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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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 On June 15, 2005, the one-hour ozone NAAQS was revoked, leaving only an eight-hour ozone standard, effective June 15, 2004.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 77th 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_Vs -- 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 3555 Timmons Lane, Houston, TX 77027 Conference Room A, (2nd floor)
Houston	January 29, 2007	6:00 P.M.	Houston-Galveston Area Council, 3555 Timmons Lane, Houston, TX 77027, Conference Room A, (2nd floor)
Dallas	January 31, 2007	7:00 P.M.	Dallas Public Library Auditorium 1515 Young St., Dallas, TX 75201
Arlington	February 1, 2007	2:00 P.M.	Arlington City Hall 101 W. Abram Street, Arlington, TX 76010
Midlothian	February 1, 2007	6:00 P.M.	Midlothian Conference Center 1 Community Center Circle, Midlothian, TX 76065
Longview	February 6, 2007	2:00 P.M.	Longview Public Library 222 W. Cotton Street, Longview, TX 75601
Austin	February 8, 2007	2:00 P.M.	Texas Commission on Environmental Quality 12100 Park 35 Circle, Austin, TX 78753 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*.

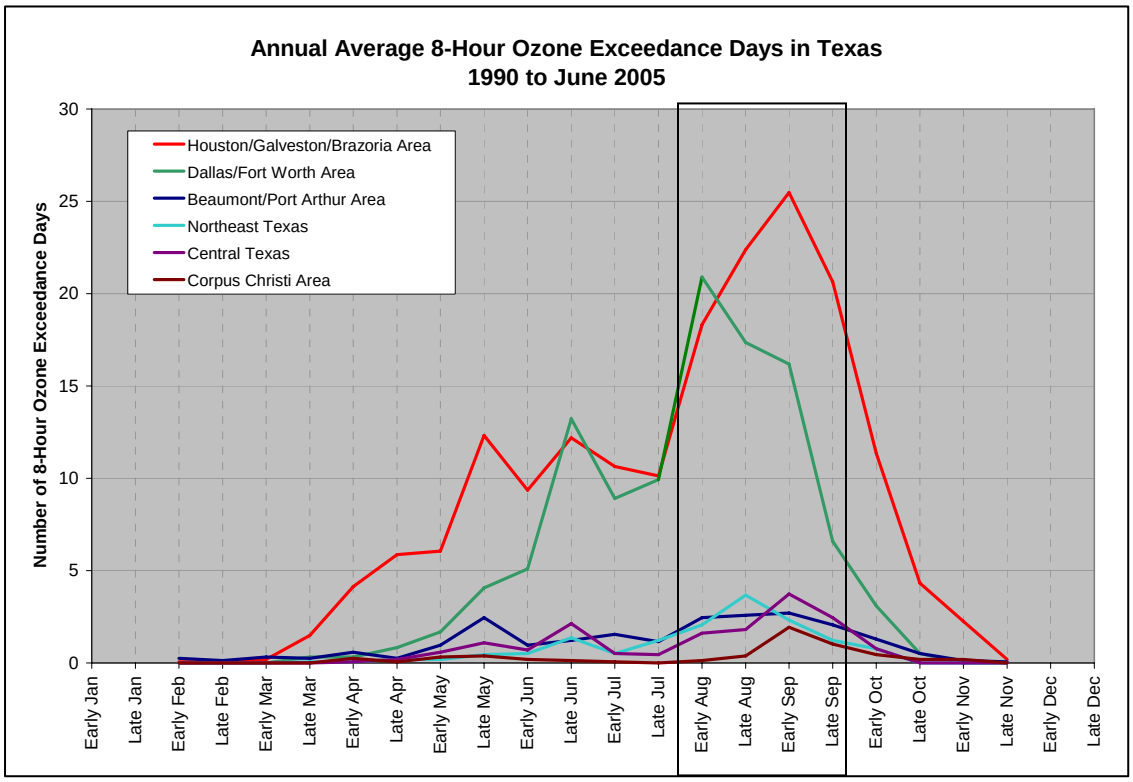


Figure 2-1: Texas Ozone Season

- 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.*

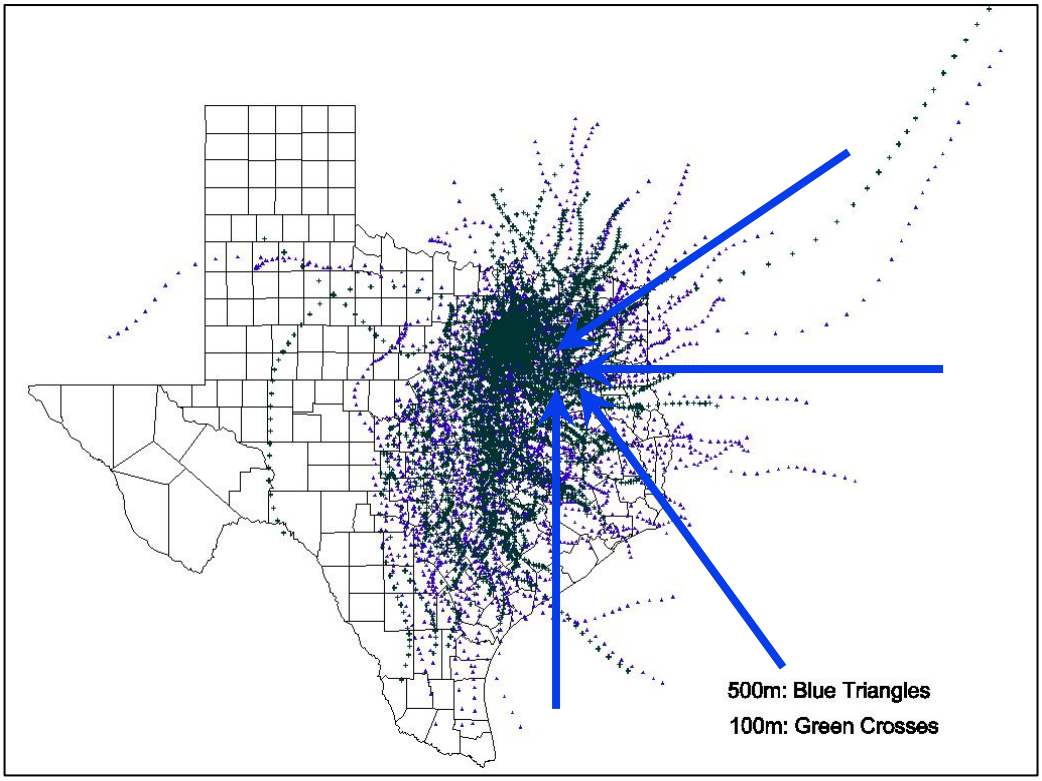


Figure 2-2: Wind Directions Associated with DFW Eight-Hour Ozone Episodes

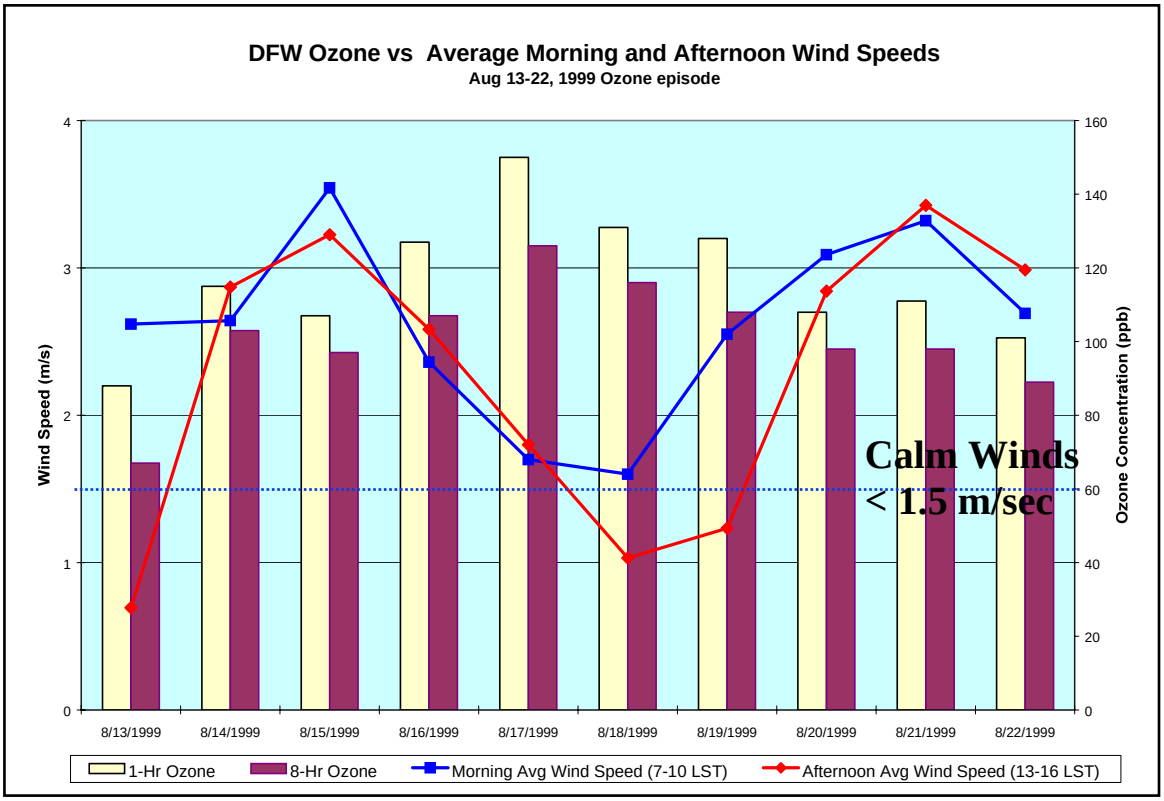


Figure 2-3: DFW Ozone vs. Morning and Afternoon Wind Speeds

- 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*.

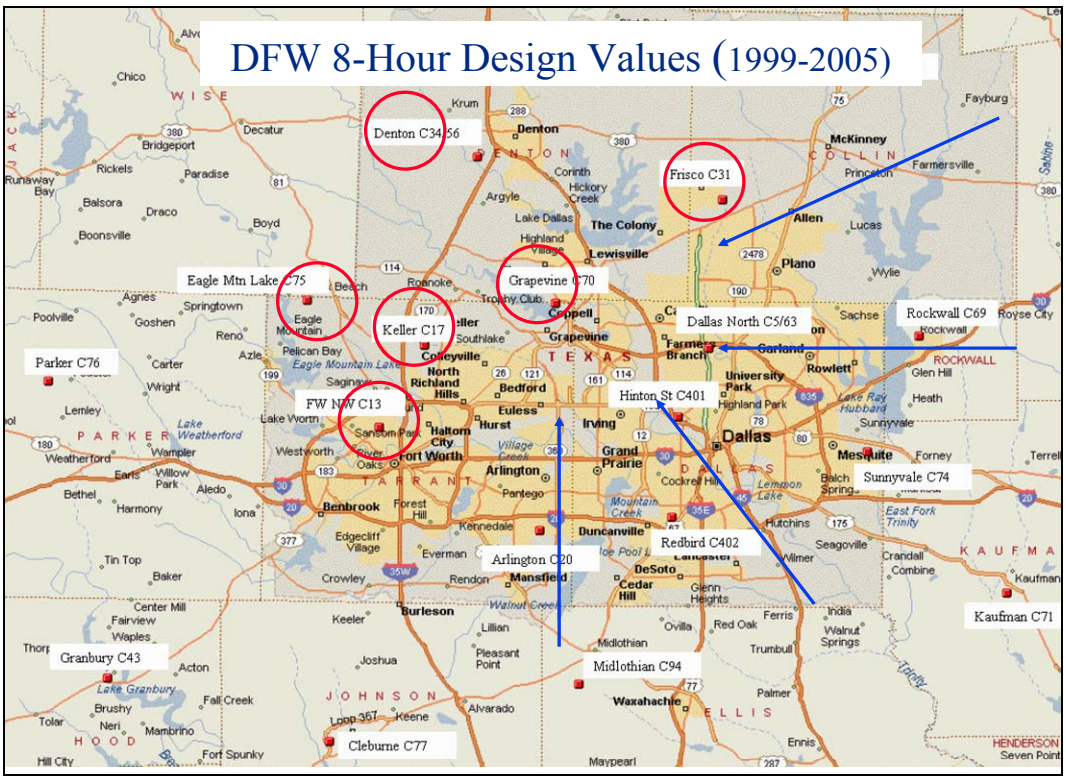


Figure 2-4: DFW Sites with High Eight-Hour Ozone Design Values

- 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.

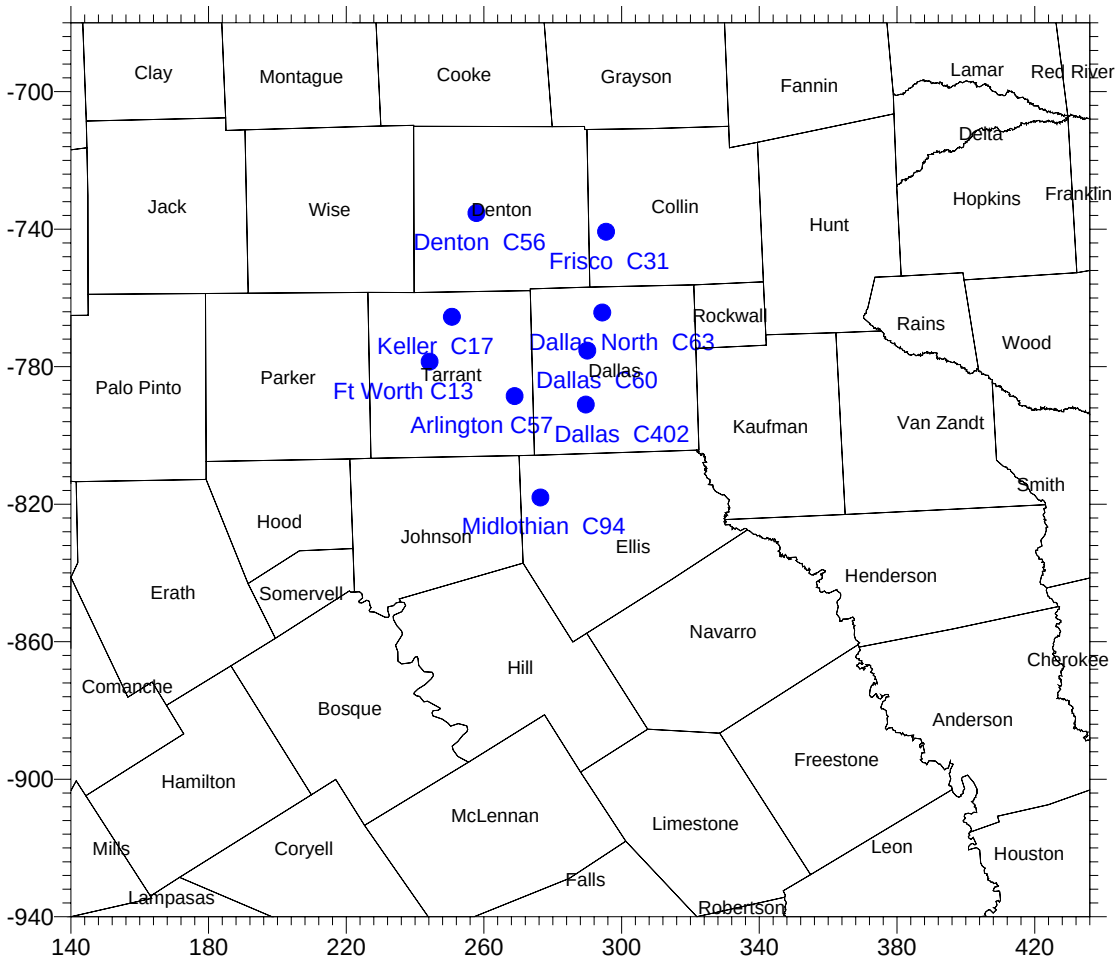
The only model to meet all three of these criteria is the Comprehensive Air Model with Extensions (CAMx). The model is based on well-established treatments of advection, diffusion, deposition, and chemistry. Another important feature is that NO_x emissions from large point sources can be treated with 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

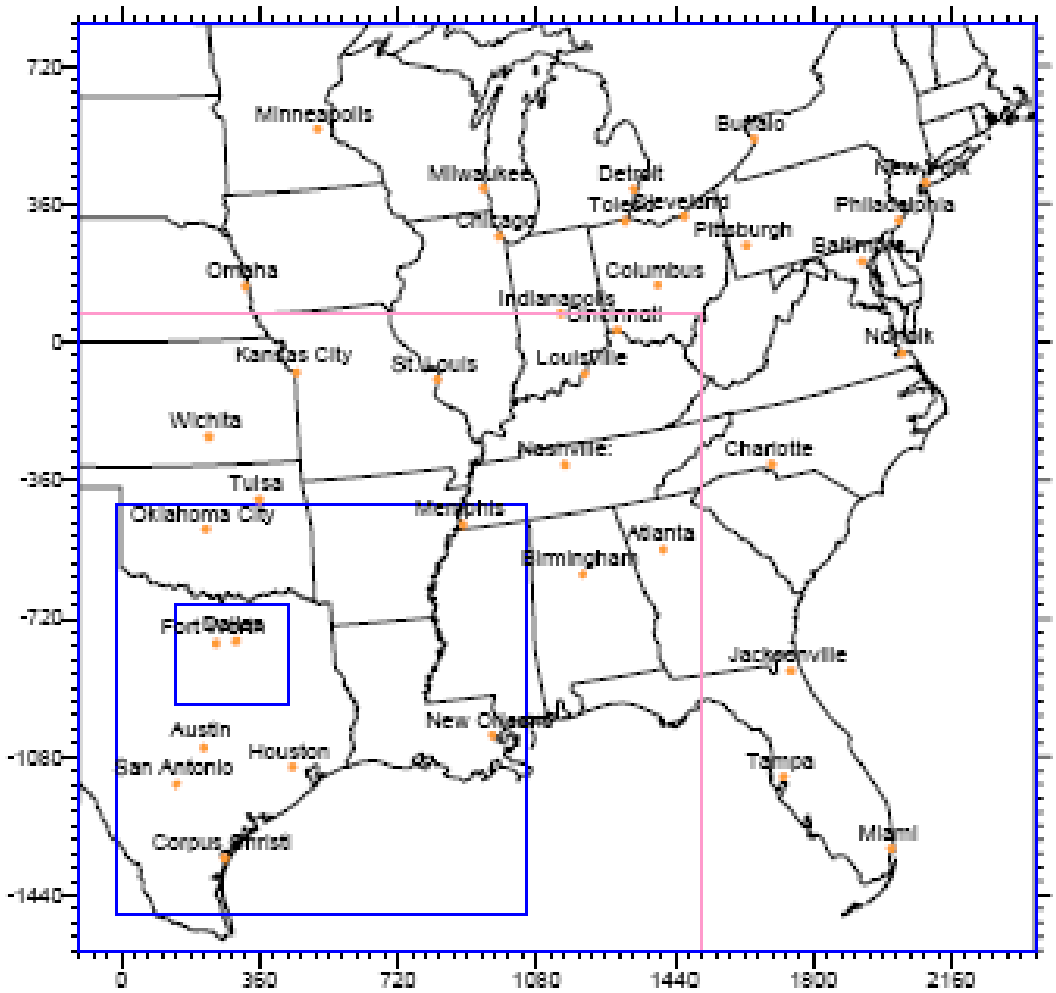
Early photochemical modeling for the DFW episode used the original DFW 36 km domain extending as far north as southern Nebraska and as far east as Georgia and the Florida Panhandle. The TCEQ expanded the modeling domain further east and north to reduce the influence of boundary conditions on ozone concentrations 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.



CAMx Grid Definitions for DFW

	nx x ny	SW to NE Corners
CAMx 36km (standard)	45 x 46	(-108, -1584) to (1512, 72)
CAMx 36km expanded	69 x 67	(-108, -1584) to (2376, 828)
CAMx 12km	89 x 89*	(-12, -1488) to (1056, -420)
CAMx 04km	74 x 65*	(140, -940) to (436, -680)

* includes buffer cells

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.

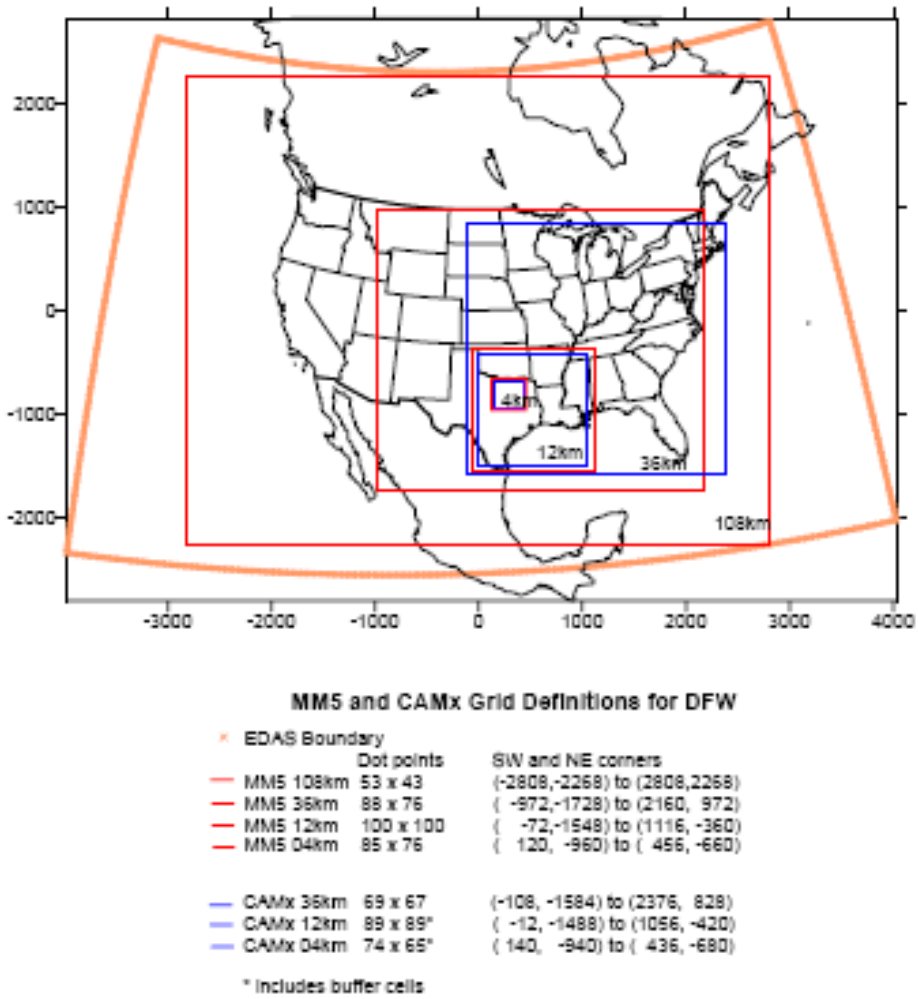


Figure 2-8: MM5 and CAMx Modeling Grids with the Expanded Domain (From Tai 2005a, Figure 4-2)

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---	^
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---	^
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---	|
						ˇ
1	0.9975	997.62	**20.19**	20.19	---1---	
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

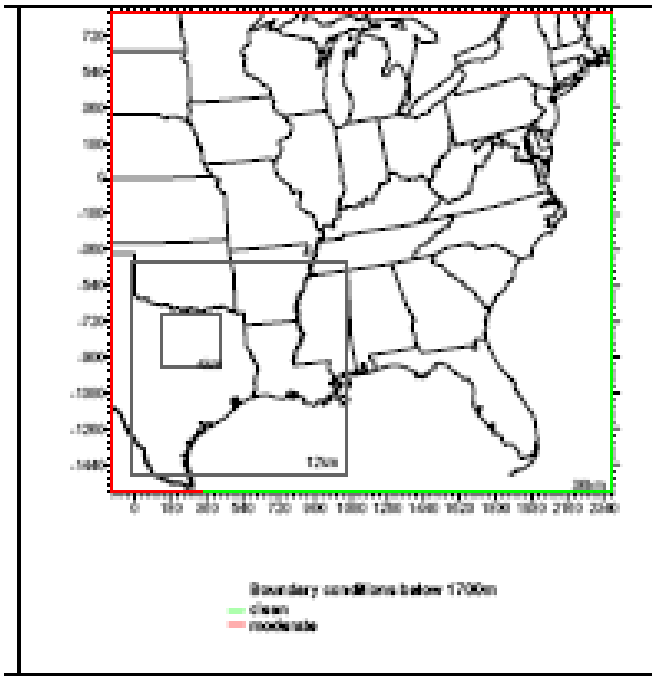


Figure 2-9: Boundary Conditions Used for the Expanded Domain in DFW Modeling

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.

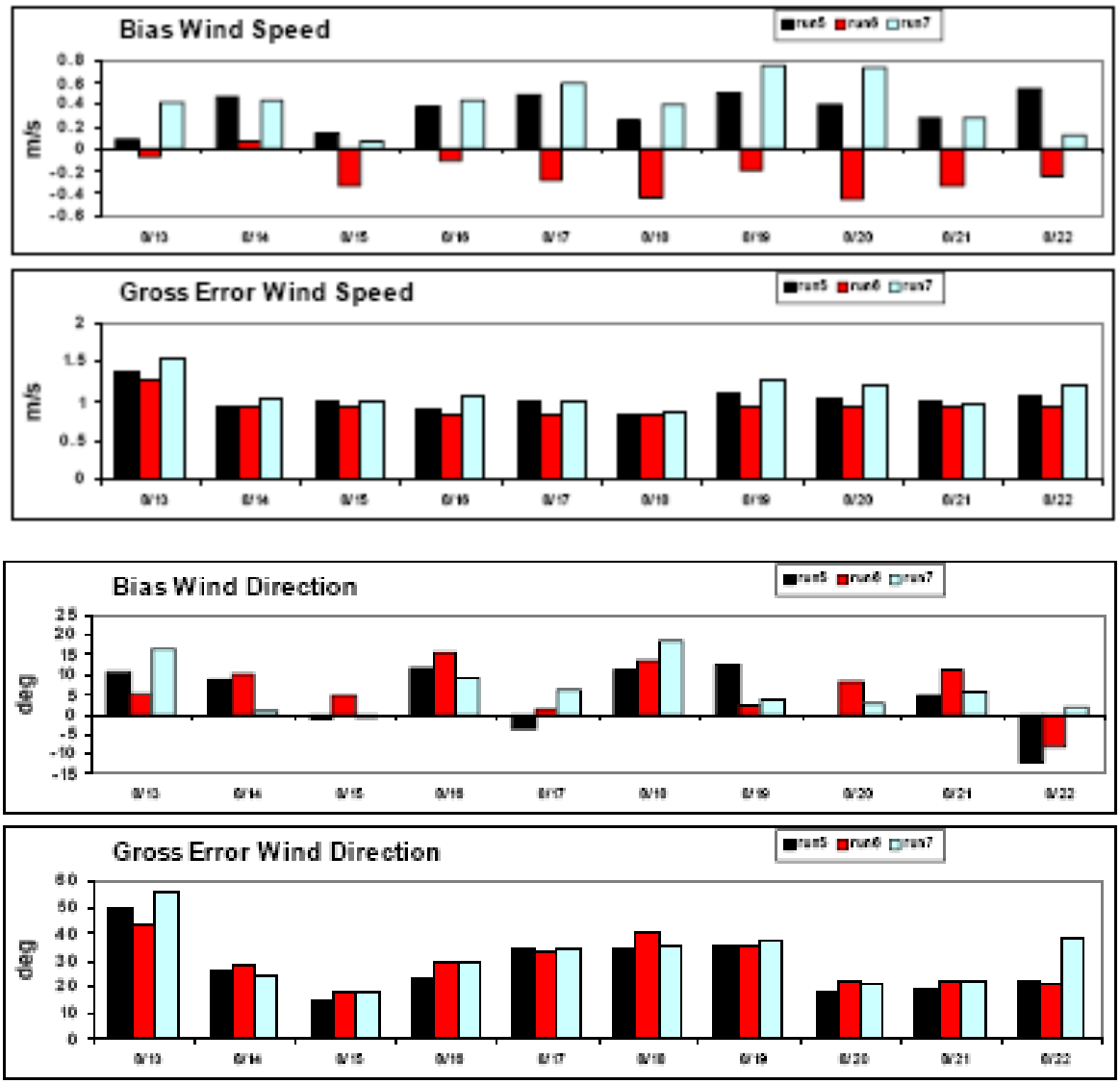


Figure 2-10: Daily Site-Averaged MM5 Wind Performance for Runs 5, 6, and 7 in the DFW 4 km Modeling Domain. Chart from Tai, 2005a, Figure 2-2(a)

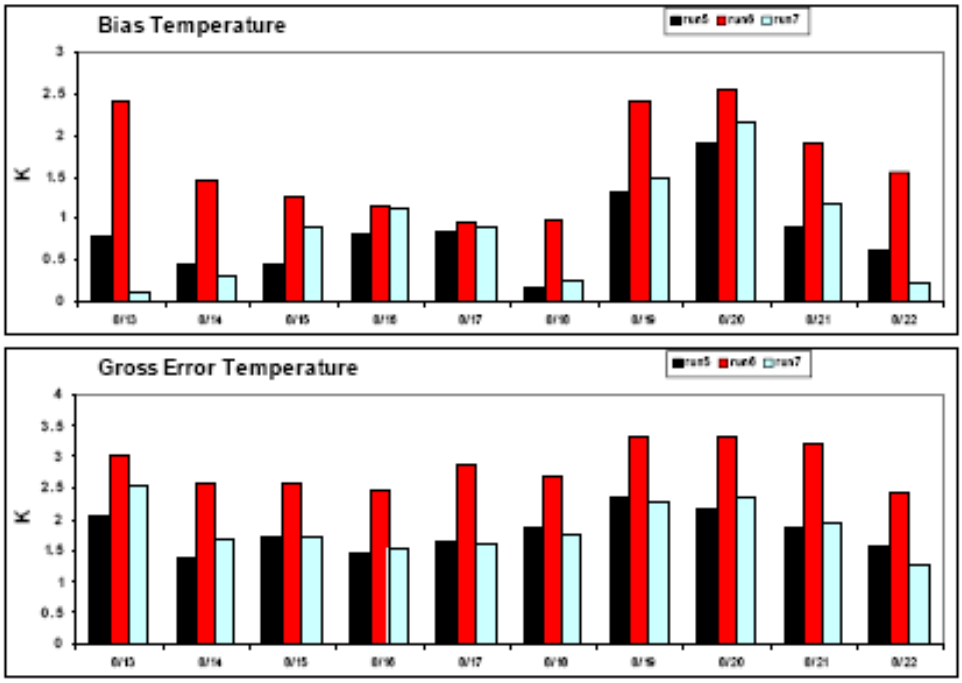


Figure 2-11: Daily Site-Averaged MM5 Temperature Performance for Runs 5, 6, and 7 in the DFW 4 km Modeling Domain

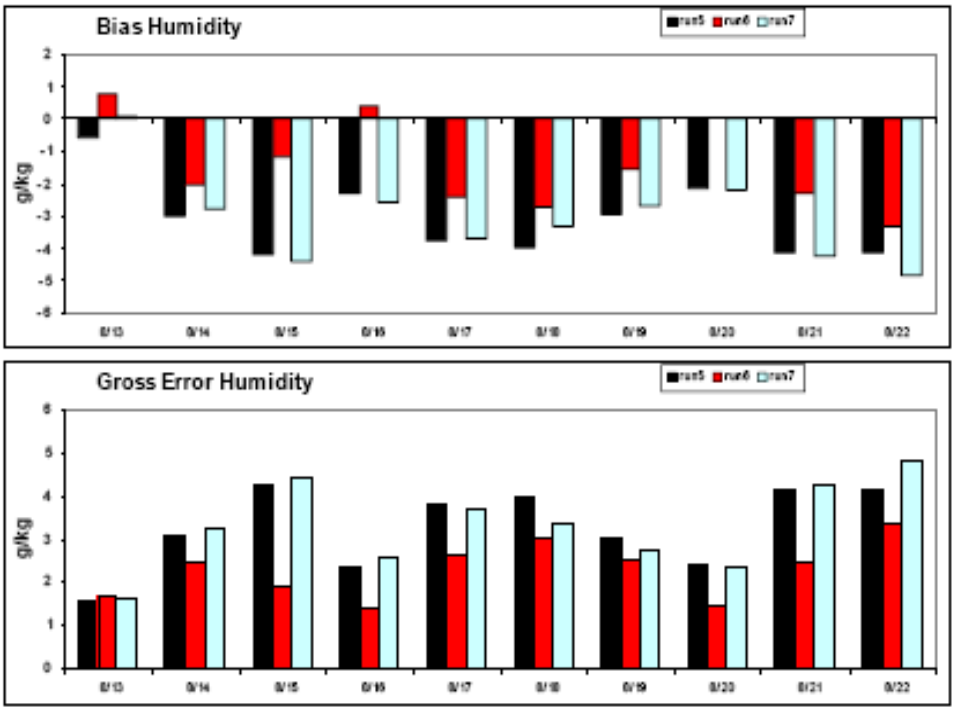


Figure 2-12: Daily Site-Averaged MM5 Humidity Performance for Runs 5, 6, and 7 in the DFW 4 km Modeling Domain

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.

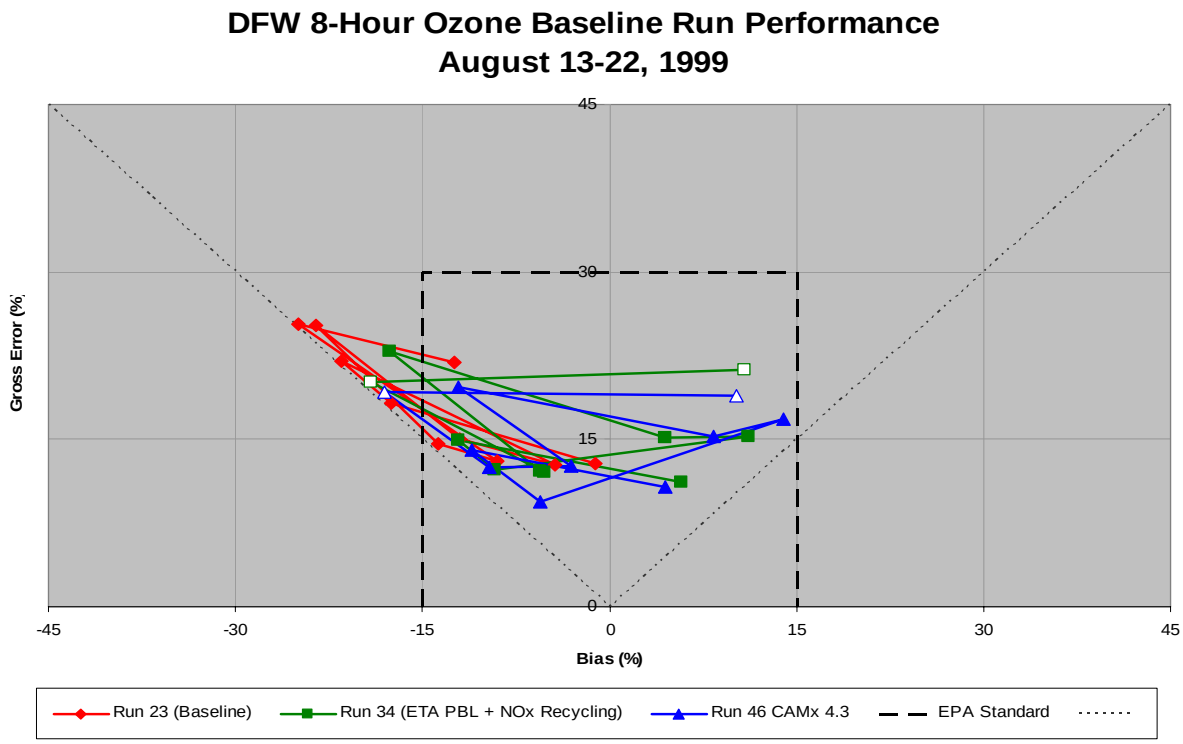


Figure 2-13: Bias and Gross Error Plotted in Error Space for Eight-Hour Ozone CAMx Modeling Runs

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 Using Noah/ETA PBL	No Change
MM5 to CAMx Extraction	-----	Updated mm5-camx version includes cloud/rain inputs
Vertical Mixing Adjustment	Kv100 post processing Increases low level mixing	Kv 100 Patch
Base Case Emissions	TCEQ Base/NEI Ver 2	NEI Ver 3 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.

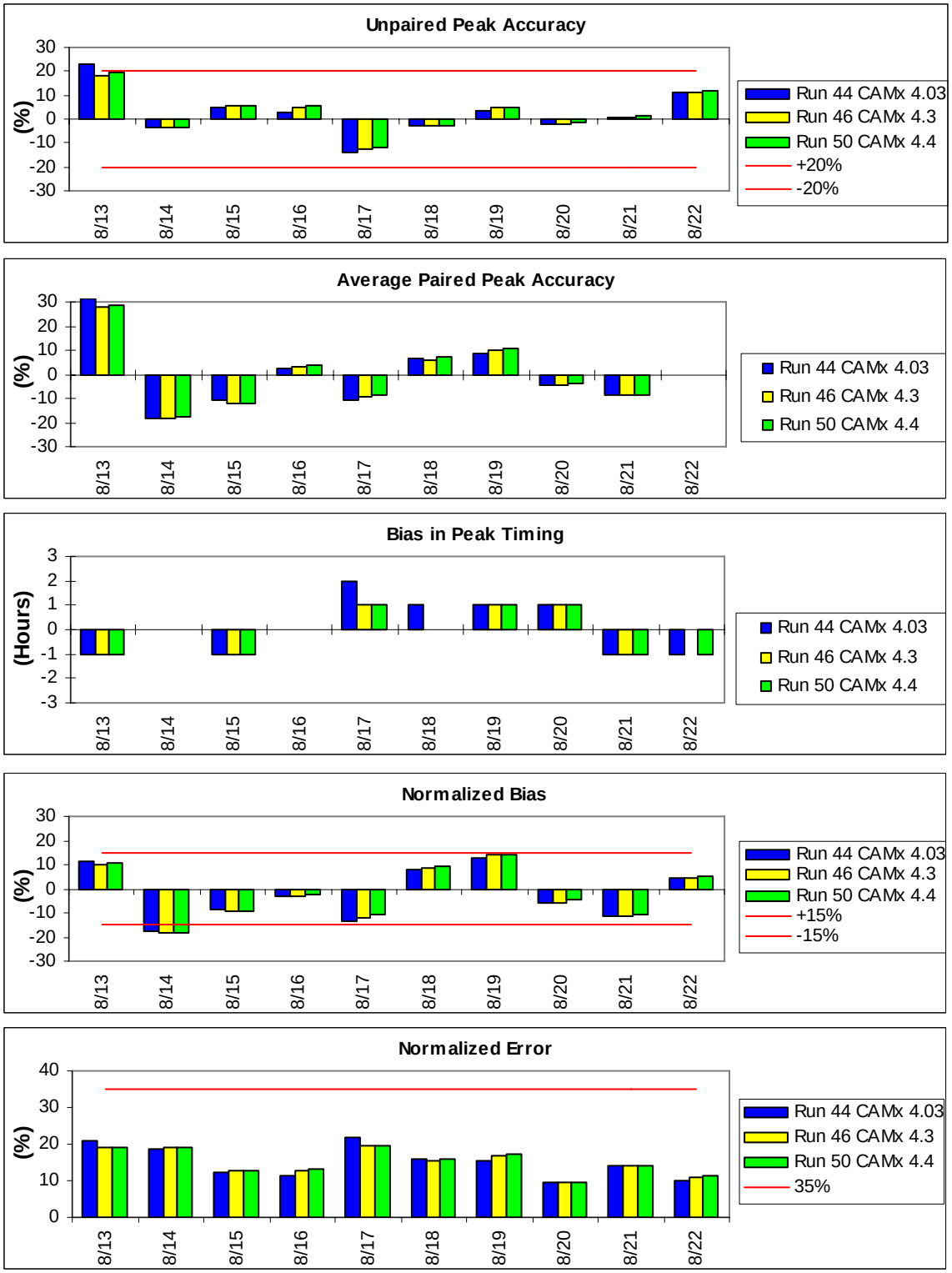


Figure 2-14: Base Case Model Performance Statistics for Eight-Hour Ozone in DFW

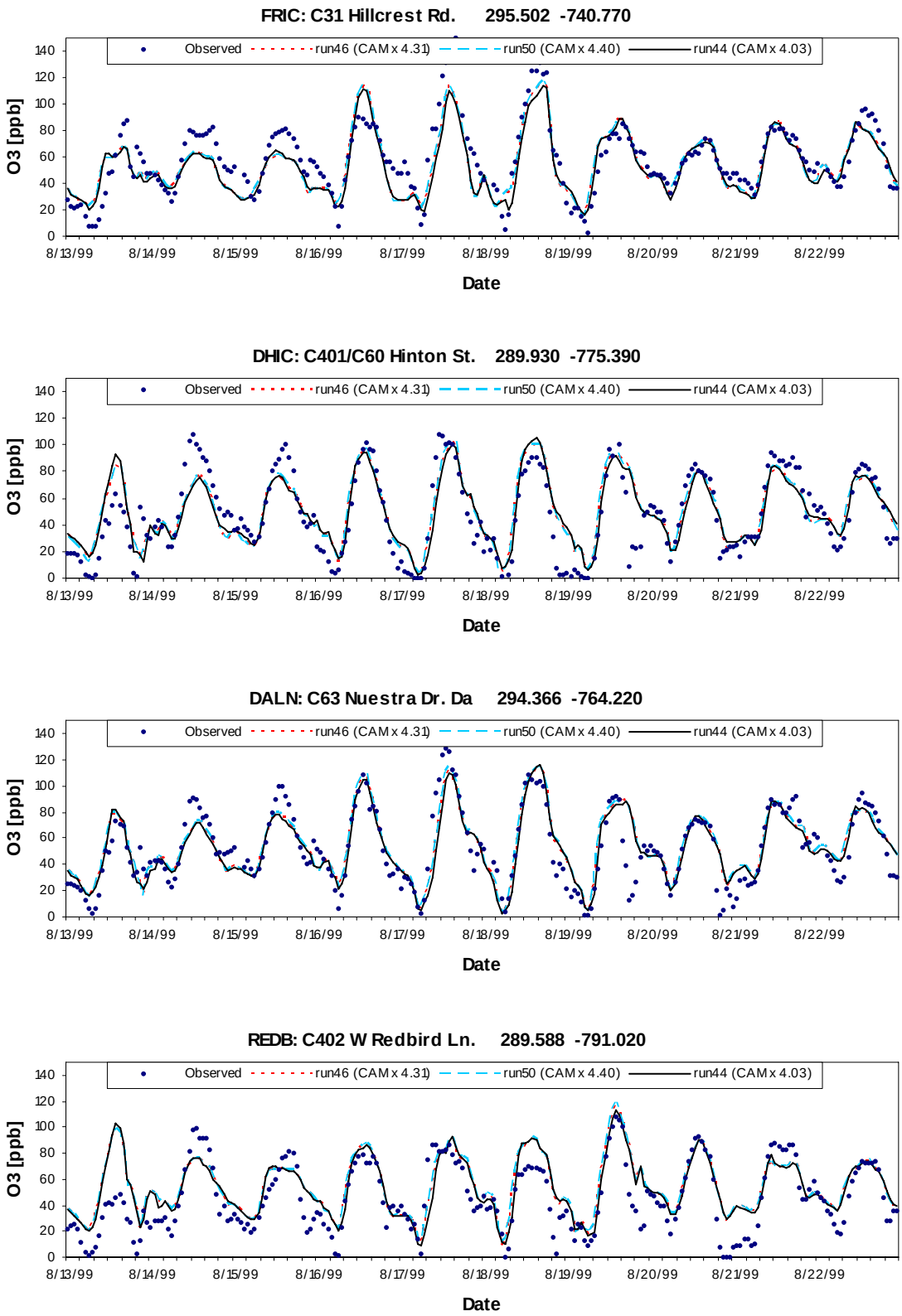


Figure 2-15a: Hourly Time Series for the 1999 Baseline Comparing Three CAMx Versions

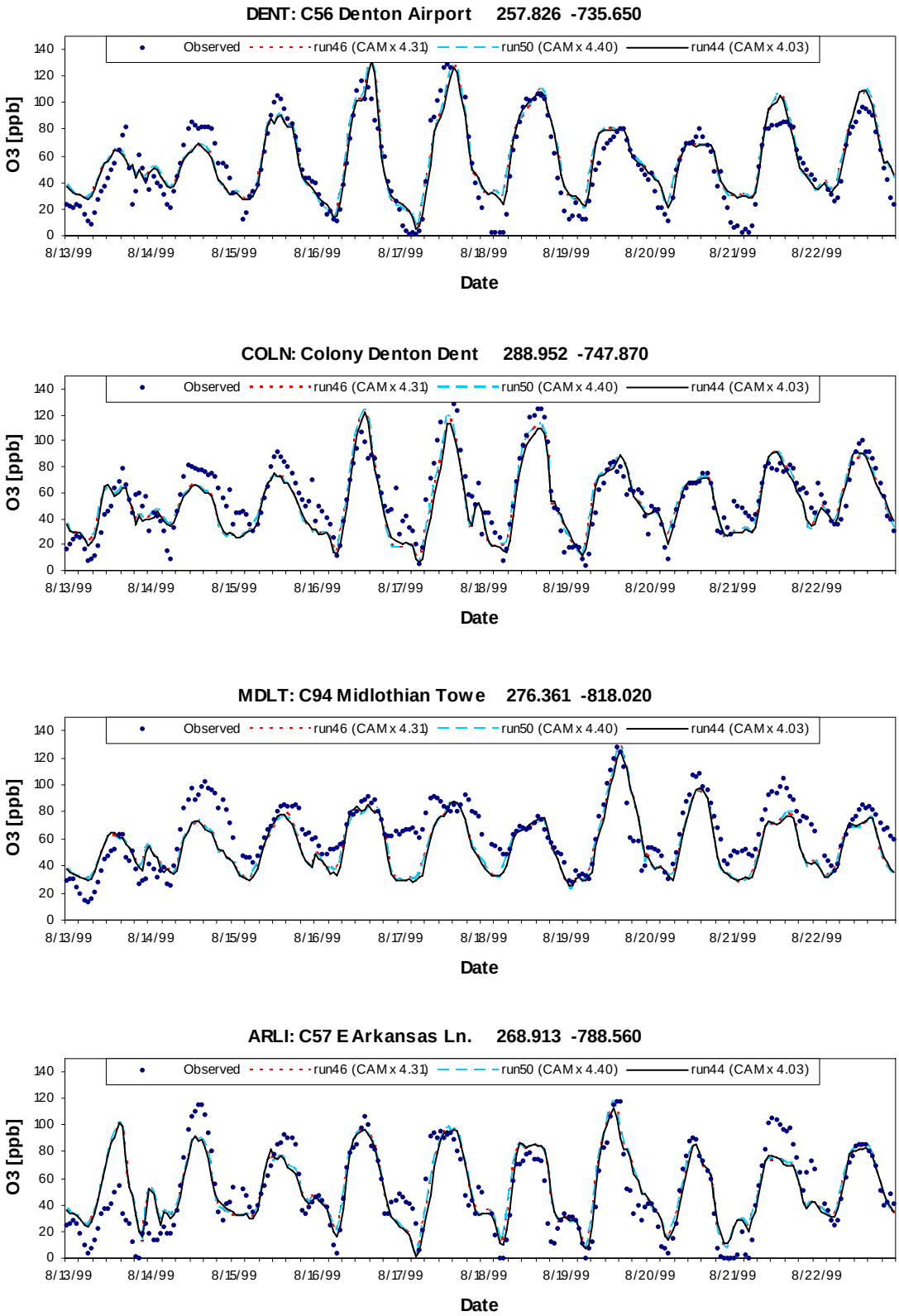
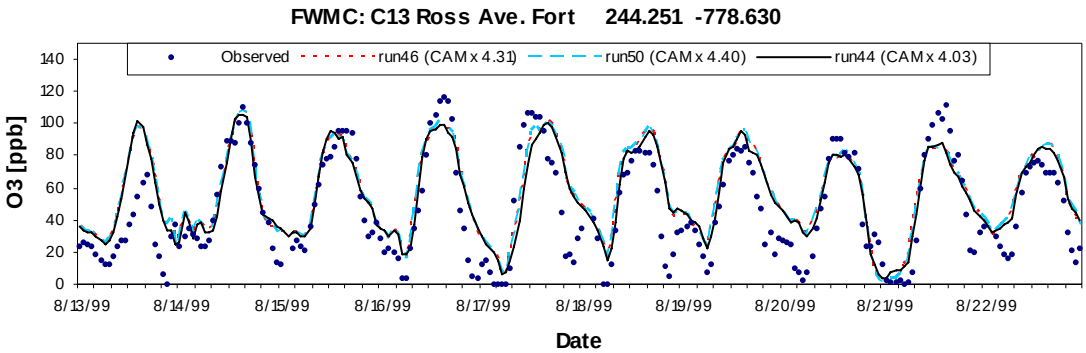


Figure 2-15b: Hourly Time Series for the 1999 Baseline Comparing Three CAMx Versions



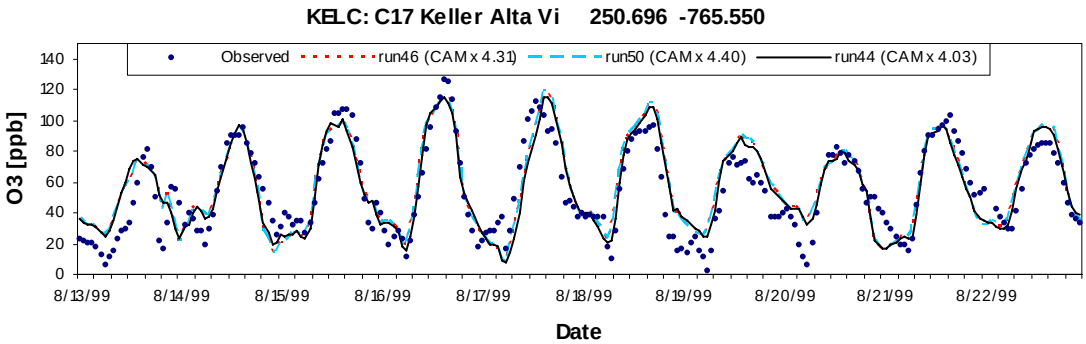


Figure 2-15c: Hourly Time Series for the 1999 Baseline Comparing Three CAMx Versions

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*.

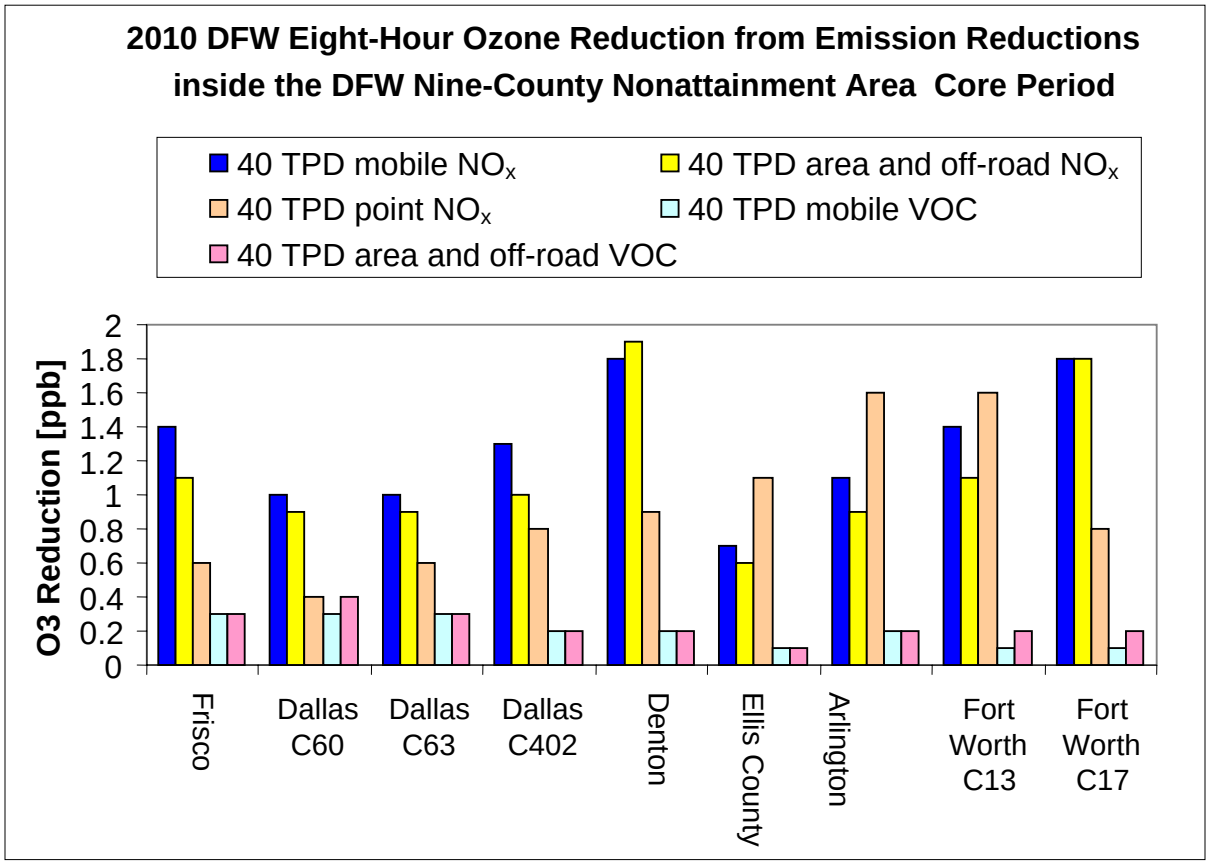


Figure 2-16: DFW 40 Ton Test Response Chart

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.

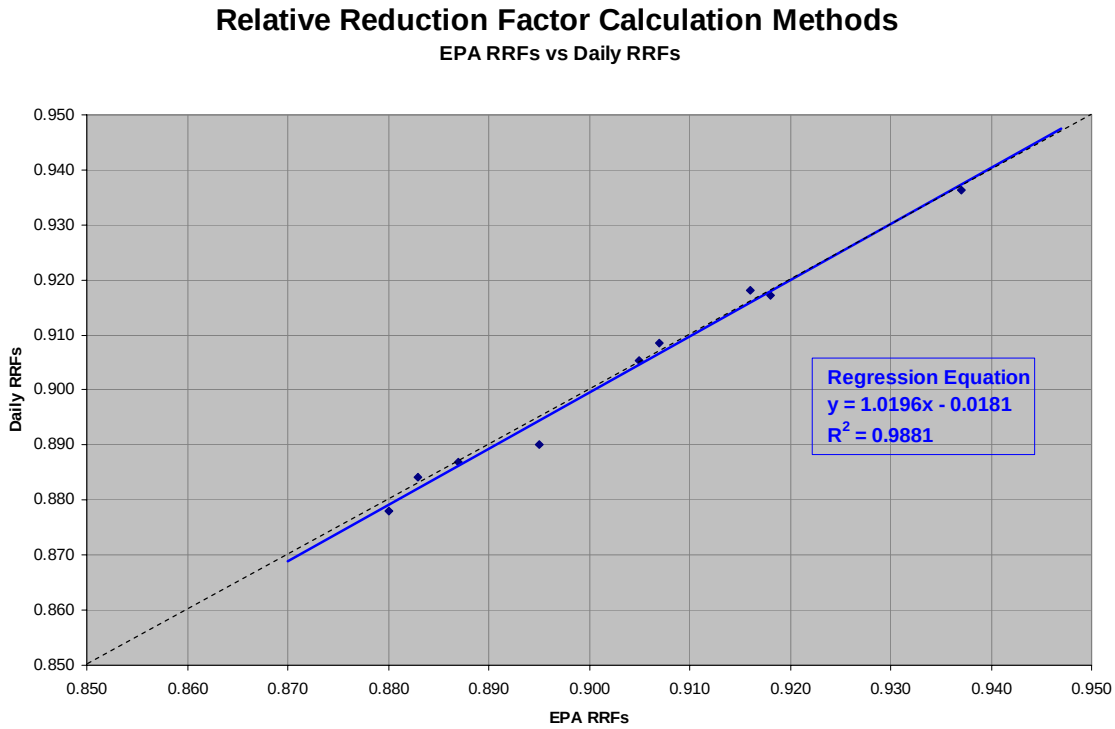


Figure 2-17 Comparison of EPA RRF Calculation Method with Daily Calculation Method

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.

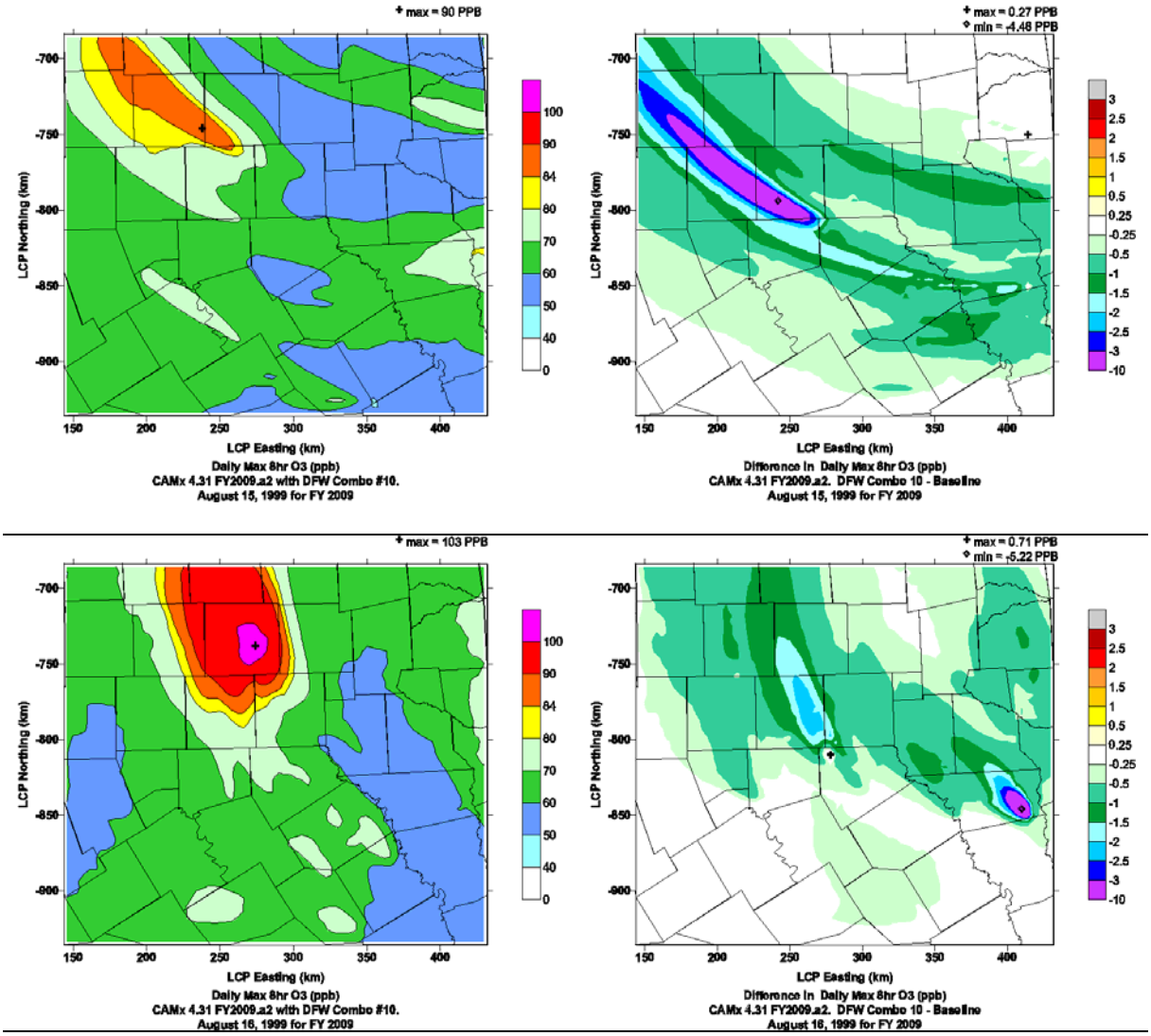


Figure 2-18: Spatial Plots of the Daily Maximum Eight-Hour Ozone in 2009 with Combination 10 Controls, and Differences from the 2009 Baseline for Each Episode Day in the DFW 4 km Domain

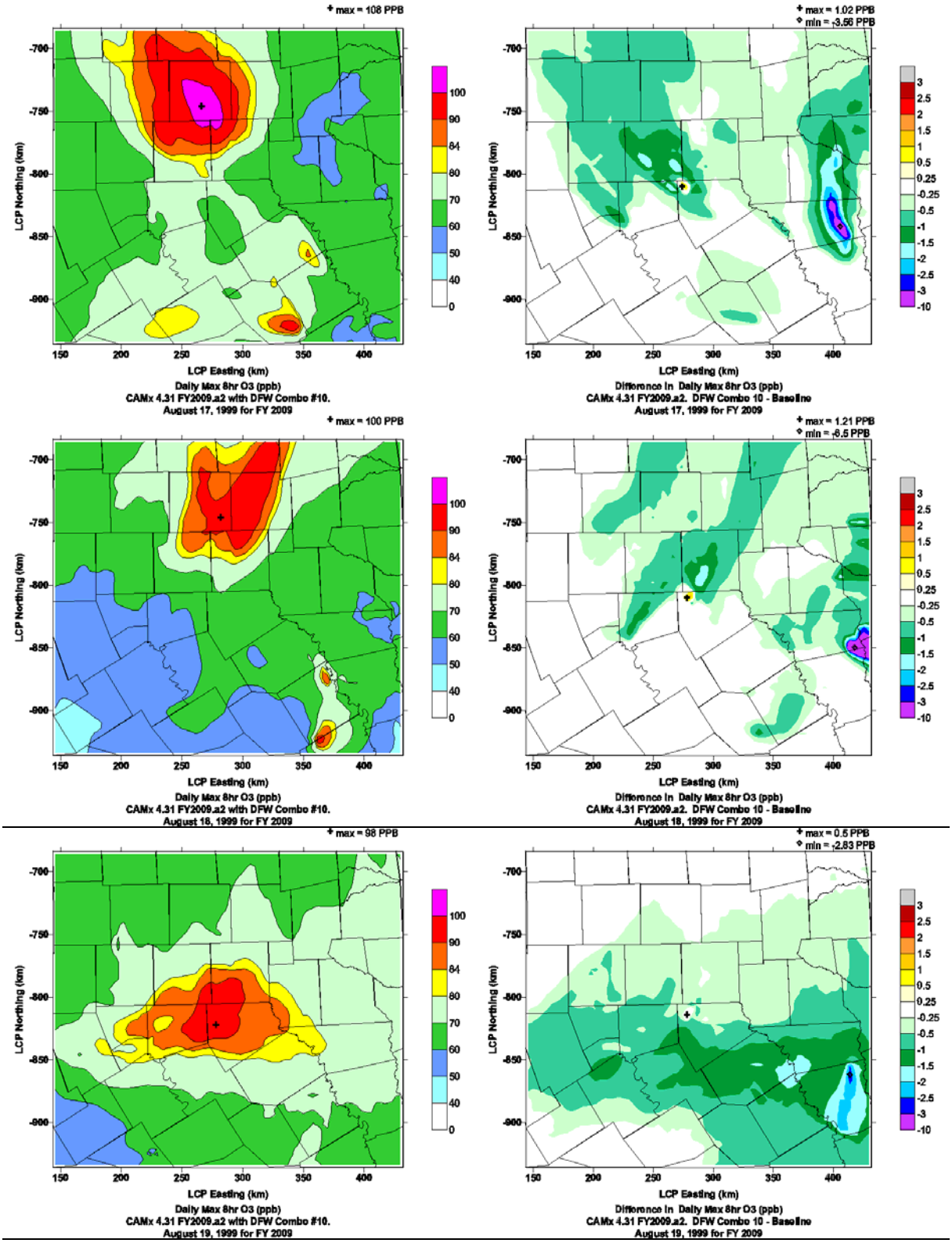


Figure 2-18: (Continued) Spatial Plots of the Daily Maximum Eight-Hour Ozone in 2009 with Combination 10 Controls, and Differences from the 2009 Baseline for Each Episode Day in the DFW 4 km Domain

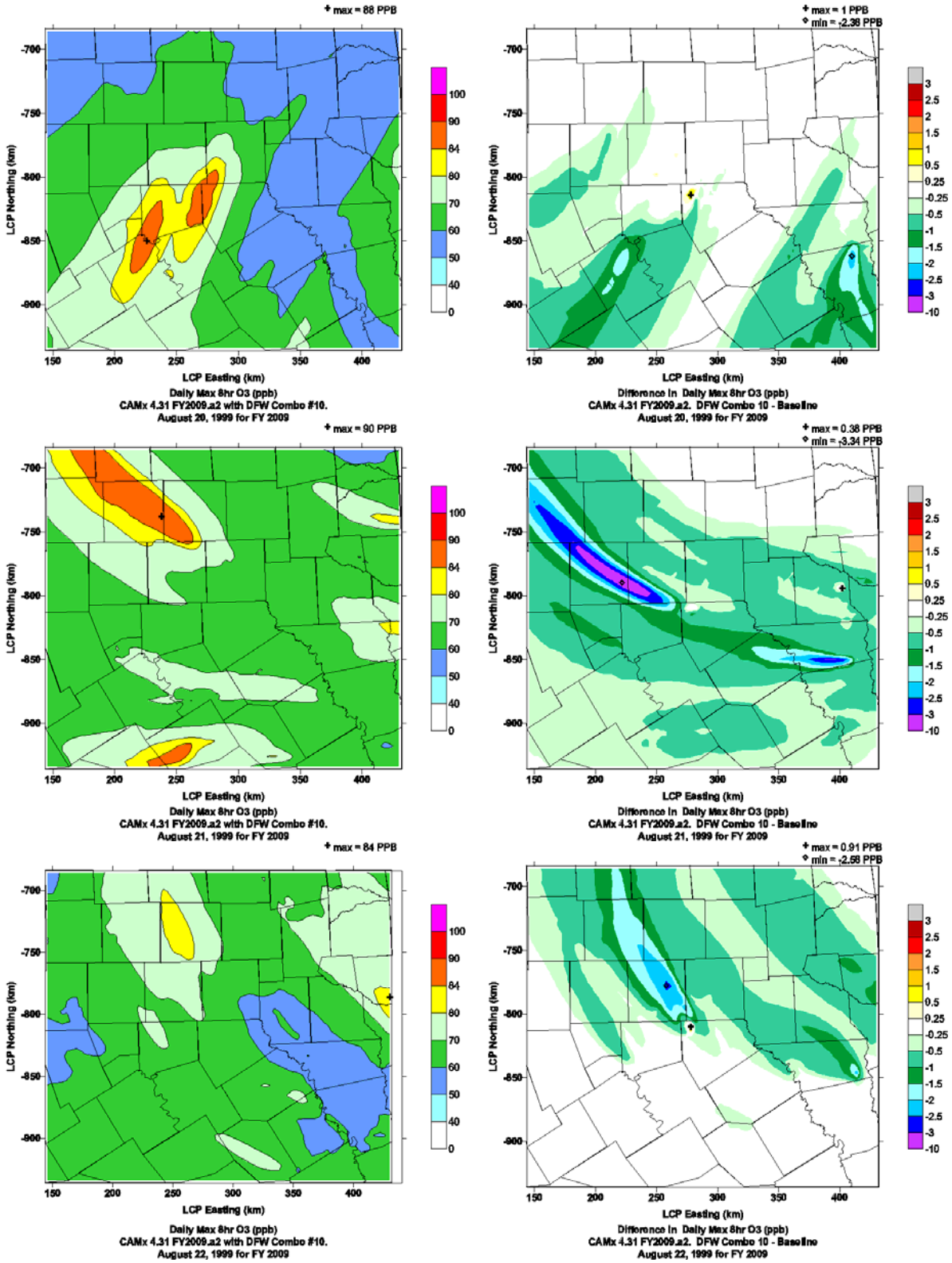


Figure 2-18: (Continued) Spatial Plots of the Daily Maximum Eight-Hour Ozone in 2009 with Combination 10 Controls, and Differences from the 2009 Baseline for Each Episode Day in the DFW 4 km Domain

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

	2009 Baseline			2009 Combo #10			
Site Name	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.

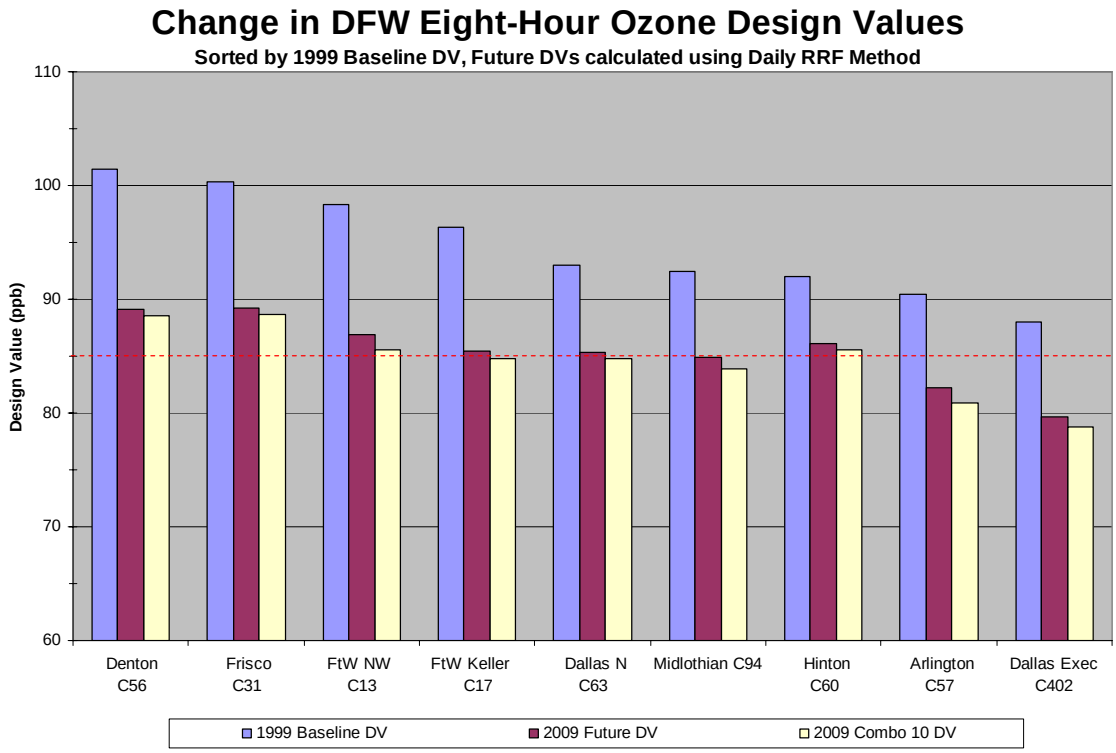


Figure 2-19: Change in DFW Eight-Hour Ozone Design Values

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.

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http://www.tceq.state.tx.us/implementation/air/airmod/docs/dfw_sip_bibliography.html

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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.

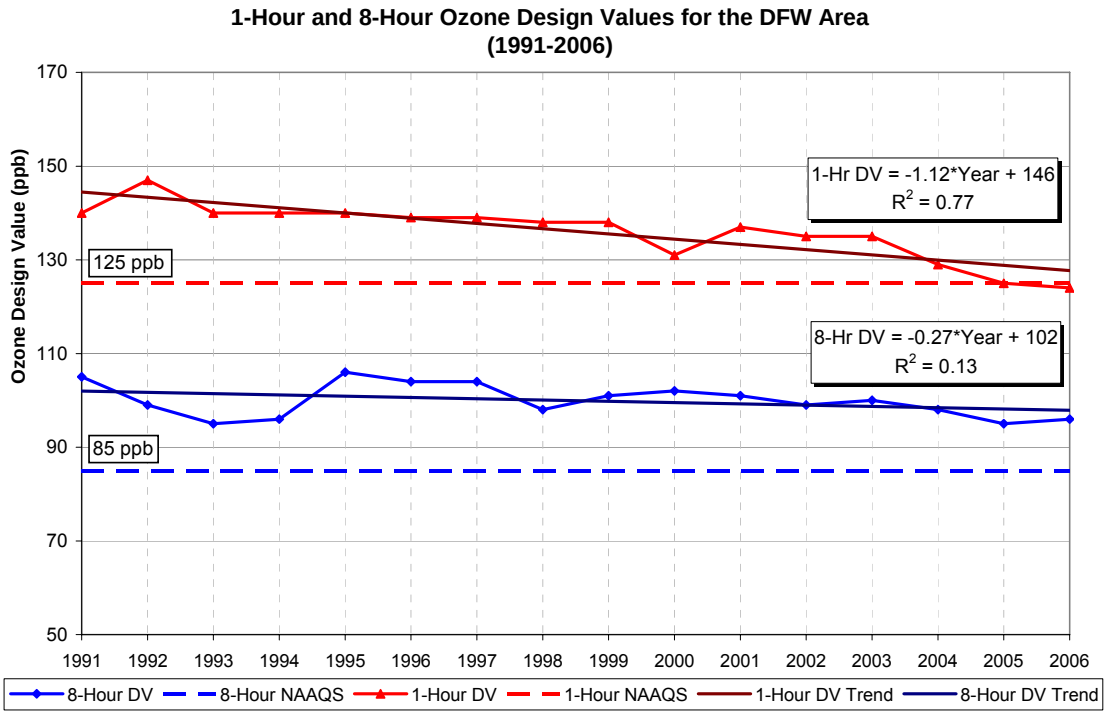
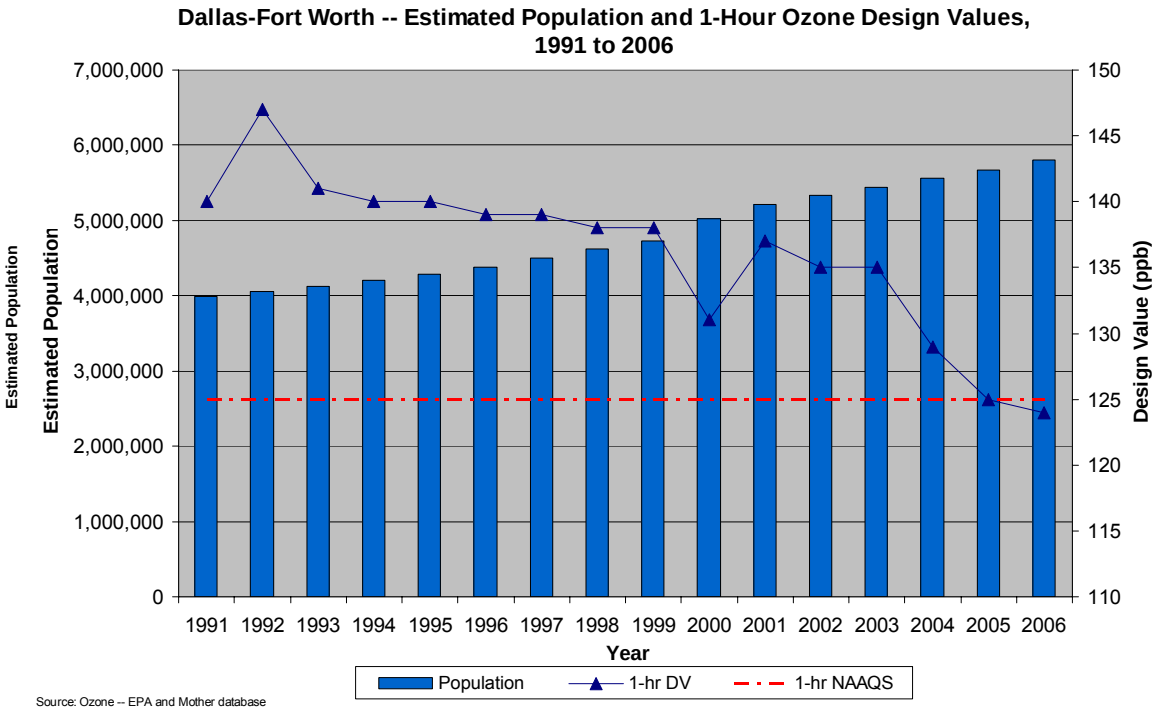


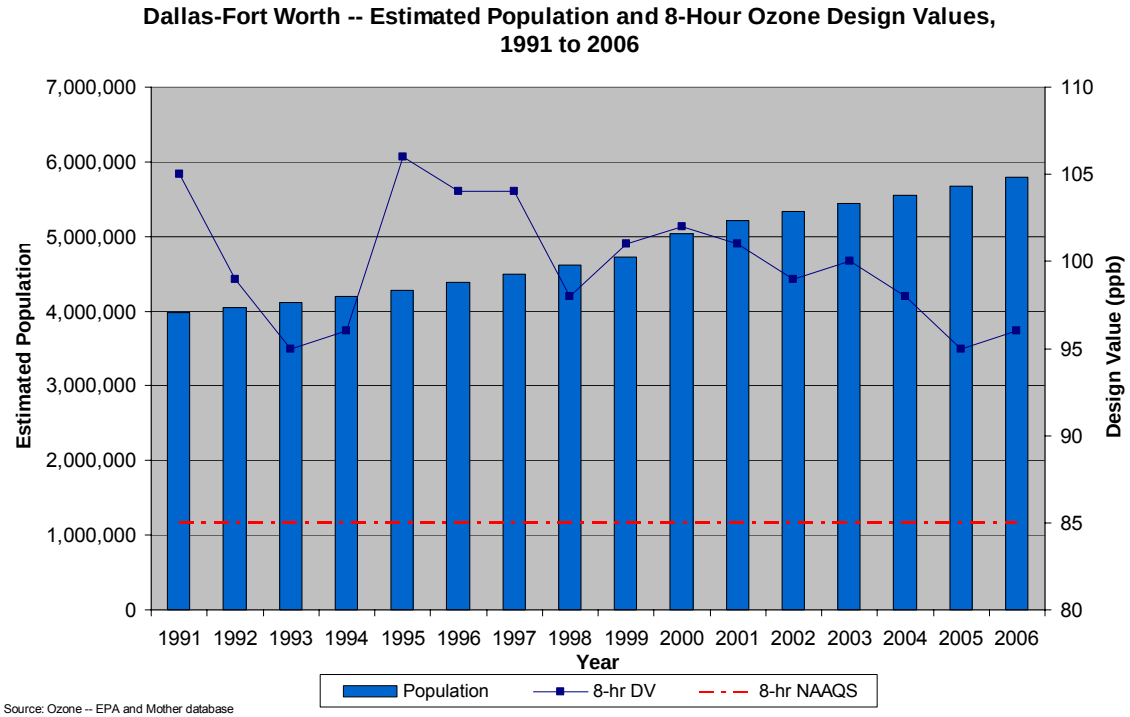
Figure 3-1: One-Hour and Eight-Hour Ozone Design Values in the DFW Area (1991-2006)

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.



Source: Ozone -- EPA and Mother database
1991-2005 Population --http://www.census.gov/popest/archives/1990s/MA-99-03b.txt and http://www.census.gov/popest/counties/CO-EST2005-01.html, July 10, 2006
2006 Population -- http://www.window.state.tx.us/ecodata/popdata/popfiles.html

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



Source: Ozone -- EPA and Mother database
1991-2005 Population --http://www.census.gov/popest/archives/1990s/MA-99-03b.txt and http://www.census.gov/popest/counties/CO-EST2005-01.html, July 10, 2006
2006 Population -- http://www.window.state.tx.us/ecodata/popdata/popfiles.html

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.

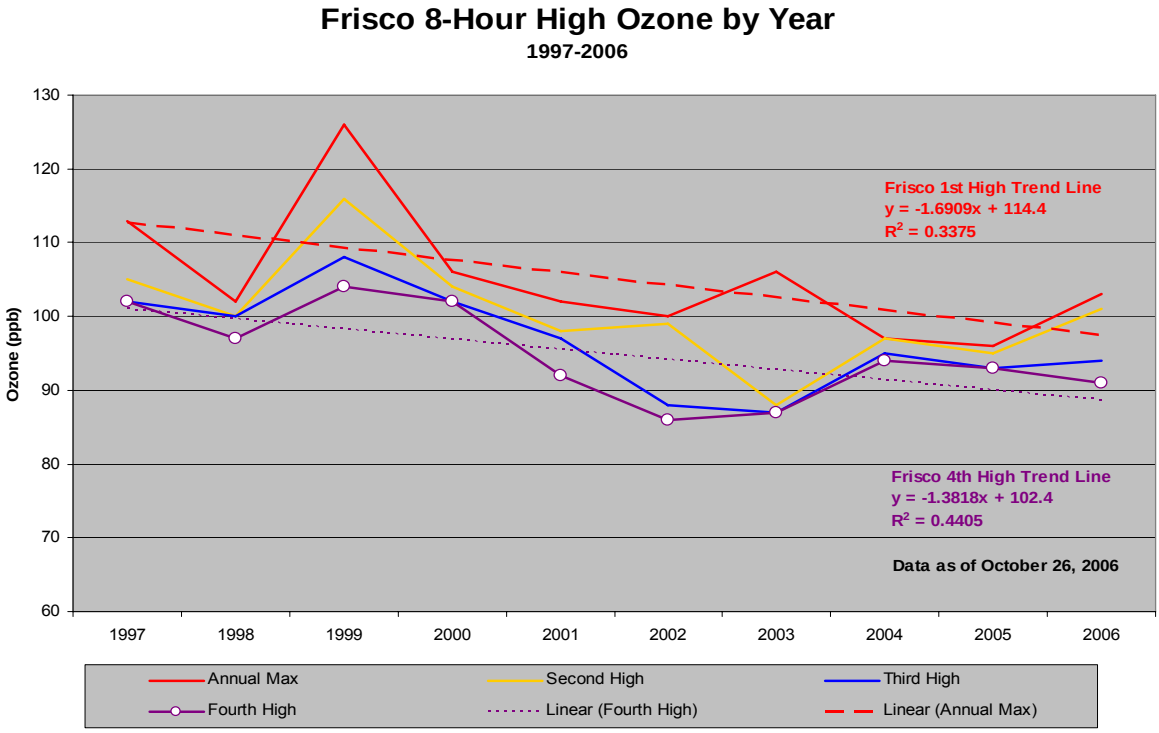


Figure 3-4: Frisco Eight-Hour Ozone Trends

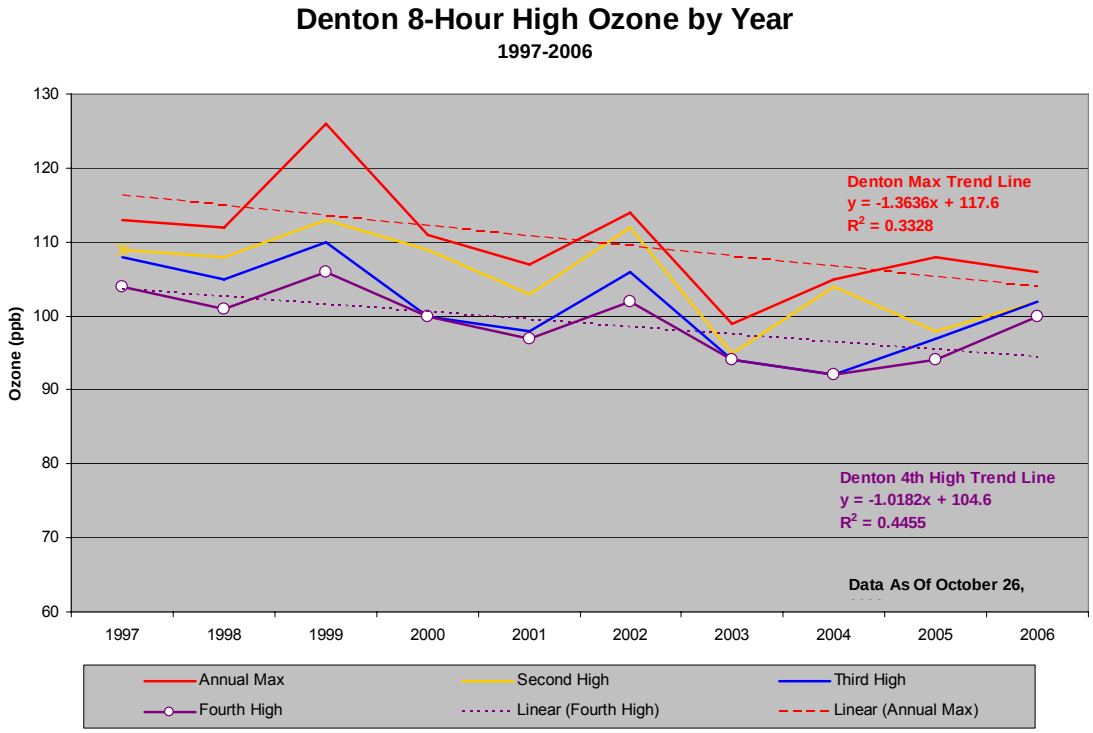


Figure 3-5: Denton Eight-Hour Ozone Trends

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).

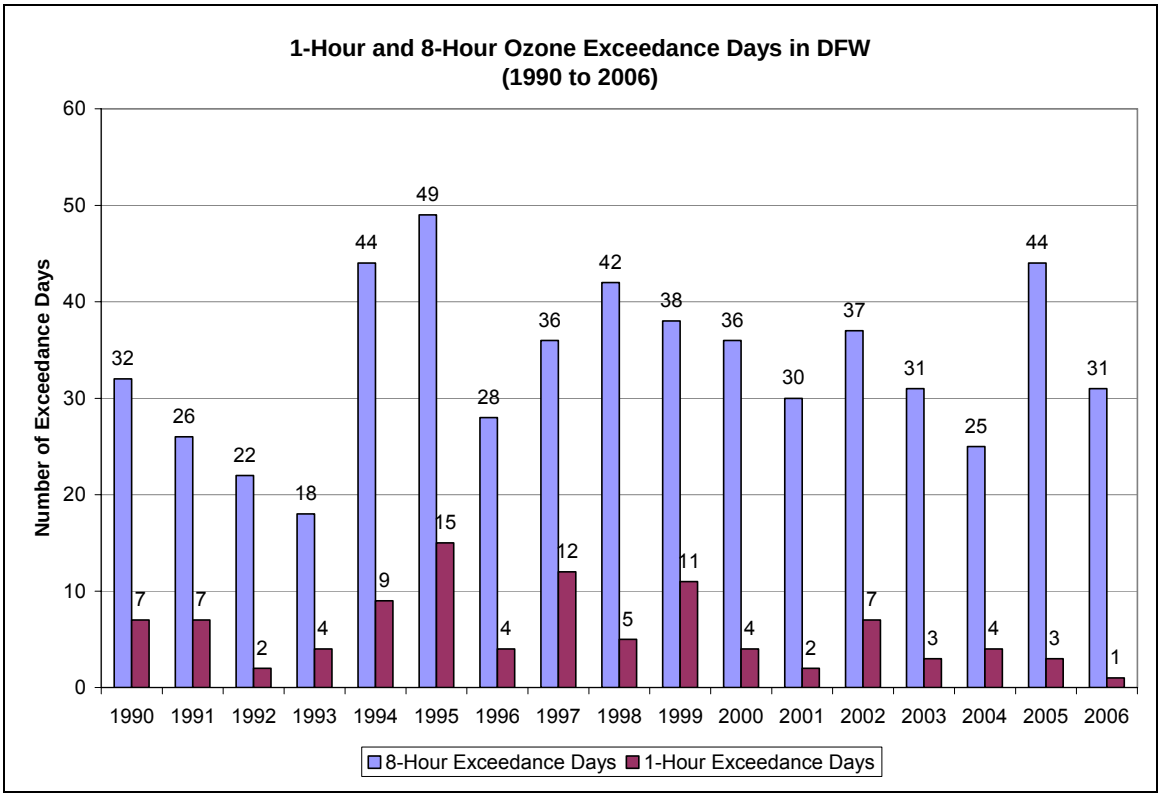


Figure 3-6: One-Hour and Eight-Hour Ozone Exceedances in the DFW Area from 1990 to 2006

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.

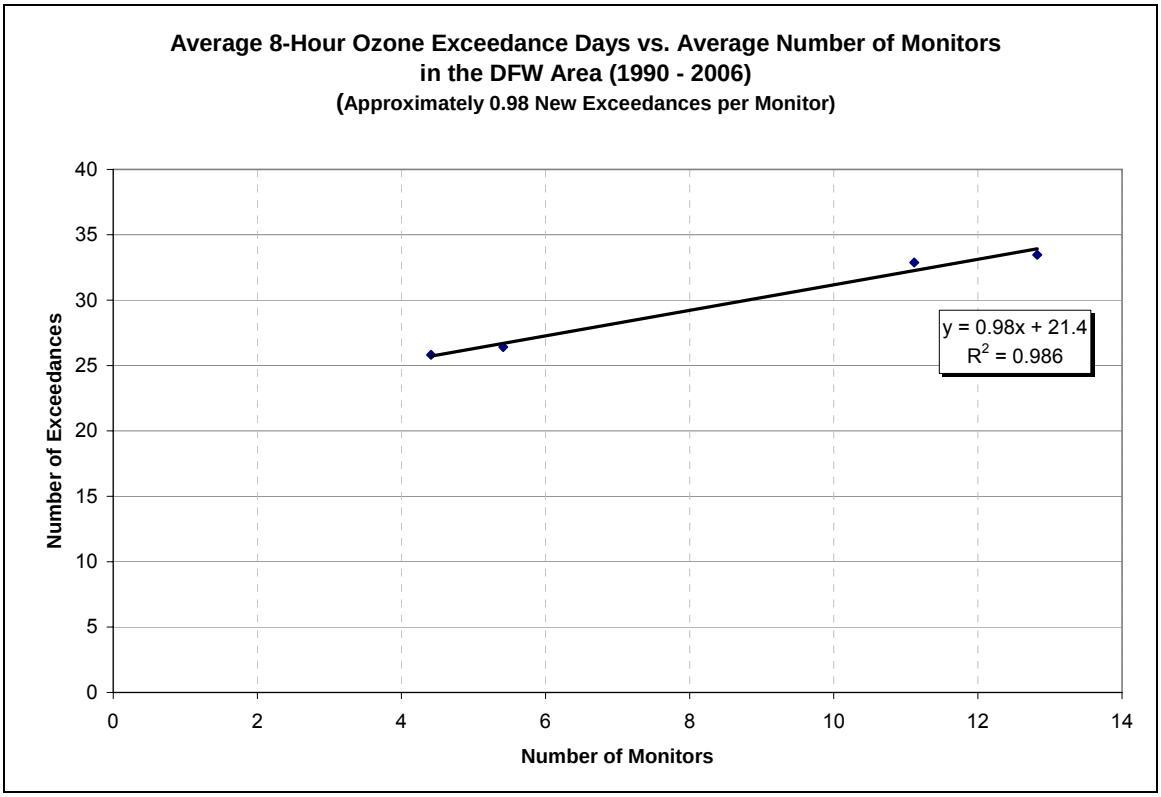


Figure 3-7: Average Eight-Hour Ozone Exceedance Days vs. Average Number of Monitors in the DFW Area from 1990 to 2006

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.

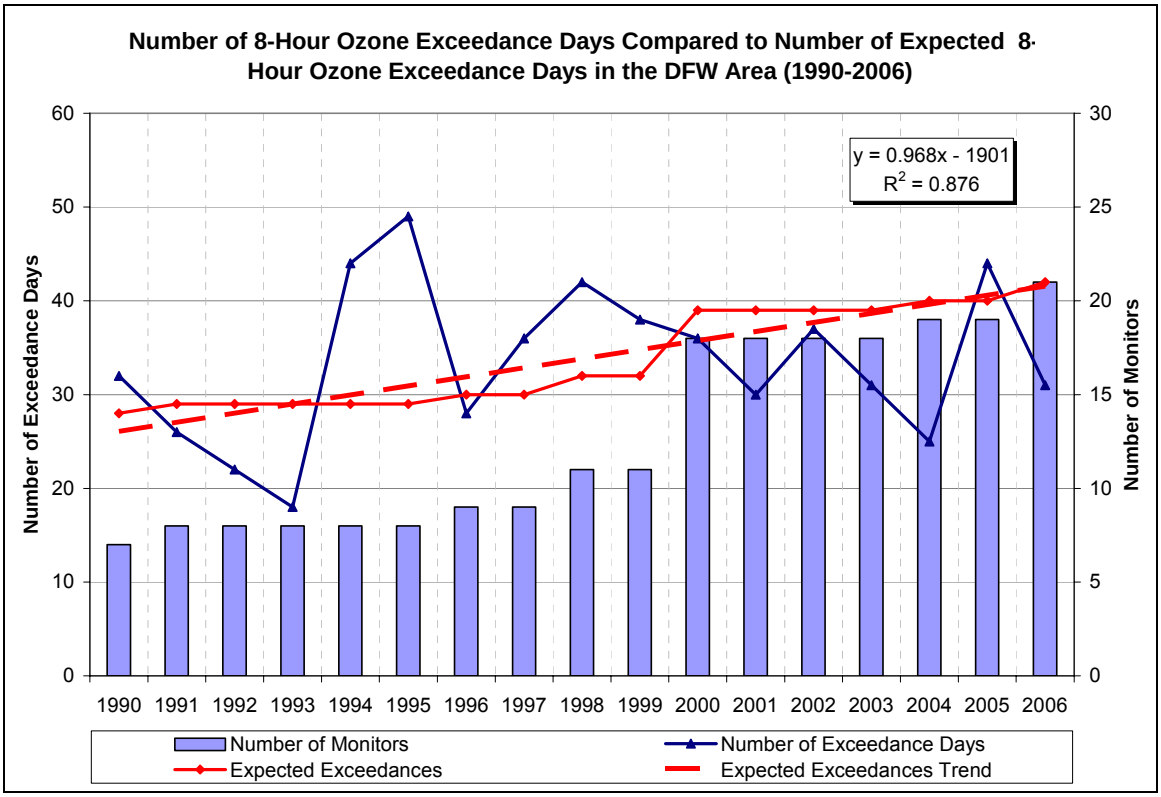
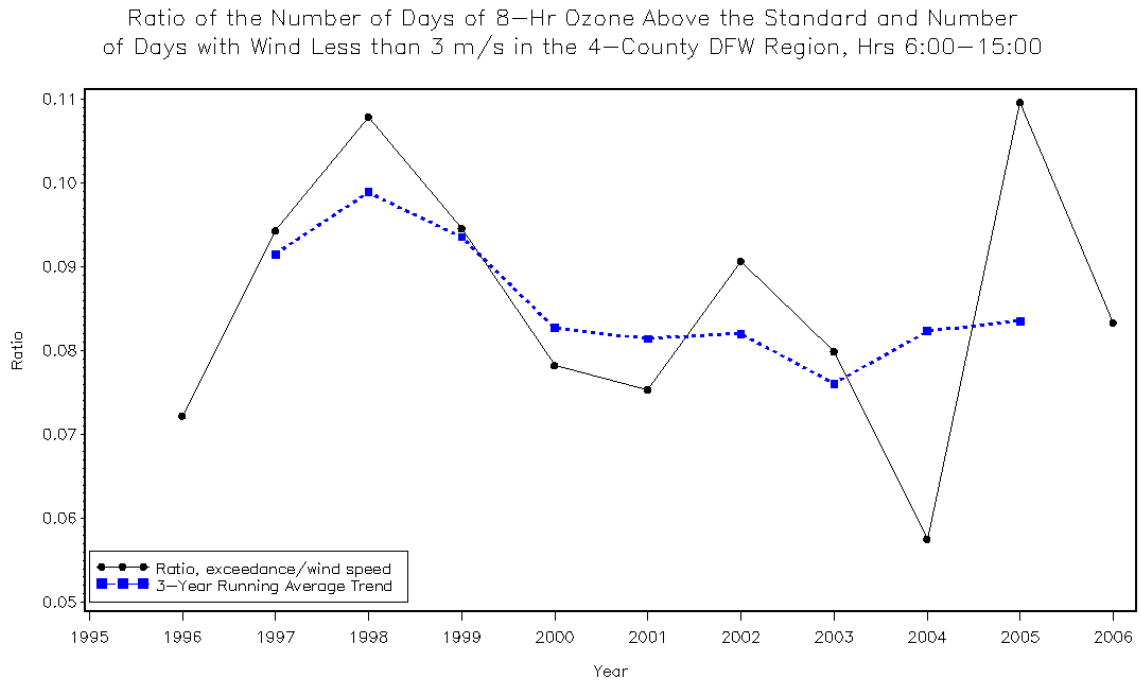


Figure 3-8: Number of Actual Eight-Hour Ozone Exceedance Days Compared to the Number of Expected Eight-Hour Ozone Exceedance Days in the DFW Area from 1990 to 2006

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.



Note: Year 2006 in incomplete, months of Jan–Jun only. Data source EPA.

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.

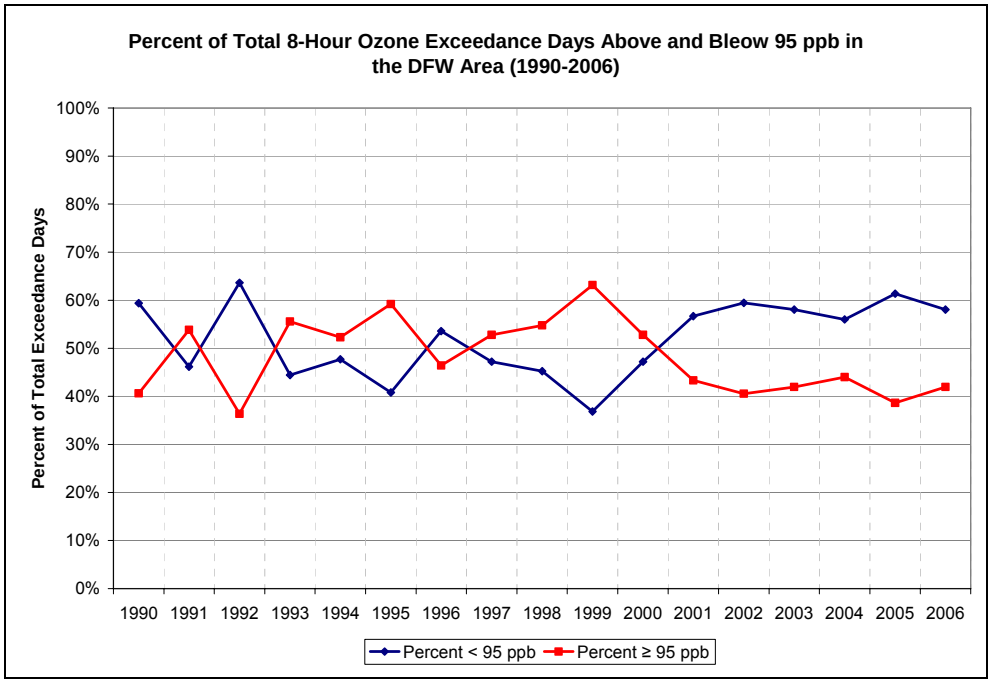


Figure 3-10: Percent of Total Eight-Hour Ozone Exceedance Days Above and Below 95 ppb in the DFW Area from 1990 to 2006

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.

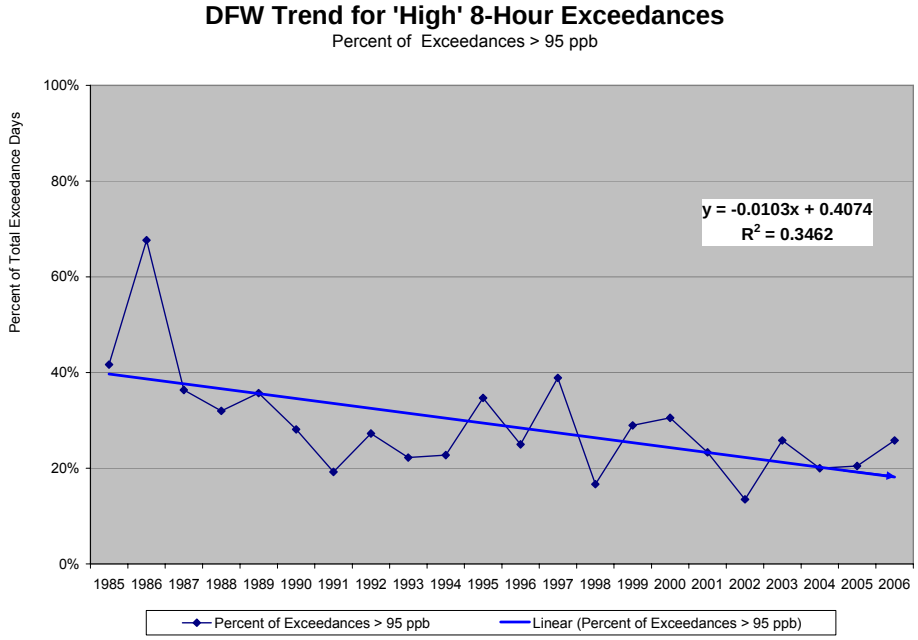


Figure 3-11: Long Term DFW Trend for Exceedances Greater Than 95 ppb

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.

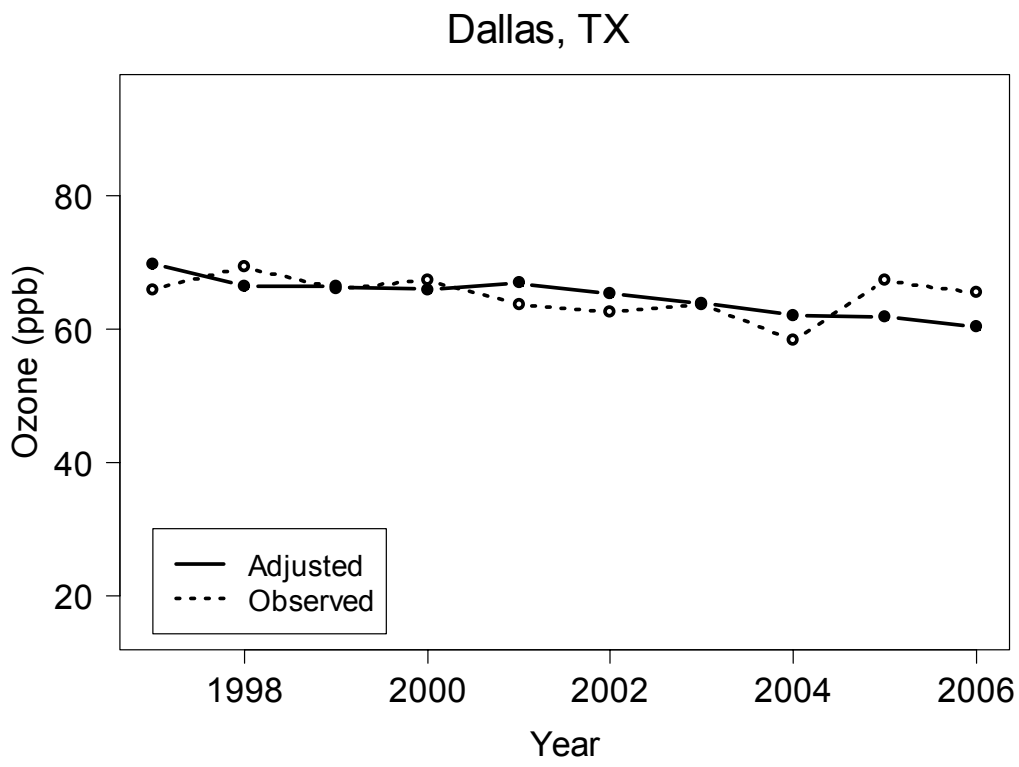


Figure 3-12: DFW Seasonal Average Eight-Hour Daily Maximum Ozone Adjusted for Meteorological Factors

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.

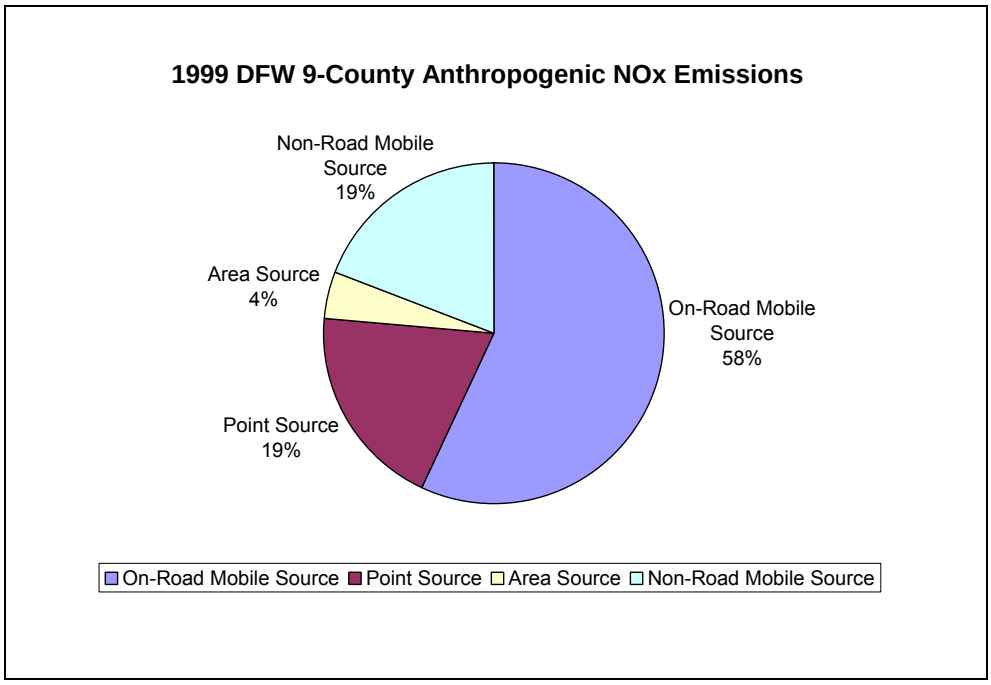


Figure 3-13: 1999 Anthropogenic NO_X Emissions by Source Category in the DFW Area

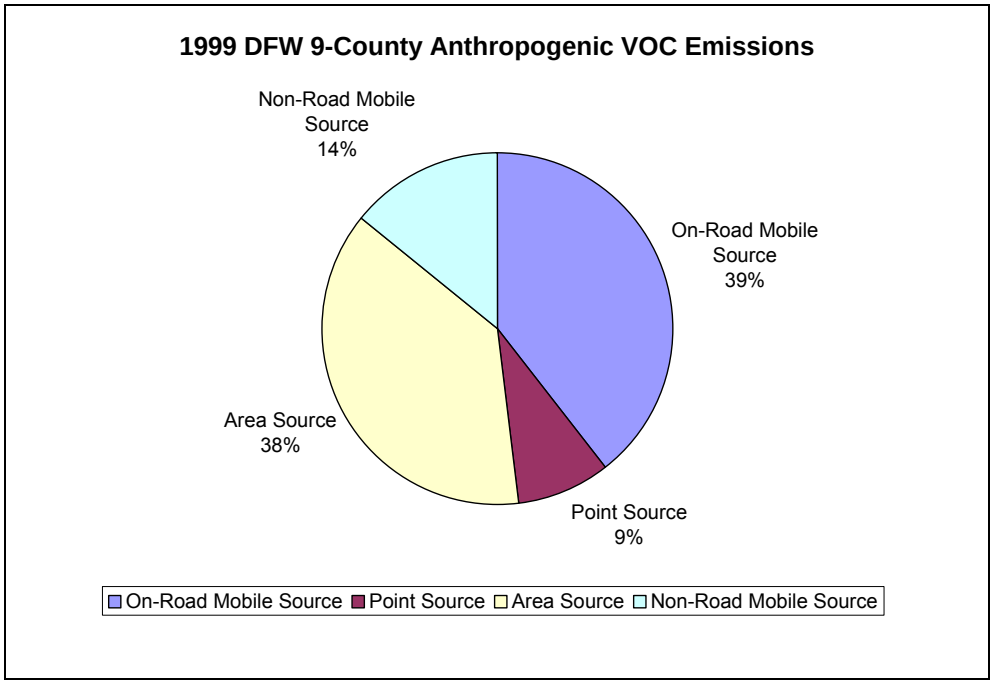


Figure 3-14: 1999 Anthropogenic VOC Emissions by Source Category in the DFW Area

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.

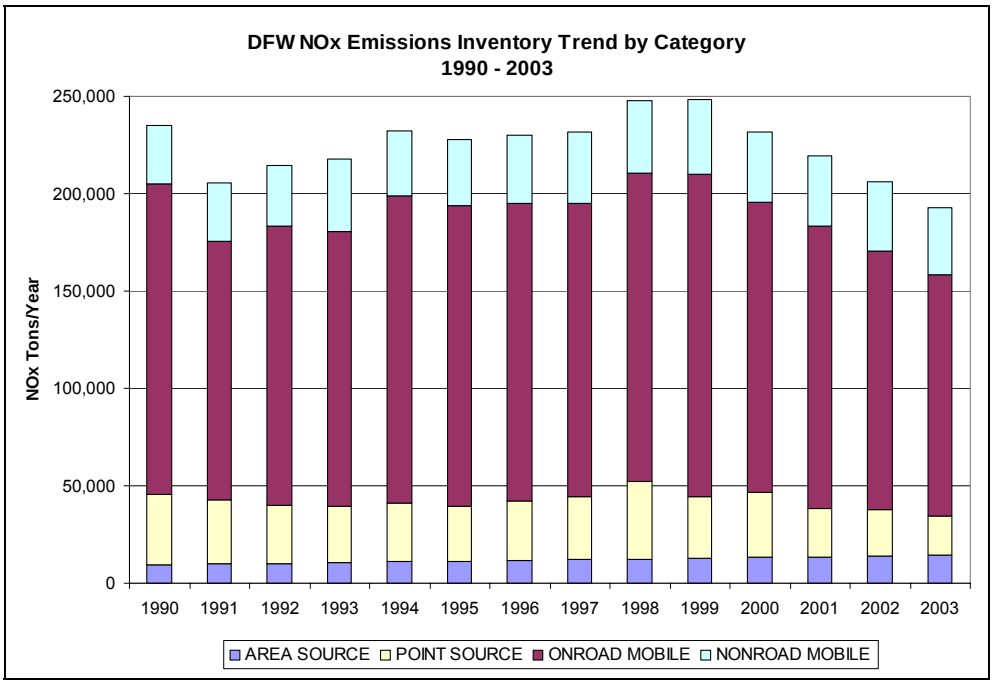


Figure 3-15: NO_X Emission Inventory Trend in the DFW Area from 1990 to 2003

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 95th 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.

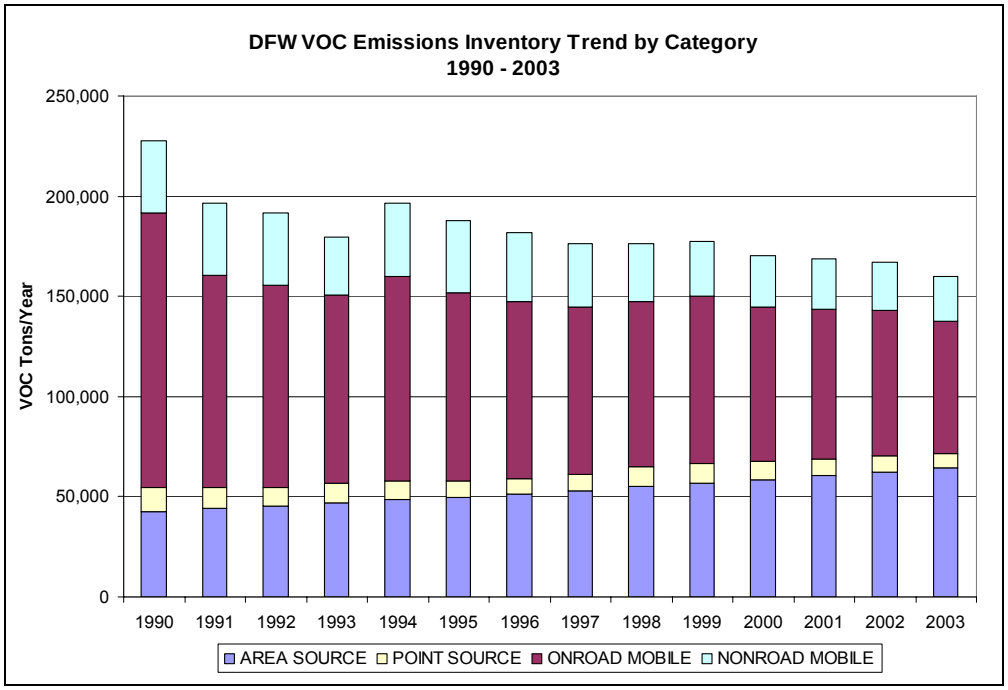


Figure 3-16: VOC Emission Inventory Trend in the DFW Area from 1990 to 2003

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.

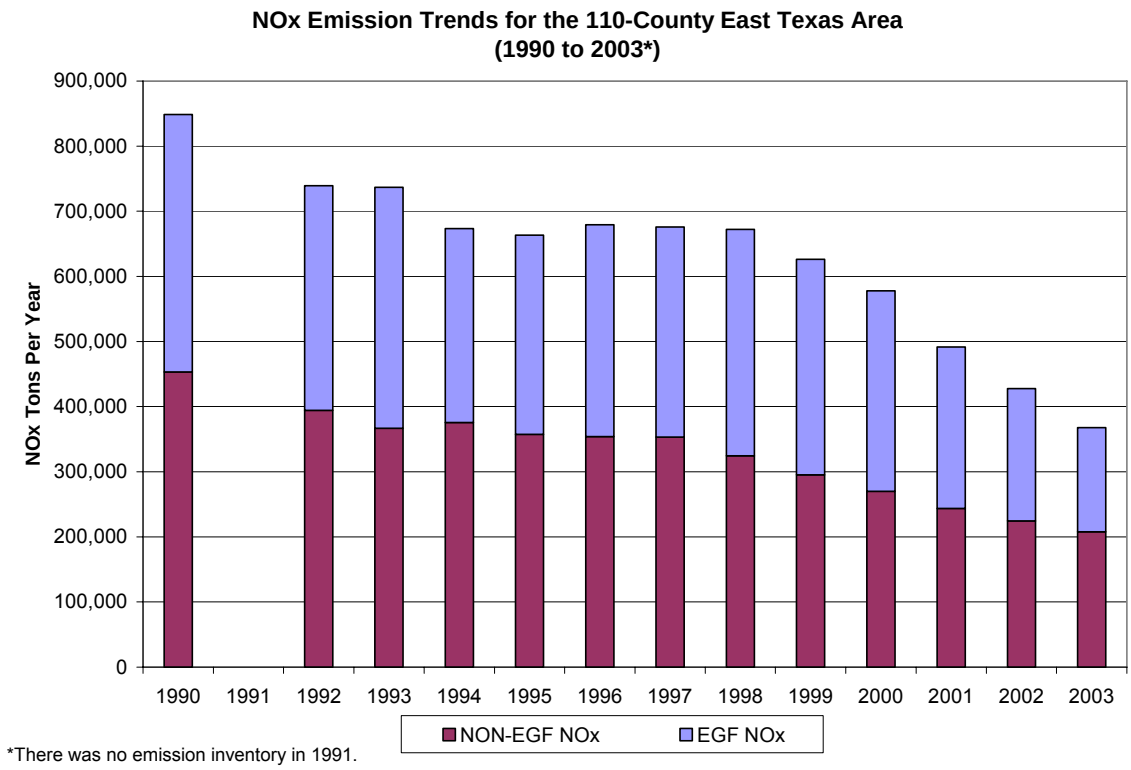


Figure 3-17: NO_X Emission Inventory Trends for the 110-County East Texas Area from 1990 to 2003

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.

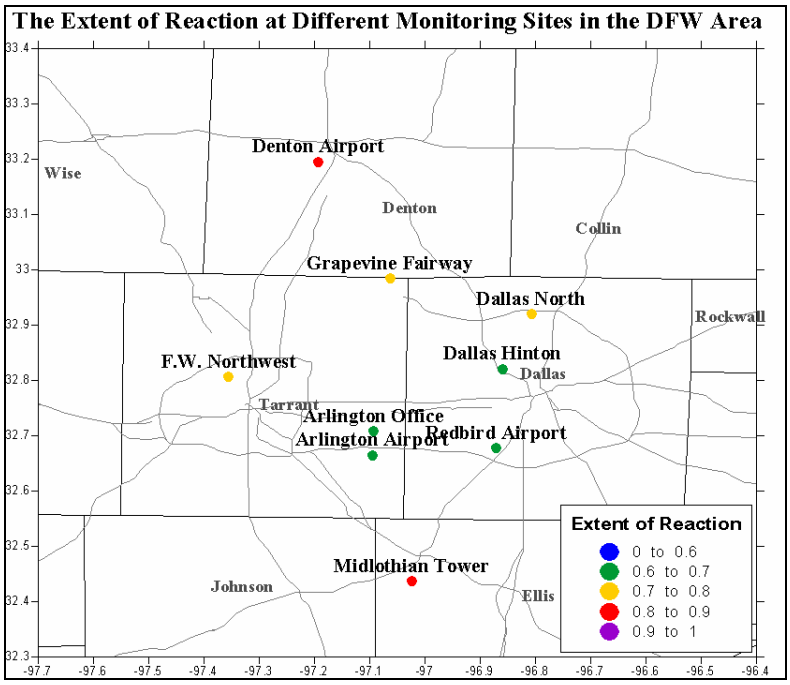


Figure 3-18: Spatial Patterns of the Extent of Reaction in the DFW Area.

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.

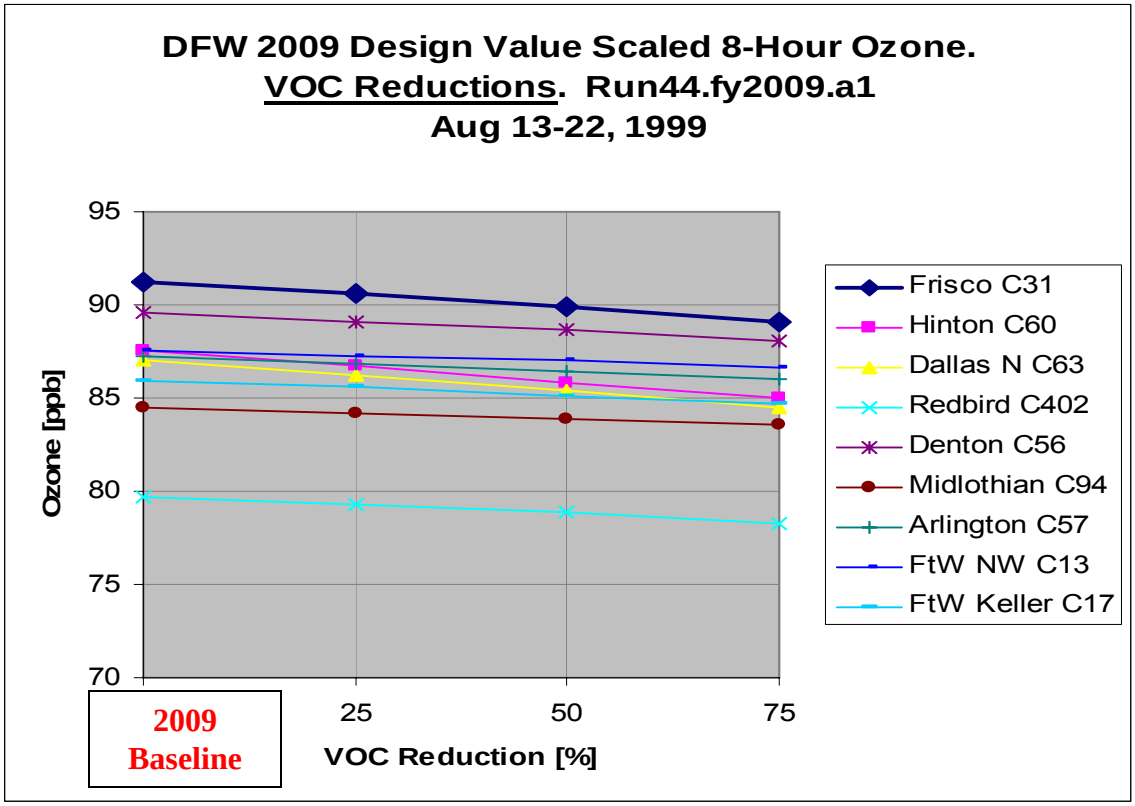


Figure 3-19: Future Case CAMx Response to VOC Reductions

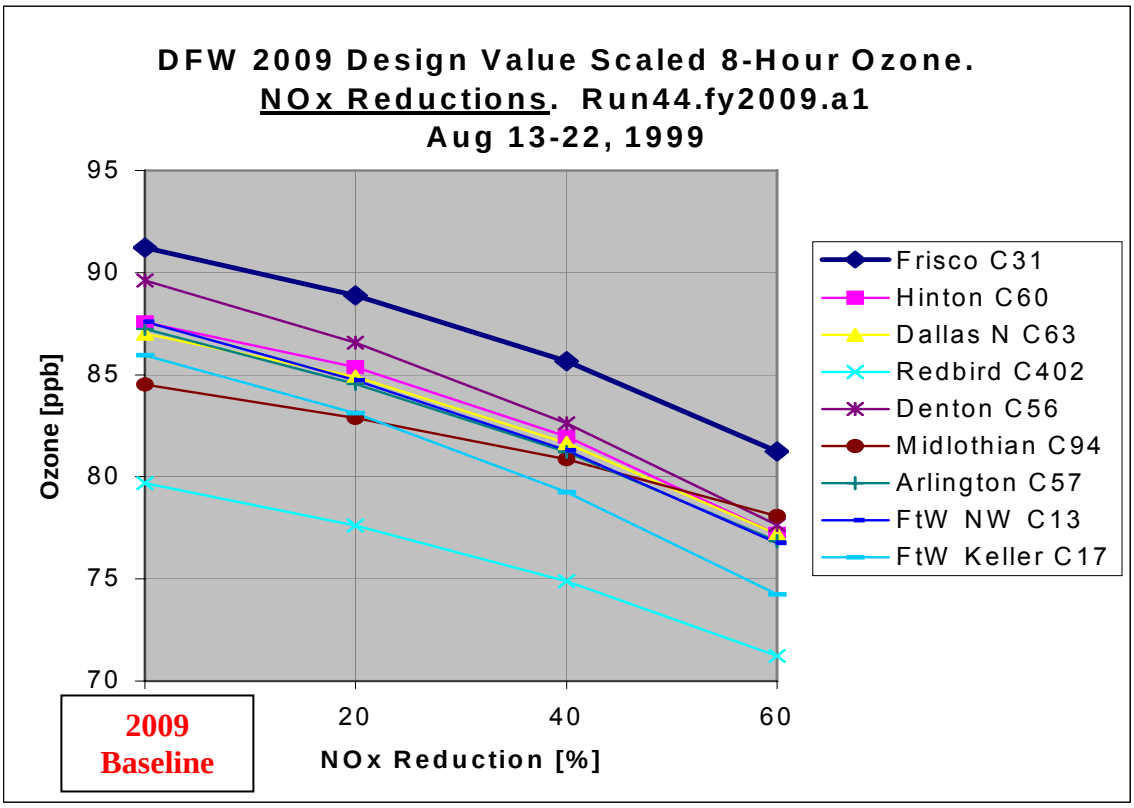


Figure 3-20: Future Case CAMX Response to NO_X Reductions

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.

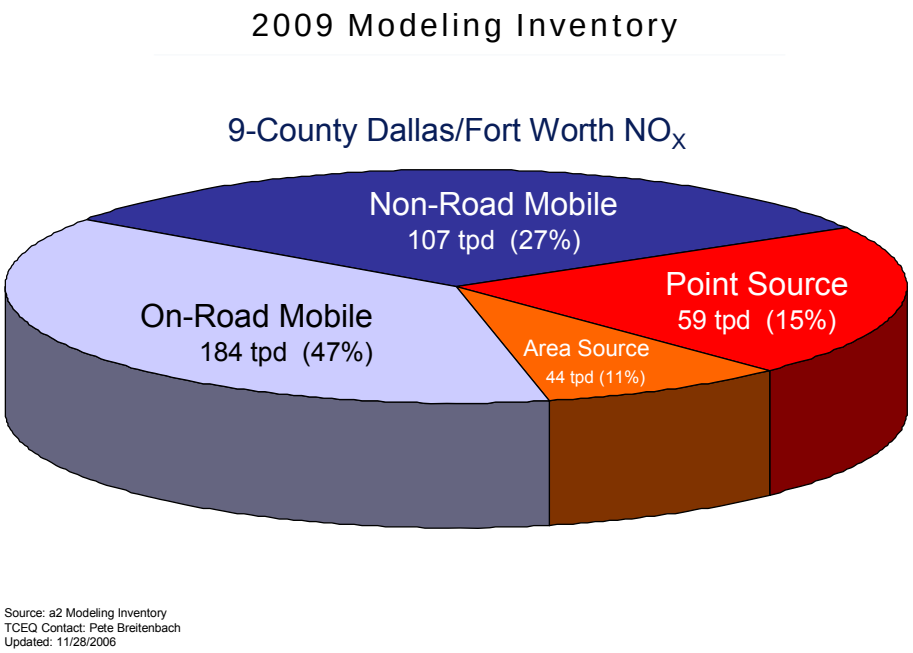


Figure 3-21: DFW Future Case (2009) NO_X Emissions by Source Category

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.

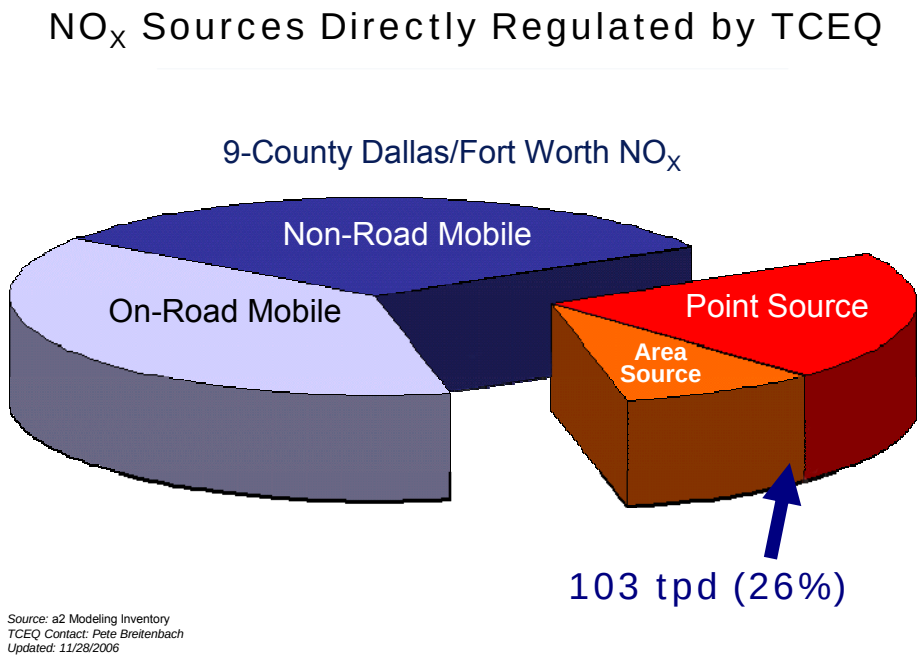


Figure 3-22: NO_X Sources Directly Regulated by TCEQ

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).

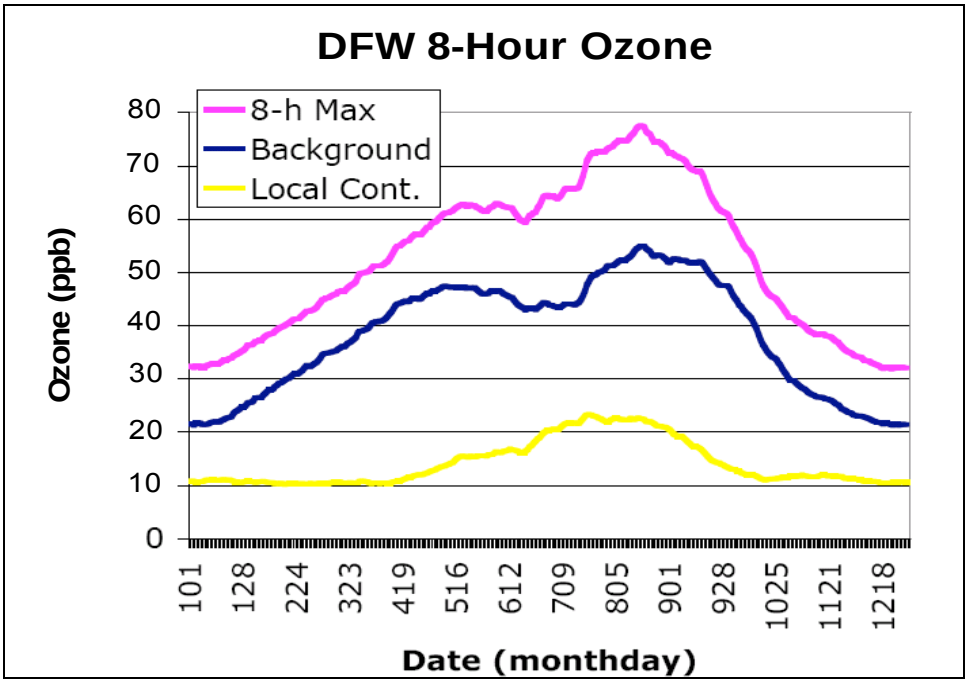


Figure 3-23: Eight-Hour Ozone in the DFW Area from 1998 to 2003

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.

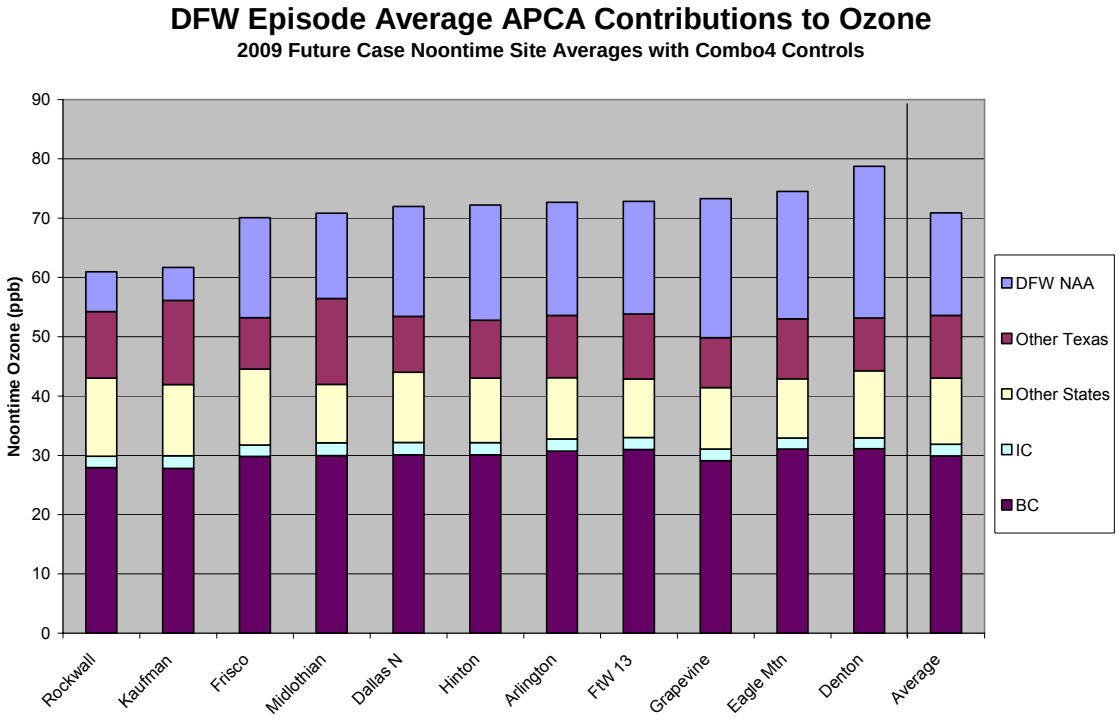


Figure 3-24: Site Specific APCA Contributions in DFW Future Case (2009)

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.
3. Chinkin, Lyle, Hilary Main, and Paul Roberts. *PAMS Data Analysis Workshops, Illustrating the use of PAMS Data to Support Ozone Control Programs*. (Accessed November 21, 2005). http://www.epa.gov/oar/oaqps/pams/analysis/index.html#preface.
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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 79th 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 77th 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.

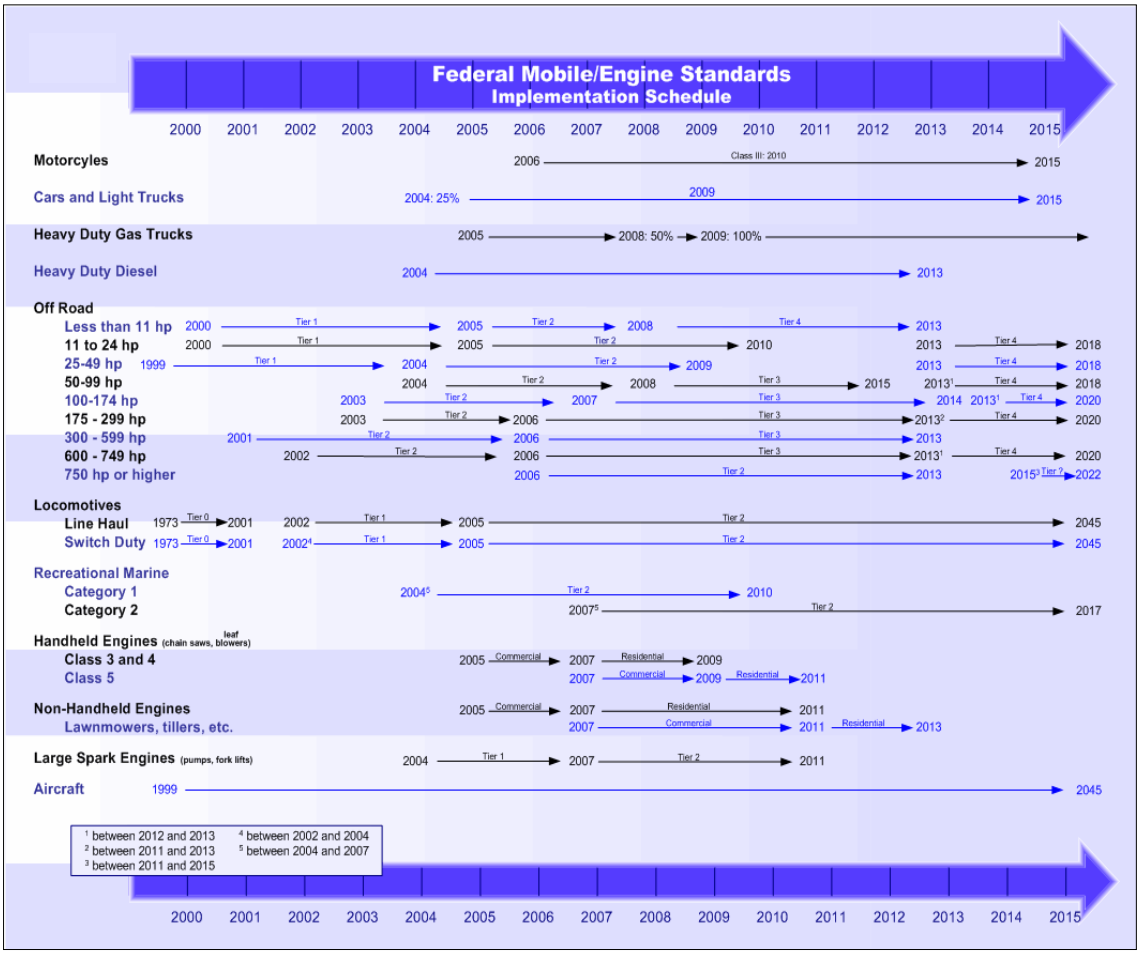
The EPA is preparing guidance to allow states to determine VOC emission reductions that will be achieved by these rules so states can use them in their SIP submittals. The EPA hopes to provide a memo giving credit information for the aerosol coatings and consumer products categories by April 30, 2007. 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*.

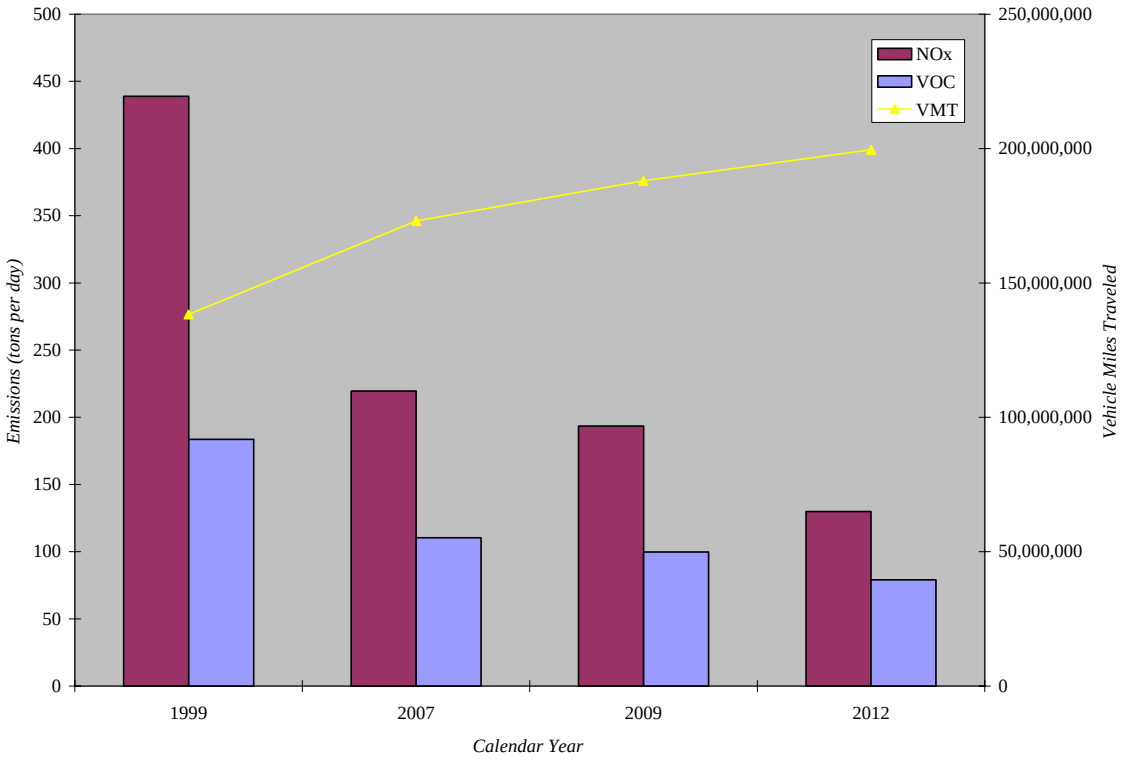


Figure 4-1: Weekday On-Road Emission Inventory Trends in Nine-County DFW from 1999-2012

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.

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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 (77th Legislative session) and several bill proposals during the 80th 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 (80th 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 (76th 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 (76th 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) 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.

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 1st, 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 <u>value</u> of additional documentation with the added <u>volume</u> 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.