingly.**

**In both of the air quality modeling technical support documents referenced above for the Tier 3 program, the EPA used gasoline properties for both 2017 and 2018 of 10 ppm sulfur and 10% ethanol. As recommended by EPA MOVES2014 technical guidance and consistent with how the EPA modeled Tier 3, the TCEQ used these same inputs in its 2017 on-road inventory development. No changes were made in response to these comments.**

The Sierra Club and Downwinders commented that the Tier 3 on-road emission benefits will be zero in 2015 and 2016, which are two of the years that will be used to calculate the DFW area design value at the end of the 2017 ozone season.

**The TCEQ concurs that there will be no benefits from Tier 3 in the 2015 and 2016 calendar years because this federal rule does not take effect until January 1, 2017. Since 2017 represents the full ozone season preceding the DFW area attainment date of July 20, 2018, it is the appropriate future year for this AD modeling. The lack of Tier 3 on-road benefits in 2015 and 2016 has no impact on the modeled ozone and emission levels in 2017. No changes were made in response to this comment.**

The Sierra Club and Downwinders commented that the TCEQ did not increase the VOC emissions in its modeling to account for the decommissioning of Stage II vapor control equipment that was approved by the EPA on March 17, 2014. The Sierra Club and Downwinders stated this would have a very small impact on both VOC emissions and modeled ozone.

**The TCEQ does not agree that it failed to increase VOC emission estimates to account for the decommissioning of Stage II. Refueling emission inventories for 2017 were modeled without Stage II benefits for all Texas counties. Development of refueling emission inventories with MOVES2014 for the 2017 future year is documented in an August 2015 report available on the TCEQ FTP site at [ftp://amdaftp.tceq.texas.gov/pub/Mobile_EI/Statewide/mvs/reports/mvs14_att_tex_17_technical_report_final_aug_2015.pdf](ftp://amdaftp.tceq.texas.gov/pub/Mobile_EI/Statewide/mvs/reports/mvs14_att_tex_17_technical_report_final_aug_2015.pdf). References to the disabling of Stage II benefits are addressed on pages 4, 15, 19, and 41 of the report. A similar MOVES2014 report from December 2014 is available on the TCEQ FTP site for development of 2006, 2012, and 2018 on-road emission inventories: [ftp://amdaftp.tceq.texas.gov/pub/Mobile_EI/Statewide/mvs/reports/mvs14_att_tex_06_12_18_technical_report_final_dec_2014.pdf](ftp://amdaftp.tceq.texas.gov/pub/Mobile_EI/Statewide/mvs/reports/mvs14_att_tex_06_12_18_technical_report_final_dec_2014.pdf). Stage II benefits were included for 2006 and 2012 when this program was still in effect, but not for 2018. This is addressed on pages 4, 16, 36, 37, 42, 57, 58, 59, 73, and 91 of the report.**

**The TCEQ agrees with the comment that any increases in VOC emissions and ozone formation from decommissioning of Stage II are minimal. This was fully documented in the Stage II Vapor Recovery Program SIP Revision adopted by the TCEQ on October 9, 2013 and approved by the EPA on March 17, 2014 (https://www.tceq.texas.gov/assets/public/implementation/air/sip/miscdocs/2361SIP.pdf). In order to report a small increase in 2017 VOC emissions from removing Stage II in this 2017 DFW AD SIP revision, the refueling inventories documented above would have to be developed for both "with Stage II" and "without Stage II" scenarios, and then the difference reported as the increase. This was done for the October 9, 2013 Stage II SIP revision as summarized in Table 12.1: *Stage II VOC Emission Reduction Benefit Loss Estimates Summary in Tons per Day*, which includes VOC increases in two-year increments from 2012 through 2030 as a result of Stage II decommissioning. The 2017 refueling inventories for all counties exclude Stage II in the 2017 DFW AD SIP revision. No changes were made in response to this comment.**

The Sierra Club and Downwinders commented that the emission inventory of stationary and area sources used in the modeling is too low because the TCEQ has assumed that sources with emission limits will not emit ozone precursors at rates higher than those emission limits. The Sierra Club and Downwinders asserted that the Texas SIP's affirmative defense is a defect in the SIP that invalidates that assumption. Specifically, the Sierra Club and Downwinders stated that the inclusion of an affirmative defense in the SIP disincentivizes compliance with emission limits, and therefore the TCEQ cannot accurately claim that emissions used in the model properly reflect actual emissions. The Sierra Club and Downwinders stated that the TCEQ must remove the illegal affirmative defense provisions before its attainment demonstration can be deemed sufficient.

**The TCEQ disagrees with this comment. Inclusion of the affirmative defense in the Texas SIP does not invalidate the 2017 DFW AD SIP revision. The best estimate of area source emissions is developed for each county with EPA-approved methodologies, and uses activity data such as the county's population. For major**

**stationary point sources, emissions inventory requirements include reporting of all actual emissions at each site regardless of the authorization status for these emissions. These emissions include those that are both authorized and unauthorized. Unauthorized emissions include, but are not limited to, emissions from events and unplanned maintenance, along with startup and shutdown activities for which an affirmative defense is available. The use of an affirmative defense does not create disincentives from compliance, since these emissions must still be reported and evaluated in the SIP planning process.**

**Despite Texas' use of the affirmative defense, the base case stationary point source emissions that were modeled are greater than the actual authorized emissions reported for that year. First, emission events (such as upsets) plus scheduled maintenance, startup, and shutdown reported emissions are added to the daily modeled inventory of authorized emissions for each point source. In general, these additions are not significant amounts of ozone precursors. Second, the TCEQ inflates the VOC emission inventory of point sources via the use of rule effectiveness, which accounts for the fact that not all controls on all sources are likely operating at 100% effectiveness all the time. For the 2006 base case that was modeled, this rule effectiveness factor added approximately 21% more VOC across the state, 8% in the 10-county DFW nonattainment area, and 34% in the eight-county HGB nonattainment area. These rule-effectiveness values represent the VOC emissions that are reported in the base case point source section of Appendix B, summarized in a table at the end of Section 2.1.4, *Summary of June 2006 Base Case Point Sources*. For the EGUs throughout the state, $NO_X$ emissions were modeled directly from the EPA's AMPD.**

**In the future case, the TCEQ added more emissions to the reported emissions in an effort to model a conservative, yet realistic emission inventory of point sources, as these emissions are projected into the future attainment year of 2017. The projection base year modeled for the non-EGUs was 2012. An inventory for 2012 was developed using the same procedures as discussed above for 2006. For the 2012 projection base year, rule effectiveness added 20% more VOC across the state, 14% in the 10-county DFW nonattainment area, and 31% in the eight-county HGB nonattainment area above and beyond what was reported. The rule effectiveness factors vary based on the reported stationary source category and type of equipment. The 2017 non-EGUs were grown from 2012 via projection factors, primarily derived from economic analytics and applied by business sector. As the table and associated discussions of Section 2.3.3.1.2, *NAA Non-EGU Projections of Control Implementation*, of Appendix B demonstrate, this overall non-EGU projected growth was flat for DFW for 2012 through 2017, so no banked emissions credits would be expected to be used. Other areas of the state were projected to increase in emissions. Within the DFW nonattainment area, the Midlothian cement kilns were modeled at their conservative capped levels of 17.6 $NO_X$ tpd, which is approximately twice what they actually emitted in 2012.**

**For the EGUs in the state, 2014 emissions were extracted from the EPA's AMPD. Sections 2.3.2, *Attainment Areas of Texas*, and 2.3.3, *Nonattainment Areas of Texas*, of Appendix B describe how post-2014 EGU growth via newly-permitted units was added to the 2017 future case at permitted levels, and then compared to**

**ERCOT's projection to make sure that the TCEQ has accounted for enough electrical demand growth. These 2017 EGU $NO_X$ emissions were then limited by the EPA CSAPR cap-and trade rules as they apply to Texas. The summary table at the end of Section 2.3.3 of Appendix B demonstrates that across Texas, the modeled CSAPR caps allow more $NO_X$ EGU emissions than were emitted in 2014. All of these factors combined demonstrate that the TCEQ models more point source emissions than are reported and models more emissions in the future than are projected to be emitted on a typical ozone season day. No changes were made in response to these comments.**

The Sierra Club and Downwinders commented that the EGU emission inputs modeled by the TCEQ for the 2017 future year were unjustifiably low. The Sierra Club and Downwinders cited a sentence from page 3-30 of the 2017 DFW AD SIP revision, and state that the description does not satisfactorily explain how the 2014 EGU operational profiles were used, how high-demand days were considered, and how the hourly variation in $NO_X$ emissions was addressed. The Sierra Club and Downwinders disputed the TCEQ's statement that the 13.98 $NO_X$ tpd for 2017 CSAPR cap is conservative when compared to an 8.25 $NO_X$ tpd average for 2012. The Sierra Club and Downwinders stated that actual emission data from the EPA Clean Air Markets database should be used for ozone modeling purposes.

**The TCEQ concurs that data from the EPA Clean Air Markets Web page should be used for modeling purposes. This information is referenced in the 2017 DFW AD SIP revision as a primary data source by both its former name of Acid Rain Data and the newer one of AMPD. Multiple references to use of these data sets are included within Chapter 3 of the 2017 DFW AD SIP revision, with a far more extensive discussion provided in Section 2 of Appendix B about how these data sets are used for developing 2017 future-year EGU emissions for modeling. At the time emissions were developed for this 2017 DFW AD SIP revision, 2014 was the latest full year for which AMPD information was available. Section 2.3.2.1.1, *EGUs*, provides details on how the 2014 hourly $NO_X$ emissions per EGU from AMPD were projected to the 2017 future year.**

**The 8.25 $NO_X$ tpd of the DFW area EGU emissions reported in Chapter 3 is based on the 2012 ozone season average and not an annual average basis as presumed by the commenter. Similarly, the 9.63 $NO_X$ tpd of DFW area EGU emissions referenced in Chapter 3 is based on the 2006 ozone season average rather than an annual one. The 13.98 $NO_X$ tpd CSAPR cap for 2017 is 4.35 $NO_X$ tpd higher (45% increase) than the 2006 level, and 5.73 $NO_X$ tpd higher (69% increase) than the 2012 level. Since the 13.98 $NO_X$ tpd CSAPR cap is modeled for each of the 67 episode days in the future case, these figures show that the 2017 EGU projections are conservative because this value is higher than the reported emission values. The 2017 case is composed of CSAPR caps with average temporal profiles from June 1 through September 30, 2014. This approach of using CSARP caps represents a conservative high demand scenario since it uses a summer profile. The TCEQ does not model the absolute highest electric demand day (HEDD) for every episode day in the future year because this would not be representative of every day modeled in the future, and there is much evidence to show that HEDDs do not necessarily correspond to high ozone. No changes were made in response to this comment.**

One individual commented that increased flight activity at Love Field due to the repeal of the Wright Amendment would increase emissions but that this is regulated at the federal level and not by the TCEQ, so the 2017 DFW AD SIP revision does not consider this.

**The TCEQ concurs that aircraft emissions are regulated by the federal government and not by Texas. However, the 2017 DFW AD SIP revision does include emission estimates for Love Field, DFW International, and smaller regional airports. Love Field emissions are reported at 1.22 $NO_X$ tpd for 2006 in Table 3-12: *2006 Base Case Airport Modeling for 10-County DFW Area*, and at 1.70 $NO_X$ tpd for 2017 in Table 3-25: *2017 Future Case Airport Modeling Emissions for 10-County DFW*. As documented in a report entitled *Emissions Inventory of Airport-Related Sources: Dallas Love Field*, June 2014, the increased activity as a result of the Wright Amendment repeal is included in the future-year emission estimates. This report is available at ftp://amdaftp.tceq.texas.gov/pub/Offroad_EI/Airports/DFW/. No changes were made in response to this comment.**

The EPA commented that it looks forward to receiving the motor vehicle emissions budget (MVEB) for this attainment demonstration.

**This information is provided in Table 4-2: 2017 *Attainment Demonstration MVEB for the 10-County DFW Area*, and is listed as 130.77 $NO_X$ tpd and 64.91 VOC tpd. These on-road MVEB figures are also reported in the Executive Summary, Chapter 3, and Appendix B. No changes were made in response to this comment.**

The North Texas Renewable Energy Group commented that Texas leads the nation in industrial carbon dioxide ($CO_2$) emissions and expressed concerns about climate change. An individual was concerned about climate change and the potential impacts to agriculture and ultimately food availability, citing statistics and forecasts from various sources.

**The 2017 DFW AD SIP revision is intended to demonstrate attainment of the 2008 eight-hour ozone NAAQS. Comments related to climate change and greenhouse gas pollution, including $CO_2$ emissions, are outside the scope of the 2017 DFW AD SIP revision. No changes were made in response to these comments.**

Sierra Club and Downwinders stated that the on-road mobile source emissions used in the modeling are "lower than actual emissions because there has been widespread cheating on mobile source emission compliance...The cheating mobile sources are all for model years after 2006 which means that TCEQ's claimed reduction in mobile source emissions post-2006 are inflated." To support this comment, Sierra Club and Downwinders attached a January 4, 2016 complaint filed against Volkswagen (VW) and its subsidiaries by the U.S. Department of Justice on behalf of EPA.

**The EPA reports that 16 light-duty diesel make/model combinations for the 2009-2016 model years manufactured by VW and its subsidiaries were designed to circumvent accurate emissions testing. Table 9: *Affected Light-Duty Diesel Make and Models* is a summary of these vehicles as reported on EPA's *Volkswagen Light Duty Diesel Vehicle Violations for Model Years 2009-2016* page, which is available at http://www.epa.gov/vw. These make and models match those reported in**

**Appendices A and B of the January 4, 2016 complaint referenced by the commenter.**

**Table 9: Affected Light-Duty Diesel Make and Models**

| Make/Model | Affected Model Years |
|---|---|
| Audi A3 | 2010-2015 |
| Audi A6 Quattro | 2014-2016 |
| Audi A7 Quattro | 2014-2016 |
| Audi A8 | 2014-2016 |
| Audi A8L | 2014-2016 |
| Audi Q5 | 2014-2016 |
| Audi Q7 | 2009-2016 |
| Porsche Cayenne | 2013-2016 |
| VW Beetle | 2013-2015 |
| VW Beetle Convertible | 2013-2015 |
| VW Golf | 2010-2015 |
| VW Golf Sportwagen | 2015 |
| VW Jetta | 2009-2015 |
| VW Jetta Sportwagen | 2009-2014 |
| VW Passat | 2012-2015 |
| VW Touareg | 2009-2016 |

**Table 10: *Available Light-Duty Vehicles by Fuel Type from 2009-2016* summarizes the number of light-duty make/model combinations by fuel type available from all manufacturers for the 2009-2016 model years, according to the EPA Green Vehicle Guide, which is available at http://www.fueleconomy.gov/feg/download.shtml. As shown, the individual make/models available range from a low of 1,010 in the 2011 model year to a high of 1,227 in the 2009 model year. The percentage of vehicles not complying with the federal emission standards under this complaint ranges from 0.3% in 2009 to 1.3% in 2014.**

**Table 10: Available Light-Duty Vehicles by Fuel Type from 2009-2016**

| Fuel Type | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|
| Gasoline | 1,147 | 1,018 | 869 | 970 | 916 | 957 | 1,006 | 993 |
| Gasoline/Ethanol | 63 | 60 | 75 | 150 | 74 | 61 | 46 | 69 |
| Diesel | 16 | 37 | 56 | 54 | 67 | 93 | 129 | 22 |
| Electricity | 0 | 0 | 5 | 8 | 13 | 15 | 16 | 13 |
| Electricity/Gasoline | 0 | 0 | 0 | 3 | 4 | 9 | 11 | 10 |
| Natural Gas | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 0 |
| Natural Gas/Gasoline | 0 | 0 | 0 | 1 | 1 | 1 | 2 | 1 |

| Fuel Type | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|
| Hydrogen | 0 | 2 | 3 | 0 | 0 | 1 | 1 | 2 |
| Total | 1,227 | 1,118 | 1,010 | 1,188 | 1,077 | 1,139 | 1,212 | 1,110 |
| Number of Affected Diesel VW/Audi/Porsche Models | 4 | 6 | 6 | 7 | 10 | 15 | 15 | 8 |
| Affected Diesel Portion of Total | 0.3% | 0.5% | 0.6% | 0.6% | 0.9% | 1.3% | 1.2% | 0.7% |

**The EPA has issued two notices of violation against VW, one in September 2015 and another in November 2015, but this matter has not yet been fully resolved. The affected vehicles are expected to be subject to a recall and may be repaired or replaced prior to 2017. In a similar situation with heavy-duty diesel engine manufacturers back in the 1990s, the EPA incorporated the effects of both the higher emissions and the corrective action into its on-road mobile model for use by states for SIP development. To date, EPA has not updated the MOVES model to incorporate the effects of either the higher emissions or the corrective action for the affected 2009-2016 model year light-duty diesel vehicles. The TCEQ has requested EPA guidance on how to handle this matter regarding the MOVES model. If EPA updates the model, the TCEQ will incorporate them in future SIP revisions.**

**Table 3-6: *VMT and Emissions by Vehicle Type for 2017 DFW On-Road Inventory* in Appendix B list reports the 2017 DFW area vehicle miles traveled (VMT) and on-road emission estimates by combination of fuel type and category. A small portion of the on-road $NO_X$ emissions inventory is represented by the affected light-duty diesel vehicles. For 2017, all diesel passenger cars are projected to contribute 1,148,364 VMT (0.54%) out of a daily on-road fleet total of 211,862,471. Using these VMT figures in combination with emission rates from the MOVES2014 model, the total 2017 diesel passenger car $NO_X$ is estimated to be 0.20 $NO_X$ tpd (0.15%) out of a daily total of 130.77 $NO_X$ tpd. No change was made in response to this comment.**

**<u>Emissions Impacts on Ozone</u>**

The EPA commented that the large year-to-year reductions in the DFW ozone nonattainment area only occurred when emission reduction measures were being implemented, such as in 2008. The EPA stated that a review of historical emissions and design value trends indicates that achieving the 75 ppb standard by 2017 would require additional $NO_X$ reductions of roughly 100-200 tpd in the local area, or a combination of local and even larger upwind $NO_X$ reductions.

**The TCEQ disagrees with these comments. The 2008 peak eight-hour ozone design value of 91 ppb at Denton Airport South has been reduced to 83 ppb as of 2015. These ozone improvements would not have occurred without the benefit of the ongoing $NO_X$ reductions that have occurred within the DFW area over several years even as growth in human population continually occurred. Section 3.7.3, *Ozone Source Apportionment Tool and Anthropogenic Precursor Culpability Analysis*, of the 2017 DFW AD SIP revision provides the 2017 ozone source apportionment results by source category for both the all days and top 10 days attainment tests. Section 3.7.3 shows that the on-road source category is the**

**largest single local contributor to Denton Airport South ozone at 9.82 ppb for the all days test and 11.81 ppb for the top 10 days test, and that the non-road source category is the second largest local ozone contributor at 3.68 ppb for the all days test and 4.68 ppb for the top 10 days test. Section 5.2.2 shows the significant ongoing $NO_X$ emission reductions that are occurring in both of these source categories of primary ozone precursors.**

**Most of these on-road and non-road reductions are due to fleet turnover effects where older high-emitting vehicles and equipment are removed from the fleet and replaced with newer low-emitting vehicles and equipment. The rather large on-road $NO_X$ reduction from 2016 to 2017 is due in part to the lowering of gasoline sulfur levels from 30 ppm to 10 ppm starting in January 2017. This Federal requirement is expected to substantially reduce $NO_X$ emissions by making the catalytic converters of in-use vehicles more efficient. The EPA incorporated these effects into the MOVES2014 model, and they are also documented in an EPA study entitled *The Effects of Ultra-Low Sulfur Gasoline on Emissions from Tier 2 Vehicles in the In-Use Fleet*, EPA-420-R-14-002, March 2014.**

**The EPA states that an additional 100-200 $NO_X$ tpd would be required in the local DFW area or in combination with upwind sources to attain the standard by the attainment deadline, but references no detailed analysis of how these estimates were reached or how such reductions could be achieved. Multiple emission summary tables within the 2017 DFW AD SIP revision demonstrate how the $NO_X$ in the DFW nonattainment area is projected to be reduced from 582 tpd in 2006 to 297 tpd in 2017, which reflects a 49% decrease of 285 tpd. It is unclear if the 100-200 $NO_X$ tpd reduction referenced by the EPA is from the 2006 baseline level or the 2017 future level. If the reduction is from the 2006 baseline, then the 2017 DFW AD SIP revision already demonstrates how 285 tpd will be achieved. If from the 2017 future case, then reducing an additional 100-200 $NO_X$ tpd from a total of 297 tpd implies further reductions in 2017 on the scale of 1/3 to 2/3 of the entire anthropogenic $NO_X$ emissions inventory, which is unsupported by the photochemical model. No changes were made in response to these comments.**

The Sierra Club and Downwinders commented that an unprecedented four-year drop of 10 ppb in the peak ozone design value occurred from 2007 through 2010 due to implementation of the cement kiln $NO_X$ reduction rules passed by the TCEQ in 2007. As evidence of this claim, the Sierra Club and Downwinders cite Section 5.2.2, *$NO_X$ Trends*, and Figure 5-5, *Reported Point Source $NO_X$ Emissions by County*, from the SIP narrative.

**The TCEQ disagrees that the reduction of ozone in the DFW nonattainment area from 2007 through 2010 was due solely to reductions in cement kiln $NO_X$ emissions. The peak ozone design value in 2007 was 95 ppb at the Eagle Mountain Lake monitor. The peak ozone design value in 2010 was 86 ppb at the Keller monitor. This 9 ppb reduction was due to combined $NO_X$ reductions from the on-road, non-road, off-road, and point source categories within the DFW nonattainment area.**

**The TCEQ concurs that some reduction in ozone is due to lower $NO_X$ emissions at cement kilns. However, these $NO_X$ reductions are confined to the Midlothian area**

**within Ellis County and have a reduced ozone impact at relatively distant monitors such as Denton Airport South, Eagle Mountain Lake, and Keller. Figure 5-5 referenced by the commenter does show large point source $NO_X$ reductions within Ellis County after implementation of the cement kiln rules in 2007, but it also shows large point source reductions in other counties occurring in previous years.**

**The commenter references Section 5.2.2 of the 2017 DFW AD SIP revision but does not acknowledge the significant on-road, non-road, and EGU $NO_X$ reductions also discussed. Section 3.5.4, *2017 Future Case Emissions*, shows how ongoing fleet turnover effects enable on-road and non-road $NO_X$ in 2017 to be reduced by 154 tpd and 53 tpd, respectively, from 2006 levels. The source apportionment results in Section 3.7.3, *Ozone Source Apportionment Tool and Anthropogenic Precursor Culpability Analysis*, clearly show that the primary ozone-contributing categories to the Denton Airport South monitor are on-road (10-12 ppb) and non-road (4-5 ppb), with the cement kilns being the smallest local contributor in the range of 0.2 ppb. No changes were made in response to this comment.**

The Sierra Club and Downwinders referenced a February 2015 set of comments from the EPA that requested modeling results to support the TCEQ's position that the Midlothian area cement kilns have only a slight contribution to ozone formation in DFW. The Sierra Club and Downwinders claim that the TCEQ did not provide any such modeling.

**The TCEQ disagrees with this comment. The EPA comments referenced were submitted to the TCEQ in February 2015 regarding the 2018 DFW AD SIP revision adopted in June 2015 (Non-Rule Project No. 2013-015-SIP-NR). That proposal from December 2014 included 2018 modeled source apportionment results showing that the DFW area cement kilns were the smallest ozone contributor of all local source categories. These results are currently available in Table 3-46: *2018 Ozone $DV_F$ Denton, Parker, and Kaufman Contributions* in the 2018 DFW AD SIP revision adopted in June 2015. The results show that the DFW area cement kilns contribute 0.21 ppb at Denton Airport South, 0.17 ppb at Parker County, and 0.03 ppb at Kaufman County.**

**During a presentation in November 2015 held at the North Central Texas Council of Governments (NCTCOG) offices, the TCEQ presented the results of a 2017 modeling scenario where the DFW area cement kiln $NO_X$ was reduced from 17.6 to 12.2 $NO_X$ tpd, which is a 5.4 $NO_X$ tpd reduction. This scenario reduced the 2017 future design value at the Denton Airport South monitor by 0.14 ppb for the all days test and 0.11 ppb for the top 10 days test. A summary for all monitors in the DFW area is available on slide 24 of *DFW Area Future Case Ozone Modeling for the 2017 Attainment Year* (http://www.nctcog.org/trans/committees/aqtc/110615/Item_4.pdf). The EPA attended this meeting. No changes were made in response to this comment.**

The Sierra Club and Downwinders commented that June 9 and June 15 are the two highest ozone days in the episode, and that the non-DFW EGUs category is the largest or second largest contributor to ozone formed on these days at the Denton Airport South monitor. As evidence for this claim, the Sierra Club and Downwinders cite the ozone source apportionment results provided by the TCEQ on page 3-72 of the SIP narrative.

**The TCEQ disagrees with this assessment of ozone contribution for the June 9 and June 15 episode days. Figure 3-31, *2017 Ozone Contributions for Denton Airport South from May 31 through June 16*, on page 3-72 graphically presents the ozone contribution results for the 17 days in the first half of the June 2006 episode. Table 11: *Relative 2017 Ozone Contributions at Denton Airport South for June 9 and June 15* presents the results for just these two episode days. As shown, the two largest anthropogenic categories for both episode days are DFW on-road and non-Texas anthropogenic sources. No changes were made in response to this comment.**

**Table 11: Relative 2017 Ozone Contributions at Denton Airport South for June 9 and June 15**

| Geographic Area and Source Type Group | June 9 | June 15 |
|---|---|---|
| DFW On-Road | 17.78% | 7.75% |
| DFW Non-Road | 7.47% | 2.81% |
| DFW Off-Road - Airports and Locomotives | 3.29% | 2.74% |
| DFW Area Sources | 4.10% | 1.62% |
| DFW Oil/Gas - Drilling and Production | 0.08% | 0.09% |
| DFW Point - Electric Utilities | 1.07% | 0.44% |
| DFW Point - Cement Kilns | 0.04% | 0.39% |
| DFW Point - Oil/Gas and Other | 0.68% | 1.80% |
| Non-DFW Texas - On-Road | 3.46% | 2.33% |
| Non-DFW Texas - Non-Road, Off-Road, and Area Sources | 3.15% | 2.91% |
| Non-DFW Texas - Oil/Gas Drilling and Production | 3.06% | 1.80% |
| Non-DFW Texas Point – EGUs | 4.62% | 3.92% |
| Non-DFW Texas Point - Cement Kilns, Oil/Gas, and Other | 2.25% | 3.03% |
| Non-Texas - All Anthropogenic | 16.98% | 32.27% |
| Biogenic - All Geographic Areas | 5.85% | 5.16% |
| Boundary Conditions | 25.89% | 30.91% |
| Initial Conditions | 0.23% | 0.04% |
| 2017 Maximum Eight-Hour Modeled Ozone | 100.00% | 100.00% |

The Sierra Club and Downwinders commented that reducing the non-DFW Texas EGU emissions by half would reduce 2017 ozone by 1.13 ppb and bring the Denton Airport South monitor into compliance with the 75 ppb standard. As evidence for this claim, the Sierra Club and Downwinders cited the ozone source apportionment results provided by the TCEQ on page 3-75 of the 2017 DFW AD SIP revision. The Sierra Club and Downwinders claimed that the non-DFW Texas EGU category represents a "but for" cause of the Denton Airport South monitor not meeting the 75 ppb standard, meaning that this monitor would meet the standard if this source category had no precursor emissions.

**The TCEQ disagrees with this comment. The non-DFW Texas EGU category is comprised of 118 individual facilities located throughout Texas, but outside of DFW, and were modeled at their 2017 CSAPR emission caps of 463.50 $NO_X$ tpd. The ozone contribution to Denton Airport South for this category is reported in**

**Section 3.7.3, *Ozone Source Apportionment Tool and Anthropogenic Precursor Culpability Analysis*, as 2.40 ppb for the all days test and 2.27 ppb for the top 10 days test.**

**An across-the-board 50% reduction of all these non-DFW Texas electric utilities would not automatically reduce ozone contributions from these sources in half to 1.1-1.2 ppb. First, the chemistry of ozone formation is non-linear, so a 50% reduction in $NO_X$ precursors will not automatically yield a 50% reduction in ozone. Second, these 118 facilities are scattered throughout the 244 Texas counties outside of the 10-county DFW nonattainment area. Many of these sources are located either downwind or relatively far away from DFW, so a 50% reduction on such sources will have little to no impact on ozone levels at Denton Airport South. No changes were made in response to this comment.**

The North Texas Renewable Energy Group commented that emissions from four coal plants formerly owned by TXU are one of the main reasons why the DFW area is in nonattainment of the ozone standard.

**The TCEQ disagrees with this comment. Section 3.7.3, *Ozone Source Apportionment Tool and Anthropogenic Precursor Culpability Analysis*, of the 2017 DFW AD SIP revision provides ozone source apportionment results by 17 combinations of source category and geographic area. The non-DFW Texas EGUs are shown to account for 2.3-2.4 ppb, while the largest local ozone contributor, DFW on-road, accounts for 10-12 ppb. The four TXU plants referenced by the commenter are included within the 118 facilities that are grouped under the non-DFW Texas EGUs category. These 118 facilities located throughout Texas, but outside of the 10-county DFW ozone nonattainment area, were modeled at their 2017 CSAPR emission caps of 463.50 $NO_X$ tpd. No changes were made in response to this comment.**

Councilmember Grayson commented that Texas cannot count on federal efforts to cut gas mileage as a means of achieving the 75 ppb eight-hour ozone standard.

**The TCEQ does not rely on fuel economy changes over time in the on-road fleet to reduce ozone levels within the DFW area or other Texas cities. On a per-mile basis, a direct correlation does not exist between the amount of fuel consumed by the engine and the amount of $NO_X$ or VOC emitted at the tailpipe. For example, the EPA's Green Vehicle Guide available on the U.S. Department of Energy's Download Fuel Economy Data Web page (http://www.fueleconomy.gov/feg/download.shtml) shows that there are 925 vehicle make/model combinations available for the 2015 model year that are certified to the current Tier 2 Bin 5 federal standard of 0.07 grams per mile. Of these 925 vehicles, the minimum fuel economy is 10 miles per gallon (mpg), the maximum is 40 mpg, and the average is 23 mpg, yet they all emit the same amount of $NO_X$ and VOC. For vehicles that meet the same emissions standard, the ones with larger engines that consume more fuel generally have more catalytic converter capacity in the exhaust stream than those with smaller engines that consume less fuel. No changes were made in response to this comment.**

**University of North Texas (UNT) Modeling**

The Dallas County Medical Society, the Texas Medical Association, the Sierra Club and Downwinders commented that a 5 ppb ozone reduction could be achieved in DFW by applying selective catalytic reduction to the five largest coal-burning EGUs in East Texas. Public Citizen commented that application of the same pollution controls that have been on cars since 1977 on these EGUs would reduce ozone by 1 ppb in DFW. The five facilities where these EGUs operate are identified by the commenters as Big Brown, Martin Lake, Monticello, Limestone, and Welsh. The commenters cited modeling work performed by UNT using the 2018 future-year modeling files developed by the TCEQ for the attainment demonstration SIP that was adopted in June 2015. UNT performed two modeling scenarios where $NO_X$ reductions were applied to EGUs at these five East Texas facilities for the 2018 future case: Scenario A represents a 90% $NO_X$ reduction; and Scenario B represents a 100% $NO_X$ reduction. The Sierra Club and Downwinders provide two separate tables of the results and both tables include the following in the heading: "*Maximum absolute difference of 8hr-mean O3 predicted in 3x3 cells nearby CAMS (Scenario – FY18)*".

**The commenter is correct that catalytic converters on cars and SCR pollution control technology for combustion sources are similar in that both technologies use catalysts to reduce emissions of $NO_X$. The commission also acknowledges that SCR has been demonstrated on coal-fired EGUs. However, as discussed elsewhere in this Response to Comments document, the commission has determined that requiring additional $NO_X$ control on coal-fired EGUs in East Texas is not justified given the commission's modeling results in this attainment demonstration for the 10-county DFW nonattainment area.**

**Additionally, the TCEQ disagrees with the commenter's interpretation of the UNT modeling results. The values reported in the comment are the maximum absolute difference of eight-hour ozone modeled at each monitor for the entire 67-day episode. This is not the approach recommended by EPA modeling guidance for assessing the modeled impact on future ozone design values at specific monitors. The absolute results are reported rather than the future design values that would result from application of the RRF attainment test. On page 18 of its official modeling guidance, the EPA states "we recommend a modeled attainment test in which model predictions are used in a relative rather than an absolute sense." Instead of reporting absolute results, the modeled attainment test figures reported in Section 3.7.2, *Future Baseline Modeling*, of the 2017 DFW AD SIP revision appropriately use the RRF approach for both the older and newer attainment tests from the EPA. For each monitor over a 67-day episode, there are a total of 1,608 absolute modeled ozone differences to choose from for reporting purposes (24 hours per day times 67 days). The ozone changes reported by the commenter are simply the maximum of 1,608 absolute modeled results per monitor from each scenario. For each scenario and monitor, no indication is given if these maximum values were modeled on low days (that are excluded from the attainment tests) or high days (that are included in the attainment test). No changes were made in response to these comments.**

The Sierra Club and Downwinders commented that the UNT modeling shows a reduction of 3.8-4 ppb that could be achieved at the Denton Airport South Monitor from a combination of various proposed controls. The Sierra Club and Downwinders reference Scenario G from the

UNT modeling study, which included the following combination of reductions: 90% $NO_X$ reduction from the five East Texas EGUs; 90% $NO_X$ reduction to the three Midlothian cement kilns; and 50% $NO_X$ reduction from 647 large compressors within DFW. Immediately prior to the table of results, the Sierra Club and Downwinders state that this combination is "enough to put the Denton air monitor under 75 ppb, or a 3.8-4 ppb improvement from the final results of the proposed TCEQ DFW SIP."

**The TCEQ disagrees with this interpretation of the UNT modeling results. Table 12: *Scenario G Eight-Hour Ozone Reductions Reported by UNT* shows the 2018 future design value at the Denton Airport South monitor reducing from 75.8 ppb to 74.8 ppb, which is a 1 ppb reduction and not the 3.8-4 ppb range stated by the Sierra Club and Downwinders for this scenario.**

**Table 12: Scenario G Eight-Hour Ozone Reductions Reported by UNT**

| DFW Area Ozone Monitor | 2006 $DV_B$ (ppb) | TCEQ Projection RRF | TCEQ Projection FY18 $DV_F$ (ppb) | Scenario G RRF | Scenario G $DV_F$ (ppb) |
|---|---|---|---|---|---|
| Fort Worth Northwest - C13 | 89.33 | 0.8209 | 73.3 | 0.8067 | 72.1 |
| Keller - C17 | 91.00 | 0.8169 | 74.3 | 0.8050 | 73.3 |
| Frisco - C31 | 87.67 | 0.8266 | 72.5 | 0.8159 | 71.5 |
| Midlothian OFW - C52 | 77.00 | 0.8255 | 63.6 | 0.8038 | 61.9 |
| Denton Airport South - C56 | 93.33 | 0.8127 | 75.8 | 0.8009 | 74.8 |
| Arlington Municipal Airport - C61 | 83.33 | 0.8260 | 68.8 | 0.8114 | 67.6 |
| Dallas North #2 - C63 | 85.00 | 0.8365 | 71.1 | 0.8268 | 70.3 |
| Rockwall Heath - C69 | 77.67 | 0.8436 | 65.5 | 0.8320 | 64.6 |
| Grapevine Fairway - C70 | 90.67 | 0.8196 | 74.3 | 0.8086 | 73.3 |
| Kaufman - C71 | 74.67 | 0.8522 | 63.6 | 0.8297 | 62.0 |
| Granbury - C73 | 83.00 | 0.8146 | 67.6 | 0.7971 | 66.2 |
| Eagle Mountain Lake - C75 | 93.33 | 0.8061 | 75.2 | 0.7960 | 74.3 |
| Parker County - C76 | 87.67 | 0.8250 | 72.3 | 0.8136 | 71.3 |
| Cleburne Airport - C77 | 85.00 | 0.8187 | 69.6 | 0.7938 | 67.5 |
| Midlothian Tower - C94 | 80.50 | 0.8246 | 66.4 | 0.8031 | 64.7 |
| Dallas Hinton Street - C401 | 81.67 | 0.8294 | 67.7 | 0.8173 | 66.7 |
| Dallas Executive Airport - C402 | 85.00 | 0.8322 | 70.7 | 0.8207 | 69.8 |
| Greenville - C1006 | 75.00 | 0.8335 | 62.5 | 0.8204 | 61.5 |
| Pilot Point - C1032 | 81.00 | 0.8140 | 65.9 | 0.8038 | 65.1 |

**The TCEQ notes that the UNT modeling does not replicate the TCEQ's 2018 future baseline design values for each monitor. UNT uses the term "TCEQ Projection" and reports associated RRF and future design values based on the top 10 days test for 2018 at each monitor, but these do not match any of the RRF and future design values reported by the TCEQ in the AD analysis for 2018 that was adopted in June 2015. For each DFW area ozone monitor, Table 13: *Comparison of UNT and TCEQ***

***Future Design Values for 2018*** **multiplies the 2006 $DV_B$ by the RRF reported by UNT. This table uses the correct $DV_B$ of 75.00 ppb for Midlothian OFW instead of the incorrect one of 77.00 ppb used by UNT. The UNT future design value figures are reported to two decimal places and compared to both the all days and top 10 days results reported by the TCEQ in Section 3.7.2,** ***Future Baseline Modeling*****, of the 2018 DFW AD SIP revision.**

**Table 13: Comparison of UNT and TCEQ Future Design Values for 2018**

| DFW Area Ozone Monitor | 2006 $DV_B$ (ppb) | UNT RRF | UNT $DV_F$ (ppb) | TCEQ All Days $DV_F$ (ppb) | TCEQ Top 10 $DV_F$ (ppb) |
|---|---|---|---|---|---|
| Fort Worth Northwest - C13 | 89.33 | 0.8209 | 73.33 | 73.73 | 72.67 |
| Keller - C17 | 91.00 | 0.8169 | 74.34 | 75.08 | 73.58 |
| Frisco - C31 | 87.67 | 0.8266 | 72.47 | 73.11 | 72.37 |
| Midlothian OFW - C52 | 75.00 | 0.8255 | 61.91 | 62.67 | 62.27 |
| Denton Airport South - C56 | 93.33 | 0.8127 | 75.85 | 76.72 | 75.25 |
| Arlington Municipal Airport - C61 | 83.33 | 0.8260 | 68.83 | 69.47 | 68.50 |
| Dallas North #2 - C63 | 85.00 | 0.8365 | 71.10 | 71.61 | 70.68 |
| Rockwall Heath - C69 | 77.67 | 0.8436 | 65.52 | 65.74 | 65.57 |
| Grapevine Fairway - C70 | 90.67 | 0.8196 | 74.31 | 75.70 | 73.84 |
| Kaufman - C71 | 74.67 | 0.8522 | 63.63 | 62.22 | 62.73 |
| Granbury - C73 | 83.00 | 0.8146 | 67.61 | 67.73 | 67.30 |
| Eagle Mountain Lake - C75 | 93.33 | 0.8061 | 75.23 | 75.88 | 74.12 |
| Parker County - C76 | 87.67 | 0.8250 | 72.33 | 71.21 | 71.40 |
| Cleburne Airport - C77 | 85.00 | 0.8187 | 69.59 | 70.27 | 68.59 |
| Midlothian Tower - C94 | 80.50 | 0.8246 | 66.38 | 67.20 | 66.75 |
| Dallas Hinton Street - C401 | 81.67 | 0.8294 | 67.74 | 68.87 | 67.20 |
| Dallas Executive Airport - C402 | 85.00 | 0.8322 | 70.74 | 70.88 | 70.68 |
| Greenville - C1006 | 75.00 | 0.8335 | 62.51 | 61.97 | 62.07 |
| Pilot Point - C1032 | 81.00 | 0.8140 | 65.93 | 66.62 | 65.62 |

**For the all days attainment test, the UNT difference ranges from 1.39 ppb lower at the Grapevine Fairway monitor to 1.41 ppb higher at the Kaufman monitor. For the top 10 days test, the UNT difference ranges from 0.37 ppb lower at the Midlothian Tower monitor and 1.11 ppb higher at the Eagle Mountain Lake monitor. In a November 6, 2015 meeting held at the NCTCOG offices in Arlington, UNT modeling staff acknowledged these differences in future design values between their work and TCEQ efforts but did not provide an explanation for what caused them.**

**The TCEQ understands that the UNT modeling project began in July 2014 under the sponsorship of the North Texas Air Quality Modeling Project (NTAQP). In a July 2014 letter to the TCEQ, NTAQP requested "an enumeration of conditions and protocols that this local modeling effort would have to meet or adhere to in order for the TCEQ to give the results due consideration." In an August 2014 reply to this**

**request, the TCEQ provided direction on obtaining modeling files and stated that a critical starting point for the local modeling effort would be to replicate the base case, baseline, and future-case Comprehensive Air Model with Extension(s) (CAMx) runs for the 2006 episodes and that, at a minimum, any submission to the TCEQ would need to document that the base case, baseline, and future case modeling scenarios were fully replicated. As the tables and explanation above demonstrate, the modeling scenarios, although close, have not been accurately replicated. No changes were made in response to these comments.**

The Sierra Club and Downwinders commented that a UNT modeling scenario was performed where the DFW area cement kiln $NO_X$ was reduced by 90% in 2018, and that this resulted in ozone reductions ranging from 1.9 to 4.5 ppb at the 20 DFW area monitoring locations. As evidence to support this claim, the Sierra Club and Downwinders present a table showing the maximum absolute difference of eight-hour average ozone predicted in a 3x3 array of cells surrounding each monitor.

**The TCEQ disagrees with this interpretation of the UNT modeling results. As stated in response to a previous comment about UNT modeling scenarios for EGUs, the air quality impact of a potential emissions change is more appropriately evaluated by looking at changes in the future design value rather than the maximum absolute difference in modeled eight-hour ozone concentrations. In fact, the impact on future design values for this scenario is reported on slide 26 of a UNT presentation entitled *North Texas Ozone Attainment Initiative Project: Preliminary Project Results*, presented on November 6, 2015 at the NCTCOG offices (http://www.nctcog.org/trans/committees/aqtc/110615/Item_8.pdf). The 90% $NO_X$ reduction to the cement kilns is shown to reduce the 2018 future design value at the Denton Airport South monitor by 0.4 ppb.**

**The results presented by UNT in slide 26 show that reducing the cement kiln $NO_X$ by 90% (roughly 15.8 $NO_X$ tpd) would increase ozone by 0.4 ppb at the Kaufman monitor and by 0.5 ppb at the Greenville monitor, yet decrease ozone by 0.2 ppb at the nearby Rockwall Heath monitor, all of which are located east of Dallas. Such ozone increases at Kaufman and Greenville in response to $NO_X$ decreases are atypical in a $NO_X$-limited environment such as DFW. These unusual modeling results were noted to UNT staff during the November 6, 2015 meeting at NCTCOG, but an explanation was not provided. No changes were made in response to these comments.**

The Sierra Club and Downwinders referenced three UNT modeling scenarios where reductions were applied to oil and gas emissions: 50% $NO_X$ reduction from electrifying half of 647 point source compressors; 100% $NO_X$ reduction from electrifying all 647 point source compressors; and 100% $NO_X$ and VOC reduction from all oil and gas sources (area and point) within the Barnett Shale, along with all Haynesville oil and gas area sources. The Sierra Club and Downwinders provided various tables showing that the modeled reductions from these scenarios range from 1-3.6 ppb at the Denton Airport South monitor and from 2.2-5.4 ppb at the Eagle Mountain Lake monitor. The tables included reflect the maximum absolute difference of eight-hour average ozone predicted in a 3x3 array of cells surrounding each monitor.

**The TCEQ disagrees with this interpretation of the UNT modeling results. As stated in response to a previous comment about UNT modeling scenarios for EGUs, the air quality impact of a potential emissions change is more appropriately evaluated by looking at changes in the future design value rather than the maximum absolute difference in modeled eight-hour ozone concentrations. In fact, the impact on future design values for these three scenarios is reported by UNT in a presentation entitled *North Texas Ozone Attainment Initiative Project: Preliminary Project Results*, presented on November 6, 2015 at the NCTCOG offices (http://www.nctcog.org/trans/committees/aqtc/110615/Item_8.pdf). The 2018 future design value changes for Scenario D (50% electrification) are presented on slide 29 and show that the reductions would only be 0.1 ppb at Denton Airport South and no change at Eagle Mountain Lake, which contrasts sharply with the 1 ppb and 2.2 ppb reductions at these monitors, respectively, that are stated by the commenters. The 2018 future design value changes for Scenario E (100% electrification) are presented on slide 32 and show the same impacts of 0.1 ppb and 0 ppb at Denton Airport South and Eagle Mountain Lake, respectively, as Scenario D (50% electrification).**

**The 2018 future design value changes for Scenario F are provided in slide 35 for 100% $NO_X$ and VOC reductions for all oil and gas sources (point and area), along with a 100% $NO_X$ and VOC reduction to Haynesville oil and gas sources (area only). These results show a 0.4 ppb reduction at Denton Airport South and a 0.1 ppb reduction at Eagle Mountain Lake, which contrasts sharply with the 3.6 ppb and 5.4 ppb reductions at these monitors, respectively, that are stated by the commenters.**

**The relatively low reductions in future design value changes from these scenarios are not surprising because compressor engine $NO_X$ has already been reduced by 93% as a result of TCEQ rules that were promulgated in 2007 for the DFW area. For each of these scenarios, UNT only reduced emissions from the various oil and gas sources assuming full or partial electrification of the compressors but did not account for the net increase in emissions that would result from additional generation of electricity to power the compressors. No changes were made in response to these comments.**

The Sierra Club and Downwinders stated that the UNT modeling demonstrates approximately 38% of the pollution contributing to DFW ozone levels come from point sources outside the 10-county DFW ozone nonattainment area but within Texas. To substantiate this claim, the Sierra Club and Downwinders provided a pie chart entitled "*Example Contributions for Eastern Receptors*" with a subtitle of "*2018 Contributions to Denton County, TX Site 034,*" which is the Denton Airport South monitor.

**The TCEQ disagrees with this interpretation of the ozone contributions for Denton County. The values referenced by the commenter reflect an aggregate contribution of 38% from all anthropogenic sources for all 254 Texas counties. Thus, it is incorrect to state that this 38% contribution is for Texas point sources outside of the 10-county DFW ozone nonattainment area.**

**Further, it appears these modeling results are incorrectly attributed to UNT modeling efforts. Instead, they were extracted from Appendix C of a January 2015 EPA report entitled *Air Quality Modeling Technical Support Document for the 2008 Ozone NAAQS Transport Assessment*. For various ozone monitors throughout the continental U.S., the 2018 ozone source apportionment results are provided by the EPA. The percentage contribution figures reported match the allocations for the Denton Airport South monitor with the listed receptor site identification code of 481210034.**

**For the 2018 DFW AD SIP revision, the TCEQ provided 2018 ozone source apportionment results in Section 3.7.3, *Ozone Source Apportionment Tool and Anthropogenic Precursor Culpability Analysis*. To be consistent with the monitor and future year referenced in the comment, these 2018 results are presented in Table 14: *2018 Ozone Source Apportionment for Denton Airport South*.**

**Table 14: 2018 Ozone Source Apportionment for Denton Airport South**

| Geographic Area and Source Type | Ozone Contribution (ppb) | Relative Contribution |
|---|---|---|
| DFW On-Road | 8.66 | 11.29% |
| DFW Non-Road | 3.39 | 4.42% |
| DFW Off-Road - Airports and Locomotives | 2.96 | 3.86% |
| DFW Area Sources | 2.77 | 3.61% |
| DFW Oil/Gas Drilling and Production | 0.40 | 0.52% |
| DFW Point - Electric Utilities | 0.41 | 0.53% |
| DFW Point - Cement Kilns | 0.21 | 0.27% |
| DFW Point - Oil/Gas and Other | 1.47 | 1.92% |
| Non-DFW TX On-Road | 2.56 | 3.34% |
| Non-DFW TX Non-Road, Off-Road, and Area Sources | 2.82 | 3.68% |
| Non-DFW TX Oil/Gas Drilling and Production | 1.67 | 2.18% |
| Non-DFW TX Point - Electric Utilities | 2.64 | 3.44% |
| Non-DFW TX Point - Cement Kilns, Oil/Gas, and Other | 1.97 | 2.57% |
| Non-TX Anthropogenic - All Source Types | 18.59 | 24.23% |
| Biogenic - All Geographic Areas | 4.40 | 5.74% |
| Boundary Conditions | 21.02 | 27.40% |
| Initial Conditions | 0.78 | 1.02% |

**As shown, the non-DFW Texas electric utilities contribute 3.44% of the Denton Airport South ozone. When combined with the aggregated non-DFW Texas point source category at 2.57%, the non-DFW Texas point source total is 6%, which is much smaller than the 38% contribution claimed by the commenter. Similar 2017 future-year ozone source apportionment results are provided in Section 3.7.3, *Ozone Source Apportionment Tool and Anthropogenic Precursor Culpability Analysis*, of the 2017 DFW AD SIP revision. No changes were made in response to these comments.**

Congresswoman Johnson and the Fort Worth League of Neighborhood Associations commented that this 2017 DFW AD SIP revision does not meet the scientific peer-reviewed modeling methods developed by experts at UNT and the UT Southwestern Medical School. The Denton Drilling Awareness Group and Frack Free Denton commented that UNT reviewed the TCEQ ozone modeling and found it to be lacking.

**The TCEQ disagrees with these comments. As documented in Chapter 3 and Appendices A, *Meteorological Modeling for the DFW Attainment Demonstration SIP Revision for the 2008 Eight-Hour Ozone*, B, C, D, and E, *Protocol for the Eight-Hour Ozone Modeling of the DFW Area*, the photochemical modeling included with this 2017 DFW AD SIP revision meets EPA requirements for ozone ADs. The TCEQ is not aware of any peer-reviewed ozone modeling methods developed by UNT or the UT Southwestern Medical School that either agree with or exceed EPA requirements. Slide 5 of the *North Texas Ozone Attainment Initiative Project: Preliminary Project Results* presentation given by UNT in November 2015 (http://www.nctcog.org/trans/committees/aqtc/110615/Item_8.pdf) states that their ozone simulations were run using the files made available by the TCEQ on its Texas Air Quality Modeling - Files and Information (2006 Episodes) Web page, (http://www.tceq.state.tx.us/airquality/airmod/data/tx2006). The UNT reported results of scenarios where specific emission categories within the TCEQ files were reduced, but they did not provide any recommendations for improving the inputs and methodologies that the TCEQ employed in developing the 2017 DFW AD SIP revision. No changes were made in response to this comment.**

## Point Sources

An individual commented on air emissions of benzene, toluene, and xylenes from the Arlington General Motors assembly plant (GM) as reported to the EPA's Toxic Release Inventory. Specifically, the individual commented that GM released 1,351 pounds of benzene in 2014, and over a 27-year period, the average annual emissions rate of toluene was 21,000 pounds (approximately 10.5 tons) and the average annual emissions rate of xylene was 252,000 pounds (approximately 126 tons).

**The TCEQ air emissions inventory (EI) data shows an overall decline in emissions from 1990 through 2014. The commenter's numbers appear to be correct; however, air emissions cannot be solely evaluated by looking at an average of 27 years of data. In its 2014 EI, GM reported 1.38 tpy of toluene emissions and 11.8 tpy of xylene emissions, which represents a decrease of 94% and 93%, respectively, from 1990 when GM first submitted an EI. These reductions are due in part to federal and state VOC and hazardous air pollutant regulations. No changes were made in response to this comment.**

An individual commented that GM is expanding but cannot reduce its air releases.

**The TCEQ's EI data indicates GM's total VOC emissions have declined approximately 67% from 1990 through 2014, although each individual species of VOC may not have declined at the same rate during this time period. Regarding the possibility of future expansions, GM is required to comply with all federal and state regulations and if any expansion results in a major modification the project**

**must demonstrate a net air quality benefit. No changes were made in response to this comment.**

The Sierra Club and Downwinders commented that five East Texas coal-fired power plants (Martin Lake, Monticello, Big Brown, Limestone, and Welsh power plants) are among the largest emitters of $NO_X$ pollution. The Sierra Club and Downwinders also commented that coal-fired power plants account for 22% of the state's annual point source $NO_X$ pollution and approximately 9% of the state's overall $NO_X$ pollution.

**The commission agrees that coal-fired power plants are large sources of emissions and account for a significant amount of the state's point source $NO_X$ emissions. However, these emissions have to be evaluated in context of their geographical location, temporal distribution, and with other emissions sources within the photochemical model. Section 3.7.3, *Ozone Source Apportionment Tool and Anthropogenic Precursor Culpability Analysis*, of the 2017 DFW AD SIP revision provides ozone source apportionment results by 17 combinations of source category and geographic area. The non-DFW Texas EGUs are shown to account for 2.3-2.4 ppb of ozone, while the largest local ozone contributor is DFW on-road at 9.8-11.8 ppb and the largest anthropogenic contributor outside of DFW is non-Texas at 17.4-18.6 ppb. The five East Texas coal-fired power plants referenced by the commenter are included within the 118 facilities that are grouped under the non-DFW Texas EGUs category. These 118 facilities are located throughout Texas, but outside of the 10-county DFW ozone nonattainment area, and were modeled at their 2017 CSAPR emission caps of 463.50 NOx tpd. No changes were made in response to these comments.**

## Water Quality

An individual expressed concerns about drilling activities impacting Lake Arlington water quality.

**Water quality is outside the scope of this SIP revision. No changes were made in response to this comment.**

## Upstream Oil and Gas Emissions Sources

The EPA requested information on the percentage of wells in the DFW nonattainment counties that have implemented green completions. The EPA also asked if the TCEQ plans on conducting outreach to encourage more green completions to facilitate attainment.

**NSPS 40 CFR Part 60, Subpart OOOO (NSPS OOOO) rules require green completions for all hydraulically fractured gas wells beginning in 2015. Based on the most recent available drilling information (calendar year 2014) used to estimate well completion emissions for the DFW ozone nonattainment counties for the 2017 DFW AD SIP revision, 99% of the wells completed in 2014 were hydraulically fractured gas wells (314 out of 327 total wells) that would have required green completions. Only 1% of the wells (two gas wells that were not hydraulically fractured, plus 12 oil wells) would not have required green completions based on the NSPS OOOO requirements, although some of them may have used green completions voluntarily. Although 2014 was the most recent available data for this determination, the TCEQ believes it is representative of**

**general drilling trends in the DFW ozone nonattainment area and therefore applicable to subsequent years through 2017.**

**The TCEQ has conducted outreach about NSPS OOOO requirements at its Environmental Trade Fair and Conference, Advanced Air Permitting Seminar, and external conferences, workshops, and trainings, and will continue those efforts as necessary. Based on required NSPS OOOO notifications submitted to the TCEQ in 2014, 330 well completions were made in the DFW ozone nonattainment area, which almost exactly matches the external drilling information cited above. The high percentage of notifications submitted in 2014 for hydraulically fractured gas wells indicates TCEQ outreach about NSPS OOOO requirements have been successful and the TCEQ will continue to provide these types of outreach efforts. No changes were made in response to these comments.**

The Sierra Club and Downwinders indicated that the TCEQ's projected $NO_X$ emissions from oil and gas compressor engines has increased by over 50% from last year's AD SIP revision, and that controlling compressor engine $NO_X$ emissions is important.

**The commission has adopted rules to reduce emissions from natural-gas fired compressor engines. For the nine-county DFW 1997 eight-hour ozone nonattainment area, the 30 TAC Chapter 117 $NO_X$ rules impose emission limits on all compressor engines rated at 50 or more horsepower. The compressor engine controls required to meet the Chapter 117 emission limits result in compressor engine $NO_X$ emissions that are about 93% lower than those from uncontrolled compressor engines.**

**Although $NO_X$ emissions estimates from area source oil and gas compressor engines increased between the two DFW AD SIP revisions, the commission disagrees that the emissions estimates increased by over 50%. It is important to note that the attainment year changed between the two SIP revisions (the previous AD SIP revision used a 2018 attainment date, and the current AD SIP revision uses a 2017 attainment date). Additionally, the current AD SIP revision uses updated oil and gas emission estimates based on more recent oil and gas production data. The previous AD SIP revision used 2013 oil and gas production data reported to the RRC, which resulted in projected 2018 $NO_X$ emissions of 7.24 tpd. The current AD SIP revision used 2014 RRC oil and gas production data, which resulted in projected 2017 $NO_X$ emissions of 9.37 tpd. This is an increase of 29% in area source compressor engine $NO_X$ emissions estimates between the two AD SIP revisions. No changes were made in response to this comment.**

The Sierra Club and Downwinders asked whether the TCEQ's area source emissions inventory improvement study to quantify current use of electric-powered compressor engines had been completed. The Sierra Club and Downwinders also asked if the results of this study were reflected in this DFW AD SIP revision.

**The study referenced in the comments, *Control Measures for Upstream Oil and Gas Sources*, was completed by Eastern Research Group, Inc. (ERG), in July 2015. As part of the study, ERG performed research to estimate the amount of electric-powered compressor motor use in populated urban areas, including the ten-**

**county DFW 2008 eight-hour ozone nonattainment area. The study found only a handful of electric compressor motors used at wellhead sites across the state. As a result, no reductions were used when estimating area source compressor engine emissions for the 2017 AD SIP revision. The study did find a small amount of electric compressor motors used at larger midstream compressor stations (possibly up to 10 % of the compressors found at these sites). Emissions from these compressor stations would be included in the AD SIP revision as point sources, and these emissions estimates would already include the effects of any electric compressor motor use. No changes were made in response to these comments.**

An individual commented that the true volumes of oil and gas pollution were hidden in the DFW AD SIP revision.

**The commission disagrees that oil and gas emissions are hidden in the 2017 DFW AD SIP revision. In the *Executive Summary* of the 2017 DFW AD SIP revision, Table ES-1: *Summary of 2006 Baseline and 2017 Future Year Anthropogenic Modeling Emissions for DFW*, includes three line item estimates of oil and gas emissions: Oil and Gas – Production, Oil and Gas – Drill Rigs, and Point – Oil and Gas. Chapter 3 of the 2017 DFW AD SIP revision includes more detailed information about the oil and gas emissions, including a breakdown of 2017 area source oil and gas emissions by Source Classification Code in Table 3-31: *2017 Oil and Gas Production Emissions for 10-County DFW Area*, and a breakdown of 2017 point source oil and gas emissions by Standard Industrial Classification in Table 3-32: *2017 Point Source Oil and Gas Emissions for 10-County DFW Area*. The 2017 DFW AD SIP revision included this level of detail so that the oil and gas emissions would be transparent.**

**As noted above, the 2017 DFW AD SIP revision used 2014 RRC oil and gas production data to develop its emissions inventory. Specifically, Chapter 3 of the 2017 DFW AD SIP revision detailed not only the RRC production data but the studies, emissions forecasting methods, and other relevant data used to develop the oil and gas emissions inventory. No changes were made in response to this comment.**

## WEIGHT OF EVIDENCE (WOE)

The RTC requested that the TCEQ remove references to transportation control measures (TCM) from Table 4-1: *Existing Ozone Control and Voluntary Measures Applicable to the DFW 10-County Nonattainment Area* because the photochemical modeling included in the proposed SIP revision does not account for emissions reductions from the TCMs and because TCMs are not required for areas that are classified as moderate nonattainment.

**The TCEQ appreciates the RTC's concerns regarding TCMs. The purpose of Table 4-1: *Existing Ozone Control and Voluntary Measures Applicable to the DFW 10-County Nonattainment Area* is simply to provide a list of ozone control measures that have been implemented in the 10-county DFW ozone nonattainment area; the table is not intended to assign requirements upon the nonattainment area or to provide a list of control measures included in the photochemical model. However, additional language has been added to the description of TCMs in Table 4-1 to**

**make clear that TCMs were implemented for previous ozone NAAQS and are not required to be considered for a moderate nonattainment area.**

The Sierra Club and Downwinders commented that the TCEQ relied on emissions reductions from numerous small, incremental, and qualitative measures to support its WoE analysis while neglecting similar emissions increases and asserted that this was arbitrary government action. The commenters provided the decommissioning of Stage II vapor control equipment as an example of such a measure.

**The qualitative WoE included in Chapter 5: *Weight of Evidence* includes measures that are not directly accounted for in the photochemical model inputs for SIP creditability. While some of these measures may result in small emissions reductions, others, such as TERP, have a significant impact on emissions in the DFW area. See the response to how decommissioning of Stage II vapor control equipment was accounted for in this Response to Comments on page 62, which explains why decommissioning does not result in significant emissions increases in the DFW area. The commenter provided no other specific examples of measures that could lead to increased emissions of ozone precursors and the TCEQ is unaware of any such measures. No changes were made in response to this comment.**

**Energy Efficiency / Renewable Energy**

The EPA requested that the TCEQ provide data data specific to the DFW area from the annual Statewide Air Emissions Calculations for Energy Efficiency, Wind, and Renewables to support the use of energy efficiency and renewable energy measures as (WoE). The EPA also asked whether the TCEQ is planning to support the DFW area in completing more energy efficiency and renewable energy projects than would be expected by March 1, 2017.

**The document referenced by the EPA, *Statewide Air Emissions Calculations for Energy Efficiency, Wind, and Renewables*, is not an annual report to the TCEQ but actually a 2008 presentation by Dr. Jeff Haberl, Ph.D., P.E., of Energy Systems Laboratory (ESL). The TCEQ does receive two annual reports from the ESL: *Statewide Air Emissions Calculations from Wind and Other Renewables*, performed under contract with the TCEQ; and *Energy Efficiency/Renewable Energy Impact in the Texas Emissions Reduction Plan (TERP)*. While these reports might be used to provide county specific estimated emission reductions from energy efficiency and renewable energy measures, the commission stopped specifically citing emission reductions estimates from energy efficiency and renewable energy measures in SIP revisions after the 2005 DFW Increment of Progress SIP Revision, even in the WoE discussion. The commission acknowledges that such measures can result in emission reductions and are beneficial for the state's air quality goals. The discussion of energy efficiency and renewable energy measures in the WoE portion of the SIP revision is included to provide additional information for the EPA's consideration of the SIP revision in light of the benefits of such measures, which the EPA itself acknowledges. However, the commission has technical and legal concerns with quantifying the emission reduction benefits from energy efficiency and renewable energy measures, particularly with doing so for narrow geographic areas such as a specific nonattainment area. While ESL is generally conservative in estimating emission reduction benefits, the amount of**

**future emission reductions actually resulting from energy efficiency and renewable energy measures is dependent on a number of variables that can change in the future, such as unit dispatch. Furthermore, providing a specific estimate of emission reductions from such measures in the WoE may lead to confusion by the public or even the EPA regarding which emission reductions are considered enforceable under the SIP. Therefore, the commission declines to provide estimates of specific emission reductions in the DFW area from energy efficiency or renewable energy measures. However, the commission has revised the energy efficiency and renewable energy discussion in the WoE portion of this SIP revision to provide a link (http://esl.tamu.edu/) to ESL's website where the EPA and other interested parties may access the most recent reports with ESL's estimates of energy savings and potential emission reductions from energy efficiency and renewable energy in Texas.**

**While the commission is not providing estimates of emission reductions for energy efficiency and renewable energy, according the EPA's own guidance, it is not necessary to quantify the specific emission reduction benefits from energy efficiency or renewable energy for consideration in the WoE portion of an AD SIP revision. The EPA's Roadmap for Incorporating Energy Efficiency/Renewable Energy Policies and Programs into State and Tribal Implementation Plans (EPA-456/D-12-001a, July 2012) provides multiple pathways for states to include energy efficiency and renewable energy measures in a SIP even if the measures do not necessarily meet all of the EPA's four criteria for SIP creditable reductions. The Weight of Evidence Pathway (EPA's Roadmap for Incorporating Energy Efficiency/Renewable Energy Policies and Programs into State and Tribal Implementation Plans, Section 7.0, page 39) is just one of the four pathways described by the EPA for states to account for energy efficiency and renewable energy in SIP revisions. The Baseline Emissions Projection Pathway (EPA's Roadmap for Incorporating Energy Efficiency/Renewable Energy Policies and Programs into State and Tribal Implementation Plans, Section 4.0, page 33) and the Emerging/Voluntary Measures Pathway (EPA's Roadmap for Incorporating Energy Efficiency/Renewable Energy Policies and Programs into State and Tribal Implementation Plans, Section 6.0, page 37) also provide flexibility for including energy efficiency and renewable energy measures that do not necessarily meet the EPA's criteria for fully creditable SIP reductions, including the requirement to be quantifiable.**

**As discussed in Chapter 5: *Weight of Evidence* of this SIP revision, Texas leads the nation in wind generation capacity. As of December 2014, Texas had more than 14,000 megawatts (MW) of installed wind generation capacity. The 2014 installed wind capacity was approximately a 37% increase just since 2011. U.S. Department of Energy National Renewable Energy Laboratory estimates indicate that Texas' total installed wind capacity by the end of 2015 was 17,713 MW, an approximate 25% increase in just one year. Even though the commission is not including specific emission reductions as SIP creditable reductions associated with the wind generation, if Texas' wind generation was not present additional generation sources, including fossil fuel-fired generation, would be needed to meet the electricity demands of the state, resulting in additional emissions that would have otherwise occurred.**

**Finally, while the TCEQ generally supports implementation of energy efficiency and renewable energy measures, the agency does not play a direct role in tracking or providing support for such measures. The Public Utility Commission of Texas and the Texas State Energy Conservation Office (SECO) oversee and provide support on energy efficiency and renewable energy programs in Texas. SECO provides direct support to local governments, residential consumers, businesses and industry, school districts and other public institutions on energy efficiency measures through programs such as the Texas LoanSTAR Program.**

**Texas Emissions Reduction Plan (TERP)**

The EPA applauded the TERP and the reductions achieved by the program and noted that it was pleased that the TERP continues to be funded through 2017. The EPA also noted that several years ago, it teamed with the TCEQ to get the word out on the TERP to as many potential participants in the DFW area as possible and encourage them to apply for TERP funds. The EPA asked if the TCEQ was planning a similar event to encourage more TERP participation in the DFW area in time to help facilitate attainment by the attainment date.

**The commission appreciates the EPA's ongoing support of the TERP. The previous collaborative effort to encourage participation in the TERP by potential participants in the DFW area was an excellent example of how federal, state, regional, and local government agencies and interested organizations can work together to contribute to the success of voluntary programs like the TERP. The commission has no current plans for organizing such a comprehensive effort again for the DFW area. However, participation in the TERP by entities in the DFW area has remained strong. The TCEQ has also continued offering TERP workshops and presentations across the state including the DFW area. The TERP staff is working on ideas and plans for enhancing TERP outreach and marketing activities and would be pleased to consider any ideas the EPA may have for making those efforts as effective as possible. No changes were made in response to these comments.**

**Local Initiatives**

The RTC staff reviewed the proposed SIP and concurs with the on-road mobile source emission inventories, 2017 MVEB, and local initiatives as referenced in Appendix H: Local Initiatives submitted by the North Central Texas Council of Governments, which are an integral part of the region coming into compliance with the eight-hour ozone NAAQS and will continue to play a significant role in decreasing ozone-forming pollutants in the DFW region.

**The TCEQ appreciates the support and is committed to working with local entities and interested parties to keep them updated on SIP developments and informed about technical issues related to air quality. No changes were made in response to these comments.**

## FIELD INVESTIGATIONS

An individual commented that people have called the TCEQ with complaints and were forced indoors and made sick by fumes where fracking and blowback was occurring on half a dozen gas pumps nearby. TCEQ reports came back to them and said they found nothing, no violations. Further, the individual noted that when they filed an open records request, a separate concurrent report was found that said there was a violation of the operator venting raw emissions, not using green completions. The individual commented that the TCEQ filmed it, and that the report was not given to the people. The commenter's child's daycare was 900 feet downwind. There was no heads up given to the school about a massive amount of smog-forming methane laced with a cocktail of chemicals floating in that direction.

**When complaints are received and investigated by the TCEQ, the complainants are notified in writing about the results of the investigation of their complaint only. Copies of reports for investigations that are not directly related to a complaint investigation can be obtained through a public information request or are available for review at the TCEQ's Central File Room or regional office. Additionally, information about violations for a specific facility is available online through the TCEQ's Central Registry Query Web page (http://www15.tceq.texas.gov/crpub/). No changes were made in response to these comments.**

Further, the individual was concerned that the TCEQ is still using landline type air testing equipment rather than state-of-the-art real-time testing equipment, that is the equivalent to smart phones, used by the Houston Advanced Research Center. The commenter stated that they were informed by the TCEQ that the TCEQ is lacking in what it needs to test for frack chemicals listed on the frack chemical disclosure registry. The commenter further stated that the TCEQ checks for explosive conditions and organics but nobody is testing for the inorganics.

**The TCEQ monitors ambient air quality in the DFW area for a variety of objectives, including evaluation of population exposure, background concentrations, upwind and downwind concentrations, and concentrations in areas that are expected to have the highest concentrations. These ambient monitoring sites include monitors that measure ozone, $NO_2$, particulate matter, sulfur dioxide, lead, carbon monoxide, and/or several species of VOC emissions. Many of these monitors operate continuously, providing ambient air quality data online and available to the public every hour. The location of these monitoring sites is selected based on the specific monitoring objective of the site and following the siting criteria specified in EPA regulations located in 40 CFR Part 58.**

**When conducting investigations, TCEQ staff utilize hand-held monitors to detect the presence of various compounds, including hydrocarbons, hydrogen sulfide, and particulate matter to determine if additional sampling is necessary. Evacuated air canisters can be collected to speciate specific VOCs if appropriate. No changes were made in response to these comments.**

**PERMITTING**

An individual expressed concern about individual urban drilling sites operating under permits by rule in the Barnett Shale.

**TCEQ permits by rule are specifically provided for minor sources of air pollutants to authorize specific emissions. Individual sources that use a permit by rule must meet the requirements of the appropriate permit. No changes were made in response to this comment.**

An individual states that he is concerned about the City of Denton and Denton Municipal Electric's plans to build natural gas-powered EGUs in the city of Denton. The individual also states that under current rules, the TCEQ does not need to review these plans before issuing emission permits, and that he understands that lower levels are required on the size of the pollution source before a review and offsetting emission reductions are required. The individual states that this defies common sense given Denton's nonattainment status.

**These comments are beyond the scope of this SIP revision. Generally, before any permit would be issued by the commission for any new electric generating facility, an application would have to be submitted and reviewed by the TCEQ. Additionally, before such a permit could be issued, it would have to go through the public notice procedures required by commission rules. It is true that if the electric generating facility's potential emissions did not exceed the major source threshold for the nonattainment area, then the electric generating facility would not be required to obtain a major source new source review (preconstruction) permit or a Title V operating permit. Instead, it would be required to obtain a minor source new source review (preconstruction) permit. It is true that only facilities above a certain level of emissions must offset those emissions with emission reduction credits. Those levels are set by the FCAA and are not discretionary. The levels are set by the FCAA for major sources of emissions of $NO_X$ and VOC in an ozone nonattainment area, as these are the precursor emissions that lead to the formation of ozone. Additional information regarding air permitting requirements is available at the TCEQ's Air Permits and Registrations Web page (https://www.tceq.texas.gov/permitting/air). No changes were made in response to these comments.**

An individual commented that West Dallas has the highest concentration of cement batch plants in the area. The individual states that this is a problem, another request for a cement batch plant in the area has just come in, and that his concerns about cement batch plants are not being heard. The individual also states that there was a request in October for a cement plant to be put in 200 yards downwind from a middle school, and that the school district, city council, and local community were not informed nor was a meeting held regarding the plant. An individual commented that there is a lack of information available, and that the EPA has taken victory laps for areas that are not really clean, in addition to unspecified concerns regarding property development in West Dallas.

**These comments are beyond the scope of this action. Cement batch plants may be authorized under different types of permits that are issued by the TCEQ. All of these permit authorizations require notice and public comment opportunities. For some types of cement batch plants, a public hearing will be held to solicit public comments. For other types, a public meeting must be requested. No changes were made in response to these comments.**

### TRANSPORT

The North Texas Renewable Energy Group stated that Wise County is only part of the nonattainment area because of transported emissions from the south, not because of industry in the county itself.

**The EPA included Wise County over the State of Texas's objection. The State of Texas and the TCEQ sued the EPA over the inclusion of Wise County in the DFW nonattainment area, but this challenge was denied by the U.S. D.C. Circuit Court of**

**Appeals in an opinion issued on June 2, 2015. The purpose of the 2017 proposed AD is to show how the DFW ozone nonattainment area will reach attainment of the 2008 ozone NAAQS. No changes were made in response to this comment.**

**SUPERFUND**

An individual commented that the EPA cleaned up a Superfund site recently and stated that the area was really safe. However, the city council denied a request for a dog park inside the levies near Trinity Groves because of high concentrations of lead and acid in the area.

**These comments are beyond the scope of this action. No changes were made in response to these comments.**

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**ORDER ADOPTING**
**REVISION TO THE STATE IMPLEMENTATION PLAN**

**Docket No. 2015-1380-SIP**
**Project No. 2015-014-SIP-NR**

On July 6, 2016, the Texas Commission on Environmental Quality (Commission), during a public meeting, considered adoption of a revision to the state implementation pan (SIP). The Commission adopts the revision to the Dallas-Fort Worth (DFW) 2008 Eight-Hour Ozone Nonattainment Area Attainment Demonstration to fulfill its commitment to address the United States Court of Appeals for the District of Columbia Circuit decision that changed the attainment deadlines for the 2008 Eight-Hour ozone NAAQS to a July 20, 2018 attainment date and a 2017 attainment year. Under Tex. Health & Safety Code Ann. §§ 382.011, 382.012, and 382.023 (West 2010), the Commission has the authority to control the quality of the state's air and to issue orders consistent with the policies and purposes of the Texas Clean Air Act, Chapter 382 of the Tex. Health & Safety Code. Notice of the proposed revision to the SIP was published for comment in the December 25, 2015, issue of the *Texas Register* (40 TexReg 9801).

Pursuant to 40 Code of Federal Regulations § 51.102 and after proper notice, the Commission conducted a public hearing to consider the revision to the SIP. Proper notice included prominent advertisement in the areas affected at least 30 days prior to the date of the hearing. Public hearings were held in Arlington, Texas, on January 21, 2016 and in Austin, Texas, on January 26, 2016.

The Commission circulated hearing notices of its intended action to the public, including interested persons, the Regional Administrator of the EPA, and all applicable local air pollution control agencies. The public was invited to submit data, views, and recommendations on the proposed SIP revision, either orally or in writing, at the hearings or during the comment period. Prior to the scheduled hearings, copies of the proposed SIP revision were available for public inspection at the Commission's central office and on the Commission's website.

Data, views, and recommendations of interested persons regarding the proposed SIP revision were submitted to the Commission during the comment period, and were considered by the Commission as reflected in the analysis of testimony incorporated by reference to this Order. The Commission finds that the analysis of testimony includes the names of all interested groups or associations offering comment on the proposed SIP revision and their position concerning the same.

IT IS THEREFORE ORDERED BY THE COMMISSION that the revision to the SIP incorporated by reference to this Order is hereby adopted. The adopted revision to the SIP is incorporated by reference in this Order as if set forth at length verbatim in this Order.

IT IS FURTHER ORDERED BY THE COMMISSION that on behalf of the Commission, the Chairman should transmit a copy of this Order, together with the adopted revision to the

SIP, to the Regional Administrator of EPA as a proposed revision to the Texas SIP pursuant to the Federal Clean Air Act, codified at 42 U.S. Code Ann. §§ 7401 - 7671q, as amended.

If any portion of this Order is for any reason held to be invalid by a court of competent jurisdiction, the invalidity of any portion shall not affect the validity of the remaining portions.

TEXAS COMMISSION ON
ENVIRONMENTAL QUALITY

____________________________________
Bryan W. Shaw, Ph.D., P.E., Chairman

____________________________________
Date Signed